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IMPACT ASSESSMENT

Accompanying the document

Proposal for a
REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change

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List of acronyms

AFOLU	Agriculture, Forestry and Other Land Use
ARD	Afforestation, Reforestation and Deforestation
BAU	Business as Usual
CAP	Common Agricultural Policy
CL	Cropland
CM	Cropland management
CP2	2nd commitment period of the Kyoto Protocol
COP	Conference of the Parties
D	Deforestation
ESD	Effort Sharing Decision
ETS	Emissions Trading System
FAO	Food and Agriculture Organization of the United Nations.
FL	Forest land
FM	Forest Management
G4M	Global Forest Model
GDP	Gross Domestic Product
GHG	Greenhouse gas
GL	Grassland
GM	Grazing land management
GPG	Good Practice Guidance
HWP	Harvested Wood Products
INDC	Intended Nationally Determined Contribution
IPCC	Inter-governmental Panel on Climate Change
JRC	Joint Research Centre of the European Commission
KP	Kyoto Protocol
LULUCF	Land Use, Land Use Change and Forestry
MRV	Monitoring, Reporting and Verification
MS(s)	Member State(s)
NFI	National Forest Inventories
NGOs	Non-Governmental Organizations
NIRs	National Inventory Reports
RMU	Removal Units
SMEs	Small- and Medium sized Enterprises
TFEU	Treaty on the Functioning of the European Union
UNFCCC	United Nations Framework Convention on Climate Change

List of definitions[1]

Accounting*	The use of reported data to quantify meaningful action on mitigation, applying standardised rules and usually in the context of target compliance.
Accuracy	Accuracy is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, so far as can be judged, and that uncertainties are reduced so far as is practicable. Appropriate methodologies conforming to guidance on *good practices* should be used to promote accuracy in inventories.
Activity data	Data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time. In the LULUCF sector, data on land areas, management systems, lime and fertilizer use are examples of activity data.
Additionality*	Direct human-induced mitigation, usually considered beyond a business as usual reference
Afforestation	The direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.
Biomass	Organic material both above ground and below ground, and both living and dead, e.g. trees, crops, grasses, tree litter, roots etc. Biomass includes the pool definition for above - and below - ground biomass.
Carbon pool	A reservoir containing carbon, which is a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored. Examples of carbon pools are forest biomass, wood products and soils.
Carbon stock	The quantity of carbon in a carbon pool.
Comparability	Comparability means that estimates of emissions and removals reported by Parties in inventories should be comparable among Parties. For this purpose, Parties should use the methodologies and formats agreed by the Conference of the Parties (COP) for estimating and reporting inventories.
Completeness	Completeness means that an inventory covers all sources and sinks for the full geographic coverage, as well as all gases included in *the IPCC Guidelines* in addition to other existing relevant source/sink categories which are specific to individual Parties (and therefore may not be included in the *IPCC Guidelines*).

[1] Source: IPCC (2003; 2006), with the exception definitions marked with a star (*).

Consistency	Consistency means that an inventory should be internally consistent in all its elements over a period of years. An inventory is consistent if the same methodologies are used for the base year and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. Under certain circumstances referred to in paragraphs 10 and 11 of FCCC/SBSTA/1999/6/Add.1, an inventory using different methodologies for different years can be considered to be consistent if it has been recalculated in a transparent manner taking into account any *good practices*.
[LULUCF] Credit*	Removal Units (RMUs) able to be applied to flexibility with other (non-LULUCF) sectors
Cropland	This category includes arable and tillage land, and agro-forestry systems where vegetation falls below the threshold used for the forest land category, consistent with the selection of national definitions.
Cropland management	The system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production.
[LULUCF] Debit	In the LULUCF sector, the increase in net emissions (or decrease in net removals) requiring compensation from other, non-LULUCF sectors.
Deforestation	The direct human-induced conversion of forested land to non-forested land.
Disturbances*	Events including wildfires, insect and disease infestations, extreme weather events and geological disturbances, but not harvesting.
Emissions*	Release of greenhouse gas to the atmosphere.
Emission factor	A coefficient that relates the activity data to the amount of chemical compound which is the source of later emissions. Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity level under a given set of operating conditions.
Flexibility*	The possible exchange of removal units, credits, or debits,between or within sectors.
Forest	A minimum area of land of 0.05–1.0 hectare with tree crown cover (or equivalent stocking level) of more than 10–30 per cent with trees with the potential to reach a minimum height of 2–5 metres at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.
Forest land	This category includes all land with woody vegetation consistent with thresholds used to define forest land in the national GHG inventory, sub-divided at the national level into managed and unmanaged and also by ecosystem type as specified in the *IPCC Guidelines.*6 It also includes systems with vegetation that currently falls below, but is expected to exceed, the threshold of the forest land category.

Forest management	A system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.
Grassland	This category includes rangelands and pasture land that is not considered as cropland. It also includes systems with vegetation that fall below the threshold used in the forest land category and is not expected to exceed, without human intervention, the thresholds used in the forest land category. This category also includes all grassland from wild lands to recreational areas as well as agricultural and silvo-pastural systems, subdivided into managed and unmanaged, consistent with national definitions.
Grazing land management	The system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.
Gross-net accounting*	Accounting approach for the actual reported net emissions (or removals) in each year of the commitment period without comparing it with 1990 or other base year or reference.
Key category	A category that is prioritised within the national inventory system because its estimate has a significant influence on a country's total inventory of direct greenhouse gases in terms of the absolute level of emissions, the trend in emissions, or both.
Land Category*	The categorisation of land cover/use into basic categories of Forest, Crop, Grass, Settlement, Wetland and Other Land, applied by the UNFCCC reporting approach.
Net-net accounting*	Accounted using the reported net emissions in each year of the accounting period minus the net emissions in 1990 (or other base year). In the situation where the net emissions have decreased, a country may issue removal units, (RMUs) and if net emissions have increased, it must cancel units (i.e. take on debits).
Reforestation	The direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the KP first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.
Removals*	Used, for the purposes of this report, together with "sink".
Removal Units	Units showing decrease in emissions or increase in removals within the LULUCF accounts.
Revegetation	A direct human-induced activity to increase carbon stocks on sites through the establishment of vegetation that covers a minimum area of 0.05 hectares and does not meet the definitions of afforestation and reforestation contained here.
Sequestration	The process of increasing the carbon content of a carbon pool other than the atmosphere. It is preferred to use the term "sink".

Sink*	The rate of build-up of CO2 in the atmosphere can be reduced by taking advantage of the fact that carbon can accumulate in vegetation and soils in terrestrial ecosystems. Any process, activity or mechanism which removes a greenhouse gas from the atmosphere is referred to as a "sink." Denoted in accounting and reporting with the negative (-) sign.
Source	The rate of emissions of CO2 in the atmosphere can be increased by anthorpogenic action releasing carbon accumulated in vegetation and soils in terrestrial ecosystems. Any process, activity or mechanism which releases a greenhouse gas from the atmosphere is referred to as a "source." Denoted in accounting and reporting with the negative (+) sign.
Transparency	Transparency means that the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information.
Wetland	This category includes land that is covered or saturated by water for all or part of the year (e.g., peatland) and that does not fall into the forest land, cropland, grassland or settlements categories. This category can be subdivided into managed and unmanaged according to national definitions. It includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.

1. PROBLEM DEFINITION

1.1. Context

1.1.1. Political context

The Paris Agreement includes a long-term goal to put the world on track to limit global warming to **well below 2°C** above pre-industrial levels, and to pursue efforts to limit the temperature increase to **1.5°C**. Regarding the agriculture, forestry and other land use sector, the Paris Agreement spells out that the contribution from land use and forests in reaching the long term climate mitigation objectives will be critical.[2]

In line with scientific findings reported by the Intergovernmental Panel on Climate Change (IPCC) in the fourth Assessment Report, the EU's objective, in the context of necessary reductions by developed countries as a group, is to reduce GHG emissions by 80-95% by 2050 compared to 1990. The Commission in its 2050 Low Carbon Economy Roadmap proposed concrete milestones to ensure the EU is on track to reduce these emissions by at least 80% domestically by 2050, with milestones of 40% and 60% reductions in 2030 and 2040. For 2020, the EU had agreed in 2007 on an economy-wide and binding target of at least 20% GHG emission reductions, as well as a binding renewables target of 20% and an indicative target of 20% energy savings. Land use, however, was not included in either of these initiatives.

The EU became the first major economy to present its climate plan for the Paris Conference (i.e. Intended Nationally Determined Contribution or "INDC") on 6 March 2015. This reflects the 2030 climate and energy policy framework set by the October 2014 European Council and the European Commission's blueprint for tackling global climate change beyond 2020.[3] The EU has set an ambitious economy-wide domestic target of at least 40% greenhouse gas emission reduction for 2030.

The 2014 European Council conclusions also mandated the European Commission to put forward policy to include Land Use, Land Use Change and Forestry (LULUCF) into the EU's 2030 climate and energy framework. The European Council specifically acknowledged "the multiple objectives of the agriculture and land use sector, with their lower mitigation potential, and the need to ensure coherence between the EU's food security and climate change objectives". It invited the Commission "to examine the best means of encouraging the sustainable intensification of food production, while optimising the sector's contribution to greenhouse gas mitigation and sequestration, including through afforestation".

The European Council's guidance on including LULUCF into the EU's 2030 climate and energy framework is also reflected in the EU's INDC. The EU announced that its target is "an economy-wide absolute reduction from base year emissions", reaching "at least 40% domestic reduction",

[2] The new long term goal was defined as achieving "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century." Paris Agreement, Art. 4 (1)

[3] European Council Conclusions, 2030 Climate and Energy Policy Framework, EUCO 169/2014 para 2.14

covering 100% of the EU's emissions. As for LULUCF, it was added that "policy on how to include Land Use, Land Use Change and Forestry into the 2030 greenhouse gas mitigation framework will be established as soon as technical conditions allow and in any case before 2020."[4]

1.1.2. Regulatory context

The current 2020 EU climate policy framework covers most sectors and greenhouse gases. It consists of two main elements:

– The EU Emissions Trading System (EU ETS), directly involving more than 11000 large installations in power generation and manufacturing industries, and operators in the aviation sector.

– A large part of the emissions from sectors[5] outside the EU ETS are addressed by the Effort Sharing Decision (ESD). The ESD sets 2020 targets, and defines a linear trajectory of corresponding binding emission limits for each year from 2013 to 2020.

Progress towards the 2020 targets is ensured through annual reporting obligations and compliance checks, set out in Regulation 525/2013/EC.[6]

Emissions and removals from the land use sector are treated differently:

– Land Use, Land Use Change and Forestry (LULUCF) greenhouse gas accounting results were not included in the EU's domestic reduction target for 2020.

– Emission and removals[7] of greenhouse gases in this sector are instead covered by international obligations only, up to 2020. The rules for the LULUCF sector for the first commitment period (2008-2012) of the Kyoto Protocol were finalised among international Parties in 2001, and formally adopted in 2005. A set of improved methodologies and rules, valid for the second commitment period of the Kyoto Protocol (2013 to 2020), was adopted at the Durban climate conference in 2011.

– Emissions and removals from LULUCF are accounted applying the so-called *"no debit rule"*. This means that internationally, the EU and each of its Member States need to ensure that the LULUCF sector does not result in extra emissions – after accounting rules are applied.

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4 Intended Nationally Determined Contribution of the EU and its Member States, 6 March 2015, http://www4.unfccc.int/submissions/INDC/Published%20Documents/Latvia/1/LV-03-06-EU%20INDC.pdf

5 The so-called "non-ETS" with more than 55% of the EU's total emissions e.g. CO_2 emissions from transport, heating of buildings, non-CO_2 emissions from agriculture and waste

6 Regulation 525/2013/EC on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC

7 When CO_2 is absorbed from the atmosphere, for example when trees and plants grow, this is termed "removal", in contrast to an emission which occurs when the biomass is burnt or decays.

– Reporting – but not accounting – in the LULUCF sector, as part of the EU's annual greenhouse gas inventory, is addressed by Regulation 525/2013/EC.[8]

1.2. Identifying and describing the main problem components

1.2.1. Lack of governance for LULUCF following the Paris Agreement

Governance today for LULUCF falls under the auspices of the UNFCCC and is agreed through the relevant decisions of the so-called Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP). Accounting of removals and emissions in the LULUCF sector is thus contingent on the specific technical guidance developed for the implementation of the Kyoto Protocol, which itself takes into account related IPCC guidelines. The current Kyoto Protocol LULUCF accounting rules have been incorporated into EU legislation by Decision 529/2013/EU ("LULUCF Decision"), but these do not apply beyond the 2nd commitment period of the Kyoto Protocol(2013-2020). Moreover, the results of these accounts play no part in the EU's domestic reduction target for 2020.

In a significant step forward, the Paris Agreement requires all Parties to report information on their LULUCF emissions and removals. In a change to the international framework and contrary to the Kyoto Protocol, however, it does not contain a single harmonised set of legally binding accounting rules. It also does not specify how emissions and removals from land use have to be counted towards national reduction targets. Parties will not be bound by one stringent international set of standards. Instead, they may be allowed to choose from a "menu of options" on how to govern LULUCF[9].

The EU's INDC clearly outlines the principles for the inclusion of LULUCF into its international commitment. The implementation of the current LULUCF Decision is underway and will deliver improved systems and broader coverage of accounting for the Member States, by the end of 2020. Nevertheless, without a legal framework consolidating this implementation and defining the applicable rules for the post-2020 period, the way in which LULUCF would be included into the 2030 framework could be heterogeneous across the EU.

In conclusion, in order to address the lack of international governance, governance within the EU needs to be further developed. The LULUCF sector needs to be fully covered under the EU climate policy framework as of 2020, which requires establishing the accounting rules to be applicable before this date. Timely action is needed to ensure that Member States, currently improving systems, direct this work towards the establishment of appropriate monitoring frameworks. EU action on the LULUCF sector could also have a wide-ranging influence on global approaches to land-based emissions and removals, influencing the overall global ambition for the period beyond 2020.

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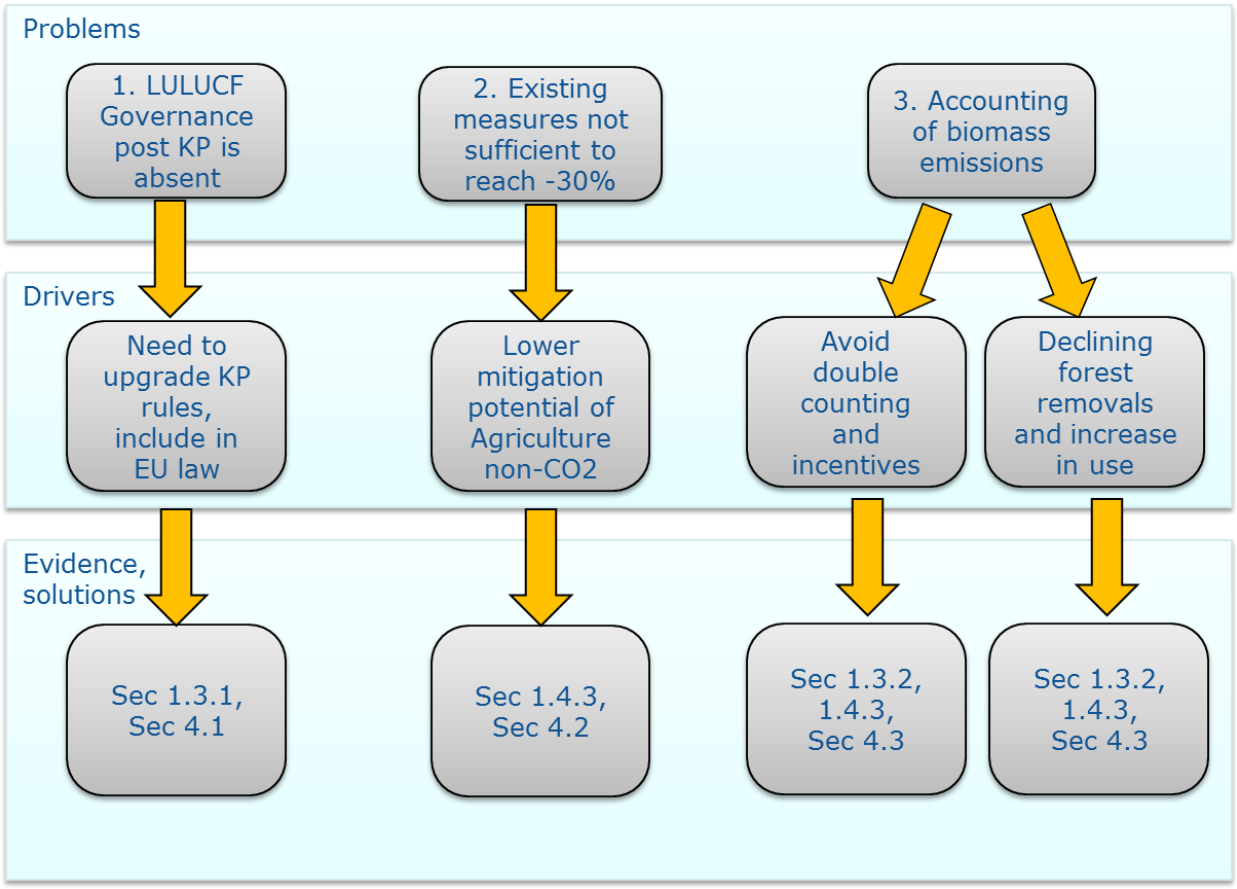
8 Greenhouse gas Monitoring Mechanism Regulation (MMR), http://rod.eionet.europa.eu/instruments/652

9 Final report "LULUCF and the Paris Agreement" ICF/COWI, 2016

Figure 1: The three main problems addressed and their drivers – structure in this document



1.2.2. Existing measures are not sufficient to reach the 2030 and 2050 EU targets

On the basis of current policies, GHG emissions are not expected to decrease sufficiently to reach the EU's 2030 target of 30% GHG domestic reductions under the ESD. In the EU Reference Scenario 2016, reflecting current trends and policies, emissions covered by the ESD are projected to decrease by around 16% in 2020 and achieve 24% reduction in 2030 compared to 2005. This reflects full implementation of existing legally binding targets as well as adopted policies. This leaves a gap of 6 percentage points to the 30% reduction in 2030, requiring cumulatively still around 1 billion ton additional reductions in the period 2021-2030.[10]

The results of earlier impact assessments for 2030[11] and 2050 firmly underline the growing importance over time of mitigation action in forests and agriculture. In the case of an overall EU emission reduction of 80%, and without additional mitigation action in agriculture compared to

[10] Further details may be found in Sec 1.3 of the Impact Assessment on Effort Sharing in 2030 Climate and Energy Policy Framework

[11] COM(2014) 15, http://ec.europa.eu/clima/policies/2030/documentation_en.htm . Hereinafter: "2030 Impact Assessment"

today, the proportion of agricultural emissions is estimated to rise to about one third of all EU emissions by 2050. This is double its current share in the EU's emission budget.[12]

At the same time, the LULUCF sector offers untapped potential for emission reduction and enhanced removals through carbon sequestration and substitution of fossil carbon.[13]

In conclusion, the importance of both land use and agriculture in terms of climate policy is, therefore, set to increase and additional mitigation efforts both in agriculture and in the LULUCF sector are needed. This is particularly important to prepare for the long-term, as emissions in the period after 2050 may well have to be counterbalanced by higher removals.[14]

1.2.3. Accounting of emissions from biomass use

The increased utilisation of biomass for energy and wood products can lower emissions in other sectors through energy and material substitution. Enhancing the bio-economy can therefore contribute positively to climate mitigation. However, the increased use of biomass for the production of renewable energy and for material substitution shifts the accounting of emissions from the energy and others sectors to the land use sector, in particular to forest management. It is therefore of key importance that the use of biomass is appropriately accounted for in LULUCF.

Under the current Kyoto accounting rules, the combustion of biomass counts as zero in the energy sector while the resulting carbon stock changes are accounted as emissions in LULUCF. This avoids double counting of emissions[15]. Under the current EU climate and energy package, bioenergy emissions are counted as zero in the ETS and in the ESD, but LULUCF is not yet fully included in the EU's domestic reduction target. Moreover, in the absence of uniform international rules after the end of the Kyoto regime, accounting for emissions generated by biomass use would be incomplete, and the EU framework would be unbalanced.

If a change in the amount of biomass harvested is a result of more biomass being used for bioenergy or materials, the impact of higher than Business as Usual (BAU) harvests would result in decreased accounted removals (or increased emissions) in the LULUCF sector with a corresponding decrease of accounted emissions in the ETS and ESD. The net impact of a harvest rate beyond the BAU in LULUCF accounts would therefore appropriately reflect – and balance – the biogenic emissions of the zero-rated energy feedstock in the full, economy wide accounts. In addition, any benefits (i.e. reduction of emissions) would potentially occur off the accounting sheet of the Member State producing the biomass, if the energy feedstock was exported.

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12 SEC(2011) 288 final, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0288

13 Mainstreaming climate change into rural development policy, Ecologic Institute 2014, http://www.ecologic.eu/10439; Policy options for including LULUCF in the EU reduction commitment and policy instruments for increasing GHG mitigation efforts in the LULUCF and agriculture sectors, 2011, http://ec.europa.eu/clima/policies/forests/lulucf/docs/synthesis_report_en.pdf; Impact assessment on the role of land use, land use change and forestry (LULUCF) in the EU's climate change commitments, SWD(2012) 41 final; ClimWood2030 'Climate benefits of material substitution by forest biomass and harvested wood products: Perspective 2030' Final Report (revised draft) , March 2016

14 See Paris Agreement, Article 4 (1)

15 See JRC Reference report EUR25354 EN

In conclusion, a robust and credible accounting regime for the LULUCF sector, within the overall EU accounting framework, is necessary to guarantee that emissions and removals resulting from biomass use are properly accounted.

1.3. Baseline scenario, and drivers of the main problems

1.3.1. Continuation of Kyoto rules

In the baseline scenario the continuation of the current (2013-2020) Kyoto accounting rules is assumed including for the three main LULUCF categories:

- Afforestation and deforestation
- Agricultural land (crop and grasslands)
- Forest management.

1.3.1.1. Reporting and accounting rules

The internationally agreed Kyoto rules applied by the EU make a key distinction between "reported" and "accounted" emissions and removals in LULUCF. While *reporting* concerns an inventory of emissions and removals, *accounting* aims to identify those which are human induced and the result of real action. A significant part of the removals associated with forests and soils is the result of the natural carbon cycle, and needs to be identified.

Until the end of the Kyoto Protocol's second commitment period, Member states are required to report in parallel under two different regimes: that of the UNFCCC (where all Parties need to report emissions and removals) and the Kyoto Protocol (specifically for developed countries). At the end of the Kyoto Protocol, this latter obligation will stop.

Because of the accounting rules, **only a limited amount of carbon sequestration *reported* in the LULUCF sector can be used towards compliance with Kyoto targets**. This restriction helps address methodological uncertainties and preserve environmental integrity.

The reporting and accounting of afforestation and deforestation as well as forest management follow the mandatory rules applicable during the 2nd commitment period of the Kyoto Protocol. However, this reporting and accounting is specific to the Kyoto Protocol and not consistent with the reporting required from all parties under the UNFCCC.

The LULUCF Decision introduced requirements for Member States to extend their use of reporting on croplands and grasslands. As of 2013, they must provide estimates of accounts for the Kyoto Protocol activities of cropland management and grazing land management to the Commission. The LULUCF Decision provides a step-wise path for implementation[16], up to the last year of the Kyoto Protocol (2020). The obligation is introduced in a gradual manner,

[16] LULUCF Decision Impact Assessment, 2011, SWD(2012) 41 final

allowing Member States first to submit preliminary and non-binding annual estimates, with full accounting only starting for the accounting year 2021.[17]

Significant progress has been made in collating and analysing relevant data. According to a recent study[18], the level of detail of reporting on cropland and grassland in Member States has improved substantially, since the adoption of the LULUCF Decision in 2013.

Nevertheless, Kyoto Protocol reporting and accounting presents issues with respect to being fit for purpose post 2020, and furthermore obliges a double reporting requirement upon Member States.

1.3.1.2.Forest management

Kyoto rules permit the accounting of emissions or removals from forest management against *projected* forest reference levels, to exclude legacy management effects and other natural factors from accounts. The actual mitigation performance in the sector is compared to a nationally determined projected forest reference level. Member State specific reference levels for 2013-20 are estimates of future removals or emissions. Some are based upon historic trends, others may take policy implementation into account, for instance harvest rates. The Kyoto Protocol granted a significant degree of choice in how these forward-looking estimates are calculated. Indeed the assumptions made in approaches applied by EU Member States, vary to a great extent.

Furthermore, under the Kyoto Protocol rules a cap is used in LULUCF accounts to limit the use of potential credits from forest management by a Party. The role of the cap is to limit uncertainty associated with the projections which underpin forest management reference levels[19], and to ensure the environmental integrity of the accounts. Forest Management removal units used to balance emissions from other LULUCF activities are only allowed up to a maximum of 3.5% of a Party's 1990 total emissions (see Annex 5).

1.3.1.3. Intra-LULUCF flexibility rules

Flexibility is already granted within the Member State LULUCF accounts: Member States can use enhanced mitigation in one LULUCF activity (e.g. forests) to compensate for accounted emissions by other LULUCF activities (e.g. emissions resulting from conversion of land to settlements). They can also trade removal units among the Kyoto Protocol Parties.

1.3.1.4.No-debit rule for LULUCF sector

As described above, emissions and removals from LULUCF are currently accounted towards the Kyoto Protocol obligations of Member States applying the so-called "*no debit rule*". These Kyoto accounts mostly concern emissions and removals from afforestation, deforestation and forest

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17 Ref to CLIMA Guidance documentation for 529/2013 estimates under Art 3(2)b

18 Hart K, Buckwell A, Freibauer A, Weiss P (2015), Assessment of costs of developing more detailed LULUCF reporting and accounting systems, Task 5 of a study for DG Climate Action: 'LULUCF implementation guidelines and policy options', Contract No CLIMA.A2/2013/AF3338, Institute for European Environmental Policy, London

19 SWD(2012) 41 final

management. Few Member States have elected non-forest activities under their international obligations[20].

Under EU legislation for the second commitment period, emission reductions in the LULUCF sector cannot be used to compensate for increased emissions in other sectors. In other words, LULUCF credits and debits are calculated only for reporting purposes and are not taken into account in measuring compliance with the EU 2020 targets in the EU ETS and the Effort Sharing Decision.

When distributing the overall EU reduction target to individual Member States, there are strong reasons in favour of keeping the current "*no debit*" approach, whereby each Member State maintains the obligation to ensure that its LULUCF sector is not in debit:

– During the stakeholder consultation and at expert meetings, many Member States signalled a preference of avoiding a complicated target-setting exercise for LULUCF;

– As Member States must comply with *no debit* targets during the second commitment period of the Kyoto Protocol, it would contravene the principle of "no backsliding" to opt for a collective level target in the post-2020 period;

– For all options that involve flexibility, LULUCF accounts per Member State can only be calculated using individual Member State LULUCF targets;

– Intra-LULUCF trading flexibility already permits the re-distribution of effort between Member States; a target-setting exercise would to some extent duplicate this.

In conclusion, the "*no debit*" approach is retained both for the overall EU target and the individual MS targets. This maintains the same ambition level of the "at least -40%" target, under the conditions as applied today under the Kyoto Protocol.

1.3.1.5. No use of LULUCF credits for compliance under ESD

In the baseline scenario, the use of the accounted LULUCF sink, or "flexibility" in the context of this impact assessment, refers only to the possible exchange of removal units within the LULUCF pillar. The baseline scenario assumes that no flexibility (or use) of LULUCF credits is permitted in the Climate and Energy Framework, as is the case for the current 2020 package.

Should intra-LULUCF flexibility not be sufficient to comply with the "*no-debit rule*", Member States can use ESD credits to compensate for inadequate mitigation in the LULUCF sector.[21] In

[20] DK, PT, ES (croplands only); other Member States (UK, DE, IE, IT) may include non-mandatory activities in the Initial report for the second commitment period

[21] Essentially, an ESD unit can be converted back to an assigned amount unit which then may be used for compliance under the Kyoto Protocol. See Council Decision 2015/1339 of 13 July 2015 on the conclusion, on behalf of the European Union, of the Doha Amendment to the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder; Commission Delegated

other words, current flexibility between different pillars of the EU's climate policy exists in one direction: from the ESD towards LULUCF.

1.3.1.6.Summary of existing provisions in the baseline scenario

The following legacy conditions will, as explained in the sections above, be included in the **baseline scenario**:

- Application of accounting rules applicable to the 2nd commitment period of the Kyoto Protocol
- Specifically, application of the projected reference level approach for assessing the performance of enhanced removals and emissions from forest land, including the application of the 3.5% cap on removal unit generation.
- Intra-LULUCF flexibility and trade of removal units between Member States;
- No-debit rule for the LULUCF sector; Member States must maintain their LULUCF accounts without debits at the end of the applicable compliance period;
- No use of LULUCF credits for ESD compliance.

Variants of these in terms of the options to be compared are specified in Table 5.

1.3.2. LULUCF sector not expected to improve its performance in baseline scenario

The reference scenario projects[22] that the LULUCF sector in 2030 would continue to be an important net sink in the EU-28 (see Table 2 and Figure 2).[23] Net removals would decrease slightly from about -299 Mt CO_2 in 2005 to -288 Mt CO_2 in 2030, under the assumed continuation of the current reporting and accounting regime.[24] To give some scale to this figure, this annual reported net sink from LULUCF is a little over 10% of the annual net emissions of the ESD in 2005.

While the overall LULUCF reported sink is projected to remain stable, the contribution by forest management (i.e. harvests of timber), new planting (afforestation), and conversion from forest to other land use (deforestation) does vary over time. In particular the sink related to forest management is projected to decline substantially. This is in part due to the natural cycle of forests in Europe, and in part due to increased biomass demand for energy.

Differences among Member States can be substantial. Several Member States expect forest management to become a *source* by 2020 (i.e. emitting more CO_2 than they absorb); examples are Ireland, Estonia, and Austria. By contrast, other countries project the forest management *sink* to develop positively by 2020, for example Hungary, Slovakia, Spain, Cyprus and the Czech Republic[25].

Regulation 2015/1844 of 13 July 2015 amending Regulation (EU) No 389/2013 as regards the technical implementation of the Kyoto Protocol after 2012

22 The Reference 2016 projection does include a number of existing and market driven policy effects (e.g. continued afforestation). It is consistent with that used in the ESD IA. See Annex 4 for more details.

23 See Annex 4.11 for more details.

24 Reference scenario 2016

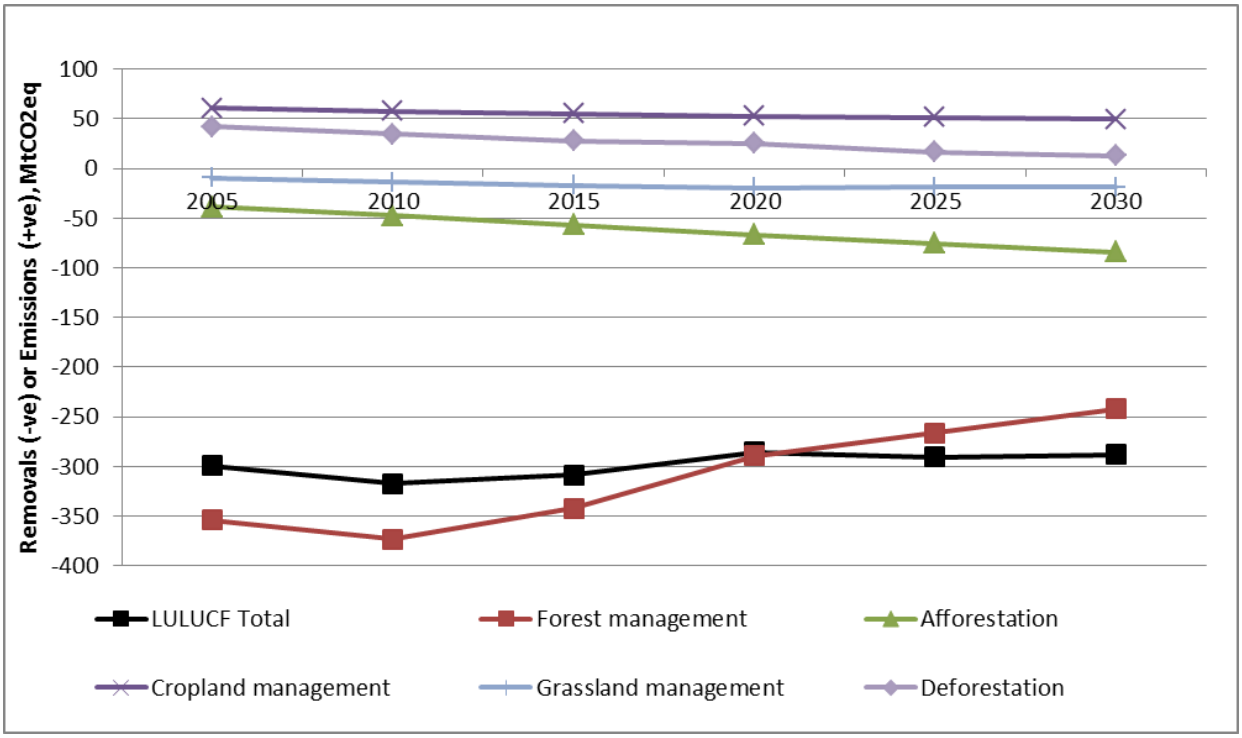
25 See Annex 6 Synthesis of Member States' LULUCF reports

In addition, the rate of afforestation reached a peak in 2009, and appears to have slowed down.[26] While the effects of earlier Afforested Land will continue to be shown in accounts for a number of decades, this positive impact is in decline.

Without additional policies, timber used in the harvested wood products pool is affected; its contribution to the sink decreases by half. The trend for decreasing deforestation is encouraging and the afforestation sink is projected to increase in the reference projection, even if future rates of new planting will decrease in most countries.

Concerning agricultural and non-forest land categories, most of the benefits expected in decreased emissions from crops result from more efficient management and (to a limited extent) the emergence of some energy crops. With more land being converted to grassland, a modest improvement in sink is also projected. The remaining emissions of wetlands and settlements are projected to remain stable and of low magnitude.

Figure 2: Projection of reported emissions (+) and removals (-) from LULUCF main activities for the EU28 2005 - 2030, in MtCO2eq



Notes: Removals (sink) and emissions (source) represented as negative and positive values, respectively
Source: EUCLIMIT Reference 2016 model projections

The impact of increased biomass demand on the EU LULUCF sink is made uncertain by different factors regarding the biomass sources. The emergence of energy crops on marginal agricultural land may perhaps not materialize, or timber demand could be higher, or the expected positive changes in certain LULUCF sub-sectors (e.g. afforestation) might not occur. In these cases, the

[26] Data on land converted to forest land, http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

overall LULUCF sink could decrease more significantly by 2030, having a negative impact on the EU's overall emissions.

In conclusion, the baseline scenario shows the complex interaction of land uses and their effects on emission and removals from the LULUCF sector. Biomass demand and supply factors create an important uncertainty in the modelling process. Existing incentives and rules for biomass may undermine the historical trend of an overall sink for the EU, potentially wasting an opportunity to underpin the EU's longer term commitment under the Paris Agreement.

1.4. Evidence of the extent of the problems, and identification of solutions

1.4.1. Need to upgrade and improve LULUCF accounting rules

Assuming a continuation of the existing Kyoto Protocol rules, the total accounted sink from LULUCF in 2021-2030 could be in the order of nearly 2000MtCO2eq over the ten-year period (see Table 1). Significant uncertainties exist for forest management in particular, as explained in Section 1.4.4.

Table 1: Estimates of potential for credit generation in three major LULUCF activities (Afforestation, Agricultural land and Forest Management) for EU28 for the period 2021-30 under existing Kyoto rules (all figures in MtCO2eq)

KP Activity:	Existing KP rules
Afforestation, Deforestation	-900
Agricultural land (cropland and grazing land)	-720
Forest management	Up to -360
Total	-1980

Notes: Removals (sink) and emissions (source) represented as negative and positive values, respectively
Source: EUCLIMIT modelling

At the same time, until the end of the Kyoto Protocol's second commitment period, Member states are required to report in parallel under two different regimes: that of the UNFCCC (where all Parties need to report emissions and removals) and the Kyoto Protocol (specifically for developed countries). This creates additional administrative burden, and renders the reporting system more complex.

In conclusion, as the Paris Agreement no longer requires reporting and accounting in technical compliance with the Kyoto Protocol, an opportunity exists to streamline reporting to the one mandatory UNFCCC approach. This would simplify the administrative and technical effort to be made both by Member States and the Commission, and remain compatible internationally with the EU's INDC.

1.4.2. Declining forest removals and increased use of biomass

Although overall LULUCF removals are projected to decrease only slightly by 2030, removals on forest land are in decline. Forest land removals are projected to decrease from -353 MtCO2eq in 2005 to approximately -242 MtCO2eq by 2030. This is a more than 30% reduction in the Forest Management sink over these 25 years. A number of interlinked reasons are behind this trend.

Table 2: Biomass demand and LULUCF emissions/removals in the Reference 2016 scenario, 2005 and 2030

	2005	**2030**
Demand biomass (Mtoe)	**86.4**	**178.3**
Of which bioenergy production (Mtoe)	85.0	152.0
Of which net imports of bioenergy (Mtoe)	1.4	26.3
Domestic production biomass feedstock (Mtoe)	**93.6**	**188.4**
of which: forestry	29.2	53.1
of which: crops	3.5	23.0
Total harvest (million m^3)	**516.3**	**564.8**
of which forest wood for energy (million m^3)	91.2	159.2
plantation wood and energy crops used for energy (million m^3)	0.0	13.5
LULUCF emissions/sink ($MtCO_2$) (emissions +ve, removals –ve)	**-299.1**	**-288.0**
Total forest land	-337.1	-321.0
of which forest management	-353.7	-242.1
of which afforestation/reforestation	-46.2	-99.0
of which deforestation	62.8	20.0
Total Cropland	61.0	49.8
Total Grassland	-9.3	-18.6
Total Wetlands	13.9	12.4
Total Settlements	28.0	20.2
Total Other land	-1.7	-1.7
Harvested Wood Products	-53.8	-29.2

Notes: Emissions and removals are absolute but remain only partially calibrated due to scope and coverage of the modelling framework
Source: EUCLIMIT Reference 2016 model projections

The decline of the forest removals is partly explained by earlier management decisions. Typically, older forests approach a steady state where gains due to growth are balanced by losses due to decay. Removal rates in mature or unmanaged forest would gradually approach zero. Although in the baseline projection carbon sequestration on afforested land increases, this is due

to the maturing of already planted trees and despite an expected decreasing trend in new planting up to 2030.

The trend of increased land-take for settlements is also a concern. This land use change is not only reducing the area available for productive land, but also reduces capacity to store carbon.[27] Trends of deforestation are projected to decline but land-take remains a major environmental issue.[28]

Another factor that could have an influence is the increasing use of biomass.[29] Forest harvests are driven mainly by demand for material wood products, even though the demand for energy increases in the Reference 2016 projection. Bioenergy is currently the biggest renewable energy source and is projected to remain so up through to 2030. Under the Renewable Energy Directive,[30] binding national targets for 2020 commit Member States to raise the share of renewable energy in their energy consumption. In 2013, biomass use for heat, power and transport represented over 60% (or 105 Mtoe) of the overall EU renewable energy consumption. Under the 2016 Reference scenario, bioenergy consumption in the EU is projected to grow by 20% between 2015 and 2020, and will stabilise or slightly grow between 2020 and 2030. Direct harvest for energy in this scenario expands to 28% (159.2Mm^3) of harvest by 2030.

