



Food and Agriculture
Organization of the
United Nations

SDG INDICATOR 2.4.1

PERCENTAGE OF AGRICULTURAL AREA UNDER PRODUCTIVE AND SUSTAINABLE AGRICULTURE

Sub-indicator templates

DRAFT

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1. Economic sub-indicators

Labour productivity

Dimension: Economic
Theme: Labour productivity
Sub-indicator: Farm output volume / Hours worked
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> This theme is relevant in the assessment of sustainability since measures of labour productivity will provide a sense of whether labour is being used effectively and whether there might be opportunities to increase production with relatively less labour input. Where there are constraints on the availability of labour, for example due to demographic shifts or loss of skills in agriculture, measures of labour productivity are likely to be important in understanding the future agricultural production possibilities. Labour productivity measures also point towards the quality of human capital since simply increasing production simply by increasing the number of hours worked will not improve labour productivity. In effect, labour productivity should be driven, over the longer term, by working smarter, for example through improvements in the education and skills of workers and through the use of improved technology and investment in assets. The retention and application of local knowledge and customs with respect to agriculture in specific locations may be of particular relevance.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> Measures of labour productivity are aimed at providing information on the quantity of labour input required to produce a given quantity or volume of output. It is a measure of the production relationship between labour and output in physical terms and hence should be independent from changes in the prices of labour and changes in the prices of output.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> <ul style="list-style-type: none">• Farm output volume / hours worked• Farm output volume / number of farm employees (or farm jobs)• Farm value added (real terms) / hours worked• Gross value of agricultural production / hours worked• Net farm income / hours worked
Definition of the sub-indicator

Define the selected sub-indicator, including relevant formula as appropriate and explain choice.

Formula:

Farm output volume / Hours worked

Discussion:

In line with the concept of labour productivity described above, the sub-indicator should be measured by dividing a measure of the volume of agricultural output (farm output volume) by a measure of the hours worked by agricultural workers, including both employees and the self-employed (owners and family members).

Farm output volume: Measures of the volume of agricultural output at farm level will generally need to take into account production of multiple outputs, e.g. different crop types, crop and livestock combinations, etc. Since the volume of agricultural outputs is not measured in commensurate units (e.g. not all outputs are measured in tonnes, and tonnes of different output represent different products), it is necessary to establish an appropriate means of aggregation.

From the perspective of economic statistics this is generally done at aggregate level by weighting together indexes of changes in the volume of production of individual products using the relative monetary value for each output, using either the relative value or relative prices of outputs at a common reference or base period. An alternative method would be to weight the output measures together using the associated hectares used which may be more suitable for sustainability assessment since the relative weight will reflect a measure of environmental input as distinct from a measure of product demand.

Under either weighting approach, a challenge remains estimation at a single point in time since aggregation using these weighting methods essentially implies measurement over time – i.e. is the volume higher in one period compared to another.

Given this challenge, one way forward is to measure the labour productivity indicator for a given farm over time. Another alternative is to measure labour productivity for distinct output types, e.g. wheat, beef, etc.

The use of farm output volumes for the measurement of productivity is fully consistent with the findings from the Global Strategy review of agricultural productivity and efficiency <http://qsars.org/wp-content/uploads/2017/02/TR-17.02.2017-Productivity-and-Efficiency-Measurement-in-Agriculture.pdf>.

In some situations however, labour (and land) productivity have been measured using farm revenues, i.e. a monetary value of farm output. While this easily overcomes the challenge of aggregating different farm outputs, in fact the indicator derived is conceptually not a measure of productivity. It is recommended that value based productivity measures not be used for this theme.

Labour input: The measure of labour input should not be limited to the quantity of labour purchased by the farmer, i.e. it should include work undertaken by the farmer and any other unpaid labour input.

While other measures of labour input may be available, hours worked is the strongly preferred measure of labour input since it takes into account the reality of the agricultural production cycle which is usually highly seasonal and not continuous over an annual timeframe. Measures of the number of employees and the number of jobs do

not take these factors into account.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

Information on labour inputs and agricultural outputs should be available from farm surveys thus providing a good basis for assessment at farm level. Information on the value of farm outputs and areas attributable to different outputs should also be available from farm surveys thus providing information to weight together output volumes at farm level.

National level estimates of labour productivity may be derived from the combination of national accounts level information on agricultural output and data on labour inputs, for example from labour force surveys. Such national level estimates may provide useful information for data quality assessment but will not directly supply information relevant for farm level analysis.

There are undoubtedly measurement challenges, particularly in measuring labour input of self-employed persons, but on the whole, information on labour and production should be available. Indeed, this information will underpin the derivation of other sub-indicators and will be central to the overall assessment of sustainability.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

The definition of the thresholds for labour productivity require further discussion. Given the range of production situations, even for the same output type, comparisons of labour productivity across countries or regions will be challenging and determining broad ranging thresholds will be difficult.

Also, since labour productivity is a ratio, it may be difficult to determine whether a precise level of productivity is sustainable or not. Consequently, assessing sustainability in terms of changes in labour productivity may be more appropriate.

An alternative approach would be to focus on specific output types, perhaps in common types of agro-ecological farming zones and compare productivity performance.

Finally, an option may be to assess labour productivity performance against a benchmark (or frontier) level of productivity. The calculation of such a frontier would likely require additional information on farm level performance.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

TBD

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

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Land productivity

Dimension: Economic
Theme: Land productivity
Sub-indicator: Farm output volume / Farm agricultural area
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> Land productivity is a measure of the volume of production of agricultural outputs from a given area of land. Maintaining or improving the volume of production over time relative to the area of land used is an important aspect in sustainability for a range of reasons. At farm level, changes in land productivity over time will reflect changes in technology and production process, the application of fertilizers and pesticides, and changes in the quantity and quality of environmental inputs (e.g. soil and water), among other factors. At a broader level, improvements in land productivity enable increases in production to take place without utilizing increasingly scarce land resources, commonly linked to deforestation and associated losses of ecosystem services and biodiversity. Improvements in land productivity will thus tend towards improving the potential for achieving food security while reducing environmental impacts of agriculture.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> Measures of land productivity are aimed at providing information on the area of land required to produce a given quantity or volume of output. It is a measure of the production relationship between land and output in physical terms and hence should be independent from changes in the prices of land and changes in the prices of output.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> <ul style="list-style-type: none">• Farm output volume / farm agricultural area• Farm value added (real terms) / farm agricultural area• Gross value of agricultural production / farm agricultural area• Net farm income / farm agricultural area
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i> <u>Formula:</u> Farm output volume / Farm agricultural area <u>Discussion:</u> In line with the concept of land productivity described above, the sub-indicator should

be measured by dividing a measure of the volume of agricultural output (farm output volume) by a measure of the land area used for agricultural activity.

