



Soil Carbon Accumulation and potentials for Carbon Trading



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Relevance of soil carbon accumulation (e_{sca})

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e_{sca} in the EU regulatory framework

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ISCC on e_{sca}

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Potentials of soil carbon accumulation in the carbon offsetting market

“Soil is a major carbon storage system, essential for sustainable agriculture and climate change mitigation. Embracing sustainable practices for soil management is key to realize the full potential of soils for carbon sequestration (...)”

United Nations, World Soil Day 2017



The REDII and the COM 2010/C 160/10 set the legislative framework to account GHG savings due to soil carbon accumulation

Renewable Energy Directive (EU 2018/2001)

EC Communication on the practical implementation of the EU biofuels and bioliquids sustainability scheme (COM 2010/C 160/10)

L 140/16 Official Journal of the European Union 5.4.2009

ANNEX V
Rules for calculating the greenhouse gas impact of biofuels, bioliquids and their fossil fuel comparators

Table 1: Typical and default values for biofuels if produced with no net carbon emissions from land-use change

Biofuel production pathway	Typical greenhouse gas emissions saving	Default greenhouse gas emissions saving
sugar beet ethanol	41 %	52 %
wheat ethanol (process fuel not specified)	32 %	16 %
wheat ethanol (straw as process fuel in CHP plant)	32 %	16 %
wheat ethanol (natural gas as process fuel in conventional boiler)	43 %	59 %
wheat ethanol (natural gas as process fuel in CHP plant)	53 %	70 %
wheat ethanol (straw as process fuel in CHP plant)	49 %	65 %
corn (maize) ethanol, Community produced (natural gas as process fuel in CHP plant)	50 %	66 %
sugar cane ethanol	71 %	87 %
the part from renewable sources of ethanol produced from the ethanol production pathway (ETB)	71 %	87 %
the part from renewable sources of ethanol produced from that of the ethanol production pathway (TAE)	71 %	87 %
rape seed biodiesel	45 %	58 %
sudlowater biodiesel	58 %	73 %
soybean biodiesel	40 %	51 %
palm oil biodiesel (process not specified)	36 %	45 %
palm oil biodiesel (process with methane capture at oil mill)	42 %	54 %
waste vegetable oil (animal) of biodiesel	83 %	83 %
hydrotreated vegetable oil from rape seed	51 %	47 %
hydrotreated vegetable oil from sudlowater	45 %	42 %
hydrotreated vegetable oil from palm oil (process not specified)	40 %	28 %
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	48 %	45 %
pure vegetable oil from rape seed	58 %	57 %
biogas from municipal organic waste as compressed natural gas	80 %	71 %
biogas from wet manure as compressed natural gas	84 %	81 %
biogas from dry manure as compressed natural gas	86 %	82 %

(1) Not including animal oil produced from animal by-products classified as category 1 material in accordance with Regulation (EC) No 1774/2003 of the European Parliament and of the Council of 1 October 2003 laying down health rules on animal by-products not intended for human consumption (7).

(2) OJ L 275, 16.10.2002, p. 1.

Annex V, Part C

C 160/8 Official Journal of the European Union 19.6.2010

ANNEX II
Methodology to calculate greenhouse gas impact: further elements

1.1. Introduction to this Communication

Table: Articles and Annexes referred to in this Communication

Renewable Energy Directive	Fuel Quality Directive
Article 2: Definitions	not included
Article 3: Calculation of the share of energy from renewable sources	not included
Article 17: Sustainability criteria for biofuels and bioliquids	Article 7: Sustainability criteria for biofuel

Methodology to calculate greenhouse gas impact: further elements

Initiation saving from soil carbon accumulation via improved agricultural management (Annex V, part C, point 1): 'improved agricultural management' could include practices such as:

- shifting to reduced or zero-tillage;
- improved crop rotations and/or cover crops, including crop residue management;
- improved fertilizer or manure management;
- use of soil improver (e.g. compost).

