Food and Agriculture Organization
of the United Nations

SESSION II part 1 Economic Theme
SDG Indicator 2.4.1 – *Indicator's Framework*

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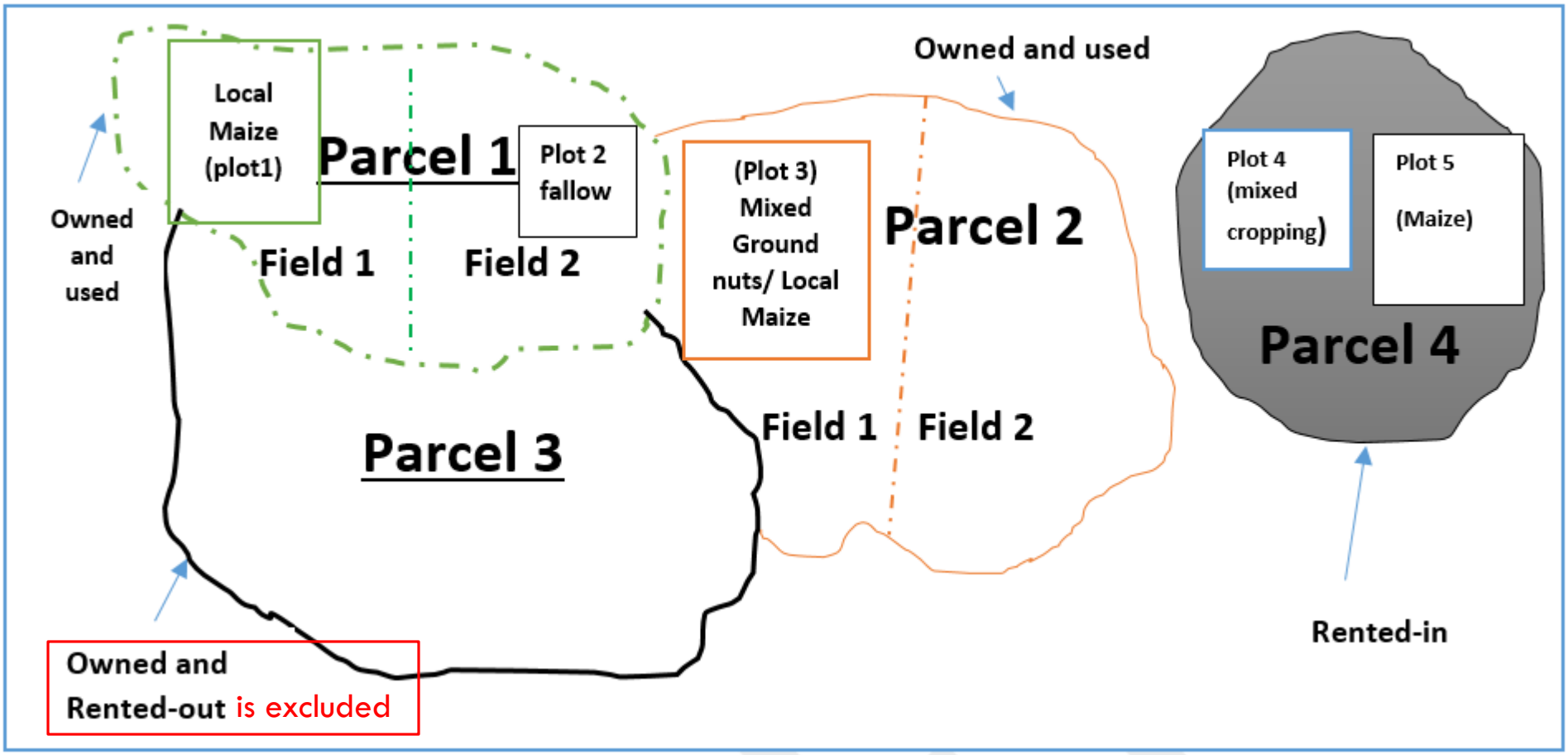
DENOMINATOR OF THE INDICATOR

$$SDG\ 2.4.1 = \frac{Area\ under\ productive\ and\ sustainable\ agriculture}{\boldsymbol{Agricultural\ land\ area}}$$

Land use classes	Aggregated land classes			
1.Land under temporary crops	Arable land	Cropland	Agricultural land	Land used for agriculture
2.Land under temporary meadows and pastures				
3.Land temporarily fallow				
4.Land under permanent crops				
5. Land under permanent meadows and pastures				
6. Land under farm buildings and farmyards				
7. Forest and other wooded land				
9.Other Land Use				

LAND TENURE


Local Maize (plot1)
Parcel 1
Plot 2 fallow
Owned and used
Field 1
Field 2
(Plot 3) Mixed Ground nuts/ Local Maize
Parcel 2
Owned and used
Plot 4 (mixed cropping)
Plot 5 (Maize)
Parcel 4
Parcel 3
Field 1
Field 2
Rented-in
Owned and Rented-out is excluded

INDICATOR'S FRAMEWORK

Dimension	Theme	Sub-indicator	Farm type	Reference period
Economic	1. Land productivity	Farm output value per hectare	All types	Last calendar yr.
	2. Profitability	Net farm income	All types	Last 3 calendar yrs.
	3. Resilience	Risk mitigation mechanisms	All types	Last calendar yr.
Environmental	4. Soil health	Prevalence of soil degradation	All types	Last 3 calendar yrs.
	5. Water use	Variation in water availability	All types	Last 3 calendar yrs.
	6. Fertilizer risk	Management of fertilizers	All types	Last calendar yr.
	7. Pesticide risk	Management of pesticides	All types	Last calendar yr.
	8. Biodiversity	Use of biodiversity-supportive practices	All types	Last calendar yr.
Social	9. Decent employment	Wage rate in agriculture	Farms hiring unskilled labour	Last calendar yr.
	10. Food security	Food Insecurity Experience Scale (FIES)	Household farms	Last 12 months
	11. Land tenure	Secure tenure rights to land	All types	Last calendar yr.

1. FARM OUTPUT VALUE PER HECTARE

Dimension: Economic

Theme: Land Productivity

Coverage: All farm types

Reference period: last calendar year

Rationale:

- Land productivity is a measure of agricultural value of outputs obtained on a given area of land for a given time period.

- At farm level, land productivity reflects technology and production processes for given agro-ecological conditions.

- In a broader sense, an increase in the level of land productivity enables higher production while reducing pressure on increasingly scarce land resources, commonly linked to deforestation and associated losses of ecosystem services and biodiversity.

1. FARM OUTPUT VALUE PER HECTARE

Data items:

Value of output (quantities and prices):

- ✓Quantities of 5 main crops produced
- ✓Quantity of 5 main by-products of crops
- ✓Quantity of 5 main livestock produced
- ✓Quantity of 5 main livestock products produced
- ✓Other on-farm products produced
- ✓Farm gate prices of the crops and livestock and its products and by-products produced
- ✓Farm gate prices of other on-farm products produces

Agricultural land area of the holding

EXAMPLE OF CATEGORIZATION OF FARMS

Step 1: Categorize farms by type

HHID	Holding_sector	Holding_activity	Holding_irrigation	Category of farm
001	Household	Crop	Yes	Crop, HH sector, irrigation
013	Household	Mixed	Yes	Mixed, HH sector, irrigation
021	Household	Livestock	Yes	Livestock, HH sector, irrigation
031	Non-Household	Crop	Yes	Crop, non-HH sector, irrigation
034	Non-Household	Livestock	Yes	Livestock, npn-HH sector, irrigation
101	Non-Household	Mixed	Yes	Mixed, non-HH sector, irrigation
…	…	…	…	…

FARM OUTPUT VALUE PER HECTARE BY CATEGORY

Step 2: calculate the farm output value per hectare by category of farms:

$$\boldsymbol{Farm\ output\ value\ per\ hectare} = \frac{Farm\ output\ value\ (LCU)_{i,f}}{Agricultural\ land\ area\ (in\ hectares)_{i,f}}$$

Where; $Farm\ output\ value\ per\ hectare_{i,f}$ is the total value of production of the *i-th* agricultural holding belonging to a given category of farm (with f going from 1 to 12); $Agricultural\ land\ area\ (in\ hectares)_{i,f}$ is the agricultural land area, as expressed in hectare of the *i-th* agricultural holding belonging to a given category of farm (with f going from 1 to 12)

TOTAL OUTPUT VALUE OF A HOLDING

Example:

Farm output value at farm level = $\sum_i^c q_{i,c} * p_{i,c}$

HHID	Crop, by-product crop, livestock, by-product livestock, on-farm commodities	Quantity in corresponding units	Farm gate prices per unit	Farm output value in LCU
001	Aman (rice)	80	750	60,000.00
001	Boro (rice)	50	650	32,500.00
001	Maize	35	780	27,300.00
001	Straw	60	480	28,800.00
001	Husk	20	400	8,000.00
	Total farm output value			156,600.00

1. FARM OUTPUT VALUE PER HECTARE

Step 4: classify the agricultural area of the farm according to the following sustainability criteria:

In general, the sustainability status of agricultural holdings is determined depending on whether (or not) the farm output value per hectare is above, below or in between the thresholds set for the category of farms it belongs to. This is to say that, for each category of farm, the computed farm output value per hectare must be benchmarked against the following thresholds for sustainability by category:

Green (desirable): Farm productivity is ≥ 2/3 of the corresponding 90th percentile

Yellow (acceptable): Farm productivity is ≥ 1/3 and < 2/3 of the corresponding 90th percentile

Red (unsustainable): Farm productivity is < 1/3 of the corresponding 90th percentile

Step 5: calculate proportion of agricultural area for the indicator by sustainability status

EXAMPLE

Sustainability assessment is carried out for each farm belonging to a particular category

HHID	Land productivity	Belongs to Category	90 percentile value of the category	2/3 of the 90 percentile	1/3 of 90 percentile
001	900	Crop, HH sector, irrigation	600	400	200
002	300	Livestock, HH sector, irrigation	800	533	267
003	200	Mixed, HH sector, irrigation	700	467	233
…					

HHID	Agriculture area (in hectare)	Sustainability status
001	2.5	Desirable
002	10	Acceptable
003	15	Unsustainable
…		

2. NET FARM INCOME (NFI)

Dimension: Economic

Theme: Profitability

Coverage: All farms types

Reference period: last three calendar year

Rationale:

- An important part of sustainability in agriculture is the economic viability of the farm, driven to a large extent by its profitability.
- In context of 2.4.1., profitability is measured using the Net Income that the farmer is able to earn from farming operations.
- Availability and use of information on farm economic performance, measured using profitability, will support better decision making both at micro and macro-economic level. Since performance measures drive behaviour, better information on performance can alter behaviour and decision-making by government and producers both in large-scale commercial farming and medium and small-scale subsistence agriculture.

2. NET FARM INCOME (NFI)

Data items: Can be computed according to two approaches i.e. sophisticated or simplified options:

Sophisticated option:

Step 1: calculate Net Farm Income using formula:

$$NFI = CR + Y_k - OE - Dep + \Delta In$$

NFI = Total Net Farm Income

CR = Total farm cash receipts including direct program payments

$\boldsymbol{Y_k}$ = Income in kind

OE = Total operating expenses after rebates (including costs of labour)

Dep = Depreciation

Δ Inv = Value of inventory change.

This is recommended option: If data on farm financial records, i.e. daily, weekly, monthly or seasonal transactions is available in an organized way. In general, large commercial farms maintain detailed financial records on the basis of which the NFI can be calculated as per above equation.

NET FARM INCOME (NFI)

Value of output = Total farm cash receipts + Direct program payments + Income in kind + Change in inventory	**Cost = Operating + Fixed cost + depreciation**
• Value of output = Quantity X Prices - Crops - Livestock - Other on-farm activities / products • Direct program payments • Income in kind • Value of inventory change	• Operating Expenses: - Labor expenses (Cash wages + in kind) - Fertilizers expenses - Pesticides expenses - Fuel expenses - Electricity expenses - Costs for feeding animals - Irrigation cost - Taxes - Depreciation charges - Others

https://www150.statcan.gc.ca/n1/en/pub/21-010-x/21-010-x2014001-eng.pdf?st=_8V1ikX6

SIMPLIFIED OPTIONS

Simplified option (1):

To be used when the detailed data are not available at farm level (better adapted to smallholders and household sector):

- Output quantity and farm gate prices of crops and livestock and its products and by-products marketed or self-consumed
- Operating expenses including i.e. inputs quantity and its market prices
- Output quantity and farm gate prices of other on-farm activities carried out on the holding e.g. aquaculture or agroforestry (in addition to crops and livestock)
- Input quantity and prices utilized in the production of the other on-farm outputs

For this option depreciation and value of inventory change are not considered.

Simplified option (2):

- Respondent's declaration on agricultural holding's profitability over the last 3 calendar years.
- Simplified option 2 is used in case of SDG indicator survey questionnaire

2. NET FARM INCOME (CONT'D)

Step 2: classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): NFI/profitability is above zero for all past 3 consecutive years

Yellow (acceptable): NFI/profitability is above zero for at least 1 of the past 3 consecutive years

Red (unsustainable): NFI/profitability is below zero for all of the past 3 consecutive years

HHID	Number of times the holding was profitable	Sustainability status
001	Profitable in two out of the three years	Acceptable
002	Profitable in three out of the three years	Desirable
181	Unprofitable in all three years	Unsustainable

EXAMPLE – COUNTRY PILOT RESULTS (2018-19)

Step 3: calculate proportion of agricultural area for the indicator by sustainability status.

Sustainability status (sub-indicator # 2)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	237.5	47%
Acceptable	250.0	49%
Non-sustainable	22.3	4%
Total	509.8	100%

3. RISK MITIGATION MECHANISMS

Dimension: Economic

Theme: Resilience

Coverage: All farms types

Reference period: Last calendar year

Rationale:

Resilience has emerged as a key factor in sustainability. Resilience encompass absorptive, anticipatory and adaptive capacities and refers to the properties of a system that allows farms to deal with shocks and stresses, to persist and to continue to be well-functioning (in the sense of providing stability, predictable rules, security and other benefits to its members).

3. RISK MITIGATION MECHANISMS

Risk mitigation mechanisms:

1. Access to or availed Insurance
2. Access to or availed Credit (both formal, informal)
3. On farm diversification (i.e. share of a single agricultural commodity or activity is not greater than 66% in the total value of production of the holding).

Access to credit and/or insurance is defined here as when a given service is available and the holder has enough means to obtain the service (i.e. the required documents, collateral, positive credit history, etc.).

Broadly, access to one or more the above 3 factors will allow the farm to prevent, resist, adapt and recover from external shocks such as, floods, droughts, market failure (e.g. price shock), climate shock and pest/animal diseases.

3. RISK MITIGATION MECHANISMS (RMM)

On-farm diversification. It captures the share of the value of production of one single agricultural commodity over total value of production of the agricultural. This variable is calculated according to the below formula:

$$On - farm\ diversification = \frac{Value\ of\ production_{i,c}}{Total\ value\ of\ production_i}$$

Where $Value\ of\ production_{i,c}$ is the value of production of the *c-th* agricultural commodity related to the *i-th* agricultural holding and $Total\ value\ of\ production_i$ is the total value of production of the *i-th* agricultural holding.

SUSTAINABILITY CRITERIA

Step 1. classify the agricultural area of the farm according to the following sustainability criteria:

A farm holding is considered resilient if it has availed or has the means to access the risk mitigation mechanisms as follows:

Green (desirable): Access to or availed at least two ofthree mitigation mechanisms.

Yellow (acceptable): Access to or availed at least one of the three mitigation mechanisms.

Red (unsustainable): No access to the three mitigation mechanisms.

EXAMPLE

HHID	Share of commodity #1 in output value	Share commodity #2 in output value	Share of commodity #3 in output value	On-farm diversification	Access to credit	Access to insurance	Total number of Risk mitigation mechanisms adopted	Sustainability Status
001	76%	24%	0%	0	1	1	2	Desirable
003	33%	33%	34%	1	0	0	1	Acceptable
004	100%	0%	0%	1	0	0	0	Non-sustainable

Source: farm survey (pilot study), Bangladesh 2018-19

SESSION II PART 2 /ENV AND SOCIAL THEMES

SDG INDICATOR 2.4.1 – *INDICATOR'S FRAMEWORK*

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4. PREVALENCE OF SOIL DEGRADATION (PSD)

Dimension: Environmental

Theme: Soil health

Coverage: All farms types

Reference period: last three calendar years

Rationale:

- Many of the processes affecting soil health are driven by agricultural practices. FAO and the Intergovernmental Technical Panel on Soils (ITPS) have identified 10 main threats to soil functions: soil erosion; soil organic carbon losses; nutrient imbalance; acidification; contamination; waterlogging; compaction; soil sealing; salinization and loss of soil biodiversity.
- A review of the 10 threats to soil shows that all except one (soil sealing, which is the loss of natural soil to construction/urbanisation) are potentially and primarily affected by inappropriate agricultural practices.
- Ideally, all soils under agricultural land area in a country should be the subject of periodic monitoring in order to assess the impact of agriculture on soils. This requires detailed surveys and sampling campaigns, associated with laboratory testing.

4. PREVALENCE OF SOIL DEGRADATION (PSD)

Rationale:

- In order to propose a manageable solution while capturing the main trends in the country in terms of soil health, the farm survey focuses on the four threats that combine the characteristics more widespread (for national monitoring, countries may choose to add any of the other areas indicated on the last slide, depending on relevance):

1. Soil erosion
2. Reduction in soil fertility
3. Salinization of irrigated land
4. Waterlogging
5. Other – specify
6. None of the above

SUSTAINABILITY CRITERIA

Step 1. classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): The combined area affected by any of the four selected threats to soil health is less than 10% of the total agriculture area of the farm.

Yellow (acceptable): The combined area affected by any of the four selected threats to soil health is between 10% and 50% of the total agriculture area of the farm.

Red (unsustainable): The combined area affected by any of the four selected threats to soil health is above 50% of the total agriculture area of the farm.

COUNTRY PILOT RESULTS (2018-19)

HHID	Soil erosion	Reduction in soil fertility	Waterlogging	Salinization	Agricultural area	Agricultural area affected	Area affected	Prevalence of soil degradation: Sustainability status
001	No	Reduction in soil fertility	Waterlogging	No	0.90	0.40	45%	Acceptable
003	No	No	No	No	0.20	0	0%	Desirable
004	Soil Erosion	Reduction in soil fertility	No	No	0.27	0.20	74%	Non-sustainable
005	No	Reduction in soil fertility	Waterlogging	No	0.61	0.35	58%	Non-sustainable
006	Soil Erosion	Reduction in soil fertility	No	No	0.78	0.50	64%	Non-sustainable
007	Soil Erosion	No	Waterlogging	No	2.15	1.62	75%	Non-sustainable

SUSTAINABILITY CRITERIA

Step 2. calculate and report the proportion of agricultural area by sustainability status

Sustainability status (sub-indicator #5)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	259.8	51%
Acceptable	147.0	29%
Unsustainable	103.0	20%
Total	509.8	100%

5. VARIATION IN WATER AVAILABILITY (VWA)

Dimension: Environmental

Theme: Water use

Coverage: All farm types

Reference period: Last calendar year

Rationale:

- Agriculture, more specifically irrigated agriculture, is by far the main economic sector using freshwater resources.
- In many places, water withdrawal from rivers and groundwater aquifers is beyond what can be considered environmentally sustainable. This affects both rivers and underground aquifers.
- Sustainable agriculture therefore requires that that level of use of freshwater for irrigation remains within acceptable boundaries.
- While there is no internationally agreed standards of water use sustainability, signals associated with unsustainable use of water typically include progressive reduction in the level of groundwater, drying out of springs and rivers, increased conflicts among water users.
- The sub-indicator captures the extent to which agriculture contributes to unsustainable patterns of water use.

5. VARIATION IN WATER AVAILABILITY (VWA)

Step 1. classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): Water availability remains stable over the years for farms irrigating crops on more than 10% of its agriculture area. Default result for farms irrigating less than 10% of their agricultural area

Yellow (acceptable): uses water to irrigate crops on at least 10% of the agriculture area of the farm, does not know whether water availability remains stable over the years, or experiences reduction on water availability over the years, but there is an organisation that effectively allocates water among users.

Red (unsustainable): in all other cases.

`COUNTRY PILOT RESULTS (2018-19)

HHID	Reduction in water availability	Organization dealing with water allocation	Area irrigated	Variation in water availability: Sustainability status
001	No, water is always available in sufficient quantity		89.7%	Desirable
002	Yes, water level in my well(s) is progressively going down	Yes, and they are working well	71.4%	Acceptable
036	Yes, water level in my well(s) is progressively going down	No, there are none	74.0%	Unsustainable
037	I don't know		0.0%	Desirable

6. MANAGEMENT OF FERTILIZERS

Dimension: Environmental

Theme: Fertilizer pollution risk

Coverage: All farm types

Reference period: last calendar year

Rationale:

- Agriculture can affect the quality of the environment through excessive use or inadequate management of fertilizers. Sustainable agriculture implies that the level of chemicals in soil and water bodies remains within acceptable thresholds. Integrated plant nutrient management considers all sources of nutrients (mineral and organic) and their management in order to obtain best nutrient balance.
- Measuring soil and water quality captures the extent and causes of pollution, but establishing monitoring systems of soil and water is costly and not always feasible in countries.
- Note: the management of plant nutrients addresses two sustainability issues: avoiding pollution, and maintaining a good level of soil fertility. This sub-indicator addresses the first issue, while the second one is addressed under sub-indicator 4 ‘Soil health’.

6. MANAGEMENT OF FERTILIZERS

The proposed approach is based on questions to farmers about their use of fertilizer, in particular mineral or synthetic fertilizers and animal manure, their awareness about the environmental risks associated with fertilizer and manure applications, and their behaviour in terms of plant nutrient management

Management measures:

1. Follow protocols as per extension service or retail outlet directions or local regulations, not exceeding recommended doses
2. Use organic source of nutrients (including manure or composting residues) alone, or in combination with synthetic or mineral fertilizers
3. Use legumes as a cover crop, or component of a multi/crop or pasture system to reduce fertilizer inputs
4. Distribute synthetic or mineral fertilizer application over the growing period
5. Consider soil type and climate in deciding fertilizer application doses and frequencies
6. Use soil sampling at least every 5 years to perform nutrient budget calculations
7. Perform site-specific nutrient management or precision farming
8. Use buffer strips along water courses

6. MANAGEMENT OF FERTILIZERS

Step 1. classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): The farm uses fertilizers but take at least 4 specific measures to mitigate environmental risks. Default result for farms not using fertilizers

Yellow (acceptable): The farm uses fertilizers and takes at least two measures to mitigate environmental risks

Red (unsustainable): The farm uses fertilizer and does not take any of the specific measures to mitigate environmental risks

COUNTRY PILOT RESULTS (2018-19)

HHID	Use of fertilizer	Measures									Management of fertilizers: Sustainability status
		#1	#2	#3	#4	#5	#6	#7	#8	Total adopted	
001	Yes	0	1	0	1	0	0	0	0	2	Acceptable
002	Yes	0	0	0	0	0	0	0	0	0	Non-sustainable
003	Yes	1	0	0	0	0	0	1	0	2	Acceptable
004	Yes	0	1	1	0	0	0	0	0	2	Acceptable
005	Yes	0	1	1	0	0	0	0	0	2	Acceptable
006	Yes	0	0	1	1	0	0	0	1	3	Acceptable
007	Yes	0	1	0	0	1	0	0	0	2	Acceptable
008	Yes	1	0	1	0	0	0	0	1	3	Acceptable
009	Yes	1	0	1	0	0	0	0	0	2	Acceptable
037	No	0	0	0	0	0	0	0	0	0	Desirable
038	Yes	0	0	0	0	1	0	0	0	1	Non-sustainable
039	Yes	1	1	0	0	1	0	1	0	4	Desirable
040	No	0	0	0	0	0	0	0	0	0	Desirable

7. MANAGEMENT OF PESTICIDES

Dimension: Environmental

Theme: Pesticides Risk

Coverage: All farm types

Reference period: last calendar year

Rationale:

- Pesticides are important inputs in modern agriculture (crop and livestock), but if not well managed they can cause harm to people's health or to the environment.
- The proposed sub-indicator is based on information on the use of pesticides on the farms, the type of pesticide used and the type of measure(s) taken to mitigate the associated risks.
- In order to keep the questionnaire manageable, the module does not consider different types of crop or livestock. Thus, the best practices could concern only one crop or livestock, while practices may be different for other ones. The method therefore assumes that if a farmer reports best practices, these practices are applied over the entire farm. It may therefore over-estimate the area under good practices.

7. MANAGEMENT OF PESTICIDES

Health measures:

1. Adherence to label directions for pesticide use (including use of protection equipment while applying pesticides)
2. Maintenance and cleansing of protection equipment after use
3. Safe disposal of waste (cartons, bottles and bags)

Environmental measures:

1. Adherence to label directions for pesticide application
2. Adopt any of the above Good Agricultural Practices (GAPs): adjust planting time, apply crop spacing, crop rotation, mixed cropping or inter-cropping
3. Perform biological pest control or use biopesticides
4. Adopt pasture rotation to suppress livestock pest population
5. Systematic removal of plant parts attacked by pests
6. Maintenance and cleansing of spray equipment after use
7. Use one pesticide no more than two times or in mixture in a season to avoid pesticide resistance

7. MANAGEMENT OF PESTICIDES

Step 1. classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): The farm uses only moderately or slightly hazardous pesticides (WHO Class II or III). In this case, it adheres to all three health-related measures and at least four out of seven of the environment-related measures. Default result for farms not using pesticides.

Yellow (acceptable): The farm uses only moderately or slightly hazardous pesticides (WHO Class II or III) and takes at least two measures each from health and environment related measures

Red (unsustainable): The farm uses highly or extremely hazardous pesticides (WHO Class Ia or Ib), illegal pesticides, or uses moderately or slightly hazardous pesticides without taking specific measures to mitigate environmental or health risks associated with their use (fewer than two from each category).

COUNTRY PILOT RESULTS (2018-19)

HHID	Use pesticides	Type of pesticides used	Environmental measures	Health Measures	Sustainability status
001	Yes	Highly, extremely hazardous, illegal	3	2	Non-sustainable
002	Yes	Moderately or slightly hazardous	2	2	Acceptable
003	Yes	Highly, extremely hazardous, illegal	0	0	Non-sustainable
004	Yes	Moderately or slightly hazardous	1	3	Non-sustainable
005	Yes	Highly, extremely hazardous, illegal	2	3	Non-sustainable
006	Yes	Highly, extremely hazardous, illegal	2	2	Non-sustainable
007	Yes	Highly, extremely hazardous, illegal	3	3	Non-sustainable
008	Yes	Highly, extremely hazardous, illegal	3	0	Non-sustainable
009	Yes	Moderately or slightly hazardous	2	3	Acceptable
010	Yes	Moderately or slightly hazardous	2	2	Acceptable
011	Yes	Moderately or slightly hazardous	4	2	Acceptable
012	Yes	Moderately or slightly hazardous	3	3	Desirable
013	Yes	Highly, extremely hazardous, illegal	4	2	Non-sustainable
014	Yes	Moderately or slightly hazardous	4	3	Desirable

SOCIAL THEME

9. WAGE RATE IN AGRICULTURE

Dimension: Social

Theme: Decent employment

Reference period: Last calender year

Coverage: Not applicable to farms that employ only family labour

Rationale:

- The theme provide information on the remuneration of employees working for the farm and belonging to the elementary occupation group, as defined by the International Standard Classification of Occupation (ISCO-08 - code 92).
- It informs about economic risks faced by unskilled workers (performing simple and routine tasks) in terms of remuneration received, the later benchmarked against the minimum wage set at national level in the agricultural sector.
- This sub-indicator allows distinguishing between holdings that pay a fair remuneration to all employees under the elementary occupation group, and agricultural holdings paying a remuneration to their employees belonging to the elementary occupation group that is below the minimum wage standard.

9. WAGE RATE IN AGRICULTURE

Step 1. calculate the daily wage rate according to the following formula:

$$Daily\ wage\ rate\ \ paid\ \ to\ unskilled\ worker = \frac{total\ annual\ compensation}{total\ annual\ hours\ worked} * 8$$

Step 2. classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): If the wage rate paid to unskilled labour is above the minimum national wage rate or minimum agricultural sector wage rate (if available). Default result for farms not hiring labour.

Yellow (acceptable): if the wage rate paid to unskilled labour is equals to the minimum national wage rate or minimum agricultural sector wage rate (if available).

Red (unsustainable): if the wage rate paid to unskilled labour is below the minimum national wage rate or minimum agricultural sector wage rate (if available).

REPORTING THE INDICATOR

Step 3. calculate the proportion of agricultural area by sustainability status.

Sustainability status (sub-indicator # 9)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	501.3	98%
Acceptable	0.0	0%
Unsustainable	8.5	2%
Total	509.8	100%

10. FOOD INSECURITY EXPERIENCE SCALE (FIES)

Dimension: Social

Theme: Food security

Coverage: Only household farms

Reference period: Last 12 months

Rationale:

- FIES is a metric of severity of food insecurity at the household level.
- It is a statistical measurement scale similar to other widely-accepted statistical scales designed to measure unobservable traits such as aptitude/intelligence, personality, and a broad range of social, psychological and health-related conditions
- The scale relies on people's direct yes/no responses to eight simple questions regarding their access to adequate food.
  - ✓ The FIES questions refer to the experiences of the individual respondent or of the respondent's household as a whole.
  - ✓ The questions focus on self-reported food-related behaviours and experiences associated with increasing difficulties in accessing food due to resource constraints.

http://www.fao.org/in-action/voices-of-the-hungry/using-fies/en/

3: CALCULATION OF THE SUSTAINABILITY STATUS OF THE AGRICULTURAL HOLDING:

Step 1. classify household farms by sustainability