Farm output volume: Measures of the volume of agricultural output at farm level will generally need to take into account production of multiple outputs, e.g. different crop types, crop and livestock combinations, etc. Since the volume of agricultural outputs is not measured in commensurate units (e.g. not all outputs are measured in tonnes, and tonnes of different output represent different products), it is necessary to establish an appropriate means of aggregation.

From the perspective of economic statistics this is generally done at aggregate level by weighting together indexes of changes in the volume of production of individual products using the relative monetary value for each output, using either the relative value or relative prices of outputs at a common reference or base period. An alternative method would be to weight the output measures together using the associated hectares used which may be more suitable for sustainability assessment since the relative weight will reflect a measure of environmental input as distinct from a measure of product demand.

Under either weighting approach, a challenge remains estimation at a single point in time since aggregation using these weighting methods essentially implies measurement over time – i.e. is the volume higher in one period compared to another.

Given this challenge, one way forward is to measure the labour productivity indicator for a given farm over time. Another alternative is to measure labour productivity for distinct output types, e.g. wheat, beef, etc.

The use of farm output volumes for the measurement of productivity is fully consistent with the findings from the Global Strategy review of agricultural productivity and efficiency <http://qsars.org/wp-content/uploads/2017/02/TR-17.02.2017-Productivity-and-Efficiency-Measurement-in-Agriculture.pdf>.

In some situations however, land productivity has been measured using farm revenues, i.e. a monetary value of farm output. While this easily overcomes the challenge of aggregating different farm outputs, in fact the indicator derived is conceptually not a measure of productivity. It is recommended that value based productivity measures not be used for this theme.

Farm area: The measure of farm area should be focused on the area of the farm used for agriculture. Thus, ideally, following the interim land use classification of the System of Environmental-Economic Accounting (SEEA), and consistent with the application of this classification for the forthcoming 2020 Agricultural Census it should include:

- Land under temporary crops
- Land under temporary meadows and pastures
- Land with temporary fallow
- Land under permanent crops
- Land under permanent meadows and pastures
- Agricultural land under protective cover

The farm agricultural area should exclude areas of the farm that have been set aside for conservation and the maintenance of ecosystems and biodiversity.

The farm agricultural area may be larger than the area planted and area harvested.

The treatment of the following areas is subject to further discussion including

consideration of the alignment with standard practice in agricultural statistics

- Land used for aquaculture
- Rented land
- Use of common lands
- Land used as part of nomadic farming practices

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

Information on farm area and agricultural outputs should be available from farm surveys thus providing a good basis for assessment at farm level. Information on the value of farm outputs and areas attributable to different outputs should also be available from farm surveys thus providing information to weight together output volumes at farm level.

National level estimates of land productivity may be derived from the combination of national accounts level information on agricultural output and data on total agricultural area. Such national level estimates may provide useful information for data quality assessment but will not directly supply information relevant for farm level analysis.

There are undoubtedly measurement challenges, but on the whole, information on farm area and agricultural production should be available. Indeed, this information will underpin the derivation of other sub-indicators and will be central to the overall assessment of sustainability.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

The definition of the thresholds for land productivity requires further discussion. Given the range of production situations, even for the same output type, comparisons of land productivity across countries or regions will be challenging and determining broad ranging thresholds will be difficult.

Also, since land productivity is a ratio, it may be difficult to determine whether a precise level of productivity is sustainable or not. Consequently, assessing sustainability in terms of changes in labour productivity over time may be more appropriate.

An alternative approach would be to focus on specific output types, perhaps in common types of agro-ecological farming zones and compare productivity performance.

Finally, an option may be to assess land productivity performance against a benchmark (or frontier) level of productivity. The calculation of such a frontier would likely require additional information on farm level performance.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

TBD

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

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Farm income

Dimension: Economic
Theme: Farm income
Sub-indicator: Net Farm Income
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> An important part of sustainability in agriculture is the economic viability of the farm. This will be driven to a large extent by the profitability of the farm – that is, the net income that the farmer is able to earn from farming operations relative to the investment in land and other assets. Farm profitability is one of the key measures on which many farm level decisions are based and is considered a main driver of agricultural policies and the potential changes in policies thereof. Availability and use of information on farm economic performance, i.e. profitability, will support better decision making both at micro and macro-economic level. Since performance measures drive behavior, better information on performance can alter behavior and decision-making by government and by producers both in large scale commercial farming, medium scale and small scale subsistence agriculture.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> To assess and capture, whether the level of income earned by the farm is reasonable while taking into account factors of production and assets employed. The focus of this sub-indicator is on income from farming operations as distinct from the total income of the farming household which may be sourced from activity in other areas, for example employment in local businesses by other family members, tourism activity, etc. While these other sources of income are likely important in the context of assessing the sustainability of living in rural areas, they are not of direct relevance in the assessment of the sustainability of agriculture.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> A variety of metrics have been used to consider profitability at farm level. All relate to some combination of revenue or sales from agricultural production and the costs of this production. Some of the measures are direct measures of “profit”, others are expressed as ratios either with respect to the asset base (or part thereof) of the farm or with respect to the revenue base. <ul style="list-style-type: none">• Net Farm Income / Farm area (acre, hectare)• Net Farm Income• Agricultural Gross Value Added• Earnings Before Interest, Taxes and Amortization (EBITA)

- Gross margin = (Revenue – Cost of Goods Sold) / Revenue
- Net margin = Net profit / Revenue
- Rate of Return on equity = Net Income / Shareholders equity
- Rate Return on Assets = EBIT / Total Assets

Definition of the sub-indicator

Define the selected sub-indicator, including relevant formula as appropriate and explain choice.

Formula:

Net Farm income

Discussion:

As can be seen from the number of different metrics listed above, there are a number of options for the measurement of farm income. There are two key considerations in selecting an indicator for this theme. The first is the precise definition and scope of farm income. The second concerns whether the measure of income for an individual farm should be scaled in some way – for example in comparison to farm area.

The proposed sub-indicator of net farm indicator implicitly reflects an understanding that the appropriate threshold for this theme is whether, for an individual farm, net farm income is positive or negative. Particularly if assessed over a three to five year period, the rationale here is that ongoing negative farm income from agricultural activities is an indicator of unsustainability.

However, on its own, net farm income cannot be used for comparison purposes across different farms since it does not account for differences in size or operations. In this situation it is important to select an appropriate denominator. Based on assessment of the literature, information on total farm area is the most straightforward and easy to capture.

The initial proposal is to define the sub-indicator as net farm income only.