Moreover, there is uncertainty to what extent biomass demand would be met through domestic sources (i.e. agriculture, forestry and waste) or imports. If more of the supply gap were met through imports, it could shift the negative impacts on the carbon sink from the EU to non-EU countries. However, the Paris Agreement contains provisions so as to make sure that corresponding international emissions from biomass harvest are to be reported and accounted towards third party nationally determined commitments.

The share of imported biomass for bioenergy is projected to increase from less than 4% of the final consumption in 2015 to about 15% in 2020, then slightly decline by 2030.

Many stakeholders, in particular environmental NGOs, have expressed concerns about increased bioenergy use and consider it an important driver of emissions. At the same time, forest or other biomass producers were of the view that current rules focus too much on maintaining the sink, thereby limiting use of wood and other biomass. Overall, many stakeholders pointed out the need to avoid an "accounting gap" in biomass use (Section 1.2.3).

In conclusion, biomass and land use change can be identified as key drivers of the LULUCF sink.

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27 In terms of emissions, up to half comes from forest lands, and a quarter each from cropland and grassland; European Union Inventory 2013, Submission 2015 v1 to UNFCCC

28 http://www.eea.europa.eu/soer-2015/europe/land

29 Study on the Wood Raw Material Supply and Demand for the EU Wood-processing Industries, Final Report, December 2013, http://ec.europa.eu/growth/sectors/raw-materials/industries/forest-based/pulp-paper/index_en.htm

30 Renewable Energy Directive (2009/28/EC): national targets will enable the EU as a whole to reach its 20% renewable energy target for 2020 – more than double the 2010 level of 9.8% – as well as a 10% share of renewable energy in the transport sector.

1.4.3. Lower mitigation potential of the agriculture sector and synergies between mitigation on land and the agriculture non-CO_2 sector

Past performance, 1990-2012

Since 1990, agriculture non-CO_2 emissions in the EU28 have declined by 24%, or in absolute terms by nearly 150 Mt CO_2eq per year.[31] Indeed by 2012, the sector's emissions amounted to 10.3 % of total emissions in the EU.[32] The largest relative reductions were reported for nine EU Member States that joined the EU in 2004 or later, headed by Bulgaria (-65%), Latvia (-59%) and Estonia (-58%). In the same period, the EU-15 Member States reduced their agricultural GHG emissions by -15%, with the biggest relative reductions reported for the Netherlands (-29%), Denmark (-23%) and Germany (-21%). This decrease demonstrates a significant de-coupling of emissions and agricultural output (Figure 3). This was achieved without specifically addressing the main actors (farmers) under direct climate legislation.

The share of agriculture emissions in national greenhouse gas ESD emissions varies considerably within the EU (Figure 4). On the basis of emissions in the period 2008-12, the share is lowest in Luxembourg (7%), Malta (8%), and the Croatia (9%) and highest in Ireland (40%), Lithuania (28%) and Denmark (27%). Member States with higher shares could be expected to need to find more mitigation in the sector to meet their future targets.

The most important source of the EU's agriculture non-CO2 emissions is nitrous oxide emissions from agricultural soil management. These represent around half of the total agriculture emissions in the EU, mainly due to the application of manure and mineral nitrogen fertilizer. Enteric fermentation emissions of methane gas make up one-third, mainly from cattle and sheep. Emissions of both gases from manure management add a further 16%.[33]

Since 1990, each of these three major sources has shown a decline in emissions of more than 20 %.[34] Figure 3 shows that maintaining agricultural output can be compatible with a reduction of emission intensities. The decrease so far can be attributed to several factors, most of all to productivity increases and a decrease in cattle numbers, as well as improvements in farm management practices.[35]

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[31] EU GHG Inventory 2014, http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2014

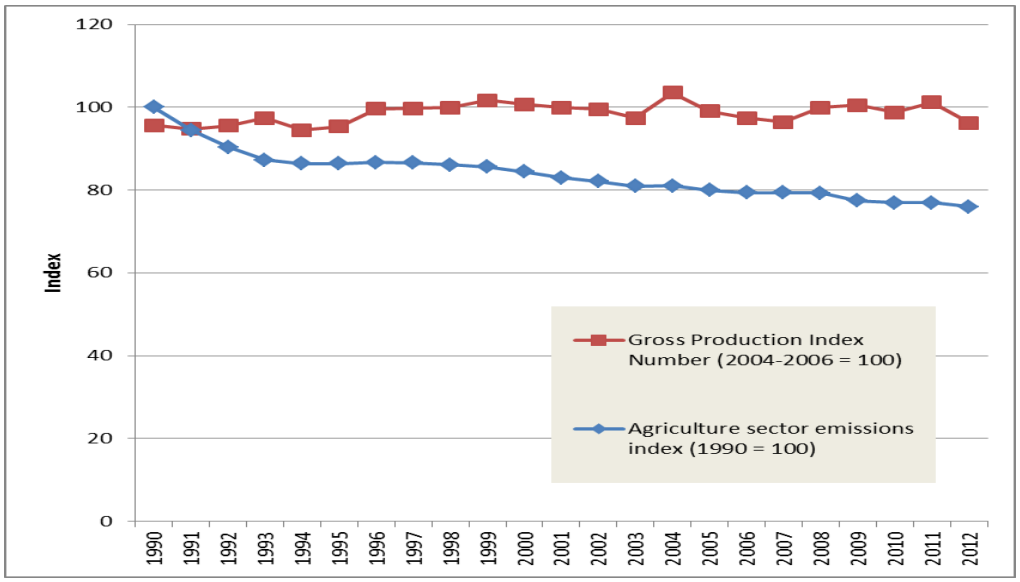
[32] EU total emissions excluding LULUCF

[33] Insert ref to EcAMPA 2 final report

[34] http://ec.europa.eu/clima/policies/g-gas/docs/kyoto_progress_2014_en.pdf.

[35] An economic assessment of GHG mitigation policy options for EU agriculture - EcAMPA -; An economic assessment of GHG mitigation policy options for EU agriculture - EcAMPA 2 - Final Report – DRAFT, February 2016

Figure 3: Non-CO_2 agricultural emissions and the volume of production in the EU28 agriculture sector, 1990-2012



Source: Compiled by European Commission, data from Eurostat and FAO

Support for climate-friendly agriculture through the Common Agricultural Policy (CAP) has significantly contributed to this "decoupling". Emission trends have been influenced by CAP measures, such as the decoupling of agricultural production from CAP subsidies since the early 2000s, and the abolishment of milk quotas. Cross-compliance under the CAP with environmental legislation will have played a significant role, such as national and EU legislation to reduce nitrogen and ammonia emissions to water and air.[36] The CAP rural development policy, for instance, supports farm modernisation in order to cut energy consumption, produce renewable energy, improve input efficiency, and thereby reduce emissions. In 2015, it is estimated that €13.6 bn of the CAP budget was climate relevant.

Despite these successes, continuing the trend of steady emission reductions from agriculture may be challenging. In most Member States the reduction path slowed down significantly between 2001 and 2012. For some countries, much of the low cost mitigation potential in agriculture non-CO_2 emissions has already been utilised. [37]

Future prospects until 2030

Agriculture non-CO_2 emissions in 2005 amounted to 446 $MtCO_2$ for the EU28. In the Reference 2016 baseline scenario, agriculture emissions are projected to decline by just 2.1% by 2020, compared to an overall 10% reduction that is required for all sectors under the ESD.

[36] 2030 Impact Assessment

[37] An economic assessment of GHG mitigation policy options for EU agriculture - EcAMPA - An economic assessment of GHG mitigation policy options for EU agriculture - EcAMPA 2 - Final Report – DRAFT, February 2016.

Regarding agricultural production, medium-term prospects show increasing production of many agricultural commodities, such as cereals, oilseed, sugar, poultry, eggs, milk and dairy products in the period 2015-2025[38]. Even so, the total utilised agricultural area is projected to decrease slightly. Similarly, a small decline in dairy cow numbers is expected, in spite of the domestic increase in dairy product supply.[39] Consistent with this, the Reference 2016 baseline scenario projects very limited reductions of emission to around –2.4% by 2030 compared to 2005. This is significantly more limited than the expected reductions of other ESD sectors, with existing measures.

Studies looking into the technical emission reduction potential show that limited opportunities for further reduction of non-CO2 emissions exist in the agricultural sector (see for instance the results of the ECAMPA study[40] in Box 1). This is, to some extent, addressed by availability of cost-efficient CO2 mitigation in the LULUCF sector, also on agricultural land. Furthermore, the importance of its role in mitigation action is dependent upon the importance of the sector, which varies considerably between Member States (Figure 4).

Hence, while the agricultural sector has a role to play in reducing emissions, the cost-efficient mitigation potential of agriculture is apparently lower than for other sectors. This has been acknowledged in the European Council Conclusions of October 2014. As the overall 2030 reduction target for the non-ETS sectors has been set at -30 %, other sectors such as buildings, transport, and waste would have to deliver relatively higher emission reductions to compensate for lower mitigation in agriculture. For Member States with agriculture sectors that dominate ESD emissions, this impact would be the even stronger.

In conclusion, there are clear synergies between mitigation on land and the agriculture non-CO_2 sector. The results of a meta-study on mitigation action on agricultural land (see Box 2) showed considerable cost-effective potential for the reduction of CO_2 emissions in agricultural land. This impact assessment will therefore look at using the increased potential of mitigation in LULUCF to address the issues of lower mitigation potential of agriculture.

38 EU Agricultural Outlook Report, Dec 2015, DG Agriculture and Rural Development

39 Prospects for EU agricultural markets and income 2014-2024, http://ec.europa.eu/agriculture/markets-and-prices/medium-term-outlook/index_en.htm

40 Final draft Report of EcAMPA 2, JRC 2016.

Figure 4: Variable share of agriculture non-CO_2 in the ESD, 2008-12.

Source: 2015 MS inventories

Box 1: Why can the Agriculture non-CO2 sector only deliver limited mitigation?

Objective: The EcAMPA study examined impacts on production, concluding that these would be relatively severe if the sector was to deliver a -20% reduction. In a scenario without explicit subsidization of mitigation technologies [HET20], supply reductions of all activities would be significant, ranging from -1.3% (poultry) to -8.9% (beef meat activities). Livestock herds reduce substantially, especially for beef production (-16.1%). In subsidized scenarios, the production impacts are more limited, although at the cost of a large budget.

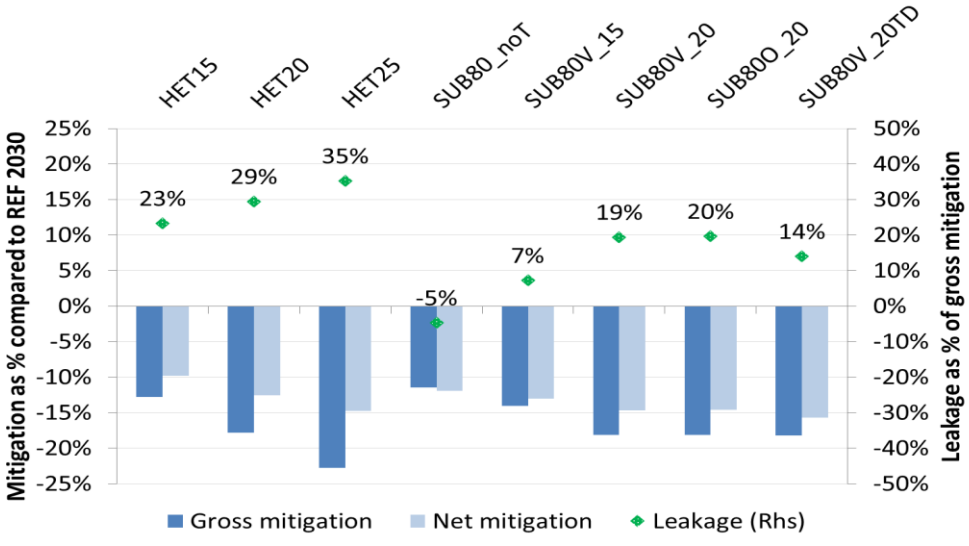
Table 3: Extract from EcAMPA [draft] final report, area and production changes for the EU-28 in 2030, all scenarios -20% reductions for agricultural non-CO2 emissions

	REF		HET20		SUB80V_20		SUB80O_20		SUB80V_20TD	
	Hectares or herd size	Supply	Hectares or herd size	Supply	Hectares or herd size	Supply	Hectares or herd size	Supply	Hectares or herd size	Supply
	1000 ha or hds	1000 t, 1000 ha	%-difference to REF							
Cereals	57,270	336,323	-4.4	-4.6	-3.1	-3.1	-3.2	-3.1	-1.9	-1.9
Oilseeds	12,040	34,137	-2.5	-2.5	-2.4	-2.4	-2.4	-2.4	-1.5	-1.7
Dairy cows	21,517	172,726	-3.4	-2.0	-3.2	0.1	-3.2	0.1	-2.7	1.0
Beef meat activities	17,985	7,822	-16.1	-8.9	-10.2	-6.0	-10.4	-6.1	-6.6	-4.1
Pig fattening	233,781	22,653	-4.0	-4.1	-0.6	-0.5	-0.7	-0.6	0.4	0.4
Sheep and Goat fattening	44,235	754	-8.8	-8.3	-7.0	-6.6	-7.2	-6.7	-5.3	-4.9
Poultry fattening	6,882	14,531	-1.2	-1.3	0.3	0.1	0.3	0.1	0.8	0.6

Note: total supply of beef includes beef from suckler cows, heifers, bulls, dairy cows and calves

When complying with a 20% emission reduction target [HET20], farmers may start adopting some technologies to dampen the effect on production. With subsidies in place (SUB80V_20 and SUB80O_20), the rate of implementation increases further, and profitability may return. According to assumptions in the study, subsidies may range from EUR 13.6 billion [SUB80V_20] to EUR15.6 billion [SUB80V_20TD], and subsidies per tonne CO_2-equivalent range between EUR 188 and EUR 215. The technologies anaerobic digestion, nitrification inhibitors, fallowing of histosols and precision farming have the largest contribution in total. The impact on displacement of production outside the EU would also be of significance. In the non-subsidised scenarios, nearly 1/3rd (29%) of mitigation achieved could be undermined by leakage. Subsidies may partially alleviate this problem, which however remains significant (14-20% of mitigation achieved). In a scenario with subsidies but no compulsory emission reduction target (SUB80V_noT), the delivery is about 13.5% of emissions' reduction compared to 2005 emissions and no displacement of production outside the EU. In this case, the necessary subsidies would be EUR 12.7 billion (EUR 278/t CO_2-eq).

Figure 5: Gross and net mitigation modelled in 2030 (% change versus EcAMPA REF 2030)



Source for Box1: *An economic assessment of GHG mitigation policy options for EU agriculture, JRC Policy and Science Report* (Pérez Domínguez et al., 2016 forthcoming)

Box 2: Meta-review study of the potential mainstreaming of climate action in the current Common Agricultural Policy (CAP) framework

Objective: The study collected existing literature and made a "meta-review" of studies and scientific articles. An expert-reviewed list of mainly CO_2 mitigation actions was assessed and information provided per action to aid understanding of their potential, geographic applicability, mode of action and implementation barriers. The study shows that **mitigation actions on agricultural land with high potential are mostly related to the actions on agricultural soils, land use management and land use change related practices, and to carbon audits.**

Of the 22 mitigation actions assessed, 11 showed significant mitigation potential (each at least 500kt CO_2eq/yr at EU level). Of these, eight were related to land use, land use change or crop production, and were focussed on carbon sequestration; two related to mitigation of N_2O emissions from fertilizer application, and one (carbon audits) is a means of identifying relevant actions at a farm business level. Two mitigation actions (zero tillage and wetland/peatland conservation/restoration) show low EU level potential, but are notable for high potential at regional level where the soil conditions show potential for action. CO_2 **mitigation actions associated with livestock systems performance generally have low potential (compared with other GHG mitigation actions).** The **CO_2 related feasible additional mitigation potential at EU level in 2030** is estimated to lie within the range of 26-56 Mt CO_2eq/yr with a **median value of 40,7 Mt CO_2eq/yr.**

The ability and limitations to account mitigation action in national inventories was also assessed. Most of the crop production and land use actions reviewed are relatively straight forward to account for as there is a physical change in the land use or activity that can be observed, recorded and reported. It is more difficult to account for **efficiency measures** or **indirect impact measures** (e.g. carbon auditing).

Cost to farmers: The evidence collected shows very low opportunity costs associated with the majority of climate mitigation actions, as many encourage efficient means of production, e.g. input use. High opportunity costs occur for measures requiring significant land use changes or high upfront capital costs. The study also points to the issue of profit margins of farming enterprises often being too small to enable cost efficient, long term investments.

Adequacy of policy tools: The CAP has an important role to play in encouraging and supporting the agricultural and forest sectors to reduce greenhouse gas emissions and increase removals. The majority of mitigation actions identified in this study, **particularly those related to the action on agricultural soils, land use management and change** can already be supported under the measures available within the CAP. Attention could be paid to how Member States choose to implement (or not) these policy tools, and how they design the detailed rules, definitions and support measures. Focus should be made on uptake of measures and targeting areas with greatest mitigation potential.

Source for Box 2: *Effective performance of tools for climate action policy - meta-review of Common Agricultural Policy (CAP) mainstreaming.* Prepared by Ricardo-AEA Ltd under contract to European Commission Specific contract number 340202/2014/688088/SER/CLIMA.A.2 implementing Framework Contract CLIMA.A.4/FRA/2011/0027

1.4.4. Absence of consistent governance framework for forest management

Under the baseline scenario, forest land would have a broadly neutral impact on the accounted sink due to the application of the projected forest reference level. However, this is sensitive to the chosen forest reference level (FRL) against which the performance of the forest management is assessed. Two hypotheses for post-2020 FRL illustrate the range of possible results. It may be expected that future forest reference levels would be between the outer boundaries (here named "strongest" or "weakest"). For this exercise, the "strongest" hypothesis assumed a continuation of current reference level values in EU legislation[41]. The "weakest" hypothesis was based on the preliminary projections used for the FRL under the period 2013-2020, aligning with a business as usual (BAU) projection.

The sensitivity analysis shows a range from -360 MtCO2 (accounted sink)[42] under lower forest harvest conditions, to +840 MtCO2 (accounted source) when a higher than business as usual (BAU) increase in harvests occurs.

Table 4: Estimated accounted sink (negative)/source (positive) for forest under KP, with different forest management scenarios and different reference levels

	Forest (Management) Reference Levels Units MtCO2 2021-2030	
Forest Land Scenario	FMRL as in LULUCF Decision (strongest)	Forest Reference Level 2021-2030 (weakest)
Higher forest harvest Low perennials available	+840	+430
Normal forest harvest, with high perennials (IA2013 Reference)	+400	+15
Lower forest harvest (-10%)	-220	-360

Notes: 1) FM 3.5% cap is applied at national level; 2) Emissions/source + (positive), Removals/sink – (negative); 3) Harvested Wood Products (HWP) not included in projections or reference
Source: EUCLIMIT and JRC modelling

The sensitivity analysis shows that the variation of the harvest levels within a range of +/- 10% leads to increases or decreases in GHG balance by some 400-600 $MtCO_2$ of the activity through the period, for each reference level hypothesis. Reporting for 2013 and 2014 already shows around a 9% lower harvest than projected for the current Kyoto commitment period, implying an improved sink of around 30 to 40$MtCO_2$ per year at EU 28 level (see Annex 5, Table 5.7). Indeed, some 80 to 100$MtCO_2$eq potential credit is being potentially being generated for the first

41 Annex II of Decision 529/2013/EU

42 This represents an impact ranging from emissions of 31% to a sink of 13.5% of the expected 2.7 Gt reductions required in the Non-ETS

two years of the period. This may point to a lack of standardisation with respect to the methodology applied, particularly with respect to policy assumptions which drive harvest levels.

As stated in Section 1.2.1 above, there will be no international process for establishing forest reference levels under the Paris Agreement. The wide range of projected sink and source outcomes for forest land in the absence of concrete values for FRLs is a major justification for today not including credits from Forest Land as part of the flexibility mechanism towards the ESD. Consequently, a neutral impact of Forest Land is assumed in this impact assessment's analysis, and flexibility approaches with the ESD discussed in this and subsequent chapters will not include direct generation of credits from this land use category.

Should the wide range of uncertainty around the projected sink and source outcomes for forest land improve, the inclusion of credits generated from Forest Land as part of the flexibility mechanism could be re-considered. In particular, if Forest Reference Levels will have been established and adopted, and an assessment has shown that they are consistent with projected harvest rates, this option could be taken into account.

It has been assumed, however, in the baseline scenario analysis that Forest Land accounting in the sector is to be applied as under today's KP rules[43]. Removal units generated by forest management could still be used by Member States to balance out their national LULUCF accounts, and for LULUCF sector trading between Member States. Any accounted source from Forest Land would need to be offset by enhanced mitigation from other LULUCF activities. Where this would not be possible, additional emission reductions from other non-ETS sectors (i.e. compliance with the *no-debit rule*) would be needed.

In conclusion, a new process to enhance and strengthen the post-2020 process for establishing reference levels for forest land will be required, given the new governance framework of the Paris Agreement[44]. More analysis on this subject is provided in Chapter 5 and Annex 5.

1.5. Who is affected?

The projected growing share of agriculture and LULUCF in the EU's emissions budget could be considered a risk if these sectors do not achieve their cost-effective mitigation potential. In such a case, other sectors (transport, buildings, waste etc.) would need to reduce even more, which would come at a higher cost. This failure could affect a wide range of players and economic sectors.

In the absence of a proper accounting framework, the zero rating for biomass use (the assumption that the combustion of biomass does not produce emissions) could result in underestimating EU emissions associated with the production of bioenergy.

While farmers and foresters are key actors in the implementation of climate action on land, the preceding discussion has shown how the EU has previously successfully protected carbon stores

[43] Including Harvested Wood Products as a forest pool, and applying a cap of 3.5%

[44] Agriculture and LULUCF in the 2030 Framework – Final Report, SPECIFIC CONTRACT No 340202/2015/715996/CLIMA.A.2

and reduced emissions without directly regulating individual actors. The agriculture sector has historically shown its ability to decouple its decarbonisation process, maintaining overall stable production while simultaneously reducing emissions at the EU28 level.

Rather than the small and medium enterprises which comprise the millions of farm and forestry holdings across the EU, the proposed Regulation is addressed at Member States and to be implemented at national level. This is consistent with this past experience. Moreover, it builds on existing legislation which already takes this approach, in particular Decision 529/2013/EU.

In conclusion, the proposal maintains this path of further integrating LULUCF into the EU's domestic climate and energy framework, rather than introducing a system change.

2. SUBSIDIARITY: WHY SHOULD THE EU ACT?

Climate change is a trans-boundary problem which cannot be solved by national or local action alone. The European Union competence to take action on climate change derives from Article 191 of the Treaty on the Functioning of the European Union. The reduction of greenhouse gas emissions and the development of renewable energy sources are among the top 10 priorities of the European Commission. As the EU addresses climate change commitments jointly, LULUCF also needs to be addressed in a coordinated manner.

The EU has adopted a common emission reduction target through its 2030 Climate and Energy Framework. The implementation of the overall policy framework and its sectoral building blocks require Union-wide legislation. The general problem analysis showing this has been done in the previous impact assessment on the 2030 Climate and Energy Framework.

Corresponding to the 2030 Climate and Energy Framework, the EU put forward an intended nationally determined contribution (INDC) under the Paris Agreement. The INDC emission reduction target is economy-wide and therefore includes emissions from agriculture and LULUCF.

This Impact Assessment and proposal is a direct response to the request of the European Council, in its 2014 October conclusions, to the European Commission to put forward policy on how to include Land Use, Land Use Change and Forestry (LULUCF) into the EU's 2030 greenhouse gas mitigation framework.

As the continuation of current Member State policies would lead to a gap of 7% compared to the necessary 2030 emission reductions of 30% in the non-ETS sectors, Member State action will remain crucial. Responsibility for progress up to 2030 will have to be shared, as is already the case in the current 2020 climate and energy package. The Effort Sharing Decision sets binding national targets, leaving it to Member States to decide how these are to be achieved, while fully respecting the principle of subsidiarity.

Similarly, the inclusion of LULUCF into the 2030 framework will provide a common framework on how the sector can be counted towards the EU's joint reduction target. The choice of action in pursuit of the various objectives related to LULUCF will be up to the Member States, thereby also fully respecting subsidiarity. The harmonised elements of such a common framework can

ensure the functioning of a single market within the EU's agricultural and forest sector, minimizing any market distortions.

The proportionality of the proposed framework is ensured by striking the balance between the multiple objectives of the area, namely: the limited mitigation potential of agriculture, the need to ensure food security, protection of biodiversity and the long term objective of enhancing sinks on land in line with the aspirational target of balancing emissions, post-2050.

3. OBJECTIVES: WHAT SHOULD BE ACHIEVED?

3.1. General objectives

The general policy objectives of the initiative are:

- Contribute to the 10 priorities of the Juncker Commission – in particular the Resilient Energy Union with a Forward-Looking Climate Change Project by consolidating the enabling environment for the transition to a low carbon economy;
- Support progress towards the EU's objective to reduce domestic GHG emissions by at least 40% by 2030 compared to 1990, and more specifically, towards the 30% GHG reduction target in non-ETS sectors compared to 2005, while maintaining the environmental integrity of the targets.
- Uphold the fairness of the overall policy framework, with respect to the social and distributional effects of the measures.
- Reflect the EU's commitment to the long term vision for limiting temperature increase as outlined in the Paris Agreement, as carbon removals will play an increasing role on the road towards 2050.

3.2. Specific objectives

The specific objectives of this proposal are to:

- Maintain, streamline and improve standardised, internationally recognised monitoring and accounting approaches, thereby addressing the lack of governance created by the end of the Kyoto Protocol;
- Determine how agriculture and LULUCF will contribute to supporting the emission reduction objectives laid down by the European Council in October 2014 for the 2030 climate and energy framework, for the non-ETS sectors, particularly with respect to the limited mitigation available in the Agriculture non-CO_2 sector;
- Ensure that there is no accounting gap relating to the use of biomass for energy in the absence of uniform international rules after the end of the Kyoto regime.

3.3. Operational objectives

The operational objectives of this proposal should:

– Take into account the specificities of the LULUCF sector, such as non-permanence, natural disturbances, legacy effects in forest management, removals related to existing land use and the need for further improvements related to monitoring and verification of emission reductions related to some LULUCF activities;

– Ensure consistency with related policies such as policies on sustainable forest management and protection of biodiversity;

– Explore the links between LULUCF and the lower mitigation potential in Member State's agriculture sectors, including in terms of flexibilities;

– Determine the least burdensome approach with respect to administrative effort for Member States, best aligned with other policies.

3.4. Consistency with other policies and the Charter for fundamental rights

A legal proposal for the inclusion of LULUCF into the 2030 EU climate and energy policy framework is a key part of the Commission framework strategy for a *resilient Energy Union with a forward looking climate change policy*, underpinning its decarbonisation dimension. In particular, the proposal is a key element needed to complete the integrated framework for climate and energy policies up to 2030 endorsed by the European Council in October 2014.

Sustainable use of biomass can – and must – make a positive contribution to reducing the EU reliance on fossil fuels, and the achievement of the EU's 2030 renewable energy targets. To that end, a robust LULUCF accounting system is required to ensure that the emissions from land use linked to the increased biomass use in the EU can be captured. This is all the more important as under KP accounting rules, biomass combustion counts as zero emissions.

Including LULUCF into the EU's 2030 climate and energy framework will be fully complementary and coherent with other related EU policy objectives, specifically:

– The EU has set the target to halt global forest cover loss by 2030 and to reduce gross tropical deforestation by at least 50% by 2020 (EU Deforestation Communication of 2008, reiterated in the 7th EAP).

– The Biodiversity Strategy emphasises the need for improved integration of biodiversity measures in forestry to support preventing the loss of species and habitats.

– The EU's Forest Strategy supports the principle of sustainable forest management throughout the Union.

– As the proposed policy primarily addresses Member States as institutional actors, it is consistent with the Charter for fundamental rights.

4. POLICY OPTIONS

Chapter 1 described the change in the international governance following the Paris Agreement, highlighting the need to develop LULUCF governance at EU level. It was recalled how the 2014

October European Council conclusions confirmed that LULUCF forms part of the non-ETS part of the overall 2030 policy package. It was also highlighted that a possible "accounting gap" could emerge if biomass use were further increased without a corresponding effect in the LULUCF accounts. In order to include LULUCF in a coherent way and to respond to the Council Conclusions the two most critical design issues that need to be assessed are:

– Choice and improvement of underlying accounting rules;

– The need and extent for flexibility towards the Agriculture sector in the ESD.

4.1. Improvement of accounting rules

The overall contribution of the LULUCF sector to the EU target in 2030 can only be measured once the accounting rules are defined. Accounts are used to determine the possible credits generated or debits incurred. The current rules of the LULUCF Decision are explained in detail in Annex 5.

These rules need to be improved with regard to three key elements were identified in consultation with key stakeholders and Member States (see Annex 2):

– choice of base year or period;

– streamlining the reporting and accounting systems and the move away from a KP-based system;

– governance of projected reference levels for forests and harvested wood products.

4.1.1. Alternative choice of base year/period

The base year used for the Kyoto Protocol is by default 1990. The level of emissions in this year is used as a reference to compare emissions or removals for major LULUCF categories (e.g. crop land) in a given accounting year. The use of a consistent base year facilitates comparability between commitments internationally[45], and avoids the selection of a reference that may artificially influence accounting results.

Current INDCs annexed to the Paris Agreement[46] use a variety of dates. In the case of land use it is usually 2005 (for example, United States, Canada).[47]

Also in contrast to the Kyoto Protocol, the EU Emissions Trading Scheme (ETS) and the ESD uniformly apply 2005 as the base year. However, the ESD applies a period average to determine the starting point of 2020 target trajectories, in order to avoid introducing random "winners and losers" through the selection of one single reporting year. A similar period approach might be suitable for the LULUCF base year.

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[45] However, 1990 is not used by a small number of Member States, who negotiated their first reduction targets in the Kyoto system outside the collective framework of EU policy. The actual base year used varies between 1985 and 1992.

[46] http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx

[47] http://unfccc.int/focus/indc_portal/items/8766.php or synthesis report http://unfccc.int/focus/indc_portal/items/9240.php

Conceptually, the use of a more recent base year or period for LULUCF accounting would provide several significant advantages:

– Alignment with the Effort Sharing Decision;

– Enhance accuracy, and reduce the uncertainty of estimates[48]. Information on agricultural land was significantly enhanced as of 2005 due to reforms in the collection of spatial data on farms under the Common Agricultural Policy[49];

– Improvement in the assessment of which mitigation action related to cropland and grazing land is truly additional, rather than historical;

– Applying a period (e.g. 2005-2007) instead of a single base year would help addressing the issue of high inter-annual variability in LULUCF, while having little overall impact on the aggregated EU accounts.

Member states and other stakeholders frequently preferred the application of periods for technical reasons stated above.

Consequently, the following two options (Options B0 – B1) will be further assessed:

- **B0:** status quo: 1990 Kyoto base year
- **B1:** Applying a base period of 2005-2007

4.1.2. Streamlining of the reporting framework – land-based accounting

A significant issue for Member States imposed by the Kyoto Protocol is the requirement to maintain two systems for showing national GHG balances from LULUCF:

– the reporting and accounting framework of LULUCF under the Kyoto Protocol (carried out by so-called "Annex 1" developed Parties that ratified the Protocol), and

– the reporting obligations under the UN Framework Convention on Climate Change (UNFCCC) (to some degree carried out by every Party).

Small, but significant differences in the approaches make the conversion to and from these two systems complex. This requires Member States to maintain two parallel systems and thereby substantially increases the administrative burden.

In essence, the UNFCCC approach requires *reports* on the current land cover categories (forest land, grassland or cropland, settlements, etc.), whereas the Kyoto Protocol reporting *and* accounting is focused on activities (e.g. forest management) or uses (of Harvested Wood Products). Streamlining would require converting Kyoto activities into equivalent UNFCCC land categories. For example, the Kyoto activity of *Forest Management* would be replaced by the UNFCCC reporting category *Forest Land remaining Forest Land*. Similarly, the Kyoto activity

[48] A major technical issue with the 1990 base year is the collection of adequate and accurate datasets, as the time series for land use change need to reach back to 20 years before the base year, i.e. to 1970.

[49] Council Regulation 1782/2003 and Commission Regulation 796/2004

Afforestation would be replaced by the UNFCCC reporting categories of *Land converted to Forest Land*.[50]

The adoption of the UNFCCC so-called "land-based" accounting approach would present several advantages:

– Reporting would be streamlined and simplified, as only one system would need to be managed by Member States and reviewed by the Commission;

– The change would be wholly consistent with the change of the base period 2005-7, thereby discounting the historical effects of land management more than 30 years before the start of the 2030 framework period;

– It would dismiss the static approach whereby land "afforested" or "deforested" under Kyoto rules continues to be categorised as such indefinitely;

– It would ensure more accurate data collection, which would be aligned to the approaches applied for land at EU level, such as LUCAS[51], the Common Agricultural Policy payment systems IACS[52], and land monitoring under the COPERNICUS programme[53];

– Forest land area under Kyoto accounts must continuously decline, as it is never replenished after deforestation. This complicates the monitoring of the sector, since the labelling of an area of land will increasingly not correspond to its current land cover, or even land use. Under a land-based approach this is avoided.

– Since few – if any – other international parties plan to continue with the Kyoto-style activity-based approach, land-based accounting would provide better comparability with third countries.

At the same time, streamlining would have an impact on the potential to generate LULUCF credits. Land use *change* categories under UNFCCC reporting transform, after a 20 year transition period[54], to their destination land category. This is in contrast to Kyoto reporting and accounting, where these areas remain labelled with the activity indefinitely. Specifically, land planted with trees (i.e. afforested) since 1990 under Kyoto remains labelled *Afforestation* even beyond 2030 and even if it undergoes harvesting, and land labelled *Deforestation* remains so even if it is replanted.

The adaptation of Kyoto Protocol rules to the "land-based" UNFCCC reporting systems has been discussed with Member States and is generally considered practicable (see Annex 2). One

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50 See Annex 5 for a full description of equivalence between land categories and KP activities.

51 European Land Use and Land Cover Survey LUCAS: http://ec.europa.eu/eurostat/statistics-explained/index.php/LUCAS_-_Land_use_and_land_cover_survey

52 Integrated Administration and Control System, IACS http://ec.europa.eu/agriculture/direct-support/iacs/index_en.htm

53 Copernicus – the European Earth Observation programme http://ec.europa.eu/growth/sectors/space/copernicus/index_en.htm

54 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Agriculture, Forestry and Other Land Use

question to explore further could be the length of period over which afforested land would be considered as such, before it moves into the forest land category.

The 20 year transition period is the default under UNFCCC reporting, and it is appropriate for accounting for land conversion in general. The application of the UNFCCC default would reduce the number of credits from historical afforestation action sharply. By the end of the Kyoto Protocol, the period actually applying to afforestation will be 30yrs (2020 – 1990). Consequently, the application of a 30-year transition period – instead of the IPCC default 20-years – could also be considered for this category[55], if appropriately justified. A 30 year period may be appropriate for certain Member States because of systematically longer rotation periods, for instance when forests continue to sequester large amounts of carbon during slower forest growth conditions.

The following three options (Options R0 – R2) are therefore assessed in Chapter 5:

- **R0** - status quo: continuation of the two concurrent systems of reporting under UNFCCC and Kyoto;
- **R1**: land-based UNFCCC reporting with 20yr transition period for Afforested Land;
- **R2**: land-based UNFCCC reporting with 30yr transition period for Afforested Land.

4.2. The need for flexibility towards agriculture in the ESD

When examining flexibility options, the problem analysis pointed to two key concerns that need to be taken into consideration:

- **The lower mitigation potential of the agriculture sector**: The 2014 October European Council established a link between the lower mitigation potential in agriculture and LULUCF, in particular afforestation.
- **Environmental integrity of the non-ETS emissions reduction target**: Allowing unlimited use of LULUCF credits in the ESD could significantly weaken incentives for emissions reductions across all ESD sectors, thereby putting the environmental credibility of the ESD as a whole at risk.

In Chapter 1, it is shown that the potential credit generation under the continuation of the Kyoto Protocol rules could be as much as 2000MtCO2eq in the period 2021-2030. In a next step, the potential credit need of agriculture's lower mitigation potential, and how to link this with LULUCF mitigation, must also be identified, and how the improved accounting rules would affect this overall amount needs to be explored.

4.2.1. First screening of flexibility options

The Communication on "A policy framework for climate and energy in the period from 2020 to 2030" and its impact assessment[56] identified three principal flexibility options:

[55] Namely that for the transition categories cropland, grass land, wetland, settlements and other land converted to forest land (CL-FL, GL-FL, WL-FL, SL-FL and OL-FL) a 30 year period could be applied instead of 20 years.

[56] COM(2014) 15, http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52014DC0015

– **A0:** self-standing pillar for LULUCF ("status quo"), i.e. with no flexibility of credits; this is the current baseline, assuming the application of Kyoto rules;

– **A1:** merge agricultural (non-CO2) emissions with those from LULUCF in a combined land sector pillar;

– **A2:** integrate LULUCF together with agricultural (non-CO2) emissions into the Effort Sharing Decision (ESD).

A first screening highlights significant risks related to an unlimited flexibility between LULUCF and Agriculture under the ESD. In particular, the following arguments speak against option A1:

– **Option A1 received the least support by the stakeholders in general**; it was the least favoured approach in each of the stakeholder groups (governments, non-governmental organisations, business and sectoral organisations). This approach would also oblige Member States to combine sectors rather than flexibility remaining optional.

– **Overall, the existing ESD delivers the intended outcomes for agriculture efficiently.** The ex-post evaluation of the Effort Sharing Decision[57] shows that individual Member States, and the EU as a whole, currently perform well against their annual emission limits under the ESD. Bearing in mind the positive result of this evaluation, changing the ESD scope (i.e. by removing agriculture non-CO_2 emissions from the ESD) could be a negative step, reducing overall policy coherence and efficiency.

– **Reduced Integration, overall**: Although Option A1 would facilitate a more integrated approach of landscape management, and could better reflect the sectors' specificities (e.g. permanence, long time-cycles, inter-annual variability, integrated action for mitigation and adaptation), it would lack the advantage of flexibility between agricultural emissions and other sectors within the overall ESD.

– **Increase in administrative burden**: The ESD was found to have resulted in limited additional administrative burden at Member State level.[58] Given the substantial structural change option A1 would entail, it would almost certainly increase administrative burden for Member State authorities.

The main arguments against retaining option A2 with broad, unlimited flexibility between the LULUCF and Agriculture non-CO2 sectors are the following;

– **Allowing *unlimited* flexibility**, in terms of LULUCF compensating for any volume of emissions by any of the ESD sectors, **is not foreseen** in the 2014 October Council conclusions. Instead, Council guidance points to the need to acknowledge the multiple objectives of agriculture and land use and ensure policy coherence, through optimisation. Stakeholders, especially governments and agriculture sector organisations also emphasized this point in a number of submissions during the stakeholder consultation.