Emission savings from such improvements can be taken into account if there is clear and verifiable evidence as provided that it can reasonably be assumed that the carbon benefits over the period in which the raw materials concerned were cultivated (7).

The emission savings in terms of g CO₂-equivalent per hectare and year as indicated in point 7 of the method, replacing the default 20 for the period in which the raw materials concerned.

Calculation (point 6):
The inputs/variables that should be used in the calculation of the default values. The default values were based on crop types typically include seeds, fuel, fertilizer, pesticides, yield, and N₂O emissions from soils. The inputs/variables that should be used in the calculation of the default values are not taken into account here to balance the equation. The inputs/variables that should be used in the calculation of the default values are not taken into account in point 13.

The methodology for the calculation of the default values is as an alternative to actual values — for the use of averages for smaller geographical areas — as an alternative to actual values — for the use of averages for smaller geographical areas — as an alternative to actual values — for the use of averages for smaller geographical areas.

N₂O emissions (point 6):
An appropriate way to take into account N₂O emissions from soils is the IPCC methodology, including what are described there as both direct and indirect N₂O emissions (8). All these IPCC data could be used by economic operators. The 3, which relies on default measurement and/or modelling, seems more relevant for the calculation of 'regional' collection values (cf. Section 3.3 of this Communication) than for other calculations of actual values.

Land use change (points 7 and 10):
Land-use change should be understood as referring to changes in terms of land cover between the six land categories used by the IPCC (arable land, grassland, cropland, wetlands, settlements and other land) plus a seventh category of permanent crops. In multi-annual crops whose main is usually not annually harvested such as short rotation coppice and oil palm (9). This means, for example, that a change from grassland to cropland is a land-use change, while a change from one crop (such as maize) to another (such as rapeseed) is not. Cropland includes fallow land (i.e. land set out for one or several years before being cultivated again). A change of management activities, tillage practice or manure input practice is not considered land-use change.

(7) Measurements of soil carbon can constitute such evidence, e.g. by a first measurement in advance of the cultivation and subsequent one at regular intervals several years apart. In such cases, before the second measurement is available, increase in soil carbon would be estimated using a relevant scientific basis. From the second measurement onwards, the measurements would constitute the basis for determining the existence of an increase in soil carbon and its magnitude.

(8) Article 18(2) and (3). These regions are specified in Annex I to Regulation (EC) No 1818/2003. Interactive maps of the regions are available at http://ec.europa.eu/energy/energy_efficiency/energy_efficiency_en.htm.

(9) Cf. 2004 IPCC guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11 http://www.ipcc-nggip.org/pdf/public/2004/guide_vol4_ch11_20040202.pdf.

(10) Because such land has features of both cropland and forest land.

Annex II, Part C

REDII Annex V provides the GHG calculation formula where **soil carbon accumulation** (e_{sca}) is accounted as GHG savings

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{CCS} - e_{CCR} - e_{ee}$$

- E** - Total GHG emissions from supply and use of the fuel (in g CO_{2eq}/MJ)
- e_{ec}** - GHG emissions from the extraction or cultivation of raw materials
- e_l** - Annualized (over 20 years) GHG emissions from carbon stock change due to land use change
- e_p** - GHG emissions from processing
- e_{td}** - GHG emissions from transport and distribution
- e_u** - GHG emissions from the fuel in use (shall be taken to be zero)
- e_{sca}** - GHG emissions savings from soil carbon accumulation via improved agricultural management
- e_{CCS}** - GHG emissions savings from carbon capture and geological storage
- e_{CCR}** - GHG emissions savings from carbon capture and replacement
- e_{ee}** - GHG emissions savings from excess electricity from cogeneration

Source: Renewable Energy Directive (2009/28/EC) and RED recast (2018/2001/EU)

Improved agricultural management practices leading to soil carbon accumulation, as defined by COM 2010/C 160/10



- Shifting to reduced or zero tillage



- Improved crop rotations and/or cover crops, including crop residues management



- Improved fertilizers or manure management



- Use of soil improver (e.g. compost)