Farm income: The general ambition is to record the earnings of a farm from agricultural activity after deducting costs of operation. Thus earnings from non-agricultural activity should be excluded such as from tourism or employment off-farm. The deduction of operating costs rules out measures covering solely revenue from sales of agricultural output. The scope of operating costs to deduct may be challenging. However, ideally wages and salaries would be deducted as well as depreciation costs of manufactured and built capital.

The measure of net farm income should also take into account payments received from government either in terms of direct subsidies or rebates. The treatment of rentals earned from leasing of agricultural land, the imputed rent of farm dwellings and the valuation of own-account production (consumed on farm) also need further discussion.

Initial research has not identified an internationally agreed definition of net farm income for statistical purposes. The following definition from Statistics Canada is therefore proposed as a starting point for discussion.

Total farm cash receipts including payments (minus) Total operating expenses after rebates (equal) Net cash income (plus) Income in kind (minus) Depreciation (equal) Realized net income (plus) Value of inventory change = total net income.

Source: <http://www.statcan.gc.ca/pub/21-010-x/21-010-x2014001-eng.pdf>

- Gross farm income refers to the monetary and non-monetary income received by farm operators. Its main components include cash receipts from the sale of farm products, government payments, other farm income (such as income from custom work), value of food and fuel produced and consumed on the same farm, rental value of farm dwellings, and change in value of year-end inventories of crops and livestock.
- Net farm income refers to the return (both monetary and non-monetary) to farm operators for their labor, management and capital, after all production expenses have been paid (that is, gross farm income minus production expenses). It includes net income from farm production, the value of commodities consumed on the farm, depreciation, and inventory changes.
- Farm cash receipts include revenues from the sale of agricultural commodities in current dollars that include sales of crops, livestock and its by-products i.e. milk, poultry, eggs, wool, fur and honey. Operating expenses represent business costs incurred by farm businesses for goods and services used in the production process. Expenses, which are recorded when the money is disbursed by the farmer, include property taxes, custom work, rent, fertilizer and lime, pesticides, machinery and building repairs, fuel for heating and machines, wages, interest and business share of insurance premiums.
- Depreciation charges account for the economic depreciation or for the loss in fair market value of the capital assets of the farm business. Calculated on farm buildings, farm machinery, and the farm business share of autos, trucks and the farm home, depreciation is generally considered to be the result of aging, wear and tear, and obsolescence. It represents a decrease in the potential economic benefits that can be generated by the capital asset.
- Income-in-kind measures the value of the agricultural goods produced on farms and consumed by farm operator families. It is included to measure total farm production.
- Value of inventory change (VIC) measures the dollar value of the physical change in producer-owned inventories. This concept is used to value total agricultural economic production. To calculate VIC, the change in producer-owned inventories (between the end and the beginning of a calendar year) is first derived and then multiplied by the average annual crop prices or value per animal. This calculation is different from the financial or accounting book value approach, which values the beginning and ending stocks, and then derives the change.
- The VIC over all the major commodities can vary widely (depending on the size of the change of inventories and prices). The VIC can be either positive (when inventories are larger at the end of the year compared to the beginning levels) or negative (when year- end inventories are smaller than the levels at the beginning of the year). If the inventory levels are the same at the beginning and end of the year, VIC will be zero despite price changes.

There is a range of other methodological reference documents that may be useful. These include:

- the Global Strategy "Cost of production" manual maybe used to collect data on various fixed and variable costs associated with farming operations. (<http://gsars.org/en/handbook-on-agricultural-cost-of-production-statistics-2/>)
- the description of methods and approaches to farm surveys in Australia <http://www.agriculture.gov.au/abares/Pages/surveys.aspx>

- Material from the Economic Research Service of USDA.
 - Gross cash income is the sum of all receipts from the sale of crops, livestock, and farm related goods and services as well as all forms of direct payments from the government.
 - Gross farm income is the same as gross cash income with the addition of non-monetary income, such as the value of home consumption of self-produced food and the imputed gross rental value of farm dwellings.
 - Net farm income is gross farm income less cash expenses and noncash expenses, such as capital consumption, perquisites to hired labor, and farm household expenses. It is a longer term measure of the ability of the farm to survive as a viable income-earning business.
- A key impact indicator for the EU Common Agricultural Policy is Agricultural entrepreneurial income – a variant on the net farm income definition that deducts interest paid. See <https://ec.europa.eu/agriculture/sites/agriculture/files/cap-indicators/impact/2016-impact-indicators-fiches.pdf>

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

Estimating profitability at a farm level will generally require compilation of basic farm financial records, i.e. capturing and reporting daily, weekly, monthly or seasonal transactions in an organized way. In general, large commercial farms maintain detailed financial records however, in case of small, medium farms and subsistence agriculture, record keeping is seldom practiced and in most of the countries it doesn't exist at all. Hence data quality and reliability will always be a question mark.

Where compiled, farm income accounts are designed to provide an annual measure of income returned to the owners of agricultural businesses from the production of agricultural commodities. Two points should be noted: 1. accounts only relate to the farm business. They do not include any income that farm operators or their families may receive from other sources (wages and salaries, investment income, etc.). 2. The accounts pertain only to the production of agricultural commodities. Revenue or expenses related to the sale or purchase of farm capital (real estate, machinery and equipment) are not included. An important component of these accounts is the farm cash receipts series which represents the cash income received from the sale of agricultural commodities as well as direct program payments made to support or subsidize the agriculture sector.

Where the detailed data ideally required are not available at farm level, estimates will need to be developed based on bringing together information from different data sources. The potential sources include:

- Farm surveys
- General business / economic surveys that cover agriculture
- Derived estimates based on production quantities, prices and assumptions regarding cost structures
- Administrative sources (e.g. taxation data)

In addition, data on the location of farms may be important in the development of thresholds. For this maps showing agro-ecological zones will be relevant.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

Based on discussion above, the proposed sub-indicator net farm income implies use of a threshold that is zero – i.e. net farm income consistently greater than zero can be considered sustainable and net farm income consistently less than zero can be considered unsustainable. This threshold can be applied irrespective of the mix of production, the location of the farm or size of operation.

If an alternative sub-indicator is selected, for example net farm income/total farm area, additional considerations concerning the appropriate threshold. One possibility is to estimate the profitability for the farms by agro-ecological zones or regions, based on results of the level of profitability, establish a profitability frontier to be used as yardstick against which the profitability of other farms will be benchmarked. To do this

- A specific method needs to be agreed on for establishing the frontier.
- The challenge is to decide on an acceptable and reasonable level of profitability threshold for different zones against which the respective farms will be benchmarked and classified sustainable or otherwise.
- The threshold is defined as a distance from the frontier and some criteria will have to be evolved e.g., maybe 1/3rd distance from the frontier.