[57] Ex-post ESD evaluation report

[58] ESD IA, Chapter 1

– **Risk of undermining the environmental ambition of the "at least -40%" reduction target**: It is also evident that there are serious concerns among stakeholders regarding the impact of LULUCF credits on the overall ambition of the ESD. It was pointed out in many submissions that unconstrained flexibility from LULUCF would risk reducing the environmental ambition of the "at least -40%" reduction target. Forestry organisations also warned of what they perceived as a risk that emissions in other sectors could be offset by measures in forestry. Finally, many environmental NGOs were strongly opposed to providing any flexibility by using LULUCF credits in the ESD, arguing that this would effectively undermine the credibility of the EU's emission reduction efforts.

– Option A2 would **increase complexity of the ESD and raise methodological issues**, including concerns related to environmental integrity and technical compliance issues, which would have to be specifically addressed (e.g. potentially large annual fluctuations in removals and emissions, or combining accounting of removals from LULUCF with emissions of other non-ETS sectors).

In conclusion, neither option A1 nor A2 seems fit for purpose. At the same time, exploring different levels of flexibility points towards a hybrid architecture, combining features from options A0 and A2. Under such an approach, **a stand-alone LULUCF policy pillar would continue to be utilised, along with a full range of flexibility to all other non-ETS sectors justified on the need derived from the agriculture sector share for each Member State in the ESD.**

4.2.2. Design of flexibility options towards ESD

Political guidance from the October 2014 European Council Conclusions clearly links flexibility from LULUCF to the lower mitigation potential of the agricultural sector. Stakeholders, in particular governments and agriculture sector organisations emphasized this link during the stakeholder consultation. At the same time it is evident that there are serious concerns among stakeholders regarding the impact of LULUCF credits on the overall ambition of the ESD. Many submissions point out that unconstrained flexibility from LULUCF could reduce the environmental ambition of the "at least -40%" reduction target. As a consequence, the maximum amount of LULUCF credits that could be used in the other non-ETS sectors should therefore be limited in function of the emission reduction effort required in the agriculture non-CO_2 sector of the ESD.

As shown in the ESD IA, the Reference Scenario points towards achieving around -16% reductions in 2020 compared to 2005 for the ESD as a whole. This is projected to continue and reach around -23% in 2030. This performance is due to the long term impacts of numerous existing policies such as transport and the Energy Performance standards for buildings, whose influence will continue to be felt in the ESD even after 2020. As shown in Figure 6, the Reference 2016 scenario projects only a modest reduction of agricultural non-CO_2 emissions to around -2.4% by 2030 compared to 2005.

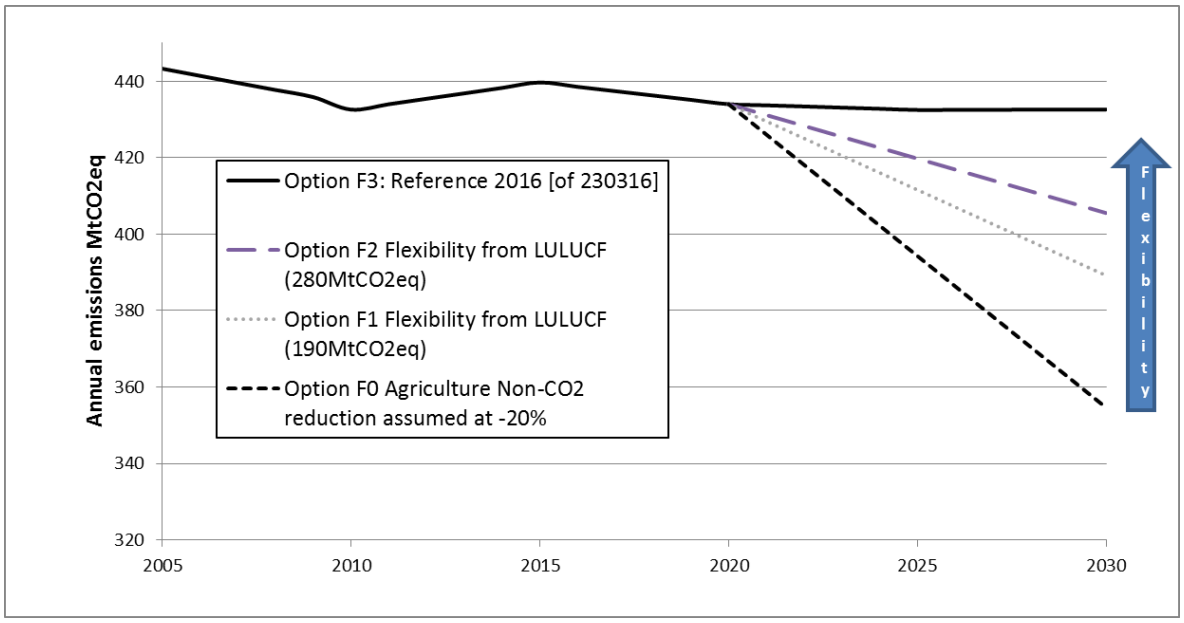
An assumed 20% reduction in the agriculture non-CO_2 greenhouse gas emissions would require an emission reduction of nearly 425 $MtCO_2eq$ between 2021 and 2030, compared to the reference projection. Such a -20% reduction of non-CO2 emissions from agriculture was examined in the

EcAMPA study, concluding that the impacts on production would be significant and substantial emission leakage could occur (see Box 1 in Chapter 1).

To adjust this effort and avoid adverse impacts on the agriculture sector, flexibility from LULUCF could be envisaged from between around half to the full level of this assumed reduction for the period. Flexibility could be determined for each Member State, in accordance with a need justified by its agriculture non-CO_2 sector. Use of flexibility by the other non-ETS sectors would be further enabled throughout the period through banking, under options F1, F2 and F3. As illustrated in Figure 6, the following four options should be analysed:

- **F0**: No flexibility ('status quo'): agricultural non-CO_2 emissions would have to be reduced by 20%; no contribution would be provided by LULUCF;
- **F1:** Low flexibility: Around half of the assumed agricultural emission reduction effort could be undertaken through reductions in the LULUCF sector, i.e. 190 Mt between 2021-2030;
- **F2**: Medium flexibility: Up to two thirds of the assumed emissions reductions could be undertaken in the LULUCF sector, i.e. 280 Mt between 2021-2030;
- **F3**: High flexibility: Emissions reductions equivalent to a reduction of non-CO2 agricultural emissions by -20% could be undertaken in the LULUCF sector, i.e. 425 Mt between 2021-2030.

Figure 6: Four options of trajectories for Agriculture non-CO2 reduction between 2020 and 2030 without and with flexibility (F3 follows the trajectory of Reference 2016)



Source: own presentation

4.2.3. Options for credit generation in LULUCF and technical conditions

Various options exist regarding the range of activities[59] that could be used to generate credits and deliver flexibility. The possible eligible activities, the following could be considered: are:

– Net balance of **afforested and deforested land**: greenhouse gas fluxes from the direct human-induced conversion of land through planting, seeding, etc.

– Net balance of **agricultural land**: emissions and removals resulting from the management of cropland and grassland, and the associated land use change to and from other land uses.

Credit generation from **forest management** for compliance under the ESD has been excluded because of the high level of uncertainty and the range of variability, as explained in section 1.

Moreover, environmental integrity always needs to be kept in mind when considering options allowing the enhanced use of flexibility. Mitigation activities in LULUCF should result in additional, measurable and sustainable enhancement of carbon sinks.

Accuracy should be enhanced through a continuous process, and assured through two minimum technical conditions. As a safeguard for compliance, LULUCF sector credit generation should only be permitted:

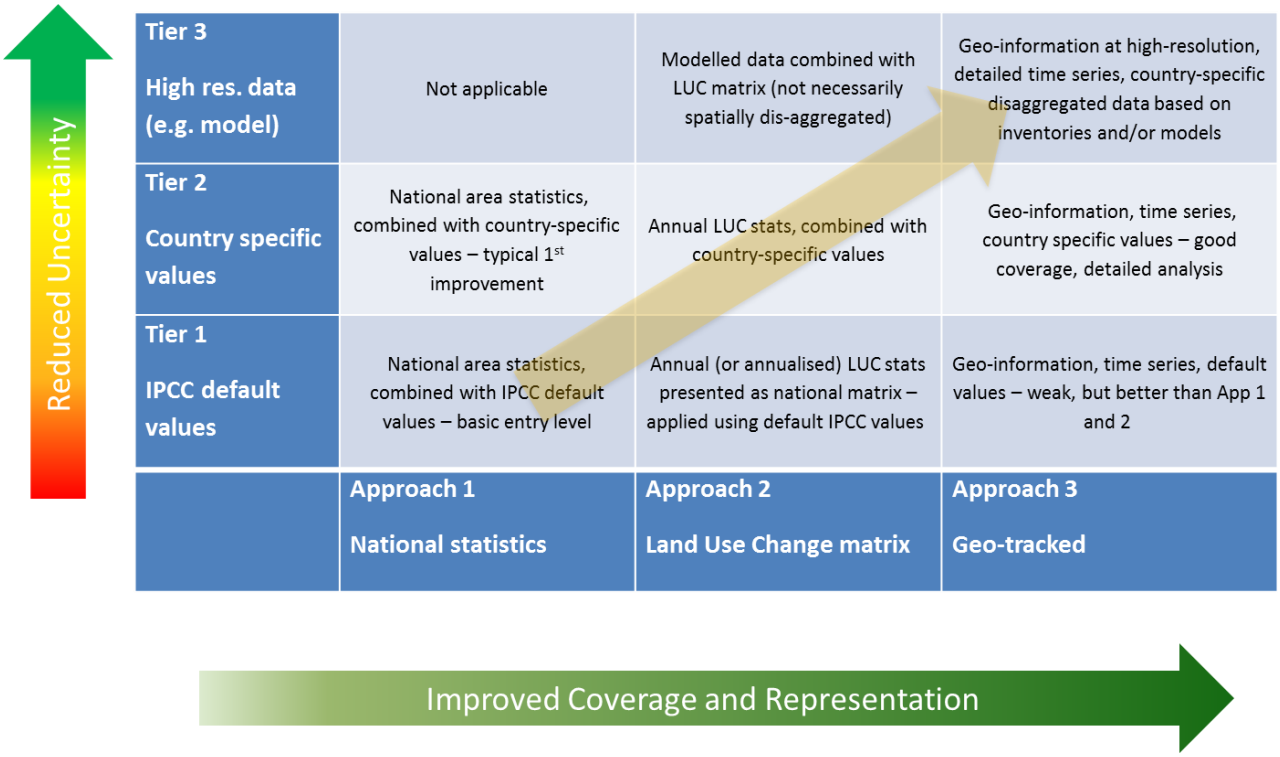
(1) When a Member State's total LULUCF account produces enhanced mitigation, i.e. it has an overall balance with more potential credits than debits, and

(2) In Member States where monitoring and reporting meet the technical conditions laid down by EU legislation (see Chapter 7.2) and the Paris Agreement[60].

[59] For all activities, see Iversen P., Lee D., and Rocha M., (2014) Understanding Land Use in the UNFCCC.

[60] FCCC/CP/2015/L.9/Rev.1, Paris Agreement, Art 4

Figure 7: Improving accuracy and coverage in the LULUCF sector in accordance with IPCC guidance



Source: own presentation

Principles for these conditions may include:

– Monitoring, reporting and accounting should provide transparent and full coverage of significant sinks and sources; removals may only be accounted for after a complete, comparable and consistent coverage of land categories.

– The adoption of international accounting rules as applicable to EU Parties, in accordance with guidance adopted by the Conference of the Parties;

– The parameters chosen to apply these accounting approaches, such as base years, business as usual projections, and the data needed to determine these parameters, are determined in accordance with IPCC guidance for higher level tiers and approaches (e.g. Tier 2 and above) as illustrated in Figure 7;

– The adoption of applicable best practice solutions, to enhance accuracy and environmental integrity of accounts, developed under the LULUCF Decision and agreed between Member States in technical guidance.

4.3. Forest land: Future governance of the projected forest reference levels

As explained in Chapter 1.2.1, the international framework governing climate mitigation policies from 2021 to 2030 will not be the same as under the Kyoto Protocol. This will also apply for the treatment of emissions and removals from LULUCF in general and the criteria for the determination of projected forest reference levels in particular. The latter will be of critical importance for sound forest and biomass GHG accounting.

Alternatives to the projected forest reference level approach have been considered – and applied – in the past[61]. In the first commitment period, the reference level was set at zero; in other words, parties could account for the actual reported net emissions (or removals) in each year of the commitment period without comparing it with a base year (so called *gross-net accounting*). Nevertheless, this approach was subject to much criticism; during the preparation of the Durban COP Decision, there was general agreement on the need for improvement. To address this, an alternative approach was discussed where the annual level of net emissions (or removals) is compared to the historical reference (so-called net-net accounting). This was finally rejected in favour of the *projected reference level*, combined with a cap (Box3), representing a compromise solution between gross-net and net-net accounting. Based on these considerations and the feedback in the stakeholder consultation, there is a strong rationale for continuing this approach in the post-2020 period, while improving transparency and comparability across Member States' FRL.

In view of determining forest management reference levels for the period between 2021 and 2030, two elements are relevant:

– the criteria upon which projected forest reference levels would be based, and

Box 3: Cap on the use of Forest for generating credits:

Under the Kyoto Protocol rules a cap is used in LULUCF accounts to limit the use of potential credits from forest management by a Party. The role of the cap is to limit uncertainty associated with the projections which underpin forest management reference levels[62], and to underpin environmental integrity of the accounts. Forest Management removal units used to balance emissions from other LULUCF activities are only allowed up to a maximum of 3.5% of a Party's 1990 total emissions (without LULUCF) (see Annex 5).

The actual impact of this cap on forest accounting depends on how far the reported forest (and Harvested Wood Product) sink would deviate from the projected forest reference level. If the forest reference level was close to the final reported value, the cap would only have marginal impacts on overall accounting results. But if the reported sink is much greater than the projected reference level, the cap has a strong effect of limiting credits and distorting incentives. However, modifying the cap values or adopting other approaches is difficult without first establishing the projected reference level; additional complications with any changes may outweigh potential short term benefits (see Annex 5).

– the governance mode for the setting of forest reference levels.

The criteria for the setting of projected forest management (and HWP) reference levels for the second commitment period of the Kyoto Protocol have already been the basis for determining today's domestic legislation[63]. In essence, and irrespective of the governance approach, the criteria for setting FRL would remain the same as under current rules (see Annex 5), and will

[61] See for example LULUCF decision Impact Assessment where options were evaluated

[62] SWD(2012) 41 final

[63] See Annex 5/section 1 for the description of the criteria and EC Decision 529/2013/EC

address the following points regarding Member States' reference levels and the assumptions used for setting them:

– consistency with the goal of achieving a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century as defined in the Paris Agreement Article 4.1;

– reflect on how to treat: forest management practices before the start of the accounting period, assumptions on the future impact of policies and markets, and projected harvest rates with existing infrastructures, current technical capacity and economic viability;

Clarifying the role of policy assumptions in the establishment of FRL and by adding the long-term goal defined in Paris, would have several benefits for forest land accounting:

– it would help avoiding the generation of "business-as-usual" removal units from forest management, which, based on the early evidence from the second commitment period, is a likely result if loose assumptions on future policy and market impacts are factored in the FRL;

– it would appropriately reflect – and balance – the biogenic emissions of the zero-rated energy feedstock in the full, economy wide accounts;

– it would take national characteristics into account, including national policies preceding the cut-off date (31/12/2009) determined in current international rules, for sustainable forest management, and ensure the establishment of FRL that would nor create undue "business-as-usual" removal units nor undue debits in case of good forestry practices based on sustainability principles.

In terms of possible sink and source scenarios, appropriately established FRLs would likely result in the accounted sink being in between the "strongest" and the "weakest" FMRL scenario described in Table 2. In a model case, it would generate close to zero removal units/debits in the absence of significant change in the forest harvest practices (unless such change is justified by the age-class structure and other national forest characteristics).

The Kyoto Protocol governance for the setting and review of forest reference levels, however, will discontinue and therefore a new system has to be specified in the legal proposal. Most Member States, as well as other stakeholders, call for the review of the governance process and support the further standardisation of methodologies and enhanced consistency of implementation. The following governance **options for determining forest reference levels post 2020** (Options G0 – G2) have therefore been reviewed and their impact will be assessed in Chapter 5:

- **G0** - Status quo: An independent body shall check compliance of the forest reference levels submitted by Member States with existing UNFCCC/IPCC guidance (i.e. technical assessment).

- **G1**: The Commission, with the support from experts from Member States, shall check and review that forest reference levels 2021-2030 submitted by Member States are in line with EU guidance on the methodology for forest reference levels.

- **G2**: The Commission shall check and review that forest reference levels 2021-2030 submitted by Member States are in line with EU guidance on the methodology for forest reference levels.

4.4. Summary of options

Table 5: Overview of options considered in this Impact Assessment

	Status quo	**Options**		
Accounting Rules				
Base year for agricultural land	**B0:** 1990 Kyoto base year	**B1:** Applying a base period of 2005-2007	---	---
Reporting framework	**R0**: continue two systems - UNFCCC and Kyoto	**R1**: land-based UNFCCC reporting with 20yr transition for Afforested Land	**R2**: land-based UNFCCC reporting with 30yr transition for Afforested Land	---
Governance of forest reference levels	**G0**: An independent body	**G1:** The Commission, with support from MS	**G2:** The Commission checks and reviews	---
Link with ESD				
Flexibility	**F0**: No flexibility	**F1:** Low flexibility, 190Mt between 2021-2030	**F2**: Medium flexibility, 280Mt between 2021-2030	**F3:** High flexibility, 425Mt between 2021-2030

5. WHAT ARE THE IMPACTS OF THE DIFFERENT POLICY OPTIONS AND WHO WILL BE AFFECTED?

5.1. Introduction

This chapter presents an analysis of the impacts related to the options selected in Chapter 4, in line with the specific objectives of this proposal as outlined in section 3.2:

– **Environmental impacts** will be evaluated in terms of the extent to which the options will enhance the existing LULUCF sink, ensure overall environmental integrity of the EU climate framework, and the long-term stability of carbon pools (forests, soils);

– **Economic impacts** will be assessed with respect to the impact of different flexibility options on production volume and mitigation costs of mitigation options available in the Member States;

– **Social impacts** will be reviewed in light of employment and the impacts of extra burden for the SMEs (specifically farms and forest holdings).

5.2. Modelling framework

The quantitative assessment presented here has been undertaken using the multi-component economic modelling framework EuCLIMIT, utilised for the entire non-ETS sector[64]. No single model exists that would combine agricultural commodity markets, agricultural land, forestry and the energy sector together with associated greenhouse gas cycles. Instead a cascade of models has been applied (Figure 8):

– Population projections, GDP and the continuation of current policies are included in the reference scenario, simulated with PRIMES.

– Links between greenhouse gas targets and agricultural commodity markets are assessed using CAPRI.

– The sector effects related to forestry measures are assessed with GLOBIOM.

– The potential credit generation from modelled emissions and removals for different LULUCF activities are assessed through a LULUCF accounting tool implementing the alternative accounting rules outlined in chapter 4.

5.3. Sensitivity analysis is carried out to demonstrate robustness of the modelling tools. Improving LULUCF accounting rules

5.3.1. Impact of the alternative choice of base year/period

As outlined in section 4.1.1, the default base year under the Kyoto Protocol is 1990. Updating the reference against which emissions and removals from agricultural (and other) land will be assessed will change the amount of removal units (internal to the LULUCF accounts) and consequently the credits (or debits) that could be generated and used for flexibility.

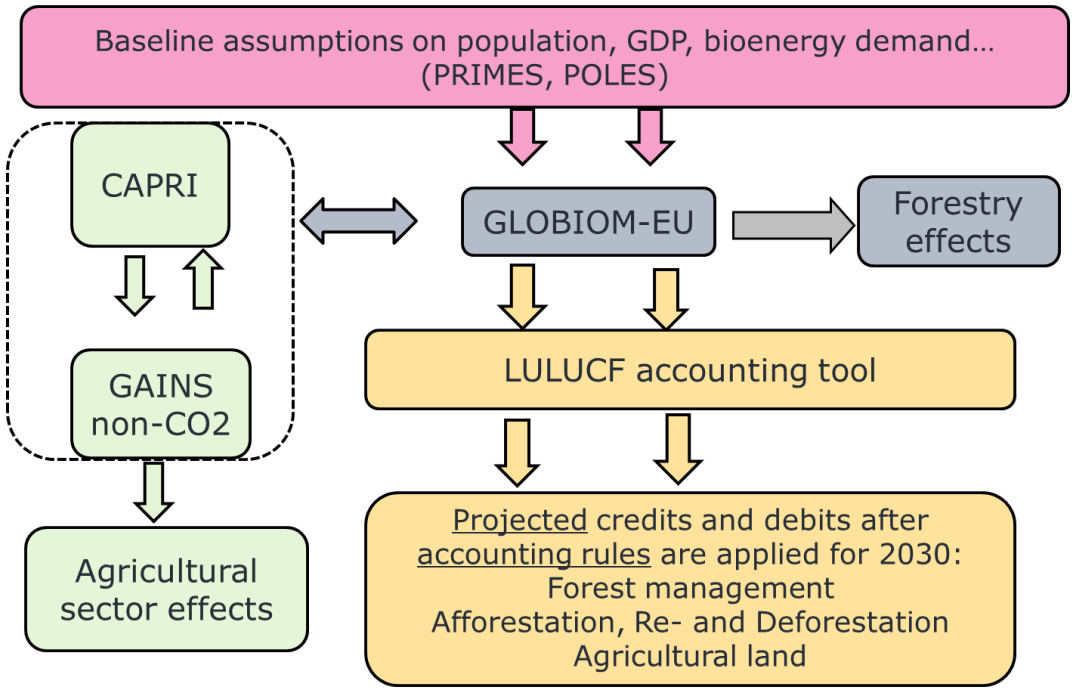
[64] Full details of the framework can be found in Annex xx of the ESD Impact Assessment, and Annex 4 of this IA.

Table 6: Impact of the base year change on the potentially available LULUCF RMUs for the EU28 from agricultural land, 2021-2030, including additional mitigation enhanced at a carbon price of €20/tonne, in MtCO2, negative value is credits

Activity	Option B0 Status quo 1990	Option B1 Base year: Avg. 2005-07
Agricultural land	-645	-437

Source: EUCLIMIT modelling

Figure 8: Overview of EUCLIMIT modelling components used for the assessment of impacts related to agriculture and LULUCF



Source: own presentation

Table 6 shows the potential number of removal units (RMUs) under the two base year options B0 (status quo, 1990) and B1 (base period 2005-2007). A carbon price similar to that applied to other ESD sectors (i.e. €20/tonne)[65] – in particular the optimal value when flexibility is available for the Agriculture non-CO_2 sector – has been used in the projection to determine the projected mitigation beyond reference on Afforested, Deforested and Agricultural land. Changing the base year to a more recent period will increase the accuracy of the estimates due to the more recent datasets used to compute the net emissions and removals. It will also reduce the EU28 potential

[65] As will be seen below, €20/tonne has been chosen since it is the optimal value when compared to the modelled marginal abatement costs for mitigation in the agriculture non-CO_2 sector.

availability of RMUs from agricultural land (i.e. cropland and grassland) from 645 MtCO2 to 437 MtCO2 for the period 2021-2030, helping determine more precisely the additional effort occurring in the period 2021-2030. Both considerations are important with respect to the environmental integrity of the accounting. Lastly, the overall amount in both options still exceeds the highest option of required flexibility of 425 Mt (Option F3) that will be considered.

Table 7: Impact of base year/period change on the potential credit generation (removal units) for agricultural land, in $MtCO_2eq$ per year (negative numbers represent removals, positive numbers emissions)

Member State	Projected RMU generation, B0 Status quo 1990	Projected RMU generation, B1 Base year: 2005-07
AT	0,2	0,0
BE	-0,7	0,5
BG	-0,7	-1,4
HR	0,0	0,0
CY	-1,1	-0,8
CZ	-3,8	-2,7
DK	-1,5	-1,2
EE	-0,3	0,7
FI	-3,7	-1,8
FR	0,8	0,1
DE	-3,3	-4,9
EL	-0,9	-1,0
HU	0,1	0,7
IE	-1,8	-0,7
IT	0,5	1,4
LV	-6,9	-3,0
LT	-3,1	2,0
LU	0,0	0,0
MT	-1,1	-0,4
NL	0,0	0,0
PL	-0,9	-0,3
PT	-3,7	-2,4
RO	-4,2	-0,4
SK	-0,3	-0,4
SI	0,4	-2,8
ES	-0,2	0,0
SE	0,2	0,1
UK	-3,4	-0,2
EU28	**-39,5**	**-18,7**

Source: 2015 Member State inventories, EUCLIMIT modelling

The impacts on individual Member States may be more substantial and have some distributional effects. Table 7 shows the distributional effect per Member State per year of the base year change, in relation to the projected potential LULUCF accounts in 2030. While most Member States would see minor differences in relation to their accounts, SE, FR, BG, would benefit the most from the adoption of option B1 (base period 2005-7). The most significant reductions following this option in potential for credit generation would be in LT, IT, PT, UK and ES.[66]

In conclusion: The overall application of a more recent base period would allow for a clear, accurate and robust assessment of the additionality of potential credits, enhancing environmental integrity of the accounts. **For the purposes of estimating potential credits for the period 2021 – 2030 (presented in the section 5.3.3 and the following chapters), option B1 (base period 2005-2007) will be used as a base period**.

5.3.2. Impacts of streamlining the reporting framework

As outlined in sections 1.3.1.1, the streamlining of the current dual reporting framework (UNFCCC and Kyoto Protocol) to the one mandatory in the post KP period (UNFCCC) would be a substantial simplification for Member States and the Commission.

With respect to EU28 greenhouse gas accounting results for Agricultural Land, the move to the land-based reporting for accounts (Option R1) will have no significant effect. This applies indeed to all KP activities that are accounted using a comparison to a reference year or level[67], known as the *net-net* accounting approach[68].

Even though the KP *Deforestation* activity foresees a temporal integration over several years in the accounting of emissions, this is not substantially affected by the use of the transitional period under UNFCCC land categories. No impact is identified for the rule transposition of this category, and emissions from Deforested Land over the period 2021-2030 are projected at 277MtCO_2eq.

For Afforested Land, the main difference is that instead of an indefinite period as under the KP *Afforestation* activity (R0), a transition period of 20 (option R1) or 30 years has been utilised (option R2). As shown in Table 8, Option R1 reduces potential credits sharply, by 464Mt over the full period. Option R2 reduces potential credits by 171 Mt, or around one-fifth for the period 2021-30. In both options the remaining amount of credits still exceeds the total amount of credits required for the high flexibility option (F3).

[66] Though it may appear as a disadvantage for these 5 MS, Table 6 clearly shows that in spite of the reduction of potential under Option B1, each of the 5 MS would still be able to reach its full credit generation potential within the cap under all 3 flexibility options. The only exception is the UK under Option F3.

[67] In essence all land categories except transitions to (afforestation) and from (deforestation) forest land, under current transposition of Kyoto Protocol rules.

[68] See Annex 5 for more details.

Table 8: Impact of streamlining framework different accounting rules on credit generation potential for Afforested Land (RMUs in $MtCO_2eq$) EU28 2021-2030 including additional mitigation enhanced at a carbon price of €20/tonne, negative value is credits

Activity	Option R0 Status quo	Option R1: Only land-based UNFCCC, 20yr	Option R1: Only land-based UNFCCC, 30yr
Afforested land	-901	-437	-730

Source: 2015 UNFCCC Inventory data and EUCLIMIT projections

The aggregate impact on EU28 level under the "Option R2, 30yr transition" variant would be approximately 20% reduction in RMU generation potential. Looking at individual MS impacts, it appears that nine Member States (BG, CY, DK, LU, MT, NL, PL, HR, SE) would slightly increase their RMU generation potential. Seven Member States would experience proportionate impact, i.e. a reduction of RMU generation potential in the range of 20% or less: AT, CZ, DE, FR, HU, IT, LT.

Twelve Member States would be expected to experience more than 20% reduction in their RMU generation potential. Four of them (EE, ES, EL, SK) would see a change above 33%, i.e. losing one-third or more of the potential. Eight others (BE, FI, IE, LU, RO, SI, UK) would be affected within a range of 20-33%.

On the other hand, the potential of Member States to generate credits (RMUs) under the cap applied for credits from forest management (Box 3) would hardly be affected: Table 10 shows that EE, ES, EL and SK could achieve their maximum credit generation potential under all options at low costs (20€/tonne CO_2 eq). The same is true for PT, SI, RO and FI; the UK would achieve its maximum potential under both F1 and F2. The only cases with a difference are LU, IE and BE.

In conclusion, using a land-based UNFCCC accounting approach and applying a 30 year moving window for Afforested Land (Option R2) could potentially deliver credits of 730MtCO2 from this LULUCF activity for the 2021 to 2030 period. Almost all Member States are expected to generate credits based on the currently projected afforestation rates. The credit generation potential from afforestation could further increase with additional support measures. For the purposes of calculations presented in the section 5.3.3 and the following chapters, **the accounting methodology based on the UNFCCC land categories will be used**.

Table 9: Impact of streamlining the framework different accounting rules on Member States' credit generation potential for Afforested Land (RMUs in MtCO2eq), 2021-2030 per Member State, negative numbers represent removals, positive numbers emissions including additional mitigation enhanced at a carbon price of €20/tonne

Member State	Option R0, KP 1990	Option R1, 20yr transition	Option R2, 30yr transition	Change R0 to R2, MtCO2
AT	-26	-13	-21	-4,7
BE	-4	-2	-3	-0,9
BG	-19	-16	-19	0,1
CY	0	0	0	0,0
CZ	-7	-4	-6	-0,8
DE	-75	-33	-60	-14,6
DK	-7	-6	-7	0,1
EE	-8	-2	-5	-2,8
ES	-88	-19	-53	-34,9
FI	-9	-3	-6	-2,6
FR	-139	-77	-122	-17,3
GR	-2	0	-1	-0,7
HR	-5	-3	-4	-0,3
HU	-28	-16	-25	-3,0
IE	-32	-11	-21	-10,3
IT	-135	-74	-115	-20,0
LT	-14	-8	-12	-2,2
LU	-2	-1	-1	-0,6
LV	-12	-12	-14	2,0
MT	0	0	0	0,0
NL	-6	-4	-6	-0,6
PL	-66	-50	-68	2,1
PT	-70	-18	-47	-23,4
RO	-63	-25	-46	-16,7
SE	-27	-20	-26	-0,6
SK	-7	-2	-5	-2,4
SI	-12	-4	-8	-3,7
UK	-40	-13	-29	-11,9
EU28	**-901**	**-437**	**-730**	**-170,8**

Source: 2015 UNFCCC Inventory data and EUCLIMIT projections

5.3.3. Impact of improved rules: Estimates of the credit generation for afforestation and agricultural land

The accounting rule changes for agricultural land and afforestation would have an aggregate effect on the overall credit generation potential from LULUCF. This needs to be compared to the existing rules under the Kyoto Protocol (status quo). In the case of the continuation of *current* Kyoto rules, the accounted credits (RMUs) for the two land categories in LULUCF in 2021-2030 could reach up to nearly 1300 MtCO2eq over the ten-year period.

The total RMUs available for credit generation applying the alternative rules (Options B1, R1) outlined above (Table 10) would be slightly below 900 MtCO2eq for 2021-2030. Potential credits at this level would still be more than twice the maximum flexibility of 425 MtCO2eq to be considered under the high Flexibility Option F3.

Importantly, these rule changes would enhance the environmental integrity of the LULUCF credits generated, because they would diminish the legacy of historic action and improve the accuracy of accounting. In practice, much of this land use change policy (such as afforestation) and the corresponding investment will have to be driven by a clear and deliberate policy support from Member States. Much will depend on the commitment of Member States to deliver additional measures and programmes, in support of mitigation action related to afforestation and agricultural land.

Table 10: Estimates of total potential credit generation (for RMU's) EU28 for the period 2021-30, under existing Kyoto rules and alternative rules (30 year transition for afforestation, base period 2005-2007 for agricultural land), in $MtCO_2eq$

Action/Activity:	Existing KP rules	Alternative rules B1, R1
Afforested Land (net)	-623	-452
Agricultural land	-645	-437
Total	-1268	-889

Notes: Afforested land is shown net of projected deforestation. Agricultural land mitigation is shown net of enhanced mitigation potential at a carbon price of €20/tonne. Totals **are net of possible debits** within the Agricultural land and Afforested land categories.
Source: EUCLIMIT Ref 2016 modelling.

For illustration, Table 11 below shows the projected LULUCF credit generation potential (for RMUs) from Afforestation and Agricultural land per Member State, for the years 2020, 2025, 2030 and the total period, at a cost of €20 per tonne of CO_2. According to the projection, the possibility to generate RMUs would be broadly constant in the EU across the period at around 94-96$MtCO_2$/yr, or some 959$MtCO_2$ over the entire period. However, there are differences between Member States. Some show the potential as increasing over time while others see it decreasing.

Table 11: Projected credit* generation potential (for RMUs) for Afforestation and Agricultural land per Member State in 2020, 2025, 2030, and total 2021-2030, including additional mitigation enhanced at a carbon price of €20/tonne, in MtCO2.

	Potential credits (for RMUs) from afforestation and agricultural land at €20/tonne enhancement, MtCO2/yr				Proportion of 2008-12 agriculture Non-CO2 emissions
	2020	2025	2030	Total period 2021-2030	
AT	-2,2	-2,1	-2,0	-21	31%
BE	-0,3	-0,3	-0,2	-3	3%
BG	-3,2	-3,3	-3,4	-33	60%
HR	-0,2	-0,4	-0,6	-4	14%
CY	0,0	0,0	0,0	0	0%
CZ	-1,6	-1,8	-2,0	-18	25%
DK	-1,0	-1,1	-1,1	-11	11%
EE	-0,7	-0,6	-0,5	-6	52%
FI	-	-	-0,3	-1	1%
FR	-9,5	-12,0	-14,6	-120	15%
DE	-9,2	-9,6	-9,6	-95	16%
EL	-1,3	-1,1	-0,8	-11	12%
HU	-3,7	-3,9	-4,2	-39	67%
IE	-3,0	-2,5	-2,0	-25	14%
IT	-15,6	-14,5	-13,1	-144	46%
LV	-	-1,4	-3,2	-15	71%
LT	-2,3	-2,3	-2,4	-23	52%
LU	-	-	-	0	0%
MT	-	-	-	0	0%
NL	-0,8	-1,4	-1,9	-14	8%
PL	-8,3	-10,7	-12,9	-107	36%
PT	-7,0	-5,5	-3,8	-55	77%
RO	-8,8	-9,1	-8,4	-89	49%
SK	-1,0	-0,8	-0,7	-8	25%
SI	-1,3	-1,1	-0,9	-11	65%
ES	-9,5	-6,6	-3,3	-65	16%
SE	-1,3	-2,3	-3,0	-22	33%
UK	-2,6	-2,0	-1,3	-19	4%
EU-28	-94,5	-96,5	-96,1	-959	22%

Source: EUCLIMIT modelling. * Potential credit values are net following the application of the no debit rule, and assuming a neutral impact of managed forest land accounting.

Applying these improved rules for afforestation and agricultural land and assuming low mitigation costs on agricultural land (20€/t CO_2 eq.) most Member States would deliver significant credits (without Forest Management) after having ensured that their LULUCF accounts would be a sink. Only a few Member States (LV, FI, LU, MT) would have to implement additional mitigation action (beyond BAU) if they wish to deliver flexibility potential

in the LULUCF sector. This could be through a reduction of deforestation rates which are still projected to be high for instance in LV and FI in the early part of the period, increased afforestation rates, developing forest management sink to offset deforestation, increasing the HWP pool, or additional measures related to enhancing the sink for agricultural land.

In conclusion: While the overall distribution is varied, the projections overall show a positive picture for the EU with respect to the strong potential to deliver cost-effective enhanced mitigation in the LULUCF sector, through afforestation and agricultural land management.

5.4. Forest Land estimates: governance

As described in section 1, credit generation from forest management and HWP for compliance under the ESD has been excluded because of the high level of uncertainty, the lack of agreed reference levels and the range of variability. Nevertheless, the accounting of forest activities is crucial for the successful implementation of policy and a new system of governance has to be specified in the legal proposal (Section 4.3).

Forest reference levels have been identified as the best approach to account for emissions and removals from EU forests and harvested wood products. In order to ensure environmental integrity it will be decisive that common criteria for the setting of reference levels are applied by Member States in a coherent and comparable way. Sensitivity analysis in presented in Section 1.4.4. and Annex 5 shows that already today a substantial difference between methodology applied – in particular harvesting rates around 10% lower than that modelled in accordance with policy assumptions – may lead to an overestimate of the projected sink by 300 to 350MtCO_2 in the period 2021-2030, if current trends continue. Correctly incorporating domestic policies in accordance with Kyoto Protocol guidance, namely the limitation of policies to those in force pre-2010, would help in reducing this divergence between projection and implementation.

An improved governance procedure, implementing current rules in a standardised manner, will also be necessary for the review and adoption of nationally determined reference levels. This process should respect the existing conditions already applied by Member States under Kyoto Protocol guidance, in particular with respect to the impact of policy assumptions.

The starting point for the assessment is to maintain the current **status quo (Option G0)**. Under Kyoto Protocol rules, an independent body has to check compliance of the forest reference levels with the 2013 Kyoto Protocol Supplement, and relevant CMP decisions (2.CMP/6, 2.CMP/7). In practice the UNFCCC secretariat composes expert teams from parties who carry out a technical assessment of the submitted reference levels. However, in the absence of internationally agreed rules for LULUCF for the post 2020 period this option does not exist and **can therefore be discarded**.

A second governance option **(Option G1)** would be to set up a joint and independent review body. In such an EU body the Commission could be supported by experts from Member States. They would have to assess jointly whether or not the Member State reference levels comply with the common criteria, and possibly adjust them. This governance option would ensure that LULUCF experts from Member States participate in the review of nationally determined

reference levels. The costs for this option would be slightly higher (more costs for travel and per diems), but these higher costs could be justified by the fact that it would ensure a review that includes a wider range of expert. This would encourage peer review and increased transparency among Member States, while ensuring consistent application of common criteria.

A third governance option **(Option G2)** for setting forest reference levels would be to ask the Commission to check and review that forest reference levels are calculated in a consistent way and based on the same criteria. The Joint Research Centre (with other EU scientific organisations) has already supported Member States in the current period in calculating their reference levels. Administratively this option would be the least cost option, as it would not be associated with any additional costs. This would contribute to harmonising EU modelling standards for forest reference levels, based on data collected and processed by the Member States, over a common reference period, and in a consistent manner.

In conclusion: In order to ensure a common and consistent application of existing and agreed international criteria, option G1 would be preferred and will be utilised to develop the new governance process for forest reference levels. Justification for choosing the option with slightly higher cost is the advantage of using wider expertise, providing additional transparency and facilitate knowledge-sharing and capacity-building between Member State experts.

5.5. Impact of flexibility options

5.5.1. Distribution of credit potential between Member States

The final step is the assessment of the impact of different degrees of flexibility. Section 3 outlined that the flexibility options F1, F2 and F3 require a limitation of credits at 190MtCO2eq, 280 and 425, respectively. Not only will such an upper limit need to be applied at EU28 level, but also allocated to each Member State reflecting their maximum needs based on the lower mitigation potential of the agriculture sector (see section 1.4.3). While the mitigation options in agriculture are limited across Europe, Figure 3 highlights that the share of agriculture non-CO_2 emissions in the ESD varies significantly. Member States which have a higher share of agricultural emissions in the ESD are particularly affected by the limited mitigation potential in agriculture. They may therefore need higher access to the use of LULUCF credits.