Requirements for claiming GHG emissions savings from soil carbon accumulation via improved agricultural management (e_{sca})

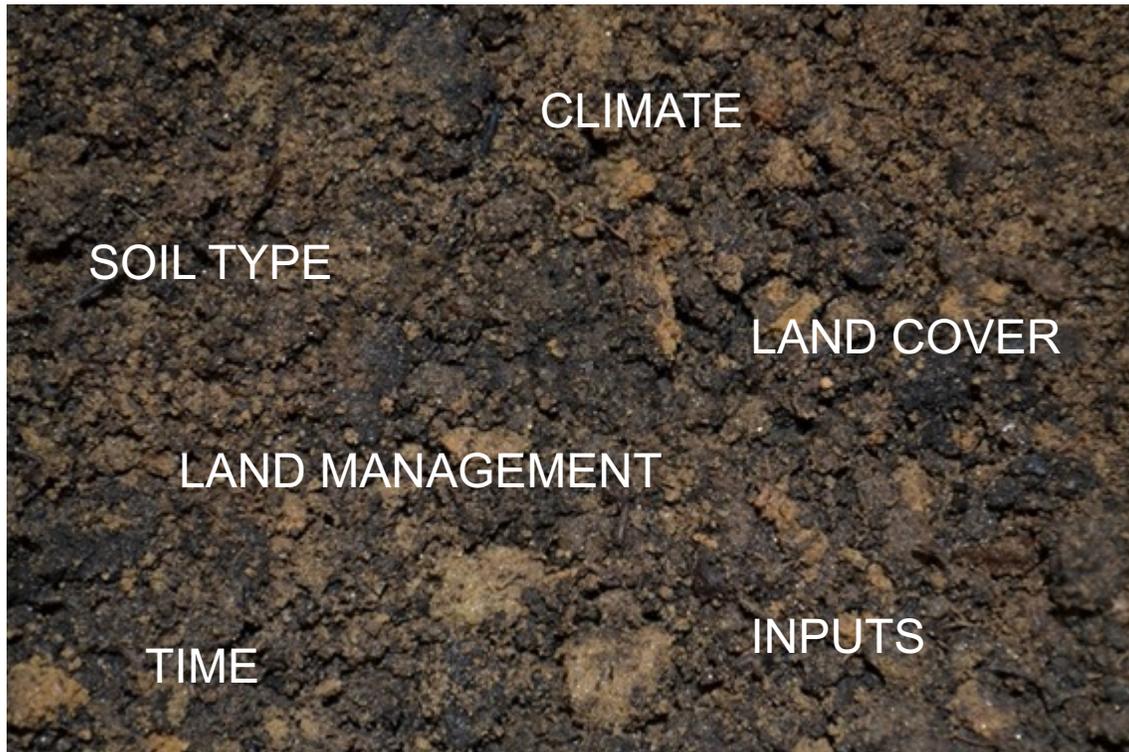


e_{sca} can be claimed if evidence is provided that:

- agricultural management practices potentially leading to soil carbon accumulation were adopted **after January 2008**,
- those are implemented **in best practice**, so that an increase in soil carbon can be expected over the period in which the raw materials concerned were cultivated,

Measurement of soil carbon could also serve as **additional evidence**.

The carbon stock (CS) associated with reference (CS_R) and actual (CS_A) status is influenced by **different soil factors***



In the e_{sca} calculation, 3 options are possible to determine carbon stock:

1. Use of standard values of IPCC(2006) guidelines approach
2. **Field measurements**
3. Other appropriate methods, provided that they take into account **climate, soil type, land cover, land management and inputs** (e.g. modelling + field measurement)

* The Commission Decision 2010/335 gives further **guidance** for the definition of soil factors in calculating carbon stocks

Requirements and restrictions for applying e_{sca} savings under ISCC

ISCC Recent System Updates

- e_{sca} emissions savings have to be calculated as **actual values** mirroring what happens in the field (i.e. individual farm level).
- The actual values **cannot** be calculated by **averaging emissions** values of farmers who use e_{sca} with farmers who do not use e_{sca} .
- Regional approach **is not allowed**.
- Carbon Stocks (CS_R and CS_A) must be verifiable and can be determined:
 - Using **IPCC standard values**.*
 - Via calculation approaches **other than IPCC**, but a report with the complete calculation methodology must be provided to the ISCC. When field measurements/modelling methods are used, the first field measurement defines CS_R and CS_A is measured periodically.
- **Reference Carbon Stock (CS_R) must be set before** the improved agriculture management is applied.