Reference: <http://gsars.org/wp-content/uploads/2017/02/TR-17.02.2017-Productivity-and-Efficiency-Measurement-in-Agriculture.pdf>

An alternative or extended approach would involve the selection and measurement of thresholds for profitability for different types, sizes, locations, and natures of farms and farming activities as there are certainly variations in profitability due to these factors even within country. Once the baseline thresholds are established for different strata, a weighted average of the different thresholds may be required for to it be a true representative of the diverse type of farms.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

TBD

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

Data collection challenges:

- Access to farm financial records / income statements in case of large and medium private commercial farms (protected by confidentiality laws).
- Non-availability of detailed financial records for small and subsistence farms and the capacity of farmers to record or recall relevant information and understand the requirements.
- Non-availability of records for farms on common lands.
- Collection and estimation of farm gate and market prices by region for different type

of products.

Policy related issues:

- Consideration and treatment of sunk costs associated with switching from one production process to another. The initial investments in terms of land preparation, machinery bought, fencing and accumulated knowledge over time may inhibit the shift from one farming activity to another.

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2. Environmental sub-indicators

Soil

Dimension: Environment
Theme: Soil
Sub-indicator: Soil erosion and soil organic matter
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> <p>Soil is a fundamental environmental asset that underpins agricultural output. Sustaining the quantity and quality of soils in agricultural areas is thus a key part of sustainability in agriculture. Unfortunately, because there are so many dimensions to soil, it is often difficult to determine which dimensions to focus on especially from the perspective of comparability. At the same time, without indicators of soil, a meaningful assessment of sustainability cannot be made. The aim here, therefore, is to identify some general indicators whose measurement will point towards the potential for agricultural production to be unsustainable. Determining the maximum potential output associated with a given soil asset is difficult since it will depend on factors including the type of soil, topography, climate and choice of crop/agricultural production.</p>
What concept needs to be measured <p>Changes in the stock of soil resources in terms of their quantity and quality such that an assessment is possible concerning the adequacy (or non adequacy) of farming practices and the maintenance of soil properties.</p>
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> <p>Reflecting the multiple perspectives and importance of soil there are a wide variety of indicators and metrics that are used in assessing soil resources. These include indicators of:</p> <ul style="list-style-type: none">• Soil salinity• Soil organic matter• Soil compaction• Soil sealing• Soil structure (e.g. clay content, depth of topsoil)• Soil fertility, including nutrient balances, pH,• Soil management practices;• Soil erosion – water and wind• Soil capability (e.g. potential for waterlogging, water capacity)• Soil biodiversity <p>Note also that among the agri-environmental indicators of the EU, a composite indicator for soil quality is derived covering biomass productivity, fertiliser response rate, production stability and soil environmental services (see http://ec.europa.eu/eurostat/statistics-</p>

[explained/index.php/Agri-environmental_indicator_-_soil_quality](http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_soil_quality))

Definition of the sub-indicator

Define the selected sub-indicator, including relevant formula as appropriate and explain choice.

Two sub-indicators are proposed for soil. The first concerns soil erosion and the second the level of soil organic carbon. Both of these indicators were highlighted as core indicators in the recent Global Strategy review into agri-environmental indicators.

Soil erosion: Soil loss due to water erosion measured in tonnes per hectare per year

For more details see, for example, http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_soil_erosion

Soil organic carbon: Average carbon content in topsoil as a percentage of total weight measured in tonnes per hectare

Measuring soil organic carbon content is increasingly accepted as a suitable metric for the assessment of soil quality, although it is accepted that it may be difficult to measure.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

Metrics concerning **soil erosion** have been developed by FAO and others and are measured in terms of tonnes of topsoil lost per hectare. Estimates of soil erosion are widely available based on environmental modelling of rainfall, slope, land use and understanding of soil types and locations (including the revised Universal Soil Loss Equation R-USLE). The R-USLE is based on a combination of biophysical characteristics and farming practices.

Assessing agricultural sustainability would therefore be based on the impact of farming practices on erosion, given specific bio-physical conditions.

Combining information from farming practices obtained from farm surveys with bio-physical information obtained either from farm surveys or from other sources (soil texture, slope, rainfall) would make it possible to assess the rate of erosion due to agricultural practices.

FAO has also developed approaches for land degradation assessment at farm, country and global level through the LADA programme. LADA-local methodology can be used to assess the suitability of agricultural practices in terms of soil degradation.

Techniques for the estimation of **soil organic carbon** can be obtained through direct measurements at field level or through modelling. However, if using modelling, one would need to identify the parameters of the model that can be influenced by farming practices in order to assess the level of sustainability of a farm in relation with soil.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

Definition of appropriate thresholds requires further discussion. One important point to keep in mind in assessing sustainability in relation with soil is the fact that the characteristics of soils in a given area (erosion, organic matter) depend of a mix of local conditions and land use practices. The assessment of sustainability of agriculture needs to capture the part of

the status that is related to agricultural practices. For instance, there are soils with high erosion rate in natural conditions, or soils with low or no carbon content in natural conditions.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

15.3.1 Proportion of land that is degraded over total land area (sub-indicators: land productivity, carbon stock, land cover change)

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

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Water use

Dimension: Environment
Theme: Water use
Sub-indicator: Water abstraction for agriculture from surface and groundwater in percentage of available water

Aim and relevance

What is the reason we need to focus on this theme? What is the relevance for decision-making?

Water is a fundamental environmental asset required for agricultural production. Water may be sourced in a number of ways for example via precipitation, or abstraction from groundwater or irrigation from surface water.

Agriculture is by far the main user of freshwater. On average, 70% of all water withdrawal is for agriculture. In many places, the collective withdrawal of water for all sectors (agriculture, cities, industries, etc.) is beyond what can be considered environmentally sustainable resulting in dry rivers without environmental flow, dried up wetlands and overexploitation of groundwater leading to progressive reduction of the groundwater table.

What concept needs to be measured?

Expressing the theme in terms of what exactly we try to capture

The extent to which water use of agriculture is unsustainable

Review of metrics used in the literature

Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.

There are a variety of ways in which water use in agriculture can be considered and hence a range of indicators and metrics has been used to consider the connection between water and agriculture. These include:

- Improved water resources management
- Depth of water table (metres)
- Water use efficiency (m³/ha or m³/output volume)
- Water availability (m³/ha/year)
- Conflicts over water use
- Safe access to the resource
- Water security

Definition of the sub-indicator

Define the selected sub-indicator, including relevant formula as appropriate and explain choice.