If flexibility was allocated to Member States on an equal basis (e.g., 5% of agriculture non-CO_2 emissions), the allocation would not respond to their different needs. Ranking the Member States by share and allocating pro-rata would create an allocation key extremely sensitive to inventory recalculation and measurement accuracy.

To avoid such issues in this analysis, Member States are allocated to one of three groups representing their need related to the relative importance of agricultural emissions in their national emission profile. The upper and lower groups contain approximately one-quarter of agriculture non-CO_2 emissions of the ESD, while the middle group contains half. The attribution to each group is based upon historical ESD share of agriculture non- CO_2 in 2008-2012. Member States with a 25% ESD share of agricultural emissions or more are allowed to use LULUCF credits of up to 15% of their agriculture non-CO_2 emissions, i.e. they would get a 15% flexibility;

those with over 14% to 24.9% would get flexibility of up to 7.5% of their agricultural emissions; less than 14% are given a 3.75% flexibility. This flexibility key is then multiplied by the average annual 2008-2012 agriculture non-CO_2 emissions to generate a national cap. This approach also guarantees that every Member State may potentially generate LULUCF credits.

Table 12: Distribution of LULUCF credit limit for the ESD on the basis of share agriculture non-CO_2 in the ESD, for Option F2.

	Share* of agriculture non-CO2 emissions in ESD 2008-2012	Average annual limit of LULUCF credits as a % of annual 2008-2012 agriculture emissions	Total limit of LULUCF credits over the period 2021-2030 in million tonnes**	Average annual limit of LULUCF credits as a % of annual 2005 ESD emissions)
EU	**16%**	**6%**	**-280**	**1.0%**
IE	40%	15%	-26.8	5.6%
LT	28%	15%	-6.5	5.0%
DK	27%	15%	-14.6	4.0%
LV	25%	15%	-3.1	3.8%
RO	24%	7.5%	-13.2	1.7%
BG	21%	7.5%	-4.1	1.5%
FR	20%	7.5%	-58.2	1.5%
EE	20%	7.5%	-0.9	1.7%
FI	18%	7.5%	-4.5	1.3%
ES	18%	7.5%	-29.1	1.3%
SE	16%	7.5%	-4.9	1.1%
CY	16%	7.5%	-0.6	1.3%
EL	16%	7.5%	-6.7	1.1%
PT	16%	7.5%	-5.2	1.0%
NL	15%	7.5%	-13.4	1.1%
SI	15%	7.5%	-1.3	1.1%
PL	15%	7.5%	-21.7	1.2%
HU	14%	3.75%	-2.1	0.5%
SK	14%	3.75%	-1.2	0.5%
UK	13%	3.75%	-17.8	0.4%
HR	13%	3.75%	-0.9	0.5%
AT	13%	3.75%	-2.5	0.4%
BE	13%	3.75%	-3.8	0.5%
DE	13%	3.75%	-22.3	0.5%
CZ	11%	3.75%	-2.6	0.4%
IT	10%	3.75%	-11.5	0.3%
MT	8%	3.75%	-0.03	0.3%
LU	7%	3.75%	-0.25	0.2%

* Rounded to the nearest percentage point
** Calibrated to match 280 million tonnes

Source: Table based upon distribution key of proportion of ESD using National inventories (Mar 2016)

This distribution and the ranked allocation by Member State is shown in Table 12, for the option F2. Under the medium flexibility option, a Member State with a high share of the agriculture sector in the ESD would be permitted to generate up to maximum 15% of their agriculture non-CO2 emissions as LULUCF credits.

For the F2 option (280Mt), the highest beneficiaries of access to LULUCF credits are IE, LT, DK and LV because of their high shares of agriculture emissions. These Member States potentially are allowed to apply the equivalent on average per annum of around 4% or more of 2005 ESD emissions, with IE having a limit of the equivalent of 5.6% of 2005 ESD emissions. By contrast, the group with low agriculture shares would potentially be allowed to bring the equivalent per annum on average of less than 0.5% of ESD emissions.

Table 13 shows the distribution of LULUCF credits to Member States using the same distribution mechanism, but for all three flexibility options.

5.5.2. Environmental impacts of flexibility options F1, F2 and F3

In the previous section a possible allocation of an EU cap on LULUCF credits between Member States based on historical data was presented. In a next step, it needs to be asked to which extent Member States are likely to actually meet their individual cap for the use of LULUCF credits based on current projections. These projections have to estimate to which extent the LULUCF activities that would be allowed to generate credits, i.e. agricultural land and afforestation, would actually deliver additional removals and hence credits.

This is done in the following section first by assessing the projected credit generation potential for the period 2021–2030 individually for each MS and then aggregating it to show the overall impact on EU level using the preferred accounting rules as identified in previous sections.

Table 14 shows therefore the projected 2021-2030[69] delivery of absolute credits by the LULUCF sector for that Member State, when restricted by the limits (the Member State specific cap) defined in Table 13.

The credit generation potential through the period is mostly constant, due to the relatively high (compared to the cap) potential generation (see Table 11). The availability of credits is mainly driven by the cap and not by the available potential of LULUCF enhanced mitigation. It can be noted that the policy options selected have usually constrained the potential, even at Member State level.

The low flexibility option F1 provides for a limited possibility of up to 190Mt to use LULUCF enhanced mitigation against the need to address the limited mitigation potential of the Agriculture Non-CO_2 sector. As shown in Table 14, all but three Member (MT, LU, CY) States would be able to generate LULUCF credits, with 187 MtCO2eq being delivered when mitigation is enhanced at 20eur/t CO_2eq.

[69] Yearly potential credit generation projected for the years 2020, 2025 and 2030 was aggregated using linear interpolation.

Table 13: Distribution per Member State of LULUCF credit limit (cap) for the ESD for all three flexibility options (low, medium, high) in MtCO2eq for the period 2021-2030. Negative numbers represent removals.

	Cap based on ESD share only		
	Option F1 Low flex	*Option F2 Med flex*	*Option F3 High flex*
AT	-1,7	-2,5	-3,8
BE	-2,6	-3,8	-5,7
BG	-2,8	-4,1	-6,2
CY	-0,4	-0,6	-0,9
CZ	-1,8	-2,6	-4,0
DE	-15,2	-22,3	-33,9
DK	-9,9	-14,6	-22,2
EE	-0,6	-0,9	-1,3
EL	-4,6	-6,7	-10,2
ES	-19,8	-29,1	-44,2
FI	-3,1	-4,5	-6,9
FR	-39,5	-58,2	-88,4
HR	-0,6	-0,9	-1,4
HU	-1,4	-2,1	-3,2
IE	-18,2	-26,8	-40,7
IT	-7,8	-11,5	-17,4
LT	-4,4	-6,5	-9,9
LU	-0,2	-0,2	-0,4
LV	-2,1	-3,1	-4,8
MT	0,0	0,0	0,0
NL	-9,1	-13,4	-20,4
PL	-14,8	-21,7	-33,0
PT	-3,5	-5,2	-7,9
RO	-8,9	-13,2	-20,0
SE	-3,4	-4,9	-7,5
SI	-0,9	-1,3	-1,9
SK	-0,8	-1,2	-1,9
UK	-12,1	-17,8	-27,0
EU	*-190,0*	*-280,0*	*-425,0*

Source: Table based upon distribution key of proportion of ESD using National inventories (Mar 2016)

Table 14: Distribution of potential credit generation under the cap, for Options F1, F2 and F3 in MtCO2 for the period 2021-2030 (figures in bold illustrate when the cap will not be reached)

	Potential credit generation within cap		
	Option F1 Low flex	*Option F2 Med flex*	*Option F3 High flex*
AT	-1,7	-2,5	-3,8
BE	-2,6	**-2,7**	**-2,7**
BG	-2,8	-4,1	-6,2
CY	**0,0**	**0,0**	**0,0**
CZ	-1,8	-2,6	-4,0
DE	-15,2	-22,3	-33,9
DK	-9,9	**-10,8**	**-10,8**
EE	-0,6	-0,9	-1,3
EL	-4,6	-6,7	-10,2
ES	-19,8	-29,1	-44,2
FI	**-0,8**	**-0,8**	**-0,8**
FR	-39,5	-58,2	-88,4
HR	-0,6	-0,9	-1,4
HU	-1,4	-2,1	-3,2
IE	-18,2	**-24,9**	**-24,9**
IT	-7,8	-11,5	-17,4
LT	-4,4	-6,5	-9,9
LU	0,0	**0,0**	0,0
LV	-2,1	-3,1	-4,8
MT	0,0	0,0	0,0
NL	-9,1	-13,4	**-13,9**
PL	-14,8	-21,7	-33,0
PT	-3,5	-5,2	-7,9
RO	-8,9	-13,2	-20,0
SE	-3,4	-4,9	-7,5
SI	-0,9	-1,3	-1,9
SK	-0,8	-1,2	-1,9
UK	-12,1	-17,8	**-19,4**
EU	***-187***	***-269***	***-373***

Source: EUCLIMIT modelling

The medium flexibility option F2 provides for a limited but somewhat higher possibility (280Mt). Table 14 shows the delivery of credits possible under the projected scenario with enhanced mitigation action for Afforested Land and Agricultural land (at 20eur/t CO_2eq). Up to 269MtCO2eq of accounted mitigation would be available for credit towards the Non-ETS target compliance, slightly below[70] the cap for EU-28 of 280MtCO_2eq. At these low mitigation costs, an additional four Member States (FI, IE, BE and DK) are not forecast to be able to fully utilise the medium flexibility at a carbon price of € 20 per tCO_2. In order to fully utilize the upper limit to use LULUCF credits, these Member States would have to invest in additional mitigation action in the LULUCF sector.

In absolute terms, the Member States with the absolute highest credit generation potential from Afforestation and Agricultural land would be FR (58MtCO2), Spain (29), Ireland (25), Germany (22), and Poland (22).

In addition to the new flexibility from LULUCF to ESD, Member States would still generate sufficient credits to balance the LULUCF sector as a whole and in order to comply with the *no-debit* rule. This would be assured through the remaining accounted sink in the sector of an estimated 609MtCO_2 (see Table 10), or a little over 25% of the expected reported sink. The fairly constant and large buffer above the cap would also provide further statistical protection and therefore stability with respect to inter-annual variation of the LULUCF sector.

Under the high flexibility option F3, a total maximum flexibility of 425 MtCO2 would be enabled over the ten-year period 2021-2030 compared to the Reference (see section 4.2).

As shown in Table 14, in this case the cap could increase most significantly for Member States with less need of flexibility in the agriculture non-CO_2 sector. In absolute terms, the Member States with the absolute highest credit possibilities under this option are FR (88MtCO2), Spain (44), Germany (34), Poland (33), and Ireland (25). However, the effect on credit generation is more heterogeneous because not all Member States would be able to generate the full number of credits permitted by the cap. Indeed, at the modelled carbon cost of €20/tonne, only some 373MtCO_2eq of flexibility would be realised. In order to fully utilise the Member States specific credit limit (as shown in Table 11) FI, LU, CY, IE, BE and DK, the UK and NL, would have to implement additional mitigation action in the LULUCF sector.

In conclusion: Under these options the LULUCF sink would be enhanced by two principle incentives: i) need for each Member State to ensure that the overall LULUCF sector is in balance and does not generate "debits" against accounting rules (i.e. it complied with the *no debit* rule); ii) the option for each Member State to utilise additional credits from agricultural land and/or afforestation. Under a medium flexibility option, Member States would have to initiate significant new Afforestation action and extra sequestration on Agricultural land. Even with this new option of utilising LULUCF to address the limited mitigation potential of agriculture in the ESD, the LULUCF sector as a whole would remain in balance as required through the no-debit rule.

[70] The amount of credits delivered is below the cap, since not all Member states would be in a position to generate full credits.

Other environmental impacts

Without specific intervention, environmental impacts of all options on soils are expected to be varied. European agricultural soils are consistently losing carbon due to management, although estimates vary as to the speed of this process. This could be reversed with improved mitigation action on agricultural land[71].

Allowing agricultural land to generate credits can incentivise Member States to promote additional action to protect or enhance soil carbon. Recent estimates of this have been using a Tier 1 approach and LUCAS data by the JRC[72], focusing on the trends under the baseline projection. While the **reference projection shows no substantial change in emissions for soils**, land use conversion (especially conversion of organic soils) is considered the major driver of soil emissions in the EU28. Mitigation actions to address this will therefore be beneficial to soil organic carbon and potentially biodiversity. The JRC studies identify a number of effective mitigation actions to reduce direct and indirect (through land use change) emissions.

5.5.3. Economic impacts: abatement costs and production impacts in the Agriculture sector

Table 15 illustrates the direct abatement costs for the different levels of flexibility between LULUCF and the ESD sectors (F0, F1, F2, and F3), resulting from the GAINS/GLOBIUM model framework. Table 16 assesses economic (production, trade) impacts derived from a different modelling framework, CAPRI. It should be noted that differences in compliance costs estimated by the different modelling approaches result to some extent from differences in the models used (GAINS and CAPRI used in EUCLIMIT framework; CAPRI used in ECAMPA) as well as the assumptions on the availability and costs of mitigation technologies over the period 2021-2030 applied.

Under the GAINS modelling framework, in option F0 (no flexibility) agriculture non-CO2 emissions would have to be reduced by 78MtCO2eq in 2030, assuming a 20% reduction in 2030 compared to 2005. The options F1 to F3 show a progressive decrease in the mitigation cost in the agriculture non-CO_2 sector, with the corresponding increase in flexibility. Under flexibility options F1 to F3, an increasing share of this reduction would be delivered by the land use and forestry sector.

Without flexibility, a carbon price of €78.6/tonne CO2eq was modelled to meet the Agriculture non-CO2 sector emission reduction of just over 78MtCO2eq (a 20% reduction in 2030 compared to 2005.). The annual (direct) costs of this would be €2.071bn in 2030, as computed by the GAINS modelling framework.

[71] Mainstreaming climate change into rural development policy post 2013, Final Report Contract No. CLIMA.A.2/SER/2013/0010

[72] JRC reports CAPRESE (A. Jones et al. 2016) and Tier 1 soil modelling (R. Hiederer 2016) (in prep)

Table 15: Direct impact of different levels of flexibility between LULUCF and ESD on GHG abatement costs in the agriculture non-CO_2 sector (annual costs in 2030 in € 2013) and assuming a 20% reduction in 2030 compared to 2005

		Flexibility Options			
	F0 No flex	**F1 Low**	**F2 Medium**	**F2 Medium (excluding breeding)**	**F3 High**
Non-CO_2 Emission reduction in 2030, $MtCO_2eq$	78.0	43.0	25.0	25.0	7.0
LULUCF reduction in 2030 $MtCO_2eq$	0	35.7	53	53	70.7
Non-CO_2 Emission reduction in 2021-2030, $MtCO_2eq$*	380	215	125	125	35
LULUCF reduction in 2021-2030 cf. 2005, $MtCO_2eq$*	0	179	265	265	354
Allocated flexibility of credits ($MtCO_2eq$ for period 2021-2030)	0	190	280	280	425
Marginal costs €/tCO_2eq. for non-CO_2 mitigation	78.6	32.5	7.3	31.4	0

Source: GAINS model/GLOBIUM for LULUCF based on AR4 Global Warming Potentials and using Reference 2016. * assuming a linear increase of mitigation between 2021 and 2030.

As a consequence of allowing increased rates of flexibility (Options F1, F2, F3), the marginal cost of mitigation in the agriculture non-CO_2 sector fall to half (€32.5/tonne) under the Low flexibility option F1, 1/10th (€7.3/tonne) for the Medium (F2) and zero for the High (F3) flexibility options. This decrease is due to the availability either of LULUCF credits or by provision of mitigation options in the agriculture non-CO2 sector modelled (in the GAINS model) at zero cost.

Examples of mitigation measures taken into account in the GAINS model at zero cost are: breeding/genetic enhancement, anaerobic digestion for larger farm sizes (typically above 500 LSU for cattle and pigs) and a ban on burning agricultural waste.

As modelled under the Medium Flexibility option F2, agriculture non-CO_2 mitigation would still need to deliver emission reductions in the order of magnitude of 25 $MtCO_2eq$. In the GAINS model these can be achieved by mitigation options which, while not free from up-front costs, have no or little net cost, for instance because they are associated with efficiency improvements. One such important mitigation option that would result in such efficiency gains is breeding of cattle focussed on health and fertility improvements. However, if these options are considered not to be available at zero cost, the benefit in the marginal cost reduction is weaker (column F2 no breeding) as, this would result in the need of more costly mitigation options in agriculture increasing overall mitigation costs (see in Table 15 column F2 Medium flexibility with no breeding).

Table 16 below presents the production, consumption and net trade (competiveness) impacts modelled using the EUCLIMIT framework for the agricultural and forestry sector for the three

options assuming a 20% reduction in non-GHG emissions in agriculture. The modelling is based on the 2016 Reference projection, and uses the CAPRI model for agricultural non-CO_2 emissions, applying AR4 global warming potentials[73] and the GLOBIUM model for the LULUCF part.

The Option F0 (no flexibility) broadly confirms the findings of the ECAMPA study, although at a different scale. Without flexibility, a carbon price of €120/t CO_2eq would be needed to achieve a 20% reduction in emissions in 2030 (or 84 MtCO_2eq). In the modelling framework, which inflexible implements this reduction target, this would increase prices for some agricultural commodities (e.g. of meat and dairy products) and could negatively impact on consumption, production, and net trade.

Under the low flexibility option (F1) access to LULUCF credits is restricted to 35Mt in 2030. Assuming that the full amount of credits would be used, the agriculture non-CO_2 reduction needed would be around 49 MtCO_2eq (84 minus 35 Mt) in 2030 at marginal cost of €42/tonne. As a result, price increases would be much more limited than without access to LULUCF credits. Consumption reductions would be smaller, production losses would be smaller and (net) trade losses would be smaller.

Under the Medium flexibility option, the pressure to reduce agricultural emissions would be sharply decreased. Given the limited reduction needed by agriculture non-CO_2 emissions (31 MtCO2eq) price increases for agricultural commodities would be much more limited, and consequently production and consumption changes would be very modest and generally below 1% (and as low as 0.1% for dairy products and meat). Net trade effects would be below 1% except for meat (which nevertheless decreases by just 5%, compared to over 25% under the reference). Compared to the reference run, the overall effects would be very limited.

Granting high flexibility under Option F3 (i.e. up to 425MtCO_2), and using LULUCF credits to offset the entire expected reduction of Agriculture non-CO_2, would further reduce the impacts on consumption, production and (net) exports of agriculture as no reduction beyond baseline would be expected in the Agriculture non-CO_2 sector.

Sensitivity analysis shows the following. Assuming the baseline delivers no accounted LULUCF sink, the carbon price required to meet the non-CO2 reduction in an efficient way would be around €33/ton. The impacts would be less strong than case F1 for meat and dairy but somewhat higher for wheat, grain and oil seeds.

Studies, specifically *EcAMPA 2* (see Box 1)[74], and *Meta-review study of mainstreaming climate action* (see Box 2)[75] show that only a limited level of mitigation of emissions from agriculture is feasible without impacting production. Support from flanking policies such as Rural Development Programmes under the CAP is also a means of limiting impacts. The studies highlight in particular the need for further applied research, capacity building, innovation and scaling up of the enabling environment for technology diffusion in the farm and forestry sectors.

[73] IPCC 4th Assessment Report (AR4) http://bit.ly/22cshAA

[74] Ref JRC

[75] Ref Ricardo IEEP

Linking use of LULUCF flexibility to the need of the agriculture sector is a rational approach to limit potential economic impacts of reduction targets.

Table 16: Economic impacts in 2030 (% change compared to baseline) based on an assumed 20% reduction in agricultural non-CO2 emissions

		Flexibility options		
	F0 No flex	**F1 Low**	**F2 Medium**	**F3 High**
Credits ($MtCO_2$) in 2030		35	53	68
Carbon price agriculture non-CO2 (€/t CO_2eq)	120	42	21	10
Non- CO_2 reduction agriculture (Mt CO_2)	84	49	31	13
PRICES				
Wheat	1.4%	0.5%	0.3%	0.2%
Coarse grains	1.5%	0.6%	0.4%	0.3%
Oilseeds	2.4%	1.2%	0.8%	0.5%
Meat	11.1%	3.7%	1.8%	0.9%
Dairy products	3.8%	1.4%	0.7%	0.4%
CONSUMPTION				
Wheat	-2.3%	-1.2%	-0.6%	-0.3%
Coarse grains	-3.1%	-1.6%	-0.9%	-0.5%
Oilseeds	-1.1%	-0.4%	-0.2%	-0.1%
Meat	-0.8%	-0.3%	-0.1%	-0.1%
Dairy products	-0.7%	-0.2%	-0.1%	-0.1%
PRODUCTION				
Wheat	-2.8%	-1.3%	-0.7%	-0.4%
Coarse grains	-3.2%	-1.6%	-0.9%	-0.5%
Oilseeds	-2.5%	-1.1%	-0.6%	-0.3%
Meat	-2.7%	-1.0%	-0.5%	-0.3%
Dairy products	-1.0%	-0.4%	-0.2%	-0.1%
FOREST				
Forest area	0.2%	0.1%	0.1%	0.1%
Final wood products	0.0%	0.0%	0.0%	0.0%
NET TRADE (positive value: net export)				
Wheat	-6.3%	-2.1%	-1.5%	-1.2%
Coarse grains	-5.2%	-1.5%	-1.4%	-1.3%
Oilseeds	2.5%	1.3%	0.8%	0.5%
Meat	-24.9%	-9.2%	-5.0%	-2.4%
Dairy products	-7.5%	-2.8%	-1.5%	-0.7%

Source: CAPRI and GLOBIUM/G4M models using Reference 2016.

5.6. Administrative, monitoring and reporting costs and who would be affected

LULUCF accounting is done at national level, but often with the technical support from research institutes or agencies. Changes to the accounting framework as a consequence of including LULUCF into the EU's domestic 2030 reduction target, and any related needs to adjust

monitoring and reporting, may potentially introduce impacts. These impacts are likely to be most felt by Member State administrations[76] responsible for GHG inventories, the Commission services and the European Environment Agency responsible for coordinating and verifying the information. It is not expected that private actors would face additional data requirements.

By far the most significant proposed change is to streamline the two existing parallel reporting systems into a single system. This will reduce administrative burden and costs for Member States and at the EU level. As the administration of the Kyoto system at the level of the UNFCCC is fully paid by the few Kyoto Parties, also these costs will fall away after 2023 when the compliance of the 2nd commitment period of the Kyoto Protocol will have been finalised.

The additional administrative impacts of the three proposed post-2020 changes is expected to be minimal, because the relevant accounting rules have already been set up as a consequence of LULUCF Decision 529/2013/EU. Member States are thus already providing information on accounted emissions and removals for LULUCF activities. They are also developing enhanced systems to account for emissions and removals for agricultural land – and other elected land categories – in order that they more accurately include emissions and removals in the national GHG inventories, and thus be compliant with existing legislation. The current Community registry system will have to be expanded to fully capture the LULUCF sector and the new transactions because of new flexibility.

Most importantly, administrative costs will not differ under the three options F1-F3 as accounting rules are assumed to be the same in all cases.

5.7. Distributional, social and employment impacts

Distributional and social impacts depend on the approach chosen by Member States in policy implementation to fulfil the ESD and LULUCF obligations. The 2030 climate and energy package does not stipulate a specific mitigation target for agriculture at EU or national, regional level. Hence, it is not the EU but Member States who will decide about the distribution of the overall national mitigation ambition across the sectors concerned, including agriculture.

As cited above, the EcAMPA 2 study looked at the cost-effective mitigation potential in EU Member States' agriculture non-CO2 sector, including scenarios with payments for environmental services to incentivise the adoption of agricultural mitigation measures. EU wide scenarios simulating emission reductions for agriculture non-CO_2 of between 15% and 25% in 2030 as compared to 2005 were tested, distributed between Member States based upon cost-effective mitigation.

According to the report, a 20% mitigation target for EU agriculture, if implemented without subsidies, would lead to slight aggregate welfare increases, mainly driven by higher income due to increased prices for agricultural goods. However, agricultural production, notably for the beef sector, would decrease, followed by a leakage of production from the EU into other parts of the

[76] Public institutions currently and potentially involved in LULUCF accounting and reporting include statistical offices, agricultural, climate, energy and environmental authorities, agencies dealing with zoning and territorial planning, as well as research institutes dealing with preparing inventories.

world and increase in total related emissions, assuming that those other parts of the world would not (yet) follow an equivalent mitigation ambition.

Such decrease in EU output could primarily be avoided by incentivising the adoption of cost efficient agricultural mitigation technologies. With these incentives, such technologies and measures[77] could reduce agricultural non-CO_2 emissions without negatively impacting production and food security. The level of competitiveness, modernisation, quality of work, and sector income in agriculture would rise. However, the overall welfare effect would be slightly negative, given that the "tax payer" (economic actors outside agriculture) would have to finance agricultural subsidies.

Employment effects would be driven by the decline in agricultural production: they would be highest in a scenario without flexibility between LULUCF and agricultural emissions under the ESD. However, there also could be positive employment effects originating from the implementation of additional mitigation measures, such as anaerobic digestion plants.

Moreover, in reality the negative employment effects of mitigation action in agriculture have been smaller than projected by economic models, because a significant share of the additional costs has been compensated by subsidies originating from the CAP. Model results also tend to under-estimate dynamic effects: mitigation measures have been a driver for higher resource efficiency and have helped to decouple agricultural production from emissions (see Figure 3). Mitigation action also helped to increase the competitiveness of European farming, which helps to safeguard jobs, and not vice versa.

Increasing access to LULUCF credits and hence flexibility would therefore further reduce the negative employment impact related to non-CO2 agriculture estimated by models. The flexibilities would have positive impacts on employment mainly since they have a positive impact on output in agriculture (compared to a no flexibility scenario). By contrast, the expected impact on employment in forestry is rather small.

Table 17: Impacts on employment in 2030 in agriculture & forestry (change compared to reference + 20% reduction in agricultural non-CO2 emissions

	F1	F2	F3
Employment (x1000 jobs)	+98	+128	+149
Employment (%)	+1.5	+1.9	+2.2

Distributional and social impacts will depend on the approach chosen by Member States in policy implementation to fulfil the ESD and LULUCF obligations. The 2030 climate and energy package does not stipulate a specific mitigation target for agriculture at EU or national / regional

[77] e.g. anaerobic digestion of animal manure, increase of the share of legumes on temporary grassland, variable rate technology/precision farming.

level. Hence, it is Member States who will decide upon the distribution of the overall national mitigation ambition across the sectors concerned, including agriculture.

In conclusion, employment effects related to emission reductions in the non-CO_2 agriculture sector could be negative, if mitigation measures would be implemented with the flexibility provisions and with cost-compensating flanking support through the CAP. The flexibilities offered have a positive impact on employment. Mitigation measures which improve overall resource efficiency could also contribute to long-term enhanced competitiveness. Moreover, some mitigation measures provide new and additional business opportunities to farmers such as afforestation or the production of renewables.

6. COMPARING THE OPTIONS

6.1. Introduction

Various options related to the inclusion of agriculture and LULUCF into the EU's climate and energy framework for 2030 have been analysed in this Impact Assessment.

This section will first synthesize the comparison of the various accounting rule improvement and flexibility options, proceed with the screening of the main options on policy architecture, and finally conclude on selecting the combination of options needed to best meet the policy objectives.

6.2. Comparison of rule improvements and flexibility options

6.2.1. Comparison of accounting rule improvements

With the current LULUCF accounting rules originating from the Kyoto Protocol as a baseline, various improvements and up-grades were all evaluated positively in Chapter 5, resulting in substantive improvements/benefits with no or few implications for additional costs (even, savings):

– B1: Application of a base period of 2005-2007 for net-net accounting of relevant non-forest land categories;

– R2: land-based UNFCCC reporting framework for accounts, with an optional 30yr transition period for Afforested Land;

– G1: Governance of the forest reference level assured by the Commission together with Member States experts;

In conclusion, these modified accounting rules are used therefore in the analysis of different levels of flexibility between LULUCF and agriculture within the ESD (Options F0 to F3), since they showed reduced credit availability, higher accuracy and hence credibility and environmental integrity of the credit generation potential from LULUCF.

6.2.2. Comparison of options with different levels of flexibility between LULUCF and Agricultural emissions in the ESD

This impact assessment also examined which LULUCF activities could generate sound and robust credits. **Credits from forest management were discarded early on** because of a wide range of projected outcomes for this activity and the lack of approved and standardised reference levels. Allowing the use of credits from forest management towards compliance under the ESD would therefore be associated with various risks. However, such removals could be used to balance emissions from other activities within the LULUCF sector up to a certain cap.

By contrast **credits generated from afforestation and agricultural land would be more sound,** particularly if coupled with improved accounting rules. Quantitative analysis indicates that each Member State would be able to generate additional yet limited credits from agricultural land and/or afforestation.

In a next step, three options with different degrees of flexibility between LULUCF and agricultural emissions in the ESD were assessed. The baseline Option (F0) is to grant no flexibility from LULUCF towards agricultural non-CO_2 emissions under the ESD. Because of the limited mitigation potential in agriculture, there is a risk under this option that ESD compliance is threatened, or that agricultural production is placed under too high pressure. A specific further risk of this option would be that production leakage may occur, thereby substantially negating any accounted climate benefits of the reductions in the sector. Furthermore, employment effects of an option without flexibility between LULUCF and agricultural emissions under the ESD could be negative, particularly without cost-compensating support measures from the CAP. Consequently, a number of disadvantages for this option are evident (see Table 17).

The next three options (F1, F2, and F3) assessed different levels of optional, limited flexibility of LULUCF credits that would be allowed to compensate for the lower mitigation potential of agriculture under the ESD.

The first option F1 introduces low flexibility with a maximum of 190 MTCO2eq over the period 2021 to 2030 available to the ESD. The effect on actions to enhance mitigation in LULUCF would be negative as even cost-effective mitigation from land use and forestry will be overlooked, and increasing performance compared to baseline would not be incentivised. Furthermore, since there would be little incentive for Member States to generate additional credits, the development of better, more accurate monitoring and reporting systems for LULUCF would not be incentivised. Consequently the pathway to important, additional, cost-effective potential related to land use and forestry would be left blocked.

Under Option F2 a Medium level of flexibility (a maximum of 280 MTCO2eq over the period 2021 to 2030) was assessed allowing a limited amount of LULUCF credits to enter the ESD sector. This would place the effort needed from the agriculture non-CO_2 sector in the ESD to be in the range closer to scenarios which had limited negative impacts on the sector, while at the same time incentivising additional action in the LULUCF sector. Nevertheless, the LULUCF sector would probably not generate debits, due to the relatively low number of credits that would be used for ESD compliance.

Table 17: Comparison of the options for flexibility between LULUCF (with improved accounting rules) and agricultural emissions in the ESD

		Flexibility option		
	Baseline (F0)	**Low (F1 190Mt 2021-2030)**	**Medium (F2 280Mt 2021-2030)**	**High (F3 425Mt 2021-2030)**
Specific objectives (Section 3.2)				
Upgrade rules and improve governance	No improvement	Upgraded, fit for 2021-30	Upgraded, fit for 2021-30	Upgraded, fit for 2021-30
Promotion of cost-efficient mitigation action on land and addressing low mitigation potential in agriculture	Reduced incentive	No significant additional effort	Significant additional effort	Significant additional effort, but risk of uneven effect
Consistency with biomass and energy policies, avoid accounting gap	Negative: gap in accounting	Consistency improved	Consistency improved	Consistency improved
Operational objectives (Section 3.3)				
Multiple objectives, Food security	Possible impacts on production high	Somewhat Reduced impacts on production & jobs	Reduced impacts on production & jobs	Strongly reduced impacts on production & jobs
Environmental integrity, specificities of LULUCF sector	KP rules provide safeguard	Upgraded rules provide better safeguard	Upgraded rules provide better safeguard	Eliminates additional reduction effort for Agriculture
Administrative effort	No change	Reporting simplified	Reporting simplified	Reporting simplified

Source: own presentation

An important argument in favour of the Medium flexibility option F2 is the importance of a landscape approach in tackling climate action. By being relevant to the implementation of policy at a farm or holding level, a hybrid approach would give some flexibility and synergies of finding cost-effective mitigation between all activities related to agriculture and land use (including afforestation, deforestation reduction, forestry, soil management, etc.).

Finally, a High flexibility option F3 (a total of 425 MTCO2eq over the period 2021 to 2030) was assessed. A similar option – with unrestricted flexibility and including forest sink – was already considered in the context of the 2012 Impact Assessment for the inclusion of LULUCF into the

2020 climate and energy framework. In that assessment, the option was rejected mainly because it was seen as diluting ambition due to LULUCF rules defined in the 1st Commitment Period of the Kyoto Protocol.

The High flexibility variant assessed in this Impact Assessment shows some improvements but the effects on environmental integrity still remain a concern. The option F3 fully alleviates pressure on the agriculture non-CO_2 sector; it would exempt this sector from further emission reductions in contrast to all other sectors in the economy. This would be in contradiction with the agriculture non-CO_2 sector's steady progress towards decarbonisation.

Furthermore, the potential utilisation of such a high level of LULUCF mitigation could place the compliance of the LULUCF sector itself at risk, due to the high inter-annual variability of the sector. This is underlined by the projected fulfilment of only 373Mt of the potential 425Mt cap under option F3, at carbon prices similar to those applied to other ESD sectors (i.e. €20/tonne).

In conclusion, the assessment of the flexibility between LULUCF and agriculture shows that from economic, environmental and sector-specific points of views the best option forward would be an option with medium flexibility (i.e. option F2).

6.2.3. Selection of level of improved rules and flexibility level between LULUCF and agriculture emissions in the ESD

As a result of the impact assessment and analysis, the best way forward for the inclusion of agriculture and LULUCF into the 2030 climate and energy framework would include two main elements:

(1) **An updating and streamlining of accounting rules** for the determination of emissions and removals from land use and forestry. Various options have been identified (B1, R2, G1) which would increase the robustness and environmental integrity of the accounting principles for the LULUCF sector. Including this sector into the 2030 framework based on these up-dated accounting rules would simplify the system and increase the credibility of the EU in the international negotiations.

(2) Allow **limited flexibility (Option F2 medium flexibility) between LULUCF and agricultural emissions under the ESD.** This option would provide additional incentives for further mitigation action related to the land use and forestry sector, while not unduly increasing compliance risk for the LULUCF sector. It would address the limited mitigation potential of the agricultural sector, and thereby ensure that other objectives such as food security can be met. At the same time, the agricultural sector would still have incentives to contribute to the overall reduction target for the non-ETS sectors.

6.3. Selection of options

Overall, the proposed way forward is that **the legal framework for the inclusion of agriculture and LULUCF into the 2030 framework builds on the current policy architecture.** Limited adjustments would be made to LULUCF accounting rules, and the design of two-way flexibility between LULUCF and the ESD would provide additional incentives to improve and optimize the mitigation potential from LULUCF.

The preferred option would be underpinned utilising the following options assessed in Chapter 5 and compared above:

– B1: Application of a base period of 2005-2007 for relevant non-forest land categories;

– R2: land-based UNFCCC reporting framework for accounts, with a 30yr transition period for Afforested Land;

– G1: Governance of the forest reference level will be assured by the Commission together with Member States experts, who shall check and review that forest reference levels were set in a transparent manner and in line with EU guidance;

– F2 - Medium flexibility: Up to 280 Mt between 2021-2030 could be transferred to the ESD through credits generated by net afforestation and agricultural land.

In conclusion, under this approach, a stand-alone LULUCF policy pillar would continue to be utilised together with the *no-debit* rule. A limited degree of flexibility between LULUCF and the ESD would be enabled, justified on the need derived from the agriculture sector share for each Member State in the ESD. This option **would be compatible** with food security and biodiversity objectives and would not result in negative employment effects. Such a hybrid option would **limit changes** of the overall architecture and would thereby **minimize administrative burden and red tape** while **maximising the contributions to the overall achievement of the EU's 2030 targets**. The inclusion of LULUCF on the basis of such a hybrid option would also incentivize additional mitigation action in the land and forestry sector and hence be **fully compliant with** the long term vision for limiting temperature increase as outlined in **the Paris Agreement.**

7. HOW WILL MONITORING AND EVALUATION BE ORGANISED?

7.1. Introduction – international framework

Compliance assessment under the current LULUCF Decision relies on an already existing, comprehensive framework of monitoring and reporting. Information on GHG emissions and removals need to be submitted every year by each Member State as part of the UNFCCC and Kyoto Protocol greenhouse gas inventory process (MMR Article 7 (1) c)-d). Decision 24/CP.19 of the UNFCCC stipulates that in preparing their annual inventories under the Convention due in the year 2015 and beyond, developed country Parties should apply the 2006 *IPCC Guidelines for National Greenhouse Gas Inventories: Agriculture, Forestry and Other Land Use*. The Guidelines are the culmination of three years of work by the IPCC National Greenhouse Gas Inventories Programme, to update its own previous guidance in response to the invitation by UNFCCC Parties in 2002.

7.2. Quality assurance

In accordance with the MMR Article 6(1), a Union Inventory system is established to ensure the timeliness, transparency, accuracy, consistency, comparability and completeness of national inventories with regard the Union GHG inventory. To this aim, a team of technical experts lead

by the EEA performs the Quality Assurance / Quality Control (QA/QC) of all individual countries' GHG inventories, which involves many technical exchanges with Member States. The Commission (through the Joint Research Centre) is responsible for the QA/QC of the Agriculture and LULUCF sectors, and also supports specific projects and workshops to help Member States in applying correctly the agreed IPCC methodologies for determining their GHG emissions.

7.3. Obligations for Member States

As regards the LULUCF accounted emissions and removals, most Member States are only obliged to complete their accounts at the end of the Kyoto Protocol second commitment period. The compliance assessment is done under Kyoto Protocol procedures, involving an international team of experts coordinated by the UNFCCC. It should be noted that three Member States (DK, HU, FR) chose annual accounting for LULUCF in the first commitment period. Decisions by Member States for the second commitment period are not available yet.

Only a minority of Member States have elected to account for cropland and grazing land management in the second commitment period.[78] Those who did not elect these activities under the Kyoto Protocol are required, prior to 1 January 2022, provide and submit to the Commission "initial, preliminary and non-binding annual estimates of emissions and removals" under the LULUCF Decision. Final estimates – for each year of CP2 – must be submitted by 15 March 2022. For the accounting period starting 1 January 2021, for which estimates would normally be delivered by 15 March 2023, full accounting for these two activities is foreseen by the LULUCF Decision.

Chapters 4 and 5 introduced and assessed the planned improvements to the reporting and accounting framework, involving the streamlining of the parallel KP and UNFCCC reporting systems. The changes proposed would not only lead to simplification and reduced administrative burden, but would also enhance data accuracy by relying on more recent datasets in Member States.

7.4. Compliance cycle

For LULUCF to be integrated with the other sectors in the Non-ETS, reporting and accounting obligations would need to be aligned ESD compliance cycle. For Member States which elect an accounting compliance cycle matching that of the ESD this question is resolved. However, a longer period for LULUCF accounting compliance would normally not only be statistically preferred, but would also reduce administrative overhead for Member States. This is reflected in the Stakeholder consultation, where many submissions expressed a preference for less frequent than annual accounting, partly in the light of the relatively high inter-annual variation in LULUCF, partly to keep administrative burden at a lower level (see Annex 2).

International obligations under the UNFCCC framework will mean that the reporting exercise remains annual. For reasons outlined in Annex 5, however, accounting of LULUCF actions are

[78] Three Member States (ES, DK, PT) elected to fully account for cropland management and two (PT, DK) for grazing land management [further MSs tbc, upon submission of initial reports for CP2]

best enabled over longer periods. LULUCF accounting as discussed in the proposal would be implemented over the full period (2021-2030), as under previous Kyoto Protocol commitment periods. Nevertheless, the use of a full ten-year period would imply that clear data on the generation of flexibility (for use with the ESD) would only be available in early 2032. To facilitate this, a compliance assessment could be done at the mid-point and at the end point of the ten-year period, providing two five-year compliance cycles (1 January 2021 to 31 December 2025, and 1 January 2026 to 31 December 2030).

Credits remaining with a Member State account at the midpoint compliance assessment would be banked. Trading between Member States of Removal Units, including flexibility within the LULUCF sector, will take place at the end of the compliance cycle. A five-year compliance cycle remains in line with many of the stakeholder views. This arrangement would enhance consistency with the ESD compliance cycles, and would also make an overall progress check possible during the period, thereby reducing the risk of non-compliance at the end of the period.

7.5. Need to monitoring progress towards the EU Non-ETS target

Progressive reporting and accounting information is necessary to monitor the progress not only towards the individual national targets but also towards the EU common target. The Commission aggregates the reporting and (when applicable) accounting information received from Member States every year and includes it in its progress report pursuant to article 21 of the MMR. This would continue to occur also for LULUCF information and thereby support the monitoring of progress towards the EU Non-ETS target.

In order to enable the EU to participate effectively in the stocktaking process laid down in Article 14 of the Paris Agreement, a review of the level of ambition is recommended to be performed in timely manner, expected to be in 2023 or soon thereafter.

ANNEXES to LULUCF Impact Assessment

Contents

ANNEX 1: PROCEDURAL INFORMATION CONCERNING THE PROCESS TO PREPARE THE IMPACT ASSESSMENT REPORT AND THE RELATED INITIATIVE, INCLUDING EXTERNAL EXPERTISE AND CONTRACTS

Organisation and timing

Preparations of the Impact Assessment formally started in January 2015, following the 2014 October Conclusions of the European Council on the 2030 climate and energy policy framework for the European Union and the adoption of the Commission Work Programme for 2015. This IA builds significantly on the impact assessment for the Commission proposal for a policy framework for climate and energy in the period from 2020 up to 2030.[79]

An Inter-service Steering Group (ISG) on climate change aspects of agriculture and land use, land use change and forestry was established in January 2015, which steered the work on the IA up to its finalisation.

The ISG met 8 times for the purposes of discussing and preparing this IA. After discussions in the ISG, a roadmap for the initiative "Addressing greenhouse gas emissions from agriculture and LULUCF in the context of the 2030 EU climate and energy framework" was adopted in March 2015. The final draft IA was submitted to the ISG group on 20 April 2016.

Chaired by the Secretariat-General (SG), the impact assessment work was led by DG Climate Action (CLIMA). Given the many links of the dossier with agriculture and land use, DG AGRI made substantial contributions to the work of this ISG. Furthermore, as a result of various Administrative Arrangements on LULUCF and JRC's high level of expertise on many of the very technical issues, JRC ISPRA provided at various times valuable input to the discussions in the ISG with thematic slide sets.

Moreover, the following DGs and services were invited to the Steering Group: Legal Service (SJ), Competition (COMP), Economic and Financial Affairs (ECFIN), Energy (ENER), Environment (ENV), Internal Market, Industry, Entrepreneurship and SMEs (GROW), Mobility and Transport (MOVE), Regional Policy (REGIO), Research and Innovation (RTD), Taxation and Customs Union (TAXUD), Trade (TRADE).

Consultation of the Regulatory Scrutiny Board

In light of the Regulatory Scrutiny Board's *Positive Opinion*, and comments communicated on 02 June 2016, the following improvements were made to the Impact Assessment report:

- The need for early and timely regulation was strengthened, noting the context and timing of the international action and placing the proposal more specifically in the context of the

[79] SWD (2014) 15 final, Impact Assessment of the Communication "A policy framework for climate and energy in the period from 2020 up to 2030"

follow-up to the Paris Agreement and the Commission's 2050 Low Carbon Economy Roadmap. This explanation underscores the longer term step-wise process, needed to align the inclusion of Land Use, Land Use Change, and Forestry sector (LULUCF) in EU climate policy as a result of the Paris Agreement outcome.

- The explanation and description of problem/driver/solutions logic was re-structured to ensure that the reader will more effectively access the narrative of the problem hierarchy. Additionally, more explanation was given of why the focus and emphasis of the report is on the functioning of flexibilities between LULUCF and the reduction commitments for the non-ETS sectors.

- The sections of the report on problem-drivers have been strengthened to demonstrate that the key issue needing to be addressed concerns the gap created by lack of Kyoto Protocol governance post-2020 and the subsequent risk of unbalanced implementation.

- The description and explanation of baseline information was also improved to better facilitate the understanding of which elements would be drawn from the existing Kyoto Protocol framework.

- Further explanation was given to clarify that the primary basis for dimensioning the flexibility options assessed is the proportion of the agriculture non-CO2 emissions in each Member State's non-ETS emission profile; by contrast it has been highlighted that flexibility options are not limited to use by that sector.

- The chapter on objectives, and consequently the analysis of options, was adjusted and improved, taking into account remarks from the Board concerning the need for these to be more related to the specific and operational aspects of the proposal.

Evidence and external expertise used

The quantitative assessment of future impacts in the EU is consistent with the analysis undertaken for the 2030 framework proposal. The Commission contracted the National Technical University of Athens, IIASA and EuroCare to model EU scenarios. The energy system and CO2 emission modelling is based on the PRIMES model. The non-CO_2 GHG emission modelling is based on the GAINS model. Agricultural non-CO2 emissions are assessed with the CAPRI modelling framework. The modelling of LULUCF emission related to forests is based on the GLOBIOM-G4M models. See Annex 4 for more detail on the modelling framework.

List of other contracts examined for the purposes of the Impact Assessment

DG CLIMA

ClimWood2030 (Climate benefits of material substitution by forest biomass and harvested wood products: Perspective 2030)

The project will provide reliable data and analysis on the overall climate change mitigation potential associated with the use of forest biomass in the EU. The analysis will take into account the renewable energy policy targets and the role of carbon in general in harvested wood products

(HWP). The timeframe of the study will be 1960-2030, in order to inform EU and Member States' policies related to climate change mitigation in relevant activities.

EU CLIMIT II (Development and application of EU economy-wide climate mitigation modelling capacity)

The objective is to update and improve quantitative tools used for the assessment of scenarios and policy options for further developing the Climate and Energy package and other climate relevant policies in the medium (up to 2020/2030) and long term (up to 2050), including economic, environmental and social impacts, both for the EU and individual EU Member States and candidate countries. The models include PRIMES, CAPRI, GAINS (non-CO2) and GLOBIUM-G4M (LULUCF). The models can be used for assessment of the impacts of measures of policy options in the 2030 climate and energy framework. (See Annex 4 for more details.)

Effective performance of tools for climate action policy - meta-review of CAP mainstreaming

Effective performance of tools for climate action policy - meta-review of Common Agricultural Policy (CAP) mainstreaming. Specific contract number 340202/2014/688088/SER/CLIMA.A.2 implementing Framework Contract CLIMA.A.4/FRA/2011/0027

Tool for Cropland and Grazing land accounting/number management

This service request covers the inception, design, prototyping and implementation of a data analysis tool for compiling and exploring historical datasets, incoming data, trends and future scenarios of the AFOLU sector.

Agriculture and LULUCF in the 2030 Framework

Assessment of the impacts of the Paris Agreement on LULUCF and the Agriculture sector in the 2030 Framework: Specific Contract No 340202/2015/715996/CLIMA.A.2 (Implementing Framework Contract CLIMA.A4/FRA/2011/0027)

LULUCF Accounting

This project, carried out in 2013-2014 by the JRC under an Administrative arrangement with DG CLIMA, is divided into two lots:

- Lot 1 – Assistance to Informal Dialogue and support to the SBSTA/ADP analysis
- Lot 2 – Cropland and Grassland management data needs.

LULUCF 2030

The aim of the project is to support the EC on the following two issues:

1) Implementation of the EU LULUCF Decision 529/2013, especially with regard to evaluating the estimates reported by MS on carbon stock changes in Cropland Management and Grazing land Management, and recommendations to help MS on the gradual improvement of reporting of emission estimates for these activities.

2) Contribution to specific elements of the IA on the inclusion of the land use sector in the 2030 EU climate and energy policy.

Report publication reference: JRC102498

Biomass supply and demand

Overarching study on the provision of data and analysis on biomass supply and demand by the JRC on a long-term basis.

DG AGRI

EcAMPA (Economic assessment of GHG mitigation policy options for EU agriculture) and follow-up project (EcAMPA2)

The aim of the project is to apply the CAPRI model to provide quantitative analysis of GHG mitigation policy options for agriculture. In the frame of the project a workshop will be organised on technological GHG emission mitigation options in agriculture.

> Reference:Pérez Domínguez, I., T. Fellmann, F. Weiss, P. Witzke, J. Barreiro-Hurlé, M. Himics, T. Jansson, G. Salputra, A. Leip (2016): An economic assessment of GHG mitigation policy options for EU agriculture (EcAMPA 2). JRC Science for Policy Report, Publications Office of the European Union, Luxembourg, EUR27973 EN, doi:10.2791/843461.

CAPRESE (Carbon preservation and sequestration in agricultural soils – Options and implications for agricultural production)

The project reviewed potential climate change mitigation actions in relation to agricultural soils across the EU and assessed their potential impact in relation to organic carbon levels in agricultural soils at MS and EU level. The impact of selected measures on production patterns for different agricultural products in terms of a shift of overall production and regional changes (at EU and national level) were analysed.

> Reference: CArbon PREservation and SEquestration in agricultural soils – options and implications for agricultural production: Report of Task 6: Policy options and monitoring tools for carbon preservation and sequestration in agricultural soils. (JRC88294)
>
> Author(s): Arwyn Jones, Vincenzo Angileri, Francesca Bampa, Marco Bertaglia, Andrej Ceglar, Maria Espinosa, Sergio Gomez y Palom, Giacomo Grassi, Adrien Leip, Philippe Loudjani, Emanuela Lugato, Luca Montanarella Stefan Niemeyer, Guna Salputra, Benjamin Van Doorslaer

AVEMAC (Assessing agriculture vulnerabilities for the design of effective measures for adaptation to climate change)

The study provides a literature overview of vulnerabilities and adaptation measures in agriculture. Based on a biophysical model, levels of production were projected for priority crops under future climate change scenarios. The vulnerability of EU agricultural systems to climate change was assessed and mapped. Future resource inputs affected by climate change (in particular water

availability), production and output characteristics were identified. Proposals for follow up actions in support of decisions for selecting policy measures for adaptation were made.

http://ec.europa.eu/agriculture/external-studies/avemac_en.htm

Medium-term prospects for EU agricultural markets and income

This annual report presents the medium-term outlook for the major EU agricultural commodity markets (arable crops, biofuels, meat and dairy products) and agricultural income in the next decade. This analysis is based on expert opinions and an agro-economic model used by DG AGRI. It is accompanied by an uncertainty analysis in order to quantify potential variations of the results stemming in particular from fluctuations in the macroeconomic environment and yields of the main crops.

Agrifood2030

Developing strategies for the agri-food sector and supporting policies to cope with these challenges are strongly depending on the future context such as the overall development of the global economy, but also specific aspects society will focus on. The AgriFood2030 project, building on initiatives analysing these questions at global scale such as AgMIP (von Lampe, 2014), draws on a foresight approach for the European agri-food system where narrative stories describing in a qualitative way coherent future development paths are mapped into quantitative scenarios for (bio)-economic simulation modelling. The specific contribution of the AgriFood2030 project to the global studies is twofold. Firstly, it complements a broader global view provided by these initiatives with a detailed one for Europe, especially with regard to regional detail. Secondly, it analyses in detail possible sectoral EU policies and initiatives fitting to the narratives.

Report on Sustainable Forest Management Criteria and Indicators

The Communication on a New EU Forest Strategy COM(2013)659 states that the Commission, in close cooperation with Member States and stakeholders, should identify by the end of 2014 "objective, ambitious and demonstrable sustainable forest management (SFM) criteria that can be applied in different policy contexts such as climate change, bioenergy or bioeconomy, regardless of the end use of biomass". The corresponding indicators should be applicable for the purpose of different EU policies when there is a need to refer to sustainable forest management and its means of evidence. This approach would ensure that assurances of sustainability for all forests and their products (including forest biomass), could follow a coherent set of requirements and use the same evidence base regardless of end use. The work is connected to the energy and climate change policy framework in the horizon of 2030 in so far as the identification of indicators for the sustainable management of forest is required under these policies.

The starting point for this exercise are the existing criteria and indicators of Sustainable Forest Management (SFM) as e.g. provided for by work carried out under FOREST EUROPE and other relevant policies, regulations and tools in place, and the analysis of their application in the EU. The outcome of this WG will be a report by June 2015 that will be discussed in both the Standing Forestry Committee and the Advisory Committee on Forestry and Cork.

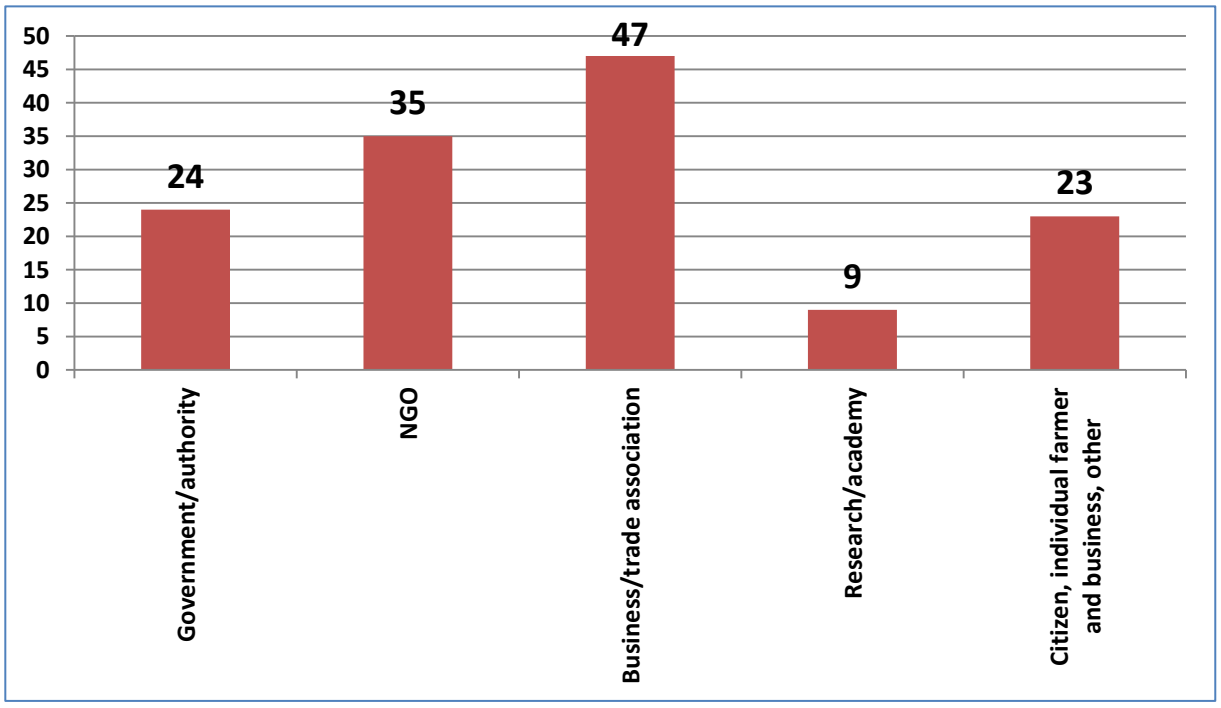
ANNEX 2 STAKEHOLDER CONSULTATION ON "ADDRESSING GREENHOUSE GAS EMISSIONS FROM AGRICULTURE AND LULUCF IN THE CONTEXT OF THE 2030 EU CLIMATE AND ENERGY FRAMEWORK"

Profile of respondents

Between March and June 2015, the European Commission conducted a public consultation on how best to address emissions from agriculture, forestry and other land use in the context of the 2030 EU climate and energy policy framework, following its endorsement by the European Council in October 2014. It sought input on the impact of existing policies in terms of reducing emissions from the land use, land-use change and forestry (LULUCF) sector and three potential policy options for integrating LULUCF into the climate and energy framework.

The consultation was open for 12 weeks, from 26 March to 18 June 2015. Most stakeholders used the online questionnaire to submit views. In total, 138 contributions were received.

Table A2.1 Respondents' profile



Replies were received from public authorities in AT, BE, CZ, DK, EE, ES, FI, FR, HU, IE, IT, LV, MT, NL, NO, PL, PT, RO and UK. In the case of several countries, responses were received from a number of public authorities, including regional entities.

The majority of non-governmental organisations were environmental NGOs, but replies were also received from organisations working on food safety, farming and youth issues.

Respondents in the 'business/trade association' group fell into five broad categories: agricultural producers, forest producers, forest product users, bioenergy (biogas and biomass) associations and other industry representatives.

All responses, except for a few where the respondents asked for confidentiality, were published on the consultation website:
http://ec.europa.eu/clima/consultations/articles/0026_en.htm

Analysis by stakeholder group

An analysis was carried out on the basis of the stakeholder categories, focusing on the three largest categories of respondents: governments/public authorities, NGOs and business associations.

Governments and regulatory authorities

Almost all answers emphasised the (geographical, biophysical, historical, economic, etc.) differences among Member States, which are considered more significant for agriculture and forestry than for other sectors. Many Member States gave constructive answers regarding mitigation measures in agriculture, though recalling the 'lower mitigation potential' (October 2014 Council conclusions) and stressing the need to incentivise climate action via supportive policies under the common agriculture policy (CAP).

Several Member States believed that setting national targets for LULUCF would be very challenging, with a few proposing possible criteria for differentiation. Some expressed a preference for having an EU-level target only.

Accounting is seen as key by many. There is broad satisfaction with the current rules, but many Member States expressed openness to discussing improvements (e.g. land-based accounting, base years).

Flexibility typically received support, though some Member States expressed concerns as regards the level of ambition in other sectors and/or the environmental quality of LULUCF credits.

Many Member States had yet to settle on a preferred option. Those that expressed a preference tended more towards option 1 (four Member States) and option 3 (five). One Member State could support either option 1 or 3. Three Member States expressed more interest in option 2. All underlined that these choices are preliminary and that they needed more information.

Agriculture, forestry trade/business associations

This was the most varied group of stakeholders; it included agricultural producers, forest producers, forest product users, bioenergy (biogas and biomass) associations and other industry representatives. Our analysis identified a few common themes and looked at views specific to the sub-categories within this stakeholder group.

Stakeholders predict that food and energy issues will gain in importance by 2030, but this is not reflected in an expectation of an increased share of GHG emissions. Nevertheless, there is considered to be no need 'for multiple objectives to compete'; rather, the challenge is to maximise outputs and integrate bio-economy chains more effectively. Forest and agricultural producers call for increases in wood mobilisation/agricultural production.

Mitigation measures mentioned explicitly include active forest management and better nutrient management in agriculture, with the caveat that support would be needed to incentivise action.

Producer associations express the opinion that strong regulation on efficient countries would be 'unfair' and that reduction targets should therefore not be linked to absolute emissions but to carbon efficiency (per unit of output). Early action was mentioned several times as a factor to be taken into account.

A number of stakeholders consider that the EU's role should be to disseminate best practice on greenhouse gas (GHG) mitigation in forests, leaving stakeholders to decide what specific action to take and what tools to use. Others argued that legislation should be 'material neutral' and should not prescribe specific materials or technology to achieve objectives. A considerable number of submissions are categorical in stating that CH_4 and N_2O emissions are 'biological' and thus 'unavoidable'. EU policy-makers are warned to avoid leakage/relocation of production outside the EU.

Forest producers believe that high costs for their industry already limit opportunities to compete in the market against other materials; combined with a lack of incentives, this means wood is not being mobilised and the full mitigation potential of forests is not being exploited. Forest management reference levels should, in the view of some, 'be set nationally'. LULUCF rules are considered 'unfair' on (forest) biomass producers, because they focus too much on maintaining the forest sink, thereby limiting the use of wood.

On options, forestry interests seem most aligned with option 1, with a perceived risk that options 2 and 3 mean that 'emissions in other sectors could be offset by measures in forestry' and would limit use of wood products. One farmers' union also clearly preferred option 1. Agricultural producer and bioenergy organisations often prefer option 2, with refinements, and a smaller but still significant grouping see option 3 as the way to reduce administrative burden.

Non-governmental organisations

NGOs emphasise as principal objectives the conservation of carbon stocks and biodiversity, and enhanced mitigation in agriculture. Bioenergy/biomass is often seen as a driver of emissions. Some urge stronger sustainability criteria, while others would simply cap bioenergy production/use. Leakage and indirect land-use change are also brought up by some. In general, stakeholders in this group call for more definitive EU policy on climate change mitigation in agriculture and forestry, and on soils.

The CAP receives widespread and strong criticism from this stakeholder group. According to some, it does not provide sufficient incentives for mitigation, while others see it as 'the main obstacle' to mitigation measures in agriculture (e.g. due to untargeted subsidies, thereby driving overproduction) and suffering from weak environmental provisions.

A number of NGOs explicitly call for binding national targets for LULUCF. Many are opposed to flexibility between LULUCF and other sectors, arguing that it would weaken ambition in the latter, and question the environmental integrity and additionality of LULUCF credits.

Option 1 is the most popular (13 replies), mostly due to fears on the flexibility issue. Those who do not choose option 1 often mention that it does not provide sufficient incentives for sustainable forest management and the enhancement of sinks.

Analysis of responses to highlighted questions

Many respondents identified accounting rules as key to the environmental integrity of the scheme. This cross-cutting issue was clearly highlighted in the stakeholder questionnaire. The section below contains more detailed analysis of answers to question 6 (How could the present rules be improved?) and responses as to the preferred policy option (question 8).

Responses on accounting rules (question 6)

For some Member State respondents, the rules in Decision No 529/2013/EU provide clear incentives and policy signals for investment in mitigation. The Decision should be the starting point for the new framework, which should account for all LULUCF activities.

With the current net-net accounting approach for cropland and grassland management, credits often relate more to land-use change than to actual carbon stock evolution on the land parcel. Moreover, the outcome in terms of credits and debits in the commitment period is largely determined by areas of cropland and grassland in 1990, rather than changes in soil carbon content during the period. Some respondents suggest that this should be reviewed to eliminate any potential adverse effects. A reference period based on a five-year average and a more recent period around 2005 could be used (rather than a single reference year), while taking into account relevant past mitigation efforts.

In forest management, some forestry organisations argue that the complicated accounting rules resulting from the Kyoto negotiations should be replaced by a simpler and more transparent approach reflecting biophysical conditions, so that accounting rules do not allow forest sink to generate debits. Others are generally satisfied with the current approach of using projected forest management reference levels, although this will need to be confirmed in coming years, when the projected levels can be compared with actual emissions/removals. Forest management reference levels would need to be updated for the 2021-2030 period.

Other respondents consider that Member States should account for all anthropogenic emissions and removals from a historical base year or period (not from projected reference levels, as is currently the case in forest management). The idea of accounting against a commitment period (not annually) received wide support.

With accounting becoming mandatory for cropland and grazing land management from 2020 in the EU, some NGO respondents would like accounting rules also to become mandatory after 2020 for other non-forest LULUCF activities, especially wetland drainage and rewetting (currently voluntary).

For some respondents, LULUCF and agriculture should be treated coherently to reflect key linkages between the sectors and improve cost-effectiveness. Monitoring and reporting of LULUCF and agriculture should be enhanced by introducing benchmarks for performance and harmonised rules to improve comparability and verification. For example, criteria could be put in

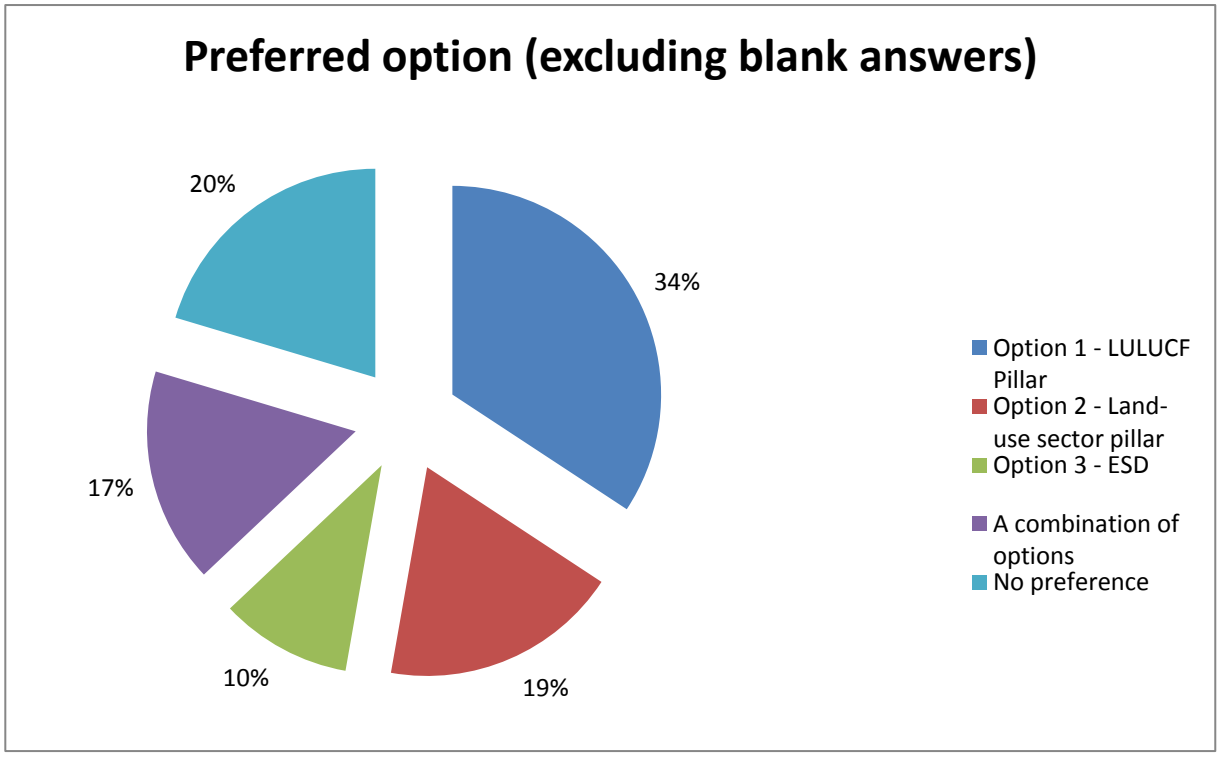
place to ensure that carbon sequestration does not undermine other objectives such as biodiversity. Environmental criteria could act as thresholds, i.e. if the environmental criteria are not met, a credit cannot count. Coordinated planning, reporting and presentation of information under the LULUCF Decision and the Monitoring Mechanism Regulation could promote long-term policy coherence between linked sectors (e.g. agriculture and waste).

Another possible improvement could be to switch to a land-based approach in line with the United Nations Framework Convention on Climate Change (UNFCCC), rather than an activity-based approach as under the Kyoto Protocol (KP). This could ensure more comprehensive coverage of emissions and removals, simplify reporting and accounting, and increase the comparability of accounting data with those of non-KP countries. In any event, any proposed changes to the existing rules should take account of developments regarding international agreements and accounting options.

Responses on the preferred policy option (question 8)

There was a certain amount of interest shown in all options, and also in combinations of options. Roughly half of the respondents in each stakeholder category expressed no clear preference for any option.

Table A2.2. Preferred options



Some respondents chose a specific option, but underlined conditions under which they would consider it truly acceptable. Others pointed to a combination of options as a way of specifying conditions or a mix of approaches that would make a specific option acceptable. Respondents' assumptions on the cross-cutting issues (accounting, targets and flexibility) are critical to understanding what approach they prefer. As a consequence, simply identifying how many stakeholders favoured which option can be misleading. Also, a review of responses to this

consultation does not provide a statistically representative picture of the EU – some Member States and sectoral organisations were over- or under-represented.

Option 1 — the LULUCF pillar: Maintain non-CO_2 agriculture sector emissions in a potential future effort-sharing decision and further develop a LULUCF sectoral policy approach separately

Slightly over a third of the respondents were in favour of keeping LULUCF as a separate pillar within the climate and energy framework, which makes option 1 the preferred option for those respondents that replied to this question. Option 1 received strong support from the majority of the environmental and climate NGOs and from the forestry sector and is also the option preferred by some agriculture organisations and at least four Member States. It was also supported to some extent by other interest groups, including one research institute and one SME.

One of the main advantages put forward by these respondents is that option 1 would ensure continuity with the approach followed to date to reporting and accounting for LULUCF emissions and removals and is therefore the most easily operational option in the short term. It would allow the LULUCF sector to be addressed independently, taking into account the specificities of the sector, thereby enabling the development of sector-specific policies, targets and accounting rules.

Some respondents indicate that the annual accounting cycle that applies to sectors covered by the effort-sharing decision (ESD) would not be appropriate for the LULUCF sector, as it could lead to errors in the annual accounts.

Several respondents, including NGOs, one agricultural organisation and one Member State, consider that option 1 would contribute best to maintaining environmental integrity. These respondents deem it important that the current carbon sink represented by LULUCF is not used to offset emissions in other ESD sectors.

Respondents from all interest groups also indicated a number of disadvantages of option 1. It would involve maintaining a divided approach to emissions/removals from agriculture and other land uses. For some respondents, it would thus have limited policy coherence. A number of respondents from various interest groups (sector organisations, academics, Member States) assumed that there would be no flexibility between the LULUCF pillar and other ESD sectors. According to some respondents, this would entail higher marginal abatement costs in the LULUCF sector and/or in the ESD.

Beyond the potential implications for marginal abatement costs, some NGOs fear that option 1 would not provide actors in the LULUCF sector with sufficient incentive for enhanced mitigation.

Option 2 — Land-use sector pillar: Merging LULUCF and agricultural non-CO_2 emissions into one new independent pillar of the EU's climate policy

Slightly under a fifth of respondents who identified a preferred option were in favour of merging LULUCF and agricultural non-CO_2 emissions into a separate pillar. This option is more often

supported by stakeholders in the agriculture sector. It is also supported by three Member States (subject to certain conditions) and a few individual businesses and research institutes.

The advantages put forward by respondents in favour of option 2 underline the integrated and holistic approach for agriculture and the forestry sector. Option 2 could promote the development of a coherent mitigation policy and a long-term policy vision. For agricultural activities, the merger of all emissions/removals into one pillar could ensure better alignment with existing agricultural policies and facilitate the use of the CAP as a means of promoting climate mitigation action in the sector. This in turn could improve the visibility of the issue and encourage farmers/foresters to maximise carbon stocks on their land.

According to some farmers' organisations and Member States with limited agriculture mitigation potential, option 2 would enable the implementation of cost-effective solutions. On the other hand, other respondents, notably environmental NGOs, argue against this flexibility/trade-off.

Option 2 would also have several disadvantages. It would require a substantial overhaul of current EU climate policy. A number of Member States, NGOs and industry respondents anticipate that target-setting for the agriculture and forestry sectors, especially establishing an *ex ante* target, would raise considerable difficulties given the complexity of merging two different emission sources. This could also result in major accounting uncertainty. As with option 1, some Member States, researchers, agricultural and industry sector respondents note that, in principle, the creation of a sector-specific target reduces flexibility between sectors and therefore the potential cost-effectiveness of mitigation measures and actions.

Other issues raised include the fact that the withdrawal of agricultural emissions from the ESD could be criticised as a retrograde step in the EU's commitment *vis-à-vis* the international community and that removing non-CO_2 agricultural emissions from the ESD could lead to the loss of close links between the agriculture and waste sectors under the ESD.

Option 3 — Effort sharing: Include the LULUCF sector in a potential future ESD

Overall, approximately 10 % of respondents were in favour of integrating the LULUCF sector in a future ESD.

Option 3 is considered by a wide range of respondents to constitute the most coherent approach to GHG reduction targets, since it would integrate all relevant sectors under the ESD. In addition, it is the only option that would consider agricultural and wood supply chain emissions together. For some respondents, this should encourage a more integrated and systemic approach to climate mitigation in these supply chains.

Some Member States and researchers suggest that option 3 could constitute a good approach to the issue of accounting for biomass use for energy. Under Intergovernmental Panel on Climate Change (IPCC) rules, CO_2 emissions from biomass combustion are not added to energy emissions, on the assumption that related carbon stock changes are captured in the LULUCF sector by a respective decrease in carbon stocks. For several respondents, this is seen as leading to major gaps in biomass emission accounting and option 3 would be a means of creating the necessary linkages.

Option 3 is considered by many as providing the greatest flexibility to achieve the ESD target. Some Member States are of the view that the combined treatment of ESD and LULUCF would offer them the flexibility they need to achieve their overall target in the most cost-effective manner.

For other respondents, one of the main disadvantages associated with option 3 is the risk that the carbon sink represented by the LULUCF sector would be used systematically to offset emissions in other ESD sectors, thereby undermining the general objective of the climate and energy framework.

Respondents from the forestry sector are typically concerned that option 3 would put additional pressure on forests to play a carbon sequestration role in the EU. This would constrain the development of the forestry sector in terms of wood production for biomass.

For some respondents, it would be detrimental if the LULUCF target under option 3 were to be calculated according to the current ESD criteria (GDP *per capita*), as this would not reflect the real potential contribution of LULUCF at Member State level.

Some also highlight that option 3 could create a greater level of uncertainty in view of the variability in emissions observed in the LULUCF sector and the absence of a robust and stable accounting system for forestry in particular. Respondents from all groups (researchers, Member States, NGOs, sectoral organisations) further stress the substantial methodological and accounting issues posed by option 3.

Stakeholder responses suggesting a combination of options

A number of respondents proposed a combination of options as their preferred approach.

Respondents in favour of a combination of options 1 and 2 stress the need to address LULUCF independently. While option 2 is appealing in that it would embrace different aspects of agricultural land management, respondents recognise the technical challenges of such an approach.

The combination of option 1 with option 3 is deemed to combine the advantages of option 1 — mitigation policy measures and action and specific accounting rules adapted to LULUCF — with those of option 3, especially the flexibility and the cost-effective mitigation solutions expected to come from the incorporation of LULUCF in the ESD target.

A few environmental and climate NGOs believe that, under all options, it is forest management that raises most difficulties. Accordingly, they believe that forest management should be separated from other LULUCF sectors and dealt with independently, while non-CO_2 emissions from agriculture and the remaining LULUCF activities (cropland management, grazing land management and wetland drainage and rewetting) should be integrated into the ESD.

Summary of the 'Agriculture and LULUCF in the 2030 EU Climate and Energy Framework' stakeholder workshop (Brussels, 14-15 September)

The workshop took place in a positive atmosphere, with substantial debate on outstanding issues. There was a very high turnout of registered participants and several last-minute arrivals,

including Member State permanent representations, ministries and other regulatory agencies (AT, BE, CZ, DE, DK, EE, ES, FI, FR, HU, IE, LT, LV, LU, MT, NL, PL, PT, RO, SE, SK, UK + CH, NO); forestry and farmers' associations (EU state forests, EU forest owners, COPA-COGECA, etc.); business associations (European Paper Industries, European Biogas Association, Cement Association, etc.); environmental NGOs (Climate Action Network, EEB, etc.); think-tanks and academia.

Some key messages emerging from the workshop were:

- There was **broad agreement that accounting** rules are strongly linked to environmental integrity. Particularly intense discussion took place on forest management and on the risk that it may flood non-ETS sectors with credits unless stringent reference levels are determined;
- Significant support was voiced for **simplification, modernisation and land-based accounting**. There was general acceptance of current accounting rules for harvested wood products and agricultural non-CO_2 gases. Policy design should increase transparency on how carbon/biomass is moved between sectors and Member States;
- Views on **flexibility** ranged from demanding unlimited flexibility to considering flexibility as a threat to ambition (environmental NGOs);
- On **burden sharing**, GDP *per capita* was seen as an insufficient basis for LULUCF due to the uneven distribution of natural potential; regulation should ensure a level playing-field; the need to recognise improvements in efficiency (carbon intensity) was emphasised;
- In terms of **barriers**, the lack of the right incentives (also in the CAP) and the lack of EU competence in forest issues were recurring themes. Imports/exports (competitiveness, trade and accounting issues) were mentioned as problematic areas;
- A **cautious coalition** of diverse (non-Member State) stakeholders emerged around option 1 (LULUCF separate pillar), but there was no consensus on what exactly it would entail;
- Several participants called for enhanced communication on the **co-benefits** of mitigation measures for adaptation, e.g. in terms of farmers becoming more resilient; and
- Expectation was expressed that the Commission would deliver a coordinated non-ETS proposal in a reasonable timeframe (2016).

The event began with opening comments and high-level statements from DG CLIMA and DG AGRI. A high-level panel discussion followed, with the participation of Pekka Pesonen (COPA-COGECA), Piotr Borkowski (EUSTAFOR), Dr Aljoscha Requardt (CEPF), Pieter De Pous (EEB), Marco Mensick (CEPI) and Jan Stambasky (European Biogas Association). The workshop continued with break-out group discussions around key topics from the consultation, as follows:

G1) Cropland/grassland/peatlands/soil and nutrient management;

G2) Livestock systems;

G3) Forest management; and

G4) Biomass/Energy/Industry nexus.

In each group, discussion was structured around the same four main questions. On Day 2, external contractors presented the outcome of studies on mitigation potential in agriculture and LULUCF.

ANNEX 3. WHO IS AFFECTED BY THE INITIATIVE AND HOW

The issue at hand is related to the EU mitigation efforts in general and how agriculture, land use and forestry can contribute to the increased ambition of the EU's 2030 emission reduction target.

While farmers and foresters are key actors in the implementation of climate action on land, the preceding discussion has shown how the EU has already successfully protected carbon stores and reduced emissions in a key sector without directly targeting individual actors. Consistent with this past experience, the proposed legal instrument is addressed at Member States (and to be implemented at national level) rather than the small and medium enterprises which comprise the millions of farm and forestry holdings across the EU. Furthermore, it builds on existing legislation which already takes this approach, in particular Decision 529/2013/EU and will therefore not imply a system change but only taking a next step in further integrating this sector into the EU's domestic mitigation framework.

Changes to the existing accounting framework, as consequence of including LULUCF into the EU's domestic 2030 reduction target, and any related needs to adjust monitoring and reporting, may potentially introduce impacts. These impacts are likely to be most felt by Member State administrations responsible for greenhouse gas inventories, and the Commission services responsible for coordinating and verifying the information. Potentially affected public institutions include statistical offices, agricultural, climate, energy and environmental authorities, agencies dealing with zoning and territorial planning, as well as universities and research institutes.

The costs of carrying out these activities are incurred by the public budget. It is not expected that private actors would face additional data requirements.

Altogether, the impact of the post-2020 changes is expected to be very limited, because the relevant accounting rules already have been set up with LULUCF Decision 529/2013/EU. Member States are thus already developing enhanced systems to account for emissions and removals for forestry and agricultural land in order to accurately include emissions and removals in the national greenhouse gas inventories, and thus be compliant with existing legislation. Moreover, several of the accounting options discussed in the IA would entail a reduction of administrative burden for Member States. Administrative costs do not differ significantly under the main policy options as accounting rules are assumed to be the same in all cases. At the same time, reduced administrative burden will deliver a positive impact through the streamlining of the currently existing parallel reporting systems (under Kyoto Protocol and under the Convention) into one.

ANNEX 4. ANALYTICAL MODELS AND MODEL-BASED SCENARIOS USED IN PREPARING THE IMPACT ASSESSMENT

The model suite used for this impact assessment has a successful record of use in the Commission's climate policy impact assessments – it is the same model suite as used for the 2030 climate and energy policy framework. The models and their linkages are briefly described in the following subsections. Detailed model descriptions can be found on the DG CLIMA website[80]. This modelling Annex is based on the counterpart in the ESD Impact Assessment.

The models cover all GHG emissions and removals:

- **Emissions:** CO_2 emissions from energy and processes (PRIMES), CH_4, N_2O, fluorinated greenhouse gases (GAINS), CO_2 emissions from LULUCF (GLOBIOM-G4M), air pollution SO_2, NOx, PM2.5-PM10, ground level ozone, VOC, NH_3 (GAINS)

- **Emission reduction and removals:** structural changes and technologies in the energy system and industrial processes (PRIMES), technological non-CO_2 emission reduction measures (GAINS), changes in land use (GLOBIOM-G4M-CAPRI)

- **Time horizon:** 1990 to 2050 (5-year time steps)

- **Geography:** individually all EU Member States, EU candidate countries and, where relevant Norway, Switzerland and Bosnia and Herzegovina

- **Impacts:** on energy, transport, industry, agriculture, forestry, land use, atmospheric dispersion, health, ecosystems (acidification, eutrophication), macro-economy with multiple sectors, employment and social welfare

- **Split ETS –ESD:** with split ETS-ESD calibrated on the basis of the existing scope for the period 2005-2050. This leads

Related to this last element, to ensure modelling consistency over time, the scope of the ESD and ETS is kept constant over the time horizon 2005-2050 which means that historic ESD estimates need to be updated to reflect changes in the coverage in the ESD. These include notably the impact of the expansions in scope of the ETS, notably in 2013 the inclusion of some industrial process CO2, N2O and PFC emissions as well as the inclusion of RO, BG and HR in the ETS after 2005 (with no monitored ETS data available for 2005 to estimate the exact split ETS-ESD).

This recalibration of historic split in 2005 ESD-ETS emissions, to take into account these scope extension afterwards, is based on an estimation method developed by the EEA[81], also taking into account most recent UNFCCC and ETS inventory submissions (for the 2016 Reference this was the inventory as submitted in 2015). This allows presenting a meaningful emission trend over time within the ETS and ESD.

[80] http://ec.europa.eu/clima/policies/strategies/analysis/models/index_en.htm

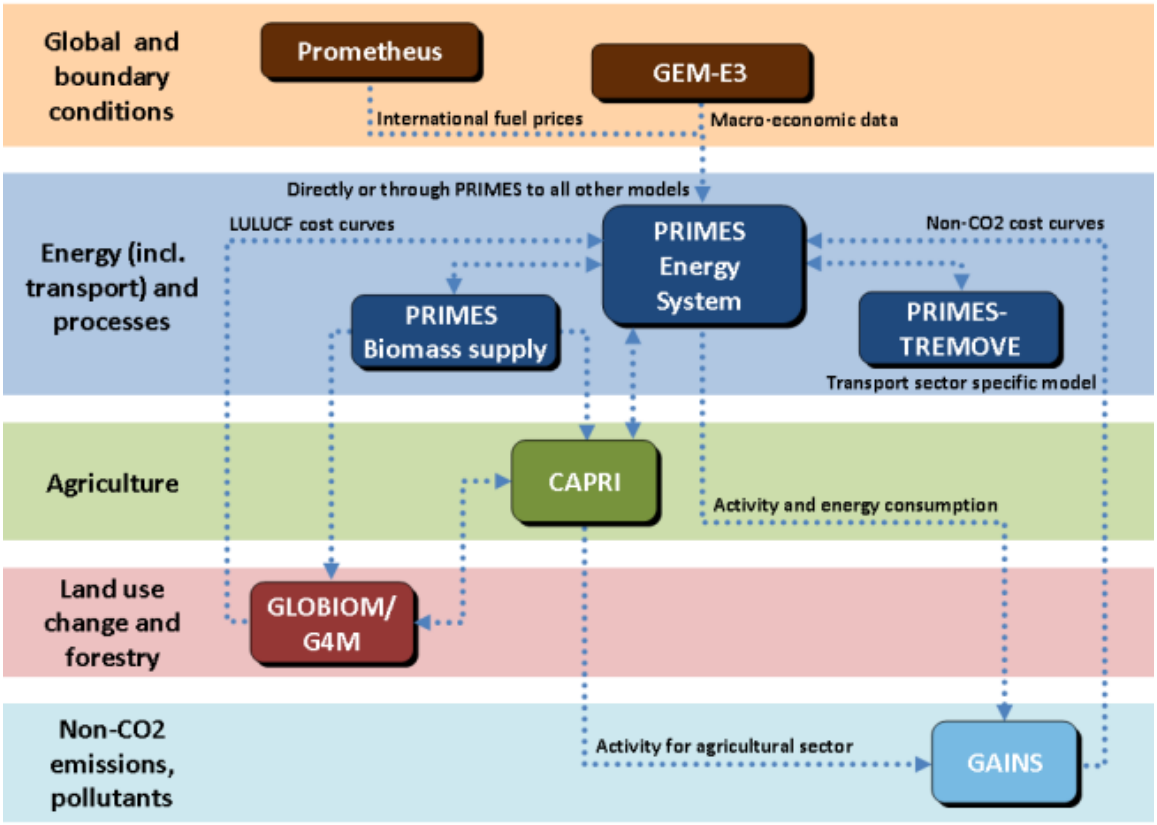
[81] See the EEA ETS data viewer (http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer) and accompanying documentation.

It can be noted that this approach is different from the approach in the ESD legislation for instance in relation to how AEA allocation was reduced due to extension of scope of the ETS in 2013 or the impact of recent inventory changes. This may lead to some difference in 2005 emissions between those used in modelling exercise, and those used as base year for setting targets in the ESD.

Overview of model inter-linkages

The models are linked with each other in formally-defined ways to ensure consistency in the building of scenarios, as shown graphically below.

Figure 9: Inter-linkages between models



Source: DG CLIMA based on E3MLab/ICCS[82]

PRIMES

The PRIMES model is an EU energy system model which simulates energy consumption and the energy supply system. It is a partial equilibrium modelling system that simulates energy market equilibrium in the European Union and each of its Member States. This includes consistent EU carbon price trajectories.

[82] http://ec.europa.eu/clima/policies/strategies/analysis/models/index_en.htm

Decision making behaviour is forward looking and grounded in micro economic theory. The model also represents in explicit and detailed way energy demand, supply and emission abatement technologies, and includes technology vintages.

The core model is complemented by a set of sub-modules, of which the transport sector module and the biomass supply module are described below separately in more detail. Industrial non-energy related CO2 emissions are covered by a sub-module so that total CO2 emissions can be projected. The model proceeds in five year steps and is for the years 2000 to 2010 calibrated to Eurostat data.

The PRIMES model is suitable for analysing the impacts of different sets of climate, energy and transport policies on the energy system as a whole, notably on the fuel mix, CO_2 emissions, investment needs and energy purchases as well as overall system costs. It is also suitable for analysing the interaction of policies on combating climate change, promotion of energy efficiency and renewables. Through the formalised linkages with GAINS non-CO_2 emission results and cost curves, it also covers total GHG emissions and total ESD sector emissions. It provides details on the Member State level, showing differential impacts across Member States.

PRIMES has been used for the analysis underpinning the Commission's proposal on the EU 2020 targets (including energy efficiency), the Low Carbon Economy and Energy 2050 Roadmaps as well as the 2030 policy framework for climate and energy.

PRIMES is a private model and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[83] in the context of a series of research programmes co-financed by the European Commission.

The model has been successfully peer reviewed[84], most recently in 2011[85].

PRIMES-TREMOVE

The PRIMES-TREMOVE Transport Model projects the evolution of demand for passengers and freight transport by transport mode and transport mean. It is essentially a dynamic system of multi-agent choices under several constraints, which are not necessarily binding simultaneously. The model consists of two main modules, the transport demand allocation module and the technology choice and equipment operation module. The two modules interact with each other and are solved simultaneously.

The projection includes details for a large number of transport means, technologies and fuels, including conventional and alternative types, and their penetration in various transport market segments. It also includes details about greenhouse gas and air pollution emissions, as well as impacts on external costs of congestion, noise and accidents.

[83] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

[84] http://ec.europa.eu/clima/policies/strategies/analysis/models/docs/primes_model_2013-2014_en.pdf.

[85] https://ec.europa.eu/energy/sites/ener/files/documents/sec_2011_1569_2.pdf

PRIMES Biomass Supply

The biomass system model is linked with the PRIMES energy system model for Europe and can be either solved as a satellite model through a closed-loop process or as a stand-alone model.

It is an economic supply model that computes the optimal use of biomass/waste resources and investment in secondary and final transformation, so as to meet a given demand of final biomass/waste energy products, projected to the future by the rest of the PRIMES model. The biomass supply model determines the consumer prices of the final biomass/waste products used for energy purposes and also the consumption of other energy products in the production, transportation and processing of the biomass/waste products. The model also reflects the sustainability criteria currently in place and can be used for reflecting policies facilitating the use of renewable energy sources. After cross check of input data and draft results, results of the biomass supply model are used to ensure consistency between PRIMES, CAPRI and GLOBIOM bioenergy modelling.

The PRIMES biomass supply model is private and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[86].

GAINS

The GAINS (Greenhouse gas and Air Pollution Information and Simulation) model is an integrated assessment model of air pollutant and greenhouse gas emissions and their interactions. GAINS brings together data on economic development, the structure, control potential and costs of emission sources and the formation and dispersion of pollutants in the atmosphere.

In addition to the projection and mitigation of greenhouse gas emissions at detailed sub-sectorial level, GAINS assesses air pollution impacts on human health from fine particulate matter and ground-level ozone, vegetation damage caused by ground-level ozone, the acidification of terrestrial and aquatic ecosystems and excess nitrogen deposition of soils.

Model uses include the projection of non-CO_2 GHG emissions and air pollutant emissions for EU Reference scenario and policy scenarios, calibrated to UNFCCC emission data as historical data source. This allows for an assessment, per Member State, of the (technical) options and emission potential for non-CO_2 emissions. Health and environmental co-benefits of climate and energy policies such as energy efficiency can also be assessed.

The GAINS model is accessible for expert users through a model interface[87] and has been developed and is maintained by the International Institute of Applied Systems Analysis[88]. The underlying algorithms are described in publicly available literature. The source code is not disclosed. GAINS and its predecessor RAINS have been peer reviewed multiple times, in 2004, 2009 and 2011.

[86] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

[87] http://gains.iiasa.ac.at/models/

[88] http://www.iiasa.ac.at/

GLOBIOM-G4M

The Global Biosphere Management Model (GLOBIOM) is a global recursive dynamic partial equilibrium model integrating the agricultural, bioenergy and forestry sectors with the aim to provide policy analysis on global issues concerning land use competition between the major land-based production sectors. Agricultural and forestry production as well as bioenergy production are modelled in a detailed way accounting for about 20 globally most important crops, a range of livestock production activities, forestry commodities as well as different energy transformation pathways.

GLOBIOM covers 28 (or 50) world regions. The disaggregation of the EU into individual countries has been performed only recently.

Model uses include the projection of emissions from land use, land use change and forestry (LULUCF) for EU Reference scenario and policy scenarios. For the forestry sector, emissions and removals are projected by the Global Forestry Model (G4M), a geographically explicit agent-based model that assesses afforestation-deforestation-forest management decisions. GLOBIOM-G4M is also used in the Impact Assessment for agriculture and LULUCF to assess the options (afforestation, deforestation, forest management, cropland and grassland management) and costs of enhancing the LULUCF sink for each Member State.

The GLOBIOM-G4M is a private model and has been developed and is maintained by the International Institute of Applied Systems Analysis.[89]

GEM-E3

The GEM-E3 (World and Europe) model is an applied general equilibrium model, simultaneously representing the whole world economy, its major regions and the 28 EU Member States, linked through endogenous bilateral trade flows and environmental flows.

GEM-E3 aims at covering the interactions between the economy, the energy system and the environment. It is a comprehensive model of the economy, the productive sectors, consumption, price formation of commodities, labour and capital, investment and dynamic growth. The model is dynamic, recursive over time, driven by accumulation of capital and equipment. Technology progress is explicitly represented in the production function. It is updated regularly using the latest revisions of the GTAP database and Eurostat statistics for the EU Member States.

It is updated regularly using the latest revisions of the GTAP database and Eurostat statistics for the EU Member States.

The GEM-E3 model has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens[90], JRC-IPTS[91] and others. It is documented in detail but the specific versions are private.

[89] http://www.iiasa.ac.at/

[90] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

[91] https://ec.europa.eu/jrc/en/institutes/ipts

The model has been used by E3MLab/ICCS to provide the macro assumptions for the Reference scenario and for the policy scenarios. It has also been used by JRC-IPTS to assess macroeconomic impacts of target setting based on GDP per capita.

Prometheus

PROMETHEUS is a fully stochastic world energy model used for assessing uncertainties and risks associated with the main energy aggregates including uncertainties associated with economic growth and resource endowment as well as the impact of policy actions. The model projects endogenously to the future the world energy prices, supply, demand and emissions for ten world regions.

World fossil fuel price trajectories are used as import price assumptions for EU Reference scenario and for policy scenario modelling.

The Prometheus model is private and has been developed and is maintained by E3MLab/ICCS of National Technical University of Athens.[92]

CAPRI

CAPRI is an open source economic partial equilibrium model developed by European Commission research funds. Operational since more than a decade, it supports decision making related to the Common Agricultural Policy and Environmental policy related to agriculture based on sound scientific quantitative analysis.

CAPRI is only viable due to its pan-European network of researchers which based on an open source approach tender together for projects, develop and maintain the model, apply it for policy impact assessment, write scientific publications and consult clients based on its results. It has been the basis of numerous peer reviewed publications.

The model has been used to provide consistent agricultural activity projections for the EU Reference scenario 2016s. It is also used in the LULUCF impact assessment.

The CAPRI model is an open source model which has been developed and is maintained by Eurocare GmbH[93], JRC, and other partners of the CAPRI network.

The EU Reference scenario 2016

Scenario design, consultation process and quality assurance

Building an EU Reference scenario is a regular exercise by the Commission. It is coordinated by DGs ENER, CLIMA and MOVE in association with the JRC, and the involvement of other services via a specific inter-service group.

The Reference scenario 2016 (REF2016) has been developed building on a modelling framework including as core models PRIMES (PRIMES-TREMOVE for transport), GAINS and

[92] http://www.e3mlab.National Technical University of Athens.gr/e3mlab/

[93] http://www.eurocare-bonn.de/

GLOBIOM-G4M and as supporting models GEM-E3, PROMETHEUS, PRIMES Biomass supply and CAPRI (see prior section for details).

Member States were consulted throughout the development process through a specific Reference scenario expert group which met three times during the development of REF2016. Member States provided information about adopted national policies via a specific questionnaire, key assumptions have been discussed and in each modelling step, draft Member State specific results were sent for consultation. Comments of Member States were addressed to the extent possible, keeping in mind the need for overall comparability and consistency of the results.

Quality of modelling results was assured by using state of the art modelling tools, detailed checks of assumptions and results by the coordinating Commission services as well as by the country specific comments by Member States.

REF2016 projects EU and Member States energy, transport and GHG emission-related developments up to 2050, given current global and EU market trends and adopted EU and Member States' energy, transport, climate and related relevant policies.

"Adopted policies" refer to those that have been cast in legislation in the EU or in MS (with a cut-off date end of 2014[94]). Therefore the binding 2020 targets are assumed to be reached in the projection. This concerns GHG emission reduction targets (both for the EU ETS as well as ESD sectors) as well as RES targets, including RES in transport.

However, policies which are not yet legally implemented, e.g. those necessary to implement the 2030 energy and climate framework, are not part of REF2016[95]. On this basis, REF2016 can help identify areas where the current policy framework falls short of reaching the EU's climate and energy objectives[96]. Notably, REF2016 shows that current policy and market conditions will deliver neither our 2030 targets nor our long-term 2050 decarbonisation goal.

REF2016 provides projections, not forecasts. Unlike forecasts, projections do not make predictions about what the future will be. They rather indicate what would happen if the assumptions which underpin the projection actually occur. Still, the scenario allows for a consistent approach in the assessment of energy and climate trends across the EU and its Member States.

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94 In addition, amendments to two Directives only adopted in the beginning of 2015 were also considered. This concerns notably the ILUC amendment to the RES directive and the Market Stability Reserve Decision amending the ETS Directive.

95 For the period after 2020, policies are included that are part of the EU *acquis*, as well as important investments that are part of Member States' national energy plans. For instance, ETS with the Market Stability Reserve is included in REF16, but not the Commission's proposal for a change in the linear reduction factor post-2020. New near-zero energy buildings after 2020 - as defined in the Energy Performance of Buildings Directive - continue to be built, as well as energy labelling continues. Member States also gave input on planned energy investments, particularly in nuclear energy.

96 Each new update of the Reference scenario models the projected impact of policy adopted up to the relevant cut-off date. Therefore, differences between two consecutive Reference scenarios , e.g. between the one from 2013 and REF2016, can be explained by the implications of policies adopted in the meantime as well as by changed economic and technological trends trends.

The report "EU Energy, Transport and GHG Emissions Trends to 2050 - Reference Scenario 2016"[97] describes the inputs and results in detail. This section summarises the main messages derived from it, especially those relevant for the Energy Union framework.

Main assumptions

The projections are based on a set of assumptions, including on population growth, macroeconomic and oil price developments, technology improvements and policies.

Macroeconomic assumptions

In REF2016, the population projections draw on the European Population Projections (EUROPOP 2013) by Eurostat. The key drivers for demographic change are: higher life expectancy, convergence in the fertility rates across Member States in the long term, and inward migration. The EU28 population is expected to grow by 0.2% per year during 2010-2030 (0.1% for 2010-2050), to 516 million in 2030 (522 million by 2050). Elderly people, aged 65 or more, would account for 24% of the total population by 2030 (28% by 2050) as opposed to 18% today.

GDP projections mirror the joint work of DG ECFIN and the Economic Policy Committee, presented in the 2015 Ageing Report[98]. The average EU GDP growth rate is projected to remain relatively low at 1.2% per year for 2010-2020, down from 1.9% per year during 1995-2010. In the medium to long term, higher expected growth rates (1.4% per year for 2020-2030 and 1.5% per year for 2030-2050) are taking account of the catching up potential of countries with relatively low GDP per capita, assuming convergence to a total factor productivity growth rate of 1% in the long run.

Sectoral activity projections are derived in a consistent way from these macroeconomic assumptions, using the macro-economic modelling tool GEM E3 as well as econometric estimates for global demand for energy intensive industries.

Fossil fuel price assumptions

Oil prices have fallen by more than 70% since mid-2014, reaching 35 $/barrel for Brent crude oil at the end of February 2016. The collapse of oil prices has been driven by low demand and sustained oversupply, due in particular to tight oil from North America and to the decision of the Organization of Petroleum Exporting Countries (OPEC) countries not to cut their output to rebalance the market. REF2016 considers a gradual adjustment process with reduced investments in upstream productive capacities by non-OPEC countries. Quota discipline is assumed to gradually improve among OPEC members. Thus, oil price is projected to reach 87 $/barrel in 2020 (in year 2013-prices). Beyond 2020, as a result of persistent demand growth in non-OECD countries driven by economic growth and the increasing number of passenger cars, oil price would rise to 113 $/barrel by 2030 and 130 $/barrel by 2050. This price trend resulting from

[97] https://ec.europa.eu/energy/en/statistics/energy-trends-2050

[98] European Commission/ DG ECFIN (2015): The 2015 Ageing Report: Economic and budgetary projections for the EU28 Member States (2013-2060), European Economy 3/2015

PROMETHEUS modelling is in line with other reference sources such as the 2015 IEA World Energy Outlook.

For the assessment of policy scenarios for this impact assessment no specific sensitivities were prepared with respect to oil and gas price developments. Still, it can be recalled that lower fossil fuel price assumptions tend to decrease energy system costs and to increase energy consumption and CO_2 emissions not covered by the ETS. The magnitude of the change would depend on the price elasticity and on the share of taxation, like excise duties, in consumer prices. Conversely, costs for emission mitigation could slightly increase. For transport, the changes would be limited (depending on the magnitude of the change in the oil price) due to the high share of excise duties in the consumer prices but they are still expected to lead to some higher energy consumption and CO_2 emissions. Different fossil price assumptions are however unlikely to lead to significantly different impacts across Member States, which is important when discussing target setting for instance in the context of cost efficiency concerns within the group of Member States with a GDP per capita above EU average.

Technoeconomic assumptions

In terms of technological developments, input assumptions are based on a wide range of sources[99], with estimates on technological costs across main types of energy equipment, from power generation to heating systems and appliances. In addition, it should be recalled that the PRIMES model (and other models where relevant) take into account technological progress, based on economies of scale effects and learning-by-doing.

In terms of technological developments relevant to the transport sector, battery costs for electric vehicles and plug-in hybrids are assumed to go down to 320-360 $/kWh by 2030 and 270-295 $/kWh by 2050; further improvements in the efficiency of both spark ignition gasoline and compression ignition diesel are assumed to take place. In addition, the market share of internal combustion engine (ICE) electric hybrids is expected to increase due to their lower fuel consumption compared to conventional ICE vehicles.

For the techno-economic assumptions in the projection of non-CO2 GHG emissions, see the detailed technical documentation[100]. In general, technological progress in this domain is strongly linked to regulation; hence Reference scenario assumptions are conservative.

Technology assumptions are based on extensive literature review and have been peer-reviewed by the Commission services, notably the Joint Research Centre of the European Commission.

Specific policy assumptions

[99] Those include, among others, the European Commission Joint Research Centre, notably for power generation costs or identification of Best Available Technologies, or MURE, ICARUS or ODYSSEE for the demand sectors.

[100] Höglund-Isaksson, L., W. Winiwarter, P. Purohit, A. Gomez-Sanabria (2016): Non-CO2 greenhouse gas emissions in the EU-28 from 2005 to 2050: GAINS 2016 Reference scenario, International Institute for Applied Systems Analysis (IIASA).

Following the above described policy modelling approach, the key policies included in the REF2016 relevant for this impact assessment are[101]:

- The Effort Sharing Decision (406/2009/EC) is assumed to be implemented, i.e. ESD GHG emission reductions at EU level in 2020 need to reach at least -10% compared to 2005 levels. It turned out that no specific policy incentives in addition to adopted EU and national policies were needed to achieve the EU level target. National ESD targets need not be achieved domestically given the existing flexibilities (e.g. transfers between Member States).

- The EU Emissions Trading System (Directive 2003/87/EC and its amendments) is fully reflected in the modelling, including the linear reduction factor of 1.74% for stationary installations and the recently adopted Market Stability Reserve[102]

- The Energy Efficiency Directive (EED) and the Energy Performance of Buildings Directive (EPBD) are reflected, including Member States' specific obligations as regards energy savings obligation and buildings codes.

- Ecodesign and Energy Labelling Directives and Regulations are also reflected.

- CO_2 standards for cars and vans regulations (Regulation (EC) No 443/2009, amended by Regulation EU No 333/2014 and Regulation (EU) No 510/2011, amended by Regulation EU 253/2014); CO2 standards for cars are assumed to be 95gCO2/km as of 2021 and for vans 147gCO2/km in line with current legislation. Standards are assumed constant after 2020/2021.

- The Renewable Energy Directive (Directive 2009/28/EC) and Fuel Quality Directive (Directive 2009/30/EC) including ILUC amendment (Directive (EU) 2015/1513): achievement of the legally binding RES target for 2020 (including 10% RES in transport target) for each MS, taking into account the use of flexibility mechanisms when relevant as well as of the cap on the amount of food or feed based biofuels (7%). Member States' specific renewable energy policies for the heating and cooling sector are also reflected where relevant.

- Directive on the deployment of alternative fuels infrastructure (Directive 2009/30/EC)

- The Waste Management Framework Directive (Directive 2008/98/EC) and in particular the Landfill Directive (Directive 1999/31/EC) which contribute to a significant reduction of emissions from waste.

- The revised F-gas Regulation (Regulation 517/2014) strengthens existing measures and introduces a number of far-reaching changes, notably limiting the total amount of the most important F-gases that can be sold in the EU from 2015 onwards and phasing them down in steps to one-fifth of 2014 sales in 2030, and banning the use of F-gases in many new types of equipment where less harmful alternatives are widely available.

- The impacts of the Reforms of the Common Agricultural Policy are taken into account, e.g. the milk quota abolition.

[101] For a more comprehensive discussion see the Reference scenario report

[102] Decision EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC

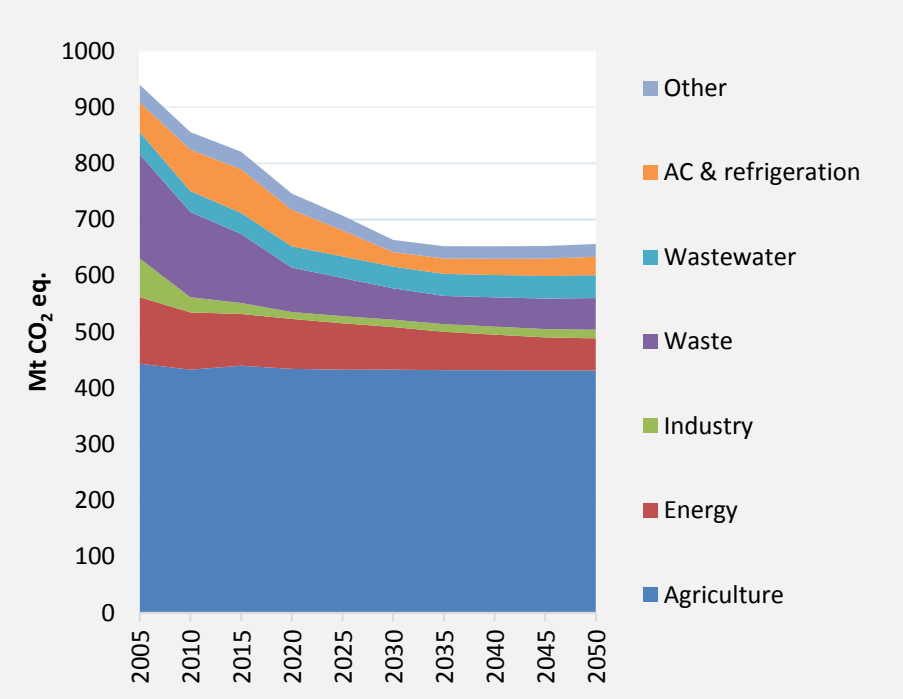
Relevant national policies, for instance on the promotion of renewable energy, on fuel and vehicle taxation or national building codes, are taken into account.

Summary of main results[103]

Non-CO2 emissions and their share in agriculture

Non-CO2 emissions (CH4, N2O and F-Gases), account currently (2013) for 18% of total EU GHG emissions (excluding LULUCF). They have decreased significantly (32%) between 1990 and 2013. They are expected to further decrease by 29% below 2005 levels in 2030, and to stagnate later on. CH4 emissions – which have the largest share in this aggregate - are projected to decrease above average (33% due to declining trends in fossil fuel production, improvements in gas distribution and waste management) and N2O emissions fall below average (17%) until 2030, both remaining flat thereafter. F-Gases would reduce by half between 2005 and 2030, largely driven by EU and Member State's policies (i.e. the 2014 F-gas regulation and mobile air conditioning directive); F-gases would increase somewhat between 2030 and 2050 in line with economic developments. Except for a very minor fraction from some specific industries, non-CO2 emissions fall under the ESD.

Figure 10: Non CO2 GHG emissions



Source: GAINS

The sectoral non-CO2 emission trends and their drivers vary per sector:

Agriculture is responsible for about half of all non-CO2 emissions and is expected to increase its share in total non-CO2 until 2030. While the agricultural non-CO2 emissions have reduced by

[103] For a summary of main results for all sectors, please see ESD IA Annex 8.4.

22% between 1990 and 2013, they are projected to roughly stabilize at current levels as a result of different trends which compensate each other, such as decreasing herd sizes (both of dairy cows and of non-dairy cattle) but increasing milk yields. Slightly reduced use of mineral fertilizer through improved efficiency (2% less in 2030 than in 2005) leads to corresponding reductions in N2O emissions from soils. Improved manure management (e.g. through anaerobic digestion) also delivers minor emission reductions. The Common Agricultural Policy influences livestock numbers/intensities and the Nitrogen Directive and the Water Framework Directive impact on the use of fertilizer.

Summary of findings for LULUCF

The EU28 Land Use Land Use Change and Forestry (LULUCF) sector is at present a net carbon sink which has been sequestering annually around -345 Mt CO_2 over the past decade according to the UNFCCC inventory data[104]. In the Reference scenario 2016, the LULUCF sink is expected to decline in the future to -288 Mt $CO_{2\ eq}$ in 2030 from -299 Mt CO_2 eq. in 2005 and decreases further after 2030. This decline is driven partly by the increase in timber demand (partially a result of the increase in bioenergy demand that is expected in order to reach the Renewable Energy targets in 2020. It is the result of changes in different land use activities of which changes in the forest sector are the most important. Figure 11 shows the projection of the total EU28 LULUCF sink in the Reference scenario 2016 and the contribution from different land use activities.

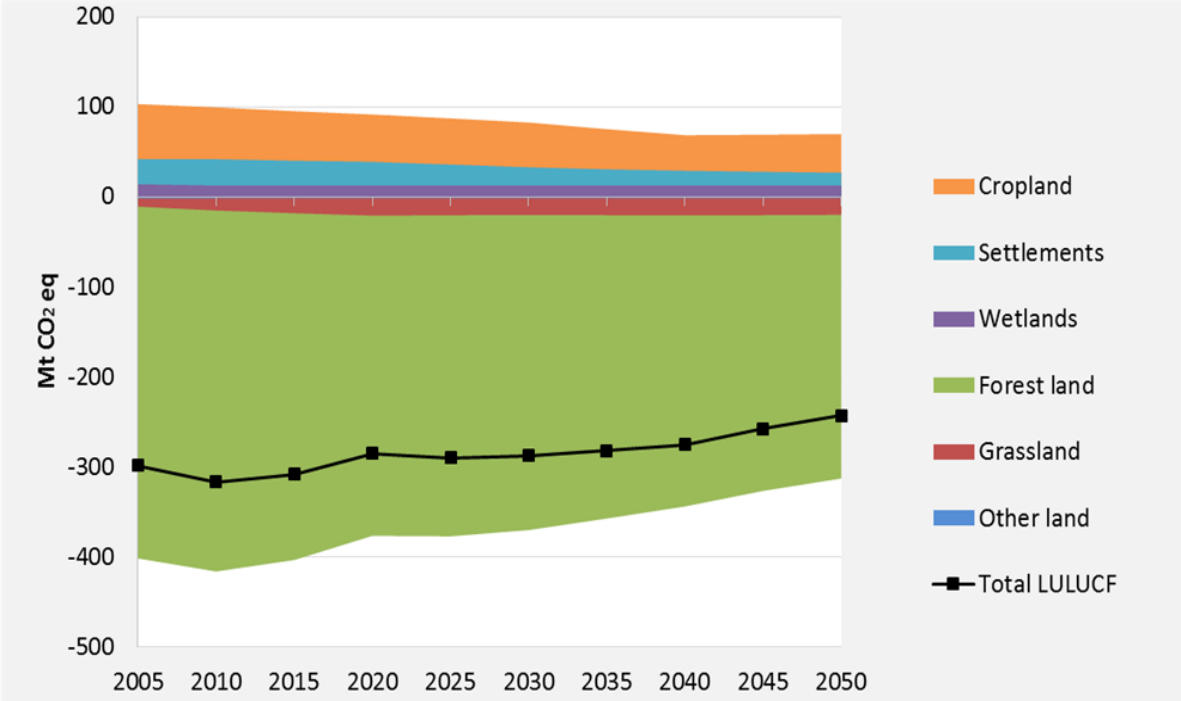
At present, the carbon sink in **managed forests** (-373 Mt $CO_{2\ eq.}$ in 2010), without applying any accounting rules, is the main contributor to the LULUCF sink. The forest management sink is driven by the balance of forest harvest and forest increment rates (accumulation of carbon in forest biomass as a result of growth of the trees with the age). Forest harvest is projected to increase over time from 516 million m^3 in 2005 to 565 million m^3 in 2030 due to growing demand for wood for material uses and energy production. As a consequence, the carbon sink in managed forests declines by 32% until 2030. This decline in the managed forests carbon sink is partially compensated by a rising carbon sink from afforestation and decreasing emissions from deforestation. Increasing demand for biomass drives wood prices up which results in increased income of forest owners which reduce deforestation to maintain forest area. Consequently, emissions from deforestation continue to decline, in line with past trends, from 63 Mt CO_2 in 2005 to 20 Mt CO_2 eq. in 2030. Carbon sequestration from afforested areas increases steadily to 99 Mt CO_2 eq. by 2030, as new forests are continuously, though at slower rate, being established. In addition, young forests that were established over the last 20 years get into a phase of high biomass production.

Activities in the **agricultural sector** (cropland and grassland) have a smaller impact on the total LULUCF sink compared to the forest sector. Still, net carbon emissions from cropland are projected to decline by some 18% by 2030 compared to 2005 as soils converge towards soil carbon equilibrium over time. In addition, perennial crops (miscanthus, switchgrass and short rotation coppice) that typically sequester additional carbon in soil and biomass contribute to decreasing cropland emissions. By 2030, 0.9 Mha of perennial crops are expected to be

[104] http://www.unfccc.int

cultivated. The grassland sink increases by 50% (from 2005) in 2030 and stabilizes at -19 Mt CO_2 eq. thereafter as land continues to be converted to grassland e.g. through cropland abandonment.

Figure 11: Development of the EU28 emissions/removals in the LULUCF sector in Mt CO2 until 2050



Source: GLOBIOM-G4M

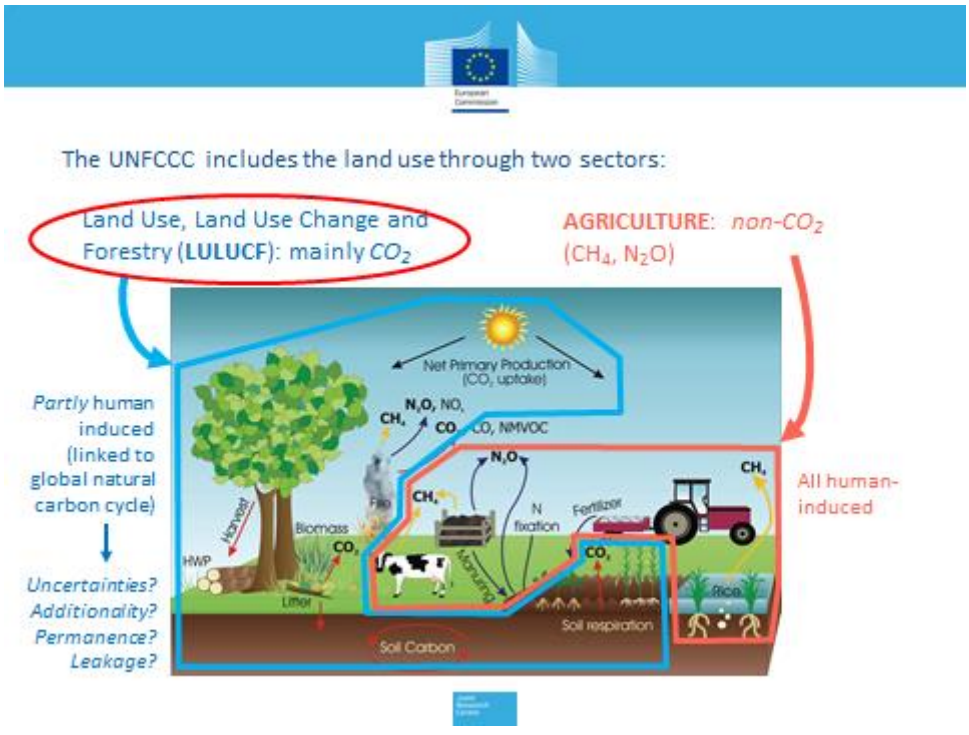
ANNEX 5: ACCOUNTING RULES

Introduction

It is widely acknowledged that reporting and accounting for emissions and removals in the LULUCF sector needs to be done carefully. This is a direct consequence of dealing with natural greenhouse gas cycles, which are more difficult to measure than e.g. emissions from industrial installations.

CO_2 emissions and removals in LULUCF mainly originate from gains and losses in the so-called LULUCF pools (living biomass, soil organic carbon etc.), belonging to different land cover categories (such as forest land, cropland, grassland etc.) At the same time, agricultural practices on farms, such as burning of crop residues, fertilizer application, rice cultivation, and emissions related to livestock (enteric fermentation and manure management) mainly produce methane and nitrous oxide emissions. These belong to the category "agriculture".

Figure Annex 5.1. Illustration of land uses that result in emissions and removals



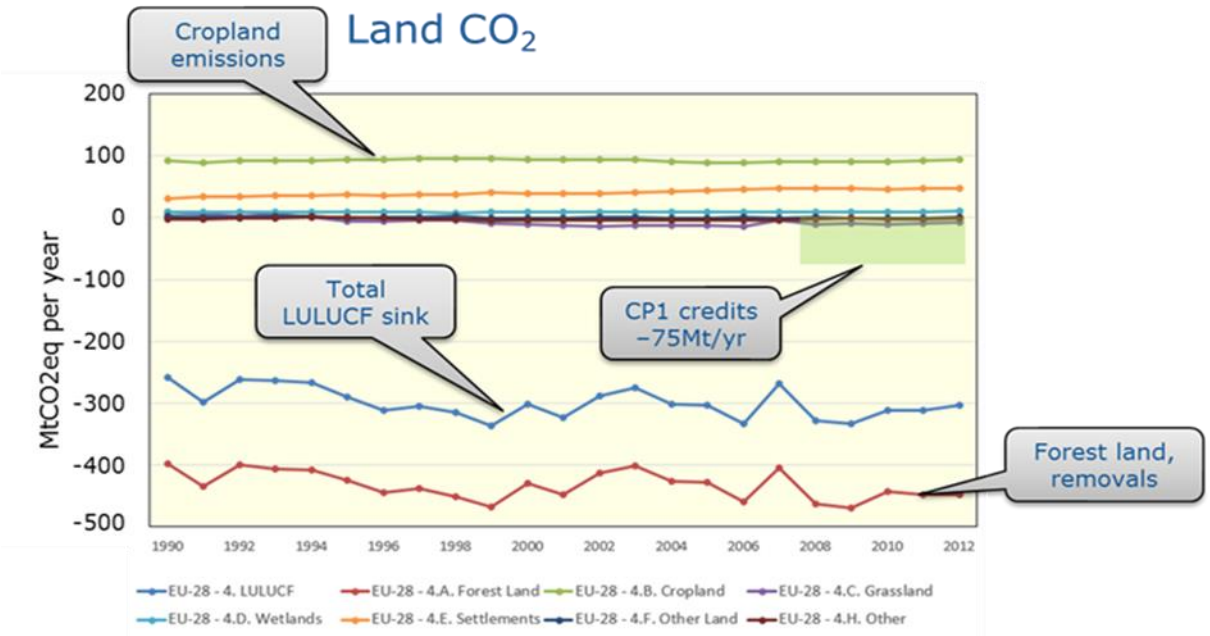
Source: own presentation, based on Iversen P., Lee D., and Rocha M., (2014) Understanding Land Use in the UNFCCC

As explained in Chapter 1 of this Impact Assessment, a key distinction needs to be made between "reported" and "accounted" emissions and removals in LULUCF. Contrary to other sectors covered by the ETS and the ESD, LULUCF emissions and removals are subject to a set of

accounting rules before they can be used towards compliance with targets. The main justification for the *accounting* approach in LULUCF is that a significant part of the removals associated with carbon stocks in forests and soils is the result of the natural greenhouse gas cycle. While *reporting* concerns an inventory of all emissions and removals, *accounting* aims to identify those which are human induced and the result of additional action.

As illustrated by Figure 5.2, the result of this distinction between "reported" and "accounted" emissions/removals leads to considerable difference when assessing performance with targets. In the Kyoto Protocol's first commitment period (2008-2012), for instance, the "reported" sink in the EU remained relatively stable at around 300 Mt CO_2 a year, while the average annual level of removals that could be used for *accounting* purposes was much smaller, i.e. 75 Mt CO_2[105], or just 1.6% of the average of EU total emissions in the same period.[106]

Figure Annex 5.2: EU28 emissions and removals in LULUCF 1990-2012. Reported values are represented as coloured lines, with emissions as positive and removals as negative values; accounted values in the first commitment period (CP1) are shown as a green "box".



Source: UNFCCC inventories, JRC compilation

These accounting rules have evolved historically in the international negotiations under the logic of the Kyoto Protocol. The first set of these rules for the first commitment period (2008-2012) of the Kyoto Protocol were finalised among international partners in 2001, formally adopted in 2005. Based upon this experience, a set of improved methodologies, valid for the second commitment period of the Kyoto Protocol, was adopted at the Durban climate conference in

105 Source: JRC

106 http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

2011. Rules rely heavily on methodologies developed under the aegis of the Intergovernmental Panel on Climate Change (IPCC). EU Member States have agreed to these accounting rules and they have been transposed into EU domestic legislation with the adoption of the so-called "LULUCF decision" (529/2013).

In addition and in order to comply with the reporting requirements agreed under UNFCCC and the KP, rules for reporting LULUCF emissions and removals were set by Regulation 525/2013 on "A Mechanism for Monitoring and Reporting greenhouse gas emissions (MMR)[107]. Annual greenhouse gas inventories on emissions and removals by sinks need to be submitted both under the UNFCCC (Article 7 c) and under the Kyoto Protocol (Article 7d).

The second commitment period of the Kyoto Protocol will end in 2020. An international agreement on the post-2020 international climate framework was adopted at the UN climate conference in December 2015 (Paris Agreement). International principles and methods on how to include the associated emissions and removals in the post-2020 period will have to be discussed among the Parties as a follow-up to Paris. It is important to take note that there will be no obligation to continue with the international rules on LULUCF defined for the second commitment period of the Kyoto Protocol. Instead, the future UNFCCC system governing emissions and removals from LULUCF will likely allow for larger heterogeneity in applied rules after 2020.[108]

The principles behind the LULUCF accounting regime under the Kyoto Protocol endeavoured to respond to concerns that the use of LULUCF activities could undermine environmental integrity of Parties' reduction commitments. The LULUCF principles agreed under the KP therefore underscore the need for sound science and consistent methodologies, as well as the importance of conserving biodiversity. They also specify that naturally-occurring removals, including those as a consequence of indirect anthropogenic effects, should be excluded from the system and that any re-release of greenhouse gases (e.g. through forest fires) must be promptly reported.

In principle, the accounting rules to be applied post-2020 should a) build on rules already agreed with Member States in the domestic LULUCF Decision, b) be fit for purpose in the period 2021 to 2030 (and beyond), and c) ensure no backsliding in terms of environmental integrity, i.e. protect existing sinks and reservoirs, and develop additional mitigation potential, at least as well as in previous periods.

Consequently, reasonable scope exists for the EU to define, in accordance with its international statements contained in the INDC of March 2015, the accounting LULUCF framework for the foreseeable future. The **main improvements evaluated in the Impact Assessment** are:

- Move to an accounting system based upon UNFCCC reporting, with a specific option for land category transition period for afforested lands (30yrs instead of 20yrs)
- Updating of the 1990 base year, to the 2005-7 period, for agricultural lands;

[107] This Annex of the impact assessment primarily deals with the changes foreseen for accounting rules, whereas possible changes to the MMR are not within the scope of the assessment. They will be addressed, at a later stage and together with the other non-ETS sectors, during the revision of the MMR for the post-2020 period.

[108] ICF/COWI study report

- Replacement of the Kyoto Protocol governance and common approach for setting Forest Reference Levels.

The impacts of these changes are analysed in Chapter 5 of the IA. Additionally, this Annex includes

- More detailed explanations related to the changes outlined in Chapter 5, namely on moving to land-based accounting and on forest management accounting;
- Additional information on accounting issues which require only modest if any changes at all compared to the current LULUCF decision, in particular regarding the cap on forest management credits and the treatment of Harvested Wood Products.

Moving to a land-based accounting regime

Under the current international climate regime information related to emissions and removals from LULUCF may come from two sources:

1) all parties have to provide information under the Convention and based on a Common Reporting Format (CRF);

2) In addition, Parties under the Kyoto Protocol have to provide information on accounted emissions and removals for LULUCF (see Figure 5.3).

UNFCCC reporting for LULUCF is organized by land use categories instead of activities (on land) which are used as the *reporting* base under the KP. Activities and land use categories are similar but not directly equivalent. While an activity refers to the action associated with land use (for example, managing a forest, making wood products), a land category relates to the land cover (forest land). Land categories are therefore more readily identifiable, for example through remote sensing or earth observation, and mapping (for example, the extent of an arable field), whereas activities are usually reported in tabular statistics (hectares of cereals and production per year).

Because reporting under the Convention and accounting under the Kyoto Protocol is based on different elements, EU Member States currently have a high administrative burden in maintaining two parallel reporting systems. As the Kyoto Protocol will not continue beyond 2020, this double reporting could be eliminated. Most international parties use the land based categories under the Convention only; indeed it is the starting point already for some Member States. Moving to this system would make EU reporting more comparable with what other Parties do, and be simpler. However, as shown in Figure 5.3 it would require that accounting rules currently only applied to the activities under the KP are put as a layer on top of the *reported* figures under the Convention. If the EU moves to land based accounting in the post 2020 world, the columns on the right hand side of Figure 5.3. would become obsolete.

Figure Annex 5.3: Reporting and accounting under Kyoto Protocol and the UN Climate Change Convention (UNFCCC)

	UNFCCC	Kyoto Protocol/Decision 529/2013
Reporting	**Land Use Categories** (CRF Tables) e.g. "Forest Land remaining Forest Land"	**ACTIVITIES,** e.g. - Forest Management - Afforestation, deforestation, reforestation - Grassland and Cropland management
Accounting	**LAND USE CATEGORIES** **AS BASIS FOR** **ACCOUNTING RULES**	**Accounting rules** defining - (mandatory) coverage, - benchmark for each activity - rules for accounting emissions related to natural disturbances - cap on forest credits etc.

Emissions from land are strongly triggered by changes between one land category and another. Under the KP, these "land use changes" are part of the relevant activity; under the UNFCCC reporting framework, they are specifically categorised, mostly as land transition categories (e.g. grassland converted to cropland, for example), except for Harvested Wood Products and Revegetation.

Table 5.4 illustrates how reported activities under KP correspond to land categories used for reporting under the Convention. There are some differences between the systems. For example, if land is converted to another land use category, such as *cropland converted to forest land*, the land will remain in this transition land use change category for 20 years before it is moved to the stable category *forest land remaining forest land*. This means that afforestation that took place in 1990-1993 will in 2014 be reported as forest land remaining forest land, while under the Kyoto Protocol it would still be under (Article) 3.3 Afforestation. By analogy, conversions from Forest Land to other categories (under the Kyoto Protocol, Deforestation) would also transition in the same 20 year cycle.

Another example is that in order to correctly reflect KP accounting of cropland emissions, land use change categories **from** cropland (for example to settlements) need to be included. Consequently, the accounting framework on the UNFCCC reporting categories needs to include some categories linked to Settlements (cropland to wetlands, settlements, and other land).

Table Annex 5.4: correspondence of UNFCCC and KP categories

UNFCCC Land use categories	Kyoto Protocol activities
Cropland converted to forest land	3.3 Afforestation and Reforestation
Grassland converted to forest land	
Wetlands, settlements and other land converted to forest land	
Forest land converted to cropland, grassland, wetlands, settlements and other land	3.3 Deforestation
Forest land remaining forest land	3.4 Forest management
Cropland remaining cropland	3.4 Cropland management
Grassland converted to cropland	
Wetlands, settlements and other land converted to cropland	
Cropland converted to other land use (wetlands, settlements and other land)	
Grassland remaining grassland	3.4 Grazing land management
Cropland converted to grassland	
Grassland converted to other land use (wetlands, settlements and other land)	
Wetlands, settlements and other land converted to grassland	
Wetlands remaining wetlands	Not included under the Kyoto Protocol
Wetlands converted to settlements and other land	
Settlements remaining settlements	
Settlements converted to wetlands and other land	
Other land remaining other land	
Other land converted to wetlands and settlements	

Source: Understanding Land Use in the UNFCCC, Iverson et al 2014. Table 9

To apply UNFCCC categories in the EU LULUCF framework, the correspondence table needs to be translated into the following nomenclature:

(1) 'Afforested land' means land-use reported as categories Cropland, Grassland, Wetlands, Settlements, and Other land converted to Forest Land.

(2) 'Deforested land' means land use reported as categories Forest Land converted to Cropland, Grassland, Wetlands, Settlements, and Other land.

(3) 'Managed Forest Land" means land use reported as the category Forest Land Remaining Forest Land, plus Harvested Wood Products.

(4) 'Managed Cropland' means land use reported as categories Cropland Remaining Cropland and Grassland, Wetlands, Settlements, Other Land converted to Cropland and Cropland converted to Wetlands, Settlements and Other Land

(5) 'Managed Grassland' means land use reported as categories Grassland Remaining Grassland and Cropland, Wetlands, Settlements, Other land converted to Grassland and Grassland converted to Wetlands, Settlements and Other Land.

(6) 'Settlements' means land use reported as categories Settlements remaining Settlements and Wetlands, Other Land converted to Settlements.

(7) 'Other Land' means land use reported as categories Other Land remaining Other Land, Wetlands converted to Other Land, Settlements.

(8) 'Managed Wetlands' means land use reported as categories Wetlands Remaining Wetlands and Settlements, Other Land converted to Wetlands.

Table Annex 5.5: Correspondence between UNFCCC land use categories and KP activities, along with the accounting approach applied

To: / From:	Forest Land FL	Cropland CL	Grassland GL	Wetlands WL	Settlements SL	Other land OL
Forest Land FL	**FL-FL**	FL-CL	FL-GL	FL-WL	FL-SL	FL-OL
Cropland CL	CL-FL	**CL-CL**	CL-GL	CL-WL	CL-SL	CL-OL
Grassland GL	GL-FL	GL-CL	**GL-GL**	GL-WL	GL-SL	GL-OL
Wetlands WL	WL-FL	WL-CL	WL-GL	**WL-WL**	WL-SL	WL-OL
Settlements SL	SL-FL	SL-CL	SL-GL	SL-WL	**SL-SL**	SL-OL
Other land OL	OL-FL	OL-CL	OL-GL	OL-WL	OL-SL	**OL-OL**

Legend / colour coding:

Land accounting category	Principle
Deforested Land	KP2 gross-net, 20yr transition
Afforested Land	KP2 gross-net, optional 20 or 30yr transition
Managed Forest Land	Against Forest Reference Levels (FRL, post-2020 method)
Managed Cropland	net-net cf. 2005-2007 avg, transitions 20yrs
Managed Grassland	net-net cf. 2005-2007 avg, transitions 20yrs
Others, if elected	net-net cf. 2005-2007 avg, transitions 20yrs

Conclusion: Moving to UNFCCC land-based accounting would result in administrative simplification for Member States, eliminating parallel reporting systems. Under current rules, the reporting and accounting obligations under the Kyoto Protocol follow an activity-based approach and exist in parallel with the reporting obligations for all developed countries (including Parties that are not signatories of the KP) under the UNFCCC, which follow a land-use based approach. Small, but significant differences in the approaches make the conversion between the two systems complex. By eliminating the Kyoto reporting obligation, only one reporting system would need to be managed by Member States and reviewed by the Commission

Box Annex 5.1: The wetland land category and the special case of peatlands

Peatlands are hotspots of carbon capture and storage in natural landscapes, with a carbon density (in MtCO2e/ha) far higher than any other ecosystem. Drained and degraded peatlands make up about 90% of soil emissions in the EU, although peatlands only occupy 6% of the total agricultural area. EU Emissions from drained or degraded wetland themselves are about 15MtCO2/y, and stable since 1990. The bulk of wetland emissions are **accounted under forest, grassland or cropland established on formerly drained wetland**. The latter categories remain mandatory under EU GHG reporting and accounting, since conversion to wetland from agriculture and forestry were already accounted for under respective Kyoto activities. MSs can also chose to elect e.g. rewetting of drained and degraded peatlands, or their conversion to settlements, as optional land use categories to be accounted relative to a 2005-2007 base period.

Accounting approaches for forests

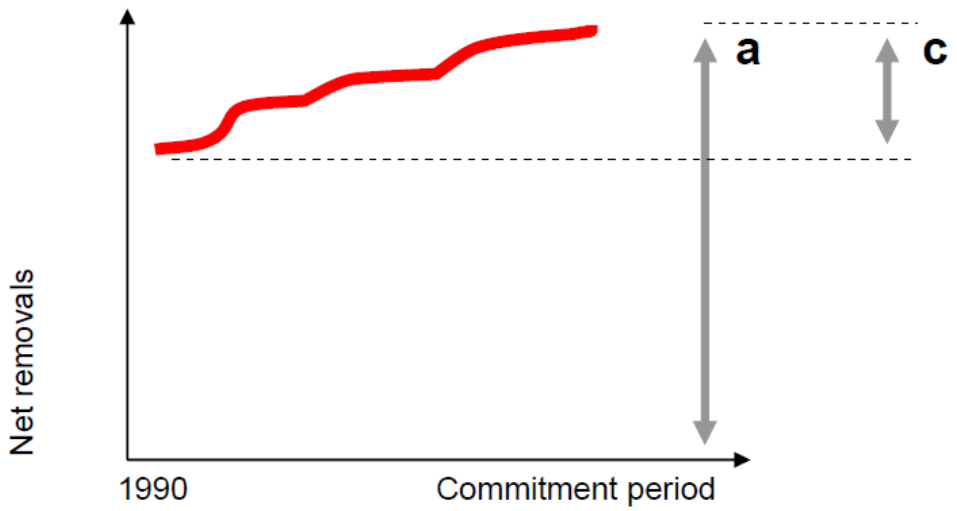
Accounting rules are frequently described using two terms with major differences in the accounted result for different actions.

The **Gross-net approach** includes in the accounts the full sink (or source) in the commitment period, with no comparison to a base year or reference. Note that this "gross" can in fact be a sum of emission and removals (which is the component referred to as "net"), for example the balance between land planted with trees, and deforested land. Since it is not a ratio, it must of course be an absolute result (e.g. tonnes). Gross-Net accounts deliver a result that is equal to all net removals during the commitment period, or **a** in the figure below. Nevertheless, the additionality and incentives of "gross-net accounting" were subject to much criticism; during the preparation of the Durban Decision, there was general agreement on the need for improvement.

By contrast the **Net-net approach** would compare the net sink (or source) in the commitment period with the corresponding same type of sink (or source) in a base year (or base period), for example between 2001 and 2005. The numbers compared are absolute (i.e. a comparison of change in flux, in tonnes) but the result can also be expressed as a ratio or percentage reduction (or increase). The accounted mitigation is computed as the difference between the removals during commitment period and the net removals in 1990 or **c** in the figure below. The reference may be a specific year, or the average of a period.

Reference levels therefore emerged as a compromise solution between gross-net and net-net accounting. Based on feedback in the stakeholder consultation, there is a strong rationale for continuing this approach in the post-2020 period, while improving transparency and comparability across Member States' FRL.

Figure Annex 5.3: Illustration of the gross-net (a) and net-net/FRL accounting approaches



Accounting for forestry and harvested wood products based on reference levels

Kyoto rules permit the accounting of emissions or removals from forest management against *projected* forest reference levels, to exclude legacy management effects and other natural factors from accounts. The actual mitigation performance in the sector is compared to a nationally determined forest reference level. A Member State specific reference level for 2013-2020 is an

estimate of future removals or emissions. Some are based upon historic trends, others took policy implementation into account, for instance harvest rates. Enhanced (or reduced) mitigation is calculated based on whether the actual performance in the sector differs from the reference level.

The Kyoto Protocol granted a significant degree of choice in how these forward-looking estimates are calculated. Indeed the approaches applied by EU Member States varied to a great extent.

Applicable guidance[109] for this exercise carried out in 2011 included the following considerations:

a) Continuity with the treatment of forest management in previous commitment periods;

b) Contributing to biodiversity and sustainable use of natural resources;

c) Disclosure and limitation of assumptions on the future impact of past policies, defined as being implemented no later than December 2009;

d) Consistency over time with greenhouse gas inventories and relevant historical data;

e) Exclusion of certain pools, gases or removals under specific conditions (e.g. resulting from elevated carbon dioxide concentrations or nitrogen deposition);

f) Provision of transparent, complete, consistent, comparable and accurate information.

In May 2011, the reference levels submitted by Kyoto Protocol, Parties were subject to a UNFCCC technical assessment in order to:

- Assess whether Parties provided transparent, complete, consistent, comparable and accurate information on the agreed elements;
- Assess whether the FMRL is consistent with the information provided;
- Provide technical recommendations to the Party.

Under existing EU legislation, updated reference levels for forest management for the next accounting period shall be submitted no later than 31 Dec 2019 and comply *inter alia* with the following:

- exclude the effects of natural and country-specific characteristics (e.g. legacy in forest age-structure);
- shall be identical to "those established by acts approved by the bodies of the UNFCCC or, in the absence of such acts, be calculated in accordance with the processes and methodologies set out in relevant UNFCCC decisions or agreements deriving from or succeeding them".

Decision No 529/2013/EU assumed the supervision of the UNFCCC in revising reference levels. However, with the enactment of Nationally Determined Contributions and facilitative stocktakes

[109] UNFCCC Decision 2/CMP.6

under the Paris Agreement, the process between 2020 and 2030 will not be the same as under the Kyoto Protocol anymore.

Strengths and weaknesses of the reference level approach

The approach seeks to accurately reflect the GHG emissions and removals from forest land ("as seen from the atmosphere") while at the same time optimising the balance and flexibility between:

- Incentivizing the conservation of healthy forest stocks and future growth potential (i.e. carbon sequestration in EU forests and soils) and their enhancement,
- Sustainably maximising forest productivity (HWP and bioenergy) as an alternative to other emission and/or imported sources, thereby promoting substitution and preventing unintended displacement/leakage effects,
- Factoring out random or legacy effects such as age class structure and natural disturbances (deemed beyond the control of Member States), while encouraging preventive action (e.g. fire prevention) and long term management (e.g. selection of resilient tree species) in the face of emerging climate change impacts in EU forestry.

In addition, the long term goal set out in the Paris Agreement aspires to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century. This aspirational goal specifically concerns global forests as the major terrestrial sink. The RL approach can be consistent with these interdependent goals:

- It addresses additionality and incentives, as it should only reward mitigation efforts beyond "business as usual",
- It addresses national circumstances (natural bio-geographic potential, effects of past forest management on forest ecosystems, etc.),
- It can help outlining intended (medium/long term) forest pathways, beyond relatively-short commitment periods, consistent with long term goals.

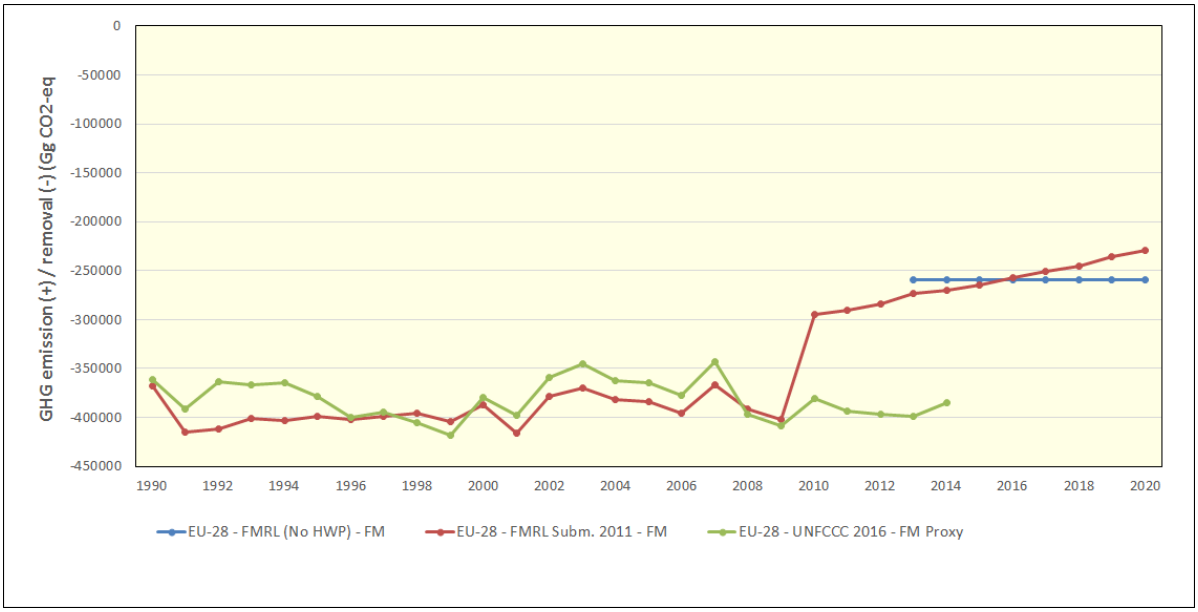
The environmental integrity and overall credibility of the approach, however, hinges on RL being a correct reflection of continued "business as usual" in forestry and downstream uses of forest products. UNFCCC technical assessments have brought to light a diversity of approaches in setting RL, which hindered comparability across Parties.

Early experience from forest management reference levels in the 2nd commitment period

Nearly five years have passed since the projected forest reference levels for the EU Member States for the period 2013 to 2020 were set. Inventory data under the second commitment period of the Kyoto Protocol is still only complete for two (2013, 2014) out of eight years. From a preliminary assessment, it seems that there is a significant gap between the projected forest harvest values and reported data. The 2016 Reference projection, as well as early results from LULUCF inventories for the period 2011-2014 (Figure 5.12 and Figure 5.13), indicate **notably lower harvest rates** than expected under BAU. The earlier expected decrease in the reported

forest sink does not yet appear. This preliminary assessment suggests that for the EU28, the reported forest management sink in 2013-2014 would be approximately 120 $MtCO_2$/yr greater than the reference level.[110]

Figure 5.12: Comparison of aggregated gross removals 1990-2013 in EU forest land sink (green line) as reported by Member States in 2015 inventories, the aggregate EU28 forest management reference level (blue line), and the model output (red line 2010-2020) and historical data (red line 1990-2009) for Forest Management

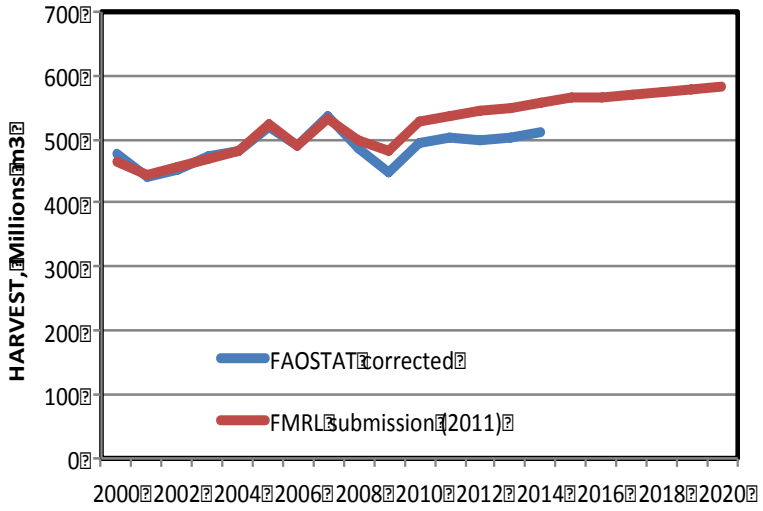


Source: UNFCCC inventories and EUCLIMIT modelling

Figure 5.13 shows the same tendency from the point of view of harvest data, comparing EU-28 forest harvest rates from different data sources. It should be noted, however, that there is still a possibility for a change in harvest data in the remaining years of the second commitment period.

[110] As Croatia was not yet a member of the EU in 2011, it is not included in some of the aggregate EU FMRL calculations. Also note that these are reported values; accounted values are likely to be smaller as a result of the FM cap on credit generation.

Figure 5.13: Comparison of EU-28 forest harvest rates (historical and projected) from FAOSTAT (blue line) and from UNFCCC submission of forest management reference level (red line; FMRL), 2000-2020



Source: FAOSTAT interpreted by JRC

During the 2011 exercise for setting projected forest management reference levels, EU Member States followed two different routes:

- 14 Member States) had their reference level modelled by the European Commission and the Joint Research Centre, while
- 13 Member States modelled the reference levels on their own. Table Annex 5.7 shows the difference observed so far regarding the assumed and observed harvest rates in the two groups. Altogether, Member States which modeled FMRL on their own predicted a higher increase of harvest, and indeed increased harvest more (though not to the extent expected).

As far as can be observed – and though consistency of reported data may improve towards 2020 - Table 5.7 shows that the harvest levels submitted in 2011 for 27 Member States are so far about 9 percentage points (i.e. difference between 114% and 105%) higher than reported forest harvest. According to the sensitivity analysis presented in Section 1.4.4, (Table 4) a corresponding increase in accounted forest sink of some 30 to 35MtCO2eq per year may occur, leaving aside HWP and possible technical corrections.

Table Annex 5.7: Difference between expected and observed EU harvest in 2013-2014, grouped by modelling approach (as submitted in 2011 under UNFCCC FMRL review).

	Average harvest in 2000-2008 (from FMRL subm 2011). Mm3	**Expected harvest** in 2013-2014 (from FMRL subm 2011)		**Observed harvest** in 2013-2014 (FAOSTAT, corrected to make it consistent with FMRL)	
		Mm3	*% relative to 2000-2008*	Mm3	*% relative to 2000-2008*
Modeled by IIASA/JRC/EFI	176	**187**	*106%*	**177**	*101%*
MS own modelling	308	**367**	*119%*	**329**	*107%*
Total EU	484	**554**	*114%*	**506**	*105%*

Source: European Commission/JRC, 2016

The forest sink has so far remained steady in EU27 (350-400MtCO_2/y), whereas it was projected in 2011 to decrease by 120MtCO_2/y, by 2020. This could potentially generate 80-85MtCO_2 credits per year in 2013 and 2014 (subject to uncertainties due to future technical corrections, emission trends etc.), limited by the 3.5% cap on these credits.

Accounting for Harvested Wood Products (HWP)

Under the Kyoto regime, Member States must include emissions and removals resulting from changes in the HWP pool, in the context of the forest management activity, based on the IPCC production approach. HWP are therefore accounted (and capped) relative to the Forest Management Reference Level in which a projected value for HWP is included.

The European Union has defined a cumulative reference level in CP2 of 314 MtCO2/y with a contribution of HWP of 53 MtCO2/y (i.e. 17%). Additional EU mitigation potential in HWP is estimated to be 10-15 MtCO2/y between 2020 and 2030, assuming current EU and MS bioenergy targets are met.[111] In the longer run, if solar and wind energy grew faster or if e.g. short rotation coppice developed rapidly, there would be more opportunities to develop cascade use and to enhance the importance of HWP, especially as material substitution becomes more relevant than mitigation in saturated forests[112].

Under Convention reporting, Member States are in principle free not to use the Production Approach. If all countries applied the same IPCC methodological approach, they would all be equivalent in accounting terms. If, on the contrary, different countries use different HWP approaches, virtual sinks or double accounting may occur. Since currently, the production approach is used by most Member States, it is recommended to maintain this approach post-2020 so that EU reporting and EU accounting of HWP is made fully consistent.

[111] ClimWood study, 2016

[112] As reflected in the 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol

Forest management credit cap and compensation rule

Removals from forest management may be used to compensate for emissions in other LULUCF categories. With a view to the uncertainties associated with the reference level approach, it was agreed for the second Commitment Period to limit this possibility: credits from forest management are only allowed up to 3.5% of 1990 total emissions (without LULUCF) to balance emissions from other LULUCF activities. Debits from the same activity are not capped. Compliance risks related to inter-annual variation and natural disasters are addressed in the context of provisions on natural disturbances.

International discussions preceding the introduction of the current cap are described in detail in Annex 2 of the impact assessment accompanying the LULUCF Decision.[113] The description highlights the alternatives discussed at that time, and the analysis on how the different cap levels could affect individual Member States. It was deduced from this analysis that in case of decreased harvest rates, a few forest-rich countries with low levels of historical industrialisation and/or emissions in 1990 (Latvia, Sweden, Finland) may exceed their cap on credits.

In discussions with Member States, various alternatives have emerged. Table Annex 5.8 summarises the alternatives discussed, highlighting possible impacts.

In the following tables, all options are assessed showing

- Credit/debit generation potential in the second commitment period of the Kyoto Protocol for each Member State under the different options,
- Distributive impacts,
- National compliance risk.

[113] SWD (2012) 41

Table Annex 5.8: Options regarding the credit cap

	Change in rules	Impact
C0 Status quo	3.5% cap	Slight compliance risk for a limited number of MS
C1 Modify the cap	Replace current 3,5 % cap by a cap based on -10% harvest (relative to FRL)	- Could better reflect national forest circumstances; - Distributive impacts: would be favourable for certain MS, but it would expose other MS to compliance risks (see table 5.9)
C2 Modify the cap	Replace current 3,5 % cap by a cap in proportion of the national forest area	- Could better reflect national forest circumstances; - Distributive impacts: would be favourable for certain MS, but it would expose other MS to compliance risks (see table 5.9)
C3 Re-establish the compensation rule	In KP1, a Member State that incurred land use change debits (from deforestation), could compensate these from the forest management sink, up to $33MtCO_2$/year[114].	- This rule (repealed in KP2) could completely offset all deforestation emissions in most Member States, provided they have sufficient sink in managed forests; - Emissions from deforestation and afforestation would get neutralised post-2020, whereas they are fully accounted in KP2.
C4 Consider HWP as a separate category (i.e. distinct from forest land accounting)	The land reporting category FL-FL would be accounted against the FRL with instantaneous oxidation, while HWP would be accounted separately and would not be subject to the 3,5% cap	- Uncapped HWP credits could provide additional credits to countries that increase their HWP stocks, especially forest-rich countries with low levels of historical industrialisation; - Distributive impacts: might expose other MS to compliance risks (see table 5.10) - Would incentivize mitigation in HWP beyond cap, thus encouraging substitution, energy and resource efficiency in the bio-economy.

In the absence of adopted Forest Reference Levels for the period 2021-2030, the credit/debit generation potential is assessed for the current commitment period (2013-2020), only with the purpose of facilitating the comparison of options.

[114] Annex to UNFCCC Decision 16/CMP.1, paragraph 10 of section C.

Table Annex 5.9: Distributive impacts of options regarding the credit cap, based on early KP2 reports and JRC projections, illustrative calculation for the period 2013-2020, in MtCO2/year

Member States	C0 Status quo (3.5% cap)	C1 Modified cap based on a 10% reduction in projected harvest rates	C2 Modified cap based on forest area, assuming EU cap at 197 MtCO2/year	C3 Compensation rule
Austria	-2.7	-2.5	-4.8	-33
Belgium	-5	-0.6	-0.9	-33
Bulgaria	-3.8	-0.8	-4.6	-33
Croatia	-1.1	-1.1	-2.9	-33
Cyprus	-0.2	0	-0.2	-33
Czech R.	-6.9	-2.3	-3.2	-33
Denmark	-2.5	-0.2	-0.7	-33
Estonia	-1.4	-1.4	-2.8	-33
Finland	-2.5	-8.7	-27.3	-33
France	-19.6	-3	-28.2	-33
Germany	-43.7	-5.3	-13.8	-33
Greece	-3.7	-0.4	-4.2	-33
Hungary	-3.4	-0.8	-2.4	-33
Ireland	-1.9	-0.7	-0.6	-33
Italy	-18.2	-2	-9.7	-33
Latvia	-0.9	-1.8	-3.9	-33
Lithuania	-1.7	-0.8	-2.6	-33
Luxembourg	-0.5	0	-0.1	-33
Malta	-0.1	0	0	-33
Netherlands	-7.4	-0.1	-0.4	-33
Poland	-16.3	-4.9	-10.9	-33
Portugal	-2.1	-1.8	-4.9	-33
Romania	-8.7	-3.1	-8.6	-33
Slovakia	-2.6	-1.3	-2.5	-33
Slovenia	-0.6	-0.4	-1.4	-33
Spain	-9.9	-8	-17.9	-33
Sweden	-2.5	-9.3	-34.6	-33
United Kingdom	-27.4	-1.5	-3	-33
EU 28	-197	-63	-197	-924

Source: European Commission/JRC, 2016

Table Annex 5.10: Distributive impacts of HWP as a separate category (Option C4), in MtCO2/year, illustrative calculation for the period 2013-2020[115]

Member State	CREDITS (-) or DEBITS (+) before capping		C) Cap 3.5% 1990	Total credits for Forest Management [=forest plus HWP] after capping		F) Difference (=E-D)
	A) Forest Credits/ Debits	B) HWP Credits/ Debits		D) forest and HWP capped together	E) only forest capped, HWP accounted separately	
AT	-6.0	2.9	-2.7	-2.7	0.2	2.9
CZ	-4.5	1.9	-6.9	-2.6	-2.6	0.0
EE	-2.1	0.3	-1.4	-1.4	-1.2	0.3
FI	-10.9	-4.3	-2.5	-2.5	-6.8	-4.3
DE	-36.0	18.0	-43.7	-17.9	-17.9	0.0
EL	-0.5	-0.3	-3.7	-0.8	-0.8	0.0
HU	-1.8	-0.6	-3.4	-2.4	-2.4	0.0
IE	0.3	-0.3	-1.9	0.1	0.1	0.0
IT	-12.2	-1.6	-18.2	-13.8	-13.8	0.0
LV	4.5	0.4	-0.9	4.8	4.8	0.0
LT	-4.4	-0.6	-1.7	-1.7	-2.3	-0.6
PL	-8.1	-0.2	-16.3	-8.3	-8.3	0.0
PT	-5.4	0.3	-2.1	-2.1	-1.8	0.3
RO	-8.4	0.0	-8.7	-8.4	-8.4	0.0
SK	-1.9	-0.7	-2.6	-2.6	-2.7	-0.1
ES	4.3	2.1	-9.9	6.4	6.4	0.0
SE	-19.0	1.6	-2.5	-2.5	-1.0	1.6
UK	-4.8	1.6	-27.4	-3.3	-3.3	0.0
Total for 18 MS	-116.9	20.4	-156.5	-61.8	-61.7	0.1

Source: European Commission/JRC, 2016

[115] Calculations are based on MS FMRL (with or without HWP) and National Inventory Data 2014 for 18 Member States where these were available

ANNEX 6. SYNTHESIS OF MEMBER STATES REPORT ON LULUCF INFORMATION ACTION (ARTICLE 10 OF DECISION 529/2013)

Executive summary

LULUCF is the last key sector of the economy not covered by EU climate policies and emissions reduction targets. The current EU provisions on LULUCF until 2020 (in Decision No 529/2013/EU)[116] aim to integrate the accounting rules for the sector under the UNFCCC Kyoto Protocol (KP) into EU law for the 2013-2020 accounting period and thereafter.

To prepare for the potential inclusion of the LULUCF sector in the Union's emission reduction targets in the post-2020 accounting period, the Decision aims to harmonise and improve monitoring and reporting, particularly for the emissions and removals associated with agricultural land-use activities of which the Member States have less experience.

An array of implementation options is critical to the success of mitigation efforts in the areas of LULUCF, so the Decision requires Member States to transmit information to the Commission on action that they plan to take to increase removals and reduce emissions of GHG from activities relating to forests and agricultural land use. Under Article 10(1) and (2), Member States must submit information on their most relevant current and future LULUCF action for all activities referred to in Article 3(1), (2) and (3).

This summary report brings together information from the Article 10 reporting exercise. The process was initiated with the first phase of Member State reporting, which is to be followed by a mid-term (end of 2016) and final report (end of 2020).

By 21 June 2016, 27 Member States had provided information on their current and future LULUCF action, setting out nationally determined measures to limit or reduce emissions and to maintain or increase removals in the LULUCF sector.

The reporting exercise provided an opportunity to:

- raise awareness among stakeholders in each Member State;
- stimulate collective learning between Member States and the Commission, enabling the sharing of efforts and developments, and consolidating and documenting experience;
- identify information and knowledge gaps as regards effective ways of implementing LULUCF action and quantifying its impact;
- enhance the standardisation and quality of national information, strategies or plans on LULUCF action; and
- facilitate swift improvement of information relating to mandatory accounting for cropland and grazing land management and the optional activities.

[116] Decision No 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 (OJ L 165, 18.6.2013, p. 80).

Outline

LULUCF is the last key sector of the economy not covered by EU climate policies and emission reduction targets. The current EU provisions on LULUCF until 2020 (in Decision No 529/2013/EU) aim to integrate the accounting rules for the sector under the UNFCCC/KP into EU law for the 2013-2020 accounting period and thereafter. The Decision entered into force on 8 July 2013 and provides that:

- **'**in the context of moving to a competitive low-carbon economy in 2050, *all land use should be considered in a holistic manner and LULUCF should be addressed within the Union's climate policy*'**;**[117] and
- 'Member States are encouraged to use these estimates to identify key categories and develop country-specific Tier 2 and Tier 3 key methodologies for the robust and accurate estimation of emissions and removals*'*.[118]

To prepare for the potential inclusion of the LULUCF sector in the Union's emission reduction targets in the post-2020 accounting period, the Decision aims to harmonise and improve monitoring and reporting, particularly for the emissions and removals associated with agricultural land-use activities of which Member States have less experience.

An array of implementation options is critical to the success of mitigation efforts in the areas of LULUCF, so the Decision requires Member States to transmit information to the Commission on action that they plan to take to increase removals and reduce emissions of GHG from activities relating to forests and agricultural land use. Under Article 10(1) and (2), Member States must submit information on their most relevant current and future LULUCF action for all LULUCF activities referred to in Article 3(1), (2) and (3). Article 10(4) further requires them to submit progress reports on LULUCF action halfway through and by the end of each accounting period.

Guidance was developed to assist Member States to report in such a way that information on LULUCF action could:

- ensure linkages are made to other national strategies and plans associated with cross-sectoral and climate policies;
- use and build on information available or under preparation within Member States' land-use, forestry and/or agriculture policies;
- identify and indicate potential synergies in existing spatial land data and information collection methods which should be available in Member States;
- be adaptable to the varying needs and situations in different Member States; and
- ensure compatibility with current KP reporting and accounting processes, the latest UNFCCC reporting requirements and IPCC methodologies.

Member States were presented with several options as regards the format of the reports, but these were expected to be based on a particular framework to ensure that all necessary information was included. The underlying idea was to generate information that could be reviewed and compared at EU level, in the form of a strategy covering national LULUCF action or a plan on low carbon

[117] Recital 2 of Decision No 529/2013/EU.

[118] Article 3(2)(b) of Decision No 529/2013/EU.

development (or other related issues) that would cover all related LULUCF activities. The framework was as follows:

1. **Context and background**: this includes an overview of information on:
    a. the national situation in relation to land use and policy frameworks in place; and
    b. communication and collaboration between government departments and with stakeholders;
2. **Technical information**: on past trends and projections of emissions and removals, and estimates of mitigation potential;
3. **Policy information**:
    a. the most appropriate measures to increase removals and reduce emissions; and
    b. the associated policies that can help ensure that these measures are taken up and implemented; and
4. **Timetable for implementation**: setting out the proposed timetable for the implementation of the most appropriate measures identified to increase removals and reduce emissions.

This report compiles information from the Member States' reports on context and background, technical and policy information. It does not discuss the timetable for implementation. Best or interesting practices are highlighted in each section of the report. Two separate sections summarise the information relating to forests and agriculture land. A list by Member State of identified actions with mitigation potential is annexed. A second annex contains the Member States' reports.

Information on context and background provided by Article 10 reports

The EU LULUCF sector is a net sink that removes from the atmosphere a volume of GHGs equivalent to a significant proportion of the EU's total GHG emissions. LULUCF activities cause anthropogenic emissions and removals of GHGs as a consequence of changes in the quantity of carbon stored in vegetation and soils, and emissions of non-CO_2 GHGs. The increased sustainable use of harvested wood products can substantially limit emissions and enhance removals of GHGs.

The Member States' Article 10 reports are based on a variety of sources. Most Member States use information provided and assessed under KP Decision 2/CMP7, national communications to the UNFCCC, information officially reported under Article 3(2) of the LULUCF Decision, forest management reference level submission, national strategies and the National Emission Ceiling Directive (2001/81/EC). Account was also taken of information compiled in the context of other EU policies, e.g. rural development programmes. The reports build on consultations and cooperation between relevant stakeholders within the national administration implementing CAP instruments (rural development programmes (RDPs) under CAP 2nd pillar, implementation of measures under CAP 1st Pillar, cross-compliance standards for good agricultural and environmental condition (GAEC), the Integrated Administration and Control System (IACS)), national research institutes, statistical departments, national (rural) networks and, in the case of Italy, other stakeholders (see Box 1 below).

Some countries, such as Denmark, the UK and the Netherlands, established short- or long-term objectives for a low carbon economy and LULUCF. Denmark plans to achieve a 40 % reduction in GHG emissions by 2020 (as compared with 1990), including for LULUCF, and has set a target to double its forest area by 2089. In the UK, the Climate Change Act 2008 provides for five-year carbon budgets, including for LULUCF, to reduce emissions by at least 80 % by 2050. The Carbon Plan details how the UK will meet current and future legislated budgets. The UK has established projections of LULUCF sectoral emissions up to 2050 in support of the requirement for carbon budgets. Setting long-term goals and integrating LULUCF action in strategies and plans to achieve them allows for the provision of better quantified data, and a clearer view of trends in LULUCF emissions and the sector's contribution to the overall effort to reduce emissions.

Box 1: Enhanced communication and stakeholder consultation (from scientific experts to national authorities, networks of stakeholders such as the national rural network and interested parties) — Italy

Given the broad range of stakeholders involved in developing land-use policy and designing and implementing action, enhanced communication and consultation was necessary to ensure a certain level of technical understanding. Italy started by calling on expert opinion to formulate a *White paper on climate change and the rural sector* and raise awareness in the community. Stakeholders were informed through publication in sectoral magazines. Taking advantage of existing structures and its capacity to mobilise existing networks of stakeholders, the national rural network organised a workshop (funded by the EAFRD) on the theme of efficient use of resources and the transition to a low-carbon economy in the food industry for the 2014-20 RDPs in Italy. Taking advantage of the other ongoing process of preparations for structural fund partnership programming, consultations also took place on the objectives *Supporting the shift towards a low-carbon economy in all sectors* and *Promoting climate change adaptation, risk prevention and management*. A national expert panel was formed with the involvement of relevant experts and main stakeholders from the Ministry of Environment, the Ministry of Agriculture, Food and Forestry Policies, ISMEA, ISPRA, CRA and university representatives. The regions managing 2014-2020 RDPs were asked to provide technical and financial information on new strategic climate measures.

Technical information

Ensuring linkage to current KP reporting and accounting processes, and to up-to-date UNFCCC methodologies

A total of 26 countries used outputs and structures set up for existing processes to inform their Article 10 reports, e.g. estimates of LULUCF emissions/removals in the national inventories submitted under the UNFCCC and the KP. Work is still ongoing in a majority of countries to determine the most appropriate data sources and methodologies for projections. Some are examining the possibility of setting up new structures and information collection.

Box 2: Method for establishing projections for emissions and removals for the accounting period — Slovakia

The LULUCF emission and removal projections were based on Slovakia's 2007-2013 RDP, taking into account the national forest programme (NFP) and the NFP action plan for 2009 2013. Emission and sink projections consider three scenarios (without measures, with existing measures and with additional measures) and projection parameters (area of managed forest). The base year for projection was 2010. The 'additional measures' correspond to measures provided for since 2010. The 2007-2013 RDP can be considered as the main instrument for mitigation measures, of which the following were reflected in the scenario:

- afforestation of 800 ha of low productive soil with fast-growing trees and the first afforestation of 600 ha of agricultural land by 2015;
- grassing of 50 000 ha of arable land by 2015;
- afforestation of 23 000 ha of agricultural land by 2020; and
- the effect of Forest Focus (Regulation (EC) No 2152/2003) on forest fire estimates (risk of forest fires reduced to 90 % of 2000-2003 level).

As regards the computation method, calculations were based on the IPCC *Good practice guidance for land use, land-use change and forestry*, 2003. GHG calculations were performed according to the procedures referred to in chapter 3 and sub-chapters 3.2 (Forest land), 3.3 (Cropland), 3.4 (Grassland), 3.6 (Settlements) and 3.7 (Other land). The values of the emission factors and conversion/expansion factors used for the projections are identical to those applied in the 2012 LULUCF emission inventories, as published in Slovakia's 2014 National Inventory Report.

Box 3: Method for establishing projections for emissions and removals for the accounting period — United Kingdom

The UK produced four initial policy scenarios based on historical data from the 2014 GHG inventory (covering the period 1990 to 2012):

- business as usual (BAU);
- high emissions;
- moderate emissions; and
- low emissions.

Alternative versions of the non-BAU scenarios were modified to include continuing cropland-grassland rotations ('churn').

The **BAU scenario** continues the 2010 afforestation rate from the present to 2050: this represents a '**without additional policy and measures'** scenario for the forest management reference level reporting under the Kyoto Protocol second commitment period. The BAU scenario used the moderate emissions scenario assumptions for all other activities.

In the **high emissions scenario**, the policy priority is to **increase food production** and there is less of a focus on bioenergy crops and forestry (exploring the highest level of emissions that the sector might produce), reflecting currently funded policies but assuming a continuation of the current level of publically funded afforestation beyond the expiry of the current CAP programme.

The **moderate emissions scenario** (with measures — includes the impact of all the UK's planned policies and measures if they are fully adopted and implemented) uses land-use change, afforestation and deforestation rates midway between the high and low scenario rates. The UK believes that this scenario is likely to reflect future policy aspiration. It should be noted that a number of policies and measures are facilitated by government, but explicitly require action and funding from outside government. These policies and measures and their projected CO_2e savings are detailed in chapter 5 of the UK report.

The **low emission scenario** (with additional measures) emphasises bioenergy crop production and woodland creation and includes policies and measures which have been adopted and implemented to mitigate climate change, and potential additional policies and measures that are planned for that purpose.

Past EU-level emissions and removals

According to the information in the Article 10 reports, the LULUCF sector (either UNFCCC categories or KP activities depending on the submitted data) is a net sink in 22 Member States and a net source in five (Austria, Denmark, Estonia, Germany and the Netherlands).[119] No conclusions can be drawn at EU level, as aggregation of the information in the Article 10 reports has proven difficult, due to its heterogeneity. Some countries provided descriptive, schematic (diagrams), partial or no information for their aggregated past emissions and removals, or incomplete sub-category information.

A total of 23 countries provided at least one figure for past (until 2013) GHG emissions and removals for at least one key category and key land management type (Austria, Belgium, Bulgaria, Cyprus (FM only), Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Malta, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the UK). Hungary, Latvia and Lithuania provided only total LULUCF figures for the past and projections.

Some 21 Member States provided quantitative projections for one or more categories (Austria, Belgium, Bulgaria, Cyprus (total LULUCF and FM), the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece (only AR/D), Hungary (only at total LULUCF level), Ireland, Italy, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the UK).

Of those, 12 provided projections for a 2020 horizon (Austria, Bulgaria, Cyprus, Finland, Germany, Greece, Luxembourg, the Netherlands, Poland, Romania, Spain and Sweden), Hungary for a 2025 horizon and 10 others at least until 2030 (Belgium, the Czech Republic, Denmark, Estonia, France — 2035, Ireland, Italy, Slovakia, Slovenia, the UK – 2050).

[119] No data for Luxembourg or Portugal.

In all, 20 countries provided figures for their LULUCF sector situation in 2020 or 2030. Of these, five will see their net sink increase by 2030: Slovakia (increase in all scenarios), France (the 'additional measures' scenario results in an increase), Hungary, Lithuania and the UK (which expects its sink to be increasing by 2030 and decreasing by 2050). LULUCF is projected to be a net source in 2020/2030 in Austria (as of 2015, with forest land becoming a source; these are the only modelled data provided, as all other categories replicate 2012 data), Belgium, Estonia (if forest harvest rates increase as modelled) and Latvia (due to increasing felling rates, the age structure of the forests and conversion of forest land to cropland and settlements), and Slovenia somewhat later than 2030. LULUCF is already a source, and is expected to remain so, for Germany and the Netherlands. The remaining 11 countries project a stable or declining net sink for LULUCF.

Policy approach and identification of mitigation potential

Building on linkages to other national strategies and plans associated with cross-sectoral and climate policies or with information available or under preparation under Member States' land use policies.

The degree of linking other national strategies and plans associated with cross-sectoral and climate policies varies among Member States. All Member States used information generated for the partnership agreement for the new (2014-2020) Structural Funds programming and for the RDPs. This allowed for better coordination and awareness-raising among stakeholders within national administrations, local authorities, bodies implementing EU funds and other interested parties.

Policies and other reporting requirements mentioned by Member States include:

- **EU climate policy, UNFCCC and KP requirements**, e.g.:
  - low carbon development strategies (prepared under the Regulation (EU) No 525/2013 and required by 9 January 2015);
  - national communications to the UNFCCC;[120]
  - forest management reference level submissions;[121]
  - National Emission Ceiling Directive (2001/81/EC);
- **National policies, strategies and plans**
  - setting long-term goals for their economies and LULUCF;
  - sectoral (relating to forestry, wetlands, agriculture);
- **CAP,** e.g.
  - RDPs under CAP 2nd pillar;[122]
  - implementation of measures under CAP 1st pillar;[123]

[120] 6th national communications to the UNFCCC.

[121] Guidelines for the submission of information on forest management reference levels in Annex II to Decision 2/CMP.6 (Land use, land-use change and forestry).

[122] Regulation (EU) No 1305/2013 on EAFRD support for rural development; Delegated Act C(2014) 1460.

- cross-compliance standards for GAEC;
- IACS;[124]

- **other policies that affect land use**, e.g.:
  - Nitrates Directive;[125]
  - programmes of measures within river basin management plans;
- **cross-sectoral EU policies,** e.g.:
  - the Inspire Directive;[126]
  - green growth strategies;[127] and
  - national renewable energy action plans.[128]

Box 4: Evaluation of mitigation impact of past policies (forest measures implemented in the 2007-2013 RDP) – Latvia

The initial evaluation of the implementation of the 2007-2013 RDP was carried out at the end of 2010 by the State Institute of Agrarian Economics (Lazdiņš, 2010). It reported that climate change mitigation measures had been implemented in 14 490 ha of forest in 160 municipalities in Latvia.

The average annual removals of CO_2 in living biomass due to climate change mitigation projects in 2007-2010 were 9.7 kilotonnes CO_2 and average annual removals of CO_2 in dead wood were 1.1 kt (10.8 kt CO_2 annually in total). Total additional removals of CO_2 in living biomass will reach about 922.6 kt and in dead biomass 102.0 kt during the rotation (1 024 kt CO_2 in total). Average CO_2 removals per rotation are 0.5 kt CO_2.

The most efficient climate change mitigation measure is afforestation of farmland (85 % of total additional CO_2 removals; see Figure 9). If calculated as impact per area unit, this has about the same impact as thinning and reconstructing forest stands on naturally afforested lands (583 t and 573 t ha-1 CO_2 respectively) in a forest management cycle. Support for forest regeneration has relatively less of an impact on additional CO_2 removals (56 t ha-1 CO_2). The evaluation of the preliminary results of the GHG impact of the 2007-2013 RDP demonstrated the predominance of the forestry-related measures, especially thinning and reconstruction of naturally afforested land.

When creating linkages to other national strategies and plans associated with cross-sectoral and climate policies, an important first step taken by some countries is to identify existing and additional LULUCF action with mitigation potential and quantify its costs and effects. Other countries are planning to do this in the future. Latvia is the only country that provided quantified

[123] Regulation (EU) No 1307/2013 establishing rules for direct payments to farmers under CAP support schemes; Delegated Act C(2014) 1476.

[124] Regulation (EU) No 1306/2013 on the financing, management and monitoring of the CAP; Delegated Act for IACS (C(2014) 1459).

[125] Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.

[126] INSPIRE Directive (2007/2/EC).

[127] In line with the EU 2020 strategy and inspired by the OECD's Green Growth Strategy.

[128] Prepared by Member States under Article 4 of the Renewable Energy Directive (2009/28/EC).

figures for the mitigation impact of past policies on forests (Box 4). Sharing experiences and harmonising methodologies in this field could help the remaining countries to speed up their efforts.

Identifying the mitigation potential of LULUCF action

Denmark, France, Italy, Latvia, Spain, Sweden and the UK identified the mitigation potential of various LULUCF measures; examples of their approaches and results are presented below.

The UK analyses annually the potential to limit or reduce emissions and maintain or increase removals from the LULUCF sector. This allows the government to assess the mitigation potential of LULUCF activities while identifying where further measures or action is required in the ongoing quest to reduce GHG emissions from the sector. Up-to-date information on mitigation potential is useful in making a quantitative assessment of measures that are already implemented or planned, e.g. using a bottom-up marginal abatement cost curve (MACC) approach for setting an appropriate carbon budget. MACCs detail the abatement potential from a suite of technically feasible mitigation measures and define their relative cost-effectiveness. The use of a reference carbon price allows measures to be considered from a notional cost-benefit perspective and provides a threshold for defining an efficient budget (i.e. those measures delivering mitigation at a unit cost less than the chosen reference price). There are, however, some weaknesses in a MACC-based approach, since it can be difficult to value all policy co-benefits of abatement measures, particularly those relating to social and environmental objectives. The UK government continues to develop a comprehensive analysis, using this approach, for the mitigation potential of LULUCF activities in order to inform various policy initiatives.

France identified a number of mitigation actions based on a literature review and set quantified objectives to be achieved by 2035 to preserve permanent pastures, agro-forestry systems, hedges and agro-ecologic infrastructure, soil cover and increase of organic matter in soils.

The Netherlands quantified the mitigation potential of LULUCF actions for selected measures relating to cropland and grazing land management:

Measure	**Max. potential** kton CO_2 / year	**Implementation of measure** %	**Realistic sequestration** kton CO_2 / year	**Max. per ha** kg CO_2 / ha / year
Reduced tillage	475	50	238	608
No-tillage	912	20	182	1167
Catch crop/green manure	311	50	156	398
Improvement of crop rotation	942	20	188	1205
Leave crop residues on the fields	628	20	126	803
Management of field edges	145	40	58	186
Grassland renovation	710	30	213	3586
Total of realistic combinations	**2,270**		**790**	**2,316**

In Italy, the mitigation potential of various crop systems was analysed, focusing on biophysical-technical, economic and market potential on the basis of several national studies and research papers. A quantitative assessment of factors was carried out for each of the three Italian climatic regions. On this basis, the soil organic carbon at equilibrium was estimated for each management practice and geographical zone.

tCO2/ha	1990-1999			2000-2020		
	North	Center	South	North	Center	South
Annual crops	**48,0**	**40,1**	**31,1**	**50,0**	**41,8**	**32,4**
Annual crops-organic	49,5	41,4	32,1	49,5	41,4	32,1
Annual crops-sustainable practices	57,9	48,5	37,5	57,9	48,5	37,5
Set aside	51,1	42,8	33,1	56,2	47,0	36,4
Perennial woody corps	51,1	42,8	33,1	51,1	42,8	33,1
Perennial woody corps - Organic	79,4	61,7	44,1	79,4	61,7	44,1
Perennial woody crops-sustainable practices	53,7	44,9	34,8	53,7	44,9	34,8
Annual crop no tillage	0,0	0,0	0,0	74,4	61,0	46,4

The mitigation potential/impact of LULUCF actions was described qualitatively according to production system: ordinary agriculture, sustainable agriculture, agriculture with conservation practices, organic farming, set-aside, greening, ordinary grazing land, managed grazing land and improved grazing land.

	Reduction of GHG emissions from key C sources in key crop or grazing land systems	Avoidance of new GHG emissions from key C pools in key crop and grazing land systems	Maintaining or enhancing carbon sequestration levels in key C pools in key crop and grazing land systems,
Sustainable agriculture	***	**	***
Organic agriculture	***	**	***
Agriculture with conservation practices	***	**	***
Set-aside	**	**	*
Greening	**	**	**
Managed Grazing land	*	**	*
Improved Grazing land	***	**	**

Box 5: Identification of mitigation measures, quantification of mitigation potential and cost in LULUCF for comparison with other sectors – Spain, Denmark and Sweden

Spain analysed the mitigation potential and cost-efficiency of the agriculture and livestock sector in order to select the most cost-efficient measures with mitigation potential across other sectors such as transport, residential waste, HFC non-ETS industrial sector. On the basis of the assessment of potential and cost-efficiency, some measures stood out, such as 'no tillage', training in the more efficient use of fertilisers, using biomass from permanent woody crops instead of burning it (since it has negative MACCs. The mitigation potential, cost and MACCs of these measures are calculated in the annex to *Hoja de ruta de los sectores difusos a 2020* (road map for non-ETS sectors up to 2020).[129] Additional measures taking into account sink potentials will be analysed in the forthcoming update of the road map.

[129] http://www.magrama.gob.es/es/cambio-climatico/planes-y-estrategias/Hoja_de_Ruta_2020_tcm7-351528.pdf (executive summary) and http://www.magrama.gob.es/es/cambio-climatico/temas/mitigacion-politicas-y-medidas/HojaRuta2020_Fichas_tcm7-358623.pdf (fact sheets for measures)

Denmark analysed potential additional mitigation measures and produced a *Catalogue of Danish climate change mitigation measures — reduction potentials and costs of climate change mitigation measures*.[130]

The Swedish Board of Agriculture estimated the potential to reduce the GHG emissions from Swedish agriculture to 2050, as part of the government position on developing a road map towards an emissions-neutral Sweden by 2050.[131] The measures analysed concern CO_2 emissions from cultivated mineral soils, organic soils and grasslands, and include measures such as adding organic material (e.g. animal manure, residue from biogas production or straw) to soils, rewetting wetlands and increasing the tree coverage of grasslands.

Extending the analysis to other types of measure and practice could deliver new mitigation actions in LULUCF.

Box 6: Potential and appropriate measures to reduce emissions via substitution — Sweden

Sweden has also looked into the potential and appropriate measures to reduce emissions by substituting fuel and products by bioenergy and wood products. It did so in a qualitative manner but sees a strong potential, postulating that such substitution contributes to large emission reductions. There is further potential for cost-efficient emission reductions through the substitution of fossil fuels, e.g. in transport and industry sectors, and increased use of wood for multi-storey houses and bridges can reduce emissions from metal-reinforced concrete.

Box 7: Projections of impacts of measures — Latvia

Latvia has worked on projecting the results of implementing the proposed measures. The LULUCF climate change mitigation measures to be implemented in Latvia are selected on the basis of consultations with NGOs and taking into account national circumstances, in order to pursue the mitigation potential and contribute to implementation of other policies and ecosystem services, such as biological diversity and water protection.

Latvia has started to elaborate the scientific and strategic background through various research programmes with national and extra-national (e.g. EEA Financial Mechanism) funding relating to agricultural GHG mitigation and adaptation to climate change. It has been able to estimate the net impact of proposed measures (see summary table below) at 12 136 kt CO_2, excluding the forest fire prevention system; over the total affected area (185 kha), the average annual impact is 1.4 t CO_2 ha-1 (256 kt CO_2 eq. year-1 in all affected areas. The most efficient measure is afforestation (486 kt CO_2 eq. year-1), but its total impact still has to be evaluated. According to Tier 1-based methodology, the duration of the impact of the measures in cropland is 20-30 years; according to Tier 1- and Tier 2-based methodology, the duration of the impact in forest land is 76-102 years (Eggleston *et al.*, 2006). Most (66 %) of the impact is expected after 2030, due to the long-lasting effect of the measures in affected forest lands. The mean annual impact is calculated as an average (total impact divided by duration of the measure).

[130] http://www.ens.dk/sites/ens.dk/files/policy/danish-climate-energy-policy/dk_climate_change_mitigation_uk.pdf

[131] Swedish Board of Agriculture, *A climate-friendly agriculture in 2050*, report 2012:35 (in Swedish).

Table 23: Summary of impact of the measures

	Impact period, years	Total affected area, ha	Total GHG reduction potential, tonnes CO_2 eq	Annual GHG reduction potential per area unit, tonnes CO_2 eq year^{-1}	Annual GHG reduction potential per area unit, tonnes CO_2 eq year-1 ha^{-1}	GHG reduction potential until 2020, tonnes CO_2 eq	GHG reduction potential in 2021-2030, tonnes CO_2 eq	GHG reduction potential after 2030, tonnes CO_2 eq
Measures in cropland								
Cropland drainage	20	4 615	122 024	6 101	1,3	36 607	61 012	24 405
Establishment of orchards	30	500	133 526	4 451	8,9	26 705	44 509	62 312
Greening activities	20	40 000	273 504	13 675	0,3	82 051	136 752	54 701
Production of legumes	20	50 000	1 321 925	66 096	1,3	396 578	660 963	264 385
Extensive crop rotation	20	25 000	660 963	33 048	1,3	198 289	330 481	132 193
Measures in forestland								
Drainage in forest	76	11 971	1 181 825	15 612	1,3	93 670	156 117	932 038
Afforestation	81	6 600	3 935 472	48 666	7,4	291 995	486 658	3 156 820
Forest thinning	78	15 000	2 196 836	28 056	1,9	168 337	280 562	1 747 937
Forest regeneration	102	31 000	1 862 524	18 195	0,6	109 169	181 949	1 571 406
Total impact	-	184686	11 688 599	233 900	1,27	1 403 401	2 339 002	7 946 196

Summary of forest-related information

Past removals and emission

Forest land is a sink in Austria, Bulgaria, Cyprus, the Czech Republic, Estonia, Germany, France, Latvia, Malta, the Netherlands, Spain and the UK. Afforestation and reforestation activities are a sink and deforestation a source in all countries that provided data on past emissions (Austria, Czech Republic, Denmark (source in 2012), Estonia, Finland, Hungary, Ireland, Italy, the Netherlands, Poland, Romania, Slovakia, Sweden and the UK).

Forest management (FM) is a sink in Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Ireland, Italy, Malta, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the UK. It has been a source in Austria since 2013. No information was extracted for Croatia, Greece, Germany, Latvia, Lithuania, Luxembourg, Malta or Portugal.

When looking at afforestation, reforestation and deforestation (ARD) as a whole, the combined activities are a source for five countries: Finland, France, the Netherlands, Romania and Sweden.

As regards projections, ARD remains a sink in Austria, the Czech Republic, Denmark, Ireland, Slovakia, Poland, Spain and the UK. It is expected to become a source in Estonia with additional measures (harvest rate increases) and to remain a source in France, the Netherlands, Romania, Slovenia and Sweden. No information was extracted for Belgium, Bulgaria, Croatia, Cyprus, Germany, Greece, Latvia, Lithuania, Luxembourg or Portugal.

Denmark and Poland will see their future emissions (2020 or 2030) from deforestation fall below their 2012 emissions. Emissions from Ireland, while slight, are expected almost to double by 2030 and those from the Netherlands by 2020. Slovenia is expecting a very large (750 %) increase in emissions by 2030 in this sector. Sweden's emissions will decrease from its 2012 figure but will remain higher than the 1990-2010 average. France and Austria are expecting increases of the source from this sector.

Forest management is expected to remain a sink in Belgium, Cyprus, the Czech Republic, Denmark, Estonia ("with existing measures"), Finland, France, Italy, Malta, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, Sweden and the UK. It will be a source in Austria (50 % increase by 2020), Estonia with additional measures (harvest rate increases), Germany, Greece and Ireland. In Denmark, the sink will get close to 0 as of 2013 and it is expected to decrease in France ('with additional measures' scenario), the Netherlands, Poland, Slovenia and the UK. Slovakia is expecting a significant increase in its sink by 2030. The Czech Republic, Denmark, Estonia, Ireland, Slovakia, Slovenia and the UK provided data up to 2030. No information was extracted for Bulgaria, Croatia, Hungary, Latvia, Lithuania, Luxembourg or Portugal.

Forest land will be a decreasing sink in the UK (maturity of forests and low afforestation); in France it will be an increasing sink in a 'no measures' scenario, but decreasing in a 'with measures' scenario.

Policy framework and relevant action (as reported by Member States)

For forest land, all countries identify national policies as policy frameworks, and relevant action includes state aid and/or RDPs, e.g. in Austria and the UK. Denmark, Ireland, Hungary, Poland and the UK have set afforestation targets for 2020 or later, e.g. Poland has set a target to increase forest cover to 30 % by 2020 (national afforestation programme), to be implemented via state aid or RDPs, and Ireland would like to increase its forest coverage from 11 % currently to 18 % by 2046 via a state aid programme. Other examples of current and planned action include:

- legislation forbidding the burning of full-value wood;
- sustainable forest management: harvesting at a percentage of the annual increment, optimising tree species composition, use of forest management plans and monitoring of forests, tending and thinning, thus enhancing production of goods and services in existing forests;
- protecting existing forests against natural disturbances via national programmes and RDPs;
- mobilisation and better utilisation of biomass / enhancing the production and consumption of wood products, thus promoting the substitution of GHG-intensive materials with wood;
- replacing fossil energy with bioenergy, including from harvesting residues;
- replacing GHG-intensive materials with harvested wood products;
- training for the use of wood in buildings; and
- national adaptation plan — specific measure to adapt forests and prepare wood industries for climate change.

Identification of mitigation potential

Croatia, France, Romania, Slovakia and the UK provided views on mitigation potential in forest land. Latvia provided a list of suitable mitigation actions in agriculture and forestry and quantified their impact (see Box 7).

Romania sees a very large potential in afforestation of degraded and marginal agricultural land and Croatia sees this measure as having the most significant impact on mitigation and adaptation. Afforestation of agricultural land is included in some RDPs.

Slovakia sees some potential for increasing GHG removals in relation to forestry activities via the afforestation of agricultural land with low productivity and/or on steep slopes, support for agro-forestry and extension of wood production on agricultural land (cropland, grassland) for energy purposes.

The UK sees most of the mitigation potential abatement identified in the GHG inventory projections arising from woodland creation (KP activities A and R). The nature of the woodland planted determines the level of abatement, the timeframe over which abatement is delivered and the contribution to abatement delivered in other sectors, *inter alia* by providing a renewable energy feedstock. Unmanaged woodland, particularly on productive sites, will generally make the largest contribution to LULUCF removals. Reducing deforestation and focusing forest management on increasing carbon stocks could deliver additional abatement, as well as including measures aimed at making forests more resilient to climate change. The UK quantified the

mitigation potential of woodland creation (AR), reduced deforestation (D) and improved management (FM). In order to achieve the abatement potential of the afforestation in the middle scenario, significant private sector investments will be required to supplement RDP grant aid in the UK. Policy measures are used to reduce deforestation in the UK and a strong regulatory framework means that rates of deforestation are relatively low. Most deforestation results from ecological requirements to restore open habitat and a balancing mechanism is in place to ensure that there is no risk of net deforestation; the mechanism requires compensatory planting where non-priority sites are subject to conversion.

In England, 55 % of woodlands have management plans. The government's forestry and woodlands policy statement seeks to bring 80 % of the woodland resource into management in the long term, to contribute to multiple objectives and provide opportunities for the implementation of climate change adaptation measures. The UK finds that, while reducing the level of management (i.e. harvesting) would lead to GHG abatement in the short term, other policy objectives would not be delivered and it is highly likely that England's woodlands would become less resilient to pest and disease outbreaks and the impacts of climate change, placing large carbon stocks at significant risk of being returned to the atmosphere.

France mentions 10 national plans/strategies that deliver on multiple objectives: substitution of energy and materials, carbon storage in wood products and in above- and below-ground biomass. France has recognised carbon storage, among other things, as a public good (*d'interêt general*), created a fund for action on forests and woods, a framework for wood mobilisation by forester groups, a plan for forest industries, and included the use of wood products in training for professional builders, etc. France stresses the importance of looking at the mitigation potential in forests and wood products in the broader sense by looking at all associated movements of GHGs in a long-term perspective. Increasing the above- and below-ground biomass is only one of the parameters to keep in mind. The country points out the need to develop substitute effects for forests (energy substitution and material substitution), as in the long term forested area cannot increase indefinitely (France argues that it is already stabilising in some EU countries). France sees a risk in having large stocks of carbon stored in forests as climate change could have a highly destabilising impact on forestry systems. Forest management plays an important role in reducing this risk.

Frances sees a need for policies on substituting material and energy by wood products and increasing productive potential for the provision of wood, carbon storage in wood products and the productive capacity of forests and carbon storage, and for support studies and research.

Summary of agriculture-related information

Past removals and emissions

Cropland (as reported under UNFCCC) and cropland management (CM): 16 countries provided data on past emissions and removals: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Germany, Greece, Ireland, Italy, the Netherlands, Malta, Romania, Slovakia, Spain and Sweden. Five countries (Italy, Greece, Romania, Slovakia and Spain) reported only removals from this sector; Ireland shows an alternation between sink and source, with average emissions

close to zero over the 1990-2012 period; the remaining countries show emissions. Cropland is a source for France and the UK.

On grassland (as reported under UNFCCC) and grazing land management (GM), 13 countries (Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Greece, Ireland, Italy, the Netherlands, Romania, Slovakia, Spain and Sweden) provided data on past emissions and removals. Denmark, Germany, the Netherlands and Spain are countries that show emissions. Grassland is an increasing sink in France and the UK and a source in Estonia.

Projections

A total of 12 countries (Austria, the Czech Republic, Denmark, Estonia, Germany, Greece, Italy, Romania, Malta, Slovakia, Spain and Sweden) provided projections for cropland or cropland management, of which Italy, Greece, Romania, Slovakia and Spain project removals (as in the current period). The sink is expected to be halved for Italy by 2030 and more than halved for Romania by 2020. Spain is the only country projecting an increase of its sink by 2020 (by +/- 35 % in relation to 2012). Austria is projecting to reduce its emissions by half by 2020, Malta by 30 % and the remaining countries that provided data project relative stability in their pool/sink. Five countries provide projections at a 2030 horizon: Denmark, Italy, Slovakia, the Czech Republic and Estonia (the two latter countries not modelled). Cropland is a declining source in the UK.

Of the 11 countries that provided grassland or grazing land management projections, Austria is the only one that expects a reversal from removals to emissions in 2020. Malta is expecting a tripling of its sink by 2020 and the remaining countries expect stable emissions or removals. Austria, Denmark and Spain expect emissions and the Czech Republic, Estonia, Greece, Italy, Malta, Romania, Slovakia and Sweden removals. The Czech Republic, Denmark, Estonia, Italy and Slovakia provided projections at least at a 2030 horizon. Grassland is projected to be a sink in the UK due to reduced conversion of cropland to grassland. In France, grassland is expected to be an increasing sink in the 'with additional measures' scenario.

Policy framework and relevant action (as reported by Member States)

All reports identify CAP 1st pillar, including GAEC and greening, and 2nd pillar (RDPs) as current climate action policies.

France and the UK have national policies/strategies in place that also contribute specifically to climate change mitigation in soils. Some of the action to implement these polices is financed via CAP 1st or 2nd pillar, e.g. setting up agroforestry systems, soil works, reducing mineral fertiliser use, organic production systems and increasing protein-rich cultures (France).

In Austria, agricultural production primarily contributes to climate change with its CH_4 and N_2O emissions. Austrian GHG emissions from agricultural activities show a decreasing trend of 12.4 % from 1990 until 2012. The main factors were a steady decline in the number of animals (particularly dairy cows) and the consequent significant reduction in manure disposal needs. Mainly thanks to the Austrian RDP, in particular its agri-environmental programme, the use of mineral fertiliser also declined considerably. RDP measures also contribute to increasing the share of renewable energy and carbon sequestration in the LULUCF sector.

Austria uses vocational training and information to increase the competitiveness of agricultural enterprises and raise awareness on nature conservation and environmental protection. A measure to enhance the 'human potential' of the people working in agriculture and forestry was set up to train 700 000 farmers and foresters in 2007-2013. In the first three years, around 200 000 stakeholders took part in the training courses. Another measure seeks to enhance the technical know-how of economic agents and in turn the quality of life and diversification in the rural economy.

Identification of suitable mitigation actions

Some examples are provided below from eight countries that have provided a list of relevant mitigation actions in agriculture.

Recognising the importance of GHG mitigation in agriculture, **Latvia** has started to elaborate a scientific and strategic background through various research programmes, with national or international (e.g. EEA Financial Mechanism) funding, on agricultural GHG mitigation and adaptation to climate change. Research results will be delivered in the coming years, but currently Latvia has no nationally developed cost-effective agricultural GHG mitigation strategy and is still developing its knowledge base in quantifying measures' GHG abatement potential.

The **UK** provided semi-quantitative (less than zero, zero, low to medium, high) mitigation potential of cropland management and grassland management measures. It identified converting cropland from annual tillage crops to perennial crops, fallow and set aside as having positive mitigation potential (low to medium), increasing manure, fertiliser and crop residue (low) and intensification of pasture on mineral soils (zero to low — unknown). There are constraints on the use of these practices in the UK and the increased emissions of N_2O as a result of increased nutrient inputs needs to be considered.

France identifies mitigation action on the basis of a literature review: maintaining permanent pastures and increasing the productivity of less productive pastures (grassland management), stopping soil sealing, developing agro-forestry systems and hedges, agro-ecological practices on soil cover, simplified soil tillage, longer crop rotation periods, greater use of grass-based livestock systems and grass valorisation efforts, and developing bio-based products as a substitute for GHG-intensive energy and materials.

Latvia provided a list of relevant mitigation actions in agriculture and forestry and quantified their impact (see Box 7).

Wetlands, peatland and re-vegetation

The following policies and actions are in place in various Member States:

- **Austria** currently has 126 000 ha of wetlands, which are classified as Ramsar areas. The nature protection laws stipulate that wetlands, in particular its habitats and organisms, have to be protected;
- **Belgium** — in Wallonia, the Forest Code (Decree of 15 July 2008) has introduced a number of constraints in favour of forest conservation and the maintenance of ligneous

materials and carbon, including a limitation on drainage (which encourages maintenance of organic matter);

- **Germany** — various measures are in place, including peatland protection and restoration, reduction in peat harvesting and the use of peat substitutes in horticulture and paludiculture;
- **Denmark** — a set-aside scheme for organic soils is under consideration for 2014-2017; DKK 165 million is dedicated to the initiative. The intention is to ensure biodiversity, reduce nitrogen leakage to water bodies and reduce GHG emissions. The reduction effect is heavily dependent on the biophysical specifications of the areas chosen for the set-aside;
- **Malta** — various wetlands have been identified and are protected under the Environment and Development Planning Act, having been designated as bird sanctuaries, special areas of conservation (under the Habitats Directive) and water bodies (under the Water Framework Directive). Malta has two Ramsar sites, Għadira and is-Simar (both coastal wetlands and bird sanctuaries);
- **Netherlands** — CAP 1st pillar and RDPs, which include a measure on meadow bird management to raise groundwater level in peat pasture areas and prevent further loss of permanent grassland;
- **Poland** — limiting fertilisation, the number of dates for cutting operations or the intensity of grazing in environmentally valuable areas, including moss bogs, tall-sedge rushes, Molinion and Cnidion meadows, semi-natural wet meadows, semi-natural fresh meadows, Nardus grasslands, salt marshes and other natural sites, such as different types of peat-bog. In the areas covered by this package, ploughing, rolling and fertilisation are banned (or substantially restricted);
- **Romania** — a rural development measure is in place on the protection of soils with high content of organic matter, including by restoration of wetlands;
- **Slovakia** — a number of documents set out objectives and measures on the maintenance, protection, management, sustainable use, restoration and renaturation of wetlands; the latter is also taken into account in the preparation of new strategic documents (e.g. national strategy for invasive alien species, 2015-2020 RDP);
- **Sweden —** measures to stop drainage and stimulate restoration of wetland; around 1.5 million ha have been drained in Sweden to increase agricultural or forest production; and
- **UK** — peatland restoration (rewetting) has been identified as a measure to reduce GHG emissions, although the degree of abatement is still being investigated.

Concluding remarks

The reporting exercise under Article 10 of the LULUCF Decision raised national administrators' and stakeholders' awareness of LULUCF action and highlighted information and knowledge gaps as regards effective means of implementation and quantifying its effects. It provided an opportunity to:

- raise awareness among stakeholders in the Member States;
- stimulate collective learning between Member States and the Commission, enabling the sharing of efforts and developments, and consolidating and documenting experience;

- identify information and knowledge gaps as regard effective means of implementing LULUCF action and quantifying its effects;
- enhance the quality and standardisation of national information, strategies or plans on LULUCF action; and
- facilitate speedy progress in improving information on mandatory accounting for CM, GM, WDR and RV.

The first phase of the process is to be followed by a mid-term (end of 2016) and final report (end of 2020). The latter will report on the implementation of LULUCF mitigation action and provide an opportunity to pass on new knowledge that will have become available by December 2016 as regards effective means of implementing it and quantifying its effects.

Reporting timetable (Article 10 of Decision No 529/2013/EU)

Milestone date	Phase	Milestone requirement
1 July 2014	Start of process	First submission of Article 10(2) information
Alternatively: 9 January 2015		First submission for Member States who opt to include Article 10 information in low-carbon development plans under the MMR Regulation
31 December 2016	Mid-term review	Progress reports on implementing LULUCF action
31 December 2020	End of period review	Progress reports on implementing LULUCF action

The above progress reports form only part of the reporting obligations in Decision No 529/2013/EU. A series of reports on estimated emissions is also to be submitted under Article 3(2), the timing of which is intended to facilitate action to improve data availability and quality. For example, information gathered under Article 10 should help improve systems for reporting emissions and removals under CM and GM in preparation for mandatory reporting for agricultural land as of 2022.

The process will continue with the Article 10(4) report on implementation of LULUCF action (due in December 2016), which will provide Member States with an opportunity to add information not present in the 2014 report.

The Commission will consider issuing additional guidance in the second half of 2016 on updating the Member State Article 10(4) reports.