<https://www.iscc-system.org/update/10-march-2021>

*ISCC System Document 205 "Greenhouse Gas Emissions"

ISCC is developing a **Guidance Document for the Calculation and Verification of Emission Savings from Soil Carbon Accumulation**



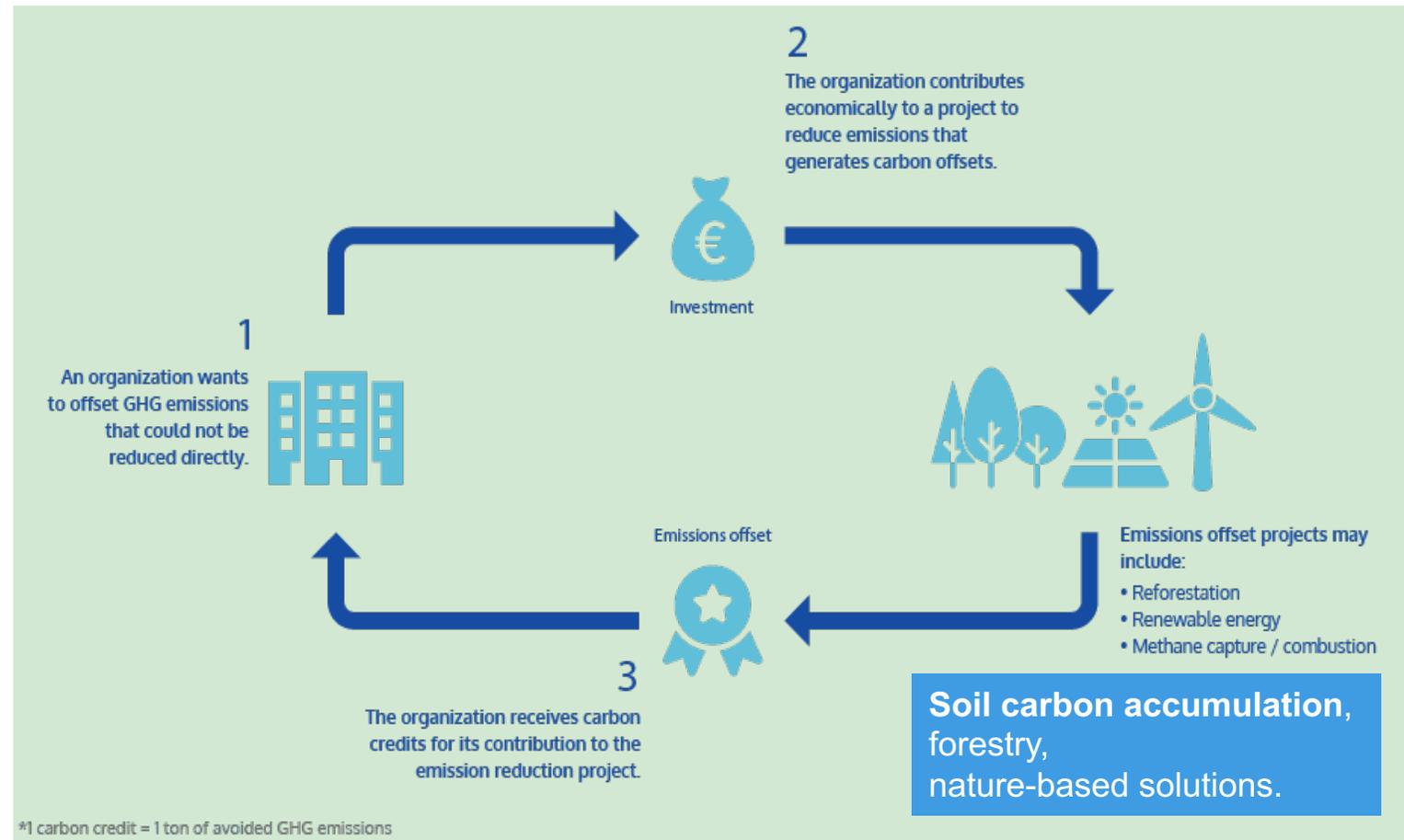
Main issues tackled in the upcoming ISCC Guidance