Formula:

Water abstraction for agriculture from surface and groundwater in percentage of available water

Discussion:

Water resources and use are connected through the water cycle, through which water falls on the ground, replenishes rivers and aquifers, and flows to the sea. The natural spatial area to assess the sustainability of water use is the river basin (or groundwater aquifer in dry areas). All users are connected in the river basin, and water withdrawal by one user can potentially affect other users downstream, or the environment. It is, however, the collective action of all users that determines sustainability of water use in a given river basin.

Agricultural water abstraction refers to the water that is used for irrigation (and in a few places for aquaculture or livestock). Other uses of water in agriculture can be considered marginal.

Available water usually includes the volume of groundwater that is replenished on a yearly basis, and the part of the river flow that excludes water needed to maintain the environmental functions of the river.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

At national and local level, water accounting allows to establish the relative level of water use and sustainability levels.

Countries experiencing problems with excessive water use are usually well equipped with information at national level. Water authorities maintain maps of river basins and aquifers with a measure of the level of water use. In general, the availability of water information is an indicator of the level of water stress in a country.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

Measures of water use sustainability must capture the imbalance between supply and demand in the river basin. At international level, thresholds in the rate of water withdrawal over water resources in river basins have been used to express the level of stress on the water system, associated to a certain extent with the sustainability of water use: the higher the rate, the most likely it is that water use pattern be unsustainable. Thresholds used at international level are 20% and 40%

For river basin, the sustainability level is usually measured in terms of the respect of 'environmental flow' needed for the river to perform its environmental services. For groundwater, sustainability is usually associated with inter-annual trend in level of the water table: a lowering of the water table over years can be considered unsustainable pattern. In both cases, there is no universally agreed sustainability threshold.

Attributing sustainability levels in terms of water quantity to single farms is impossible in

view of the interconnectedness between users in the river basin. However, it may be possible to obtain a rough estimate of sustainability in relation with water quantity through a farm survey as follows:

- Do you use water from rivers, ponds, or wells for agriculture (irrigation, aquaculture)
 1. If no → no sustainability issue
 2. If yes, are there problems of water availability in the region (water level decreasing, conflict on water, rivers drying part of the year)?
 - a. If no → no sustainability issue
 - b. If yes → sustainability issue. In this case, it is necessary to calculate to what extent all users contribute to unsustainable use in the river basin or aquifer, and then estimate the percentage of those who are unsustainable.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

Indicators 6.4.1 (water use efficiency) and 6.4.2 (water scarcity)

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

In the literature, many studies propose to use water use efficiency as a measure of sustainability in terms of water quantity. While this seems to make sense, it has been proven that water use efficiency is not directly connected to the level of sustainability in water use. To the contrary, it is in most water stressed basins that water use efficiency is usually the highest. Water use efficiency, or the more sophisticated concept of water productivity (ratio of production over water withdrawal or use) could, instead, be used as part of the productivity dimension of sustainability in agriculture (see also discussion in SDG indicator 6.4.1).

Water quality

Dimension: Environment
Theme: Water quality
Sub-indicator: To be determined
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> Intensive agriculture makes use of inputs like mineral fertilizers and pesticides. When not properly handled, part of these chemicals end up in surface water and aquifers where they affect the quality of water. In arid regions, the leaching of salt in irrigated fields may lead to excessive concentrations of salts in rivers. Intensive livestock production can also lead to excessive concentrations of ammonia leaching in the water bodies (rivers and aquifers). Sustainable agriculture implies that levels of chemicals and salts in water remain within acceptable boundaries.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> The extent to which agriculture contributes to reduction in water quality. Ideally, the impact of farming practices on water quality should be assessed by measuring the quality of water that seeps from the farm into groundwater or that feeds river reaches.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> A range of indicators of water quality can be identified, including <ul style="list-style-type: none">• Pesticides in groundwater• Water pollution• Concentration of NO in groundwater• Soil and water quality• Ambient water quality index• Waterlogging/salinity/sedimentation• Risk of surface water contamination
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i> <u>Discussion:</u> The selection and definition of a sub-indicator for water quality is subject to ongoing discussion. An ideal concept has been described above but measurement constraints noted in the following section significantly affect the potential to collect the relevant data. Proxy measures including information on quantities of fertilizer and pesticides applied at

farm level, estimates of excess nitrogen and phosphorous, and measures of the water quality in water systems affected by agricultural activity, e.g. levels of N and P and levels of pesticides should be considered.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

The water quality dimension of sustainable agriculture is directly related to farming practices, and can, in theory, be measured through farm survey and similar farm level data collection. The difficulty lies in three issues:

1. The variety of ways in which water quality can be affected by agricultural practices and the subsequent number of variables to measure
2. The difficulty and cost of measuring water quality at farm level
3. The factors not related to farming practices that affect the way by which farming impacts water quality (including soil types, topography and climate)

As noted above, ideally, the impact of farming practices on water quality should be assessed by measuring the quality of water that seeps from the farm to the groundwater or feeds river reaches. However, such measurements would be extremely expensive if they were to be made on each farm in a farm survey.

A proxy to assess impact of agriculture on water quality could be based on the volumes of fertilisers and pesticides used per hectare, or the concentration of livestock expressed per unit area.

Measurement through other methods than farm surveys

Water quality measurements in rivers and aquifers, when available, can help defining the areas of the country (including surface and groundwater systems) most affected by agriculture-related water quality issues. In particular, the presence of nitrogen and phosphate in the water, or of pesticides, would be an indicator of unsustainable agricultural practices.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

To be further discussed pending selection of sub-indicator. If proxy measures relating to farming practices are used, possible thresholds include average application rates and measures of livestock density.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

6.3.1 Percentage of wastewater safely treated, disaggregated by economic activity

6.3.2 Percentage of receiving water bodies with ambient water quality not presenting risk to the environment or human health

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

Water quality is determined by numerous chemical and biological parameters that are all important. Many of these are difficult or expensive to measure, and choices need to be done focusing on those representing the most frequent agriculture-related issues.

DRAFT

Land use change

Dimension: Environment
Theme: Land use change
Sub-indicator: Impact of agricultural expansion
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> Land use change or land cover change are often seen as an important indicator for sustainability of agriculture. Expansion of agriculture at the expenses of natural land can translate into deforestation, loss of wetlands, or loss of biodiversity and habitat. Capturing land use change in agriculture should therefore focus on the impact that agriculture expansion has on natural resources. At the same time, the sustainability of agricultural production may be threatened by the expansion of urban areas into relatively more fertile soils thus reducing the potential for using these soils and potentially increasing the distance of food production from markets.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> This indicator should be able to measure to what extent the environmental cost of expansion of agricultural land is excessively high.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> To be completed
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i> <u>Discussion:</u> This sub-indicator measures the relative impact of agricultural expansion on environmental factors like the loss of wetland, habitat, natural forest and biodiversity. It consists of <ol style="list-style-type: none">1. understanding the area of natural land that has been transformed into agriculture land over a given period (we propose 5 years); and2. assessing the environmental value of the land that has been converted into agriculture. The farm would be considered unsustainable from the point of view of land use change if the environmental value of the land that was lost to agriculture is above a given threshold.
How should this be measured (Data source and methods) <i>Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should</i>

describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

FAO LADA programme has worked on the land use change aspect of land degradation and the methodology developed by LADA at country level can be applied in the case of this sub-indicator.

The types of land for which [a metric may be developed](#) ~~environmental value may be considered~~ include:

- Natural forests
- Wetlands
- Protected areas
- Wildlife habitat areas, as defined at national level.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

To be further discussed.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

6.6. By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

15.1.1 Forest area as a proportion of total land area

15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type

15.3.1 Proportion of land that is degraded over total land area

15.4.2 Mountain Green Cover Index

15.5.1 Red List Index

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

It is important that the criteria used to calculate this indicator be based on the national legislation, or recognised international standards on environmental protection. The purpose here is to capture the share of biodiversity and environmental degradation that can be associated with unsustainable agricultural practices.

Biodiversity

Dimension: Environment
Theme: Biodiversity
Sub-indicator: Conservation area / Farm area (area of holding)
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> Biodiversity is a multifaceted concept encompassing the diversity of ecosystems, species and genes. The importance of genetic diversity in sustainable agriculture is the focus of measurement under SDG 2.5 and indeed, is likely best assessed at a broader national type level than at a farm level. Given these points, genetic diversity is not the focus of measurement here. The measurement of ecosystem diversity is also likely only meaningfully assessed at a broader, national level, particularly in the context of SDG 15. At the same time, it is clear that agricultural activity has the potential to directly affect ecosystem diversity through the destruction of habitat and the fragmentation of the landscape. Nonetheless, based on the scoping proposed for this indicator, it is proposed that these wider effects of agricultural activity are not assessed at farm level and hence should not be incorporated in the overall sustainability indicator. The measurement of species diversity is perhaps of most direct relevance to farm level sustainability. For example, pollinators are required to support crop production and the presence of birds and insects can be important in pest control. To the extent that replacing these ecosystem services requires purchase of manufactured products (pesticides, etc) or importing cultivated pollinators then these increased costs will reduce sustainability of the farm's operations. A sub-indicator pertaining to maintaining or enhancing species diversity at farm level is therefore a relevant ambition.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> The intent with this sub-indicator is to measure the extent to which agricultural activity is supporting the maintenance of species level biodiversity which can be an important input, albeit often unrecognized, to agricultural production.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> This is a difficult area of measurement. Some potential indicators include: <ul style="list-style-type: none">• Area of high nature value farmland• Population trends of farmland birds• Agricultural areas under protected and conservation status
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain</i>

choice.

Formula:

Share of conservation area of total farm area

Discussion:

The proposed approach is to measure the proportion of the farm area that is considered conservation area in the sense of being set aside for that purpose. In this regard it is proposed to follow the definition of *land used for maintenance and restoration of environmental functions* as defined in the SEEA interim land use classification. In concept this land should be delineated separately from land used for agriculture. Hence the denominator for this indicator will not be the farm's agricultural area but rather the total area of the farm under management.

It is generally considered that there is a positive relationship between the area of land set aside for conservation and the level of species biodiversity. Ideally, it would be nice to collect information on changes in the numbers and richness of species but this is very costly and difficult and would have substantial variation across countries. In Europe, an indicator of farmland bird species but providing advice on the measurement of this indicator in other parts of the world is likely difficult.

The proposed measures of conservation area is not perfect but may be measurable at farm level via farm surveys, is likely to be able to be monitored over time and is a reasonable proxy for farm level considerations with regard to biodiversity.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

This proposed sub-indicator requires further discussion in terms of feasibility and measurement approaches. In concept the data items should be able to be defined and collected at farm level but testing of this will be require.

Aside from farm level collection it may be possible to establish appropriate measures using remote sensing techniques provided the location and boundaries of the farm are well delineated. This will also require testing.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

The determination of thresholds will require further investigation and discussion with relevant experts.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

SDG 2.5.1 – measures of genetic diversity

SDG 15 – life on land

Note too that work in this area responds to SDG 15.9 on integrating information on biodiversity into national and local planning, development and poverty reduction.

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

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DRAFT

Energy use

Dimension: Environment
Theme: Energy use
Sub-indicator: Final energy use / volume of agricultural output
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> The use of direct and indirect energy is an important input to agricultural production. Direct energy is used in the form of fuels on farm, such as diesel, to power machinery and equipment, such as tractors, or as electricity for irrigation pumps. Indirect energy is the energy embedded in other inputs, such as energy used in manufacturing fertilizers used. Since, to a large extent, this energy is sourced from non-renewable sources, the issue of energy use is important in the context of sustainability.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> The extent to which agricultural production can be decoupled from energy inputs, in particular from non-renewable energy sources.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> Indicators of energy use relevant in this context include <ul style="list-style-type: none">• Final energy use• Final energy use per unit of output or per hectare• Share of final energy use from renewable energy resources
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i> <u>Formula:</u> $\text{Final energy use} / \text{Farm volume of agricultural production (joules/tonne)}$ <u>Discussion:</u> The proposal here is to use a measure of energy use intensity to gauge the extent to which agricultural activity is becoming less dependent on energy inputs. While it would be more instructive to utilise information on the use of energy from renewable sources, the collection of this information would be more challenging given the need to not only understand measures of energy use but also to collect data on energy supply. In the changing landscape of energy/electricity production such information could not be collected consistently at farm level.
How should this be measured (Data source and methods) <i>Different sustainability indicators require different data collection methods. Four main</i>

methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

A measure of final energy use, in joules, can be estimated based on data collected on fuel and electricity use from farm surveys, as well as other inputs such as fertilizer use on farm. Appropriate definitions for energy use and associated flows can be based on International Recommendations for Energy Statistics.

The farm volume of agricultural production would be estimated in a manner consistent with the measurement of sub-indicators on productivity.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

Subject to further discussion, potentially a trend towards decoupling could be used to support an assessment of sustainability.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

GHG emissions

Dimension: Environment
Theme: GHG emissions
Sub-indicator: GHG emissions (tonnes CO2 eq.) / Farm output volume
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> Adapting to and mitigating the effects of climate change is a key challenge for all sectors of the economy and this is especially the case for agriculture. Agriculture is significantly and directly affected by wider extremes in weather patterns and, at the same, is a significant contributor to the emission of greenhouse gas (GHG) that are the leading driver of climate change. At the same time, the direct effect at farm level of climate change may be challenging to determine both in terms of magnitude and likelihood, and there will not be a direct connection between the GHG emissions from a given farm and the impact of climate change on that farm. Nonetheless, particularly as it concerns overall policy relevance, there is a strong case to suggest that farms demonstrating declining trends in GHG emissions relative to output volumes are decoupling their production processes and working in a more sustainable manner. The reverse is also the case.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> Change over time in GHG emissions at the farm level relative to changes in farm output volumes.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> This sub-indicator is fairly commonly applied however different measurement scopes can be applied in terms of the coverage of GHG emissions. The main scope choice relates to the treatment of emissions from land use, land use change and forestry (LULUCF). Although often no attributed to agriculture, the majority of LULUCF emissions relate to the expansion of agricultural activity into land previously not used for agriculture.
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i> <u>Formula:</u> GHG emissions (tonnes CO2 eq.) / Farm output volume <u>Discussion:</u> The proposal here is to follow the definition developed for the measurement of GHG

emissions from agriculture by the FAO in the application of IPCC guidance.

As noted above, the proposal is to include emissions related to LULUCF alongside a range of non-CO2 emissions arising from various agricultural practices.

Measurement of farm output volumes should follow the approaches applied in the measurement of labour and land productivity sub-indicators.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

The direct measurement of GHG emissions at farm level is unlikely to be achieved. However, ideally it will be possible to gather information on the types of production processes, outputs and scale of activities (such as listed above) through farm surveys such that appropriate factors can be applied for an individual farm.

If such detailed information cannot be collected higher level assumptions, such as those underpinning the FAO methodology may be applied using information on only farm size and output mix. For a detailed description of the method see

<http://www.fao.org/climatechange/41521-0373071b6020a176718f15891d3387559.pdf>

Wherever possible, integration of estimation approaches with those being undertaken as part of international IPCC based reporting would be invaluable.

See also EU agri-environmental indicators guidance on measuring GHG emissions

[http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental indicator - greenhouse gas emissions](http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_greenhouse_gas_emissions)

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

The determination of appropriate thresholds for assessing sustainability requires further discussion. One possibility is to examine the trend in GHG emissions over time with a declining trend in emission/output suggesting sustainability.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

Interestingly an indicator of GHG emissions is only included once in the entire set of SDG indicators in relation to Target 9.4 which concerns upgrading infrastructure and retrofitting industries. SDG 9.4.1 is "CO2 emissions per unit of value added".

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator

3. Social sub-indicators

Decent work

Dimension: Social
Theme: Decent work
Sub-indicator: Working poverty rate for employed in agriculture
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> A key motivation for the measurement of decent work is the recognition that traditional employment statistics are insufficient to understand the working conditions of people, especially those working in agriculture. Indeed, in many low income countries there are low unemployment rates (<5%) but in fact many of the population live in poor households and are agricultural workers. Beyond improving the understanding of this employment situation, measures of decent work also encompass access to social protection, child labour, hazardous working condition and similar aspects to provide a more robust and complete picture of the conditions experienced by agricultural workers. Monitoring the extent of decent work in agriculture is thus relevant in assessing progress towards sustainable agriculture. Because the concept relates directly to work by individuals, it can be applied at the farm level. View from an unsustainability perspective, unless work in agriculture is decent, with appropriate working conditions, appropriate working hours and appropriate remuneration, agricultural activity cannot be considered to be sustainable.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i> The extent to which those working on agricultural holdings, including paid employees, farm owners and their families, are working in appropriate and decent conditions covering their remunerations and conditions of work, their health and safety and their overall wellbeing.
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i> Given the range of dimensions of decent work there is no single indicator that can cover all of the relevant aspects. Also, the concept of decent work is a relatively recent development and its application to agriculture is particularly challenging. Broadly, the thematic areas for decent work defined by the ILO are the following. Indicators in each of these areas may be considered. <ul style="list-style-type: none">• employment opportunities;• adequate earnings and productive work;

- decent working time;
- combination of work, family and personal life;
- work that should be abolished;
- stability and security of work;
- equal opportunity and treatment in employment;
- safe work environment;
- social security; and
- social dialogue, employers' and workers' representation

Definition of the sub-indicator

Define the selected sub-indicator, including relevant formula as appropriate and explain choice.

Discussion:

The measurement of decent work remains an area of active research. A range of research has identified key themes and a recent report for FAO (Oya, 2015) (<http://www.fao.org/3/a-i5060e.pdf>) provides a comprehensive summary of the application of the concept of decent work to agriculture and a description of the potential for measurement of decent work in agriculture around the world.

The ILO is leading work in this area and provides the following framing

“The concepts and definitions of DW have gone through a lengthy period of development and operationalisation. The ILO has developed a set of guidelines and a working definition that has been evolving in the last 10 years. DW has been broadly defined by the ILO as being productive work for women and men in conditions of freedom, equity, security and human dignity. The definition rests on basically four pillars, namely employment creation and enterprise development (Pillar I); social protection (Pillar II); standards and rights at work (Pillar III); and governance and social dialogue (Pillar IV).” (Oya, 2015, p8)

In short, the findings from Oya do not suggest immediately obvious ways forward and only some partial measures of decent work are likely to be able to be incorporated at present.

As part of the review work of the Global Strategy a soon to be released report will propose the following indicator. Its proposal here will need to be the subject of further discussion.

EARN_1_AGR_2 - Working poverty rate for employed in agriculture

The working poverty rate could be also computed for the agricultural sector, as the following

$$EARN_1_AGR_2 = \frac{\text{Number of employed persons working in agriculture living in household with incomes below the national poverty line}}{\text{Total number of employed persons working in agriculture}} \times 100$$

As for EARN_1_AGR_1 also in this case, while the aggregate at the denominator could be easily obtained from several sources, the numerator can only be obtained from a proper HBS survey or module.

Another possible indicator for assessment of progress towards decent work in agriculture is median or average agricultural wages. This indicator would provide a sense of the extent to which remuneration in agriculture is “fair” relative to other industries and relates to topics

within the decent work area such as the extent of the working poor, low pay rates, growth in average real wages. The collection of relevant data may be possible via farm surveys.

This indicator would also provide a sense of the extent to which agriculture would be able to attract workers from other industries to support ongoing farming operations. A major issue in using this indicator is the appropriate treatment of the self-employed in agriculture who represent a substantial proportion of employment.

Other indicators that may be measured include the proportion of total labour input at farm level that is (i) provided by family members; and (ii) provided by children (<15years??).

Input from experts in the measurement of decent work would be very welcome.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys

To be developed pending selection of a suitable indicator. Measurement at farm level using farm surveys or household surveys may be possible. Note that there is a 2012 ILO handbook on the measurement of decent work that can provide appropriate definitions and methods, and as noted a forthcoming Global Strategy report on measuring decent work.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

This requires further discussion pending the selection of a suitable indicator. It may be however, that a relatively universal threshold for some aspects of decent work can be proposed.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

There are links here to Target 8.3 that includes the creation of decent jobs. At present the proposed indicator excludes agriculture (SDG 8.3.1 – Proportion of informal employment in non-agriculture employment, by sex)

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

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Poverty

Dimension: Social
Theme: Poverty
Sub-indicator: National poverty measure
Aim and relevance <i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i> While the economic viability of farming operations is best assessed through the measurement of net farm income and profitability, the sustainability of farming from a social perspective will be closely linked to levels of income for farming households relative to agreed poverty thresholds. In particular, while subsistence farming and related activity is not likely to be an agreed outcome of sustainable development, it is highly likely that the potential for farming and other rural households to maintain levels of consumption above designated poverty lines through agricultural activity will be an important pathway towards sustainable development. In this context, it is important to assess overall measures of income for farming households and monitor the proportion of people in rural areas who are below a poverty line.
What concept needs to be measured? <i>Expressing the theme in terms of what exactly we try to capture</i>
Review of metrics used in the literature <i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i>
Definition of the sub-indicator <i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i> <u>Discussion:</u> The proposed sub-indicator for poverty in the context of sustainable agriculture is the rural poverty headcount ratio at national poverty lines . This indicator is being developed as part of on-going work between FAO and the World Bank/LSMS/DECRG on calculating rural poverty figures. A challenge however, will be developing this indicator for application at farm level. Also, notwithstanding the intention to define a more global definition of poverty, it is likely to be the case that many countries have already established measures of poverty for their country. Consequently, in practice the application of national poverty methods and definitions to assessing the situation with respect to farming households is likely to be the approach. At the same time, it will be relevant to ensure a clear definition can be provided to provide a comparison point. In this regard it will be important to also ensure close connection to other SDG indicators on poverty (SDG 1) that cover the entire population.

The input from experts in this area would be welcome.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

There is likely to be a wide range of material on the measurement of poverty that can be accessed to provide support for measurement. It is not clear that information from farm surveys will be the optimal collection vehicle and instead information from household surveys may be of most relevance. In this case however, it will be important to understand the ways in which household survey information can be integrated.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

There should be close links here to the indicators for SDG 1: Ending poverty, particularly those relating to the direct measurement of poverty (SDG 1.1.1 which as an urban/rural split, and 1.2.1 & 1.2.2)

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

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Farm household resilience

Dimension: Social
Theme: Farming household resilience
Sub-indicator: to be determined
<p>Aim and relevance</p> <p><i>What is the reason we need to focus on this theme? What is the relevance for decision-making?</i></p> <p>An increasingly recognised aspect of assessing sustainability is understanding the resilience of the various integrated systems that support progress towards sustainable development. This theme focuses on the resilience of farming households to deal with shocks to their livelihoods.</p>
<p>What concept needs to be measured?</p> <p><i>Expressing the theme in terms of what exactly we try to capture</i></p> <p>See discussion below</p>
<p>Review of metrics used in the literature</p> <p><i>Description of what other studies or initiatives have been using to capture the information needed to measure this theme. This will give an opportunity to discuss different sub-indicator options.</i></p> <p>See discussion below</p>
<p>Definition of the sub-indicator</p> <p><i>Define the selected sub-indicator, including relevant formula as appropriate and explain choice.</i></p> <p><u>Discussion:</u></p> <p>An indicator may emerge from the Resilience Index Measurement and Analysis – II (RIMA-II) framework. This framework integrates 5 pillars of resilience to give a broad assessment of household resilience. A quick summary of the five pillars is the following:</p> <ol style="list-style-type: none"> 1. Access to basic services: including access to health, education, water and electricity. 2. Assets: ownership of assets both agricultural and non-agricultural that can be used to manage periods of shocks. 3. Social safety nets: covering both formal payments (usually public sector) and informal transfers such as remittances and receipts of food etc in-kind. 4. Sensitivity: exposure to risk 5. Adaptive capacity: focus on the presence of appropriate institutional arrangements and networks to support households in responding to shocks. <p>For pillar 1, while clearly important for household resilience it would seem that access to these services should be covered in other areas than an indicator of sustainable agriculture.</p> <p>For pillar 2, this might be assessed at farm level although the collection of information on asset holding may be challenging</p> <p>For pillar 3, in theory this should be measurable at farm household level and may be</p>

particularly relevant in understanding the relative dependence on payments from government to support agricultural activity in the form of subsidies and rebates.

For pillar 4, exposure to risk may also be possible to conceptualise at farm level but practical applications for measurement may be more challenging.

For pillar 5, the concepts around institutional arrangements and social networks will have some relevance at farm level but are potentially more amenable to measurement at a community type level.

While this provides a framing and context for the selection of an indicator on resilience, further input from experts in this area is needed. Discussion should consider whether an indicator for resilience is actually appropriate within a sustainability assessment given that these are likely related but not dependent concepts.

How should this be measured (Data source and methods)

Different sustainability indicators require different data collection methods. Four main methods have been identified that cover the different dimensions of sustainability: farm survey; household surveys; landscape-level measurements (including remote sensing; GIS, or other geography-based measurements), or administrative surveys. The section should describe the merits of different measurement approaches, with particular note of the potential to use farm surveys.

To be developed pending selection and description of a suitable indicator. If the focus is on subsidies and rebates appropriate definitions would need to be sourced from government finance statistics and understanding of data items within household income and expenditure surveys.

What would be the thresholds to use to assess sustainability for this theme:

Indicate thresholds used in the literature or propose thresholds and give justification

To be developed pending selection and description of a suitable indicator.

Link with other SDG indicators:

Indicate whether this indicator can relate fully or partially to other SDG indicators.

TBD

Notes:

Provide any notes that you consider relevant in relation to this sub-indicator.

- A focus on household resilience for relatively small scale farming operations is likely appropriate but the relevance of this theme and sub-indicator for larger, commercial operations is less clear. This may make it difficult to apply the sub-indicator at farm level in some instances and the derivation of a national level result may be more difficult.