- Extended general provisions
- **Recommendations** to calculate e_{sca} as **actual values**.
- Requirements and **restrictions to IPCC approach** to determine carbon stocks and respective changes
- Detailed recommendations on **how to conduct field measurements** on representative soil sample, to determine carbon accumulation in soil
- Requirements for the **use of field measurements combined with soil modelling (still to be confirmed)**
- Guidelines for forwarding and verifying e_{sca} values

Work in progress...

The carbon compensation or offsetting

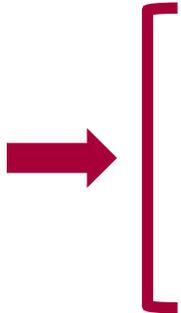
- Carbon compensation is a **policy instrument to enhance sustainability** by reducing GHG emissions
- Carbon offsetting means **buying carbon credits** from emissions reduction/prevention projects in one location, in order to **compensate for an equivalent amount of emissions** in another location
- **1 carbon credit = 1 ton of avoided CO₂ eq emissions**
- In order to generate carbon credits, projects should:
 - ✓ meet **specific requirements** (additionality, permanence, etc)
 - ✓ apply approved methodology & guidance,
 - ✓ successfully pass third-party verification



<https://www.climatetrade.com/carbon-offsetting/>

Sustainable agriculture and forestry projects have currently a great potential for carbon offsetting. Many of those focus on **soil carbon accumulation**

Project types Agriculture, Land management, agroforestry	General requirements*						
	Additionality	Verifiability	Avoidance of double counting	Effective	Prevention of leakage	Not harmful	Legal
Improved agricultural practices for soil carbon accumulation							
- Improved crop rotation schemes (e.g. differentiation of crop patterns)	X	X	X	X	X	X	X
- Introduction of cover crops	X	X	X	X	X	X	X
- Measures to prevent/reduce soil erosion	X	X	X	X	X	X	X
- Measures to improve soil fertility	X	X	X	X	X	X	X
- Measures to improve soil health and soil biodiversity	X	X	X	X	X	X	X
- Improved management of agricultural residues (e.g. no removal, no burning)	X	X	X	X	X	X	X
- Switch to zero/reduced tillage	X	X	X	X	X	X	X
Sustainable and climate smart agricultural practices							
- Practices that increase the resilience of farming systems	X		X	X	X	X	X
- Measures to improve water use efficiency	X	X	X	X	X	X	X
- Introduction of resistant crop varieties	X	X	X	X	X	X	X
Sustainable Agroforestry							
- Increase forest cover of non-forest land	X	X	X	X	X	X	X



* As defined by the most diffused Standards on the market

ISCC is investigating on a **carbon trading platform** focusing on the voluntary market and allowing GHG emission compensation



The **functions** of a carbon trading platform are:

- **Buying carbon credits** directly from project developers
- **Selling carbon credits** to the interested stakeholder
- Ensuring that **ecosystem services** provision and **biodiversity** conservation are addressed by carbon offsetting projects
- Providing **additional functions** to support and promote emission reduction (e.g. carbon footprint calculation, needs of carbon credits estimate, etc)

ISCC is looking for partners to conduct pilot projects



Many thanks for your attention!

Follow us on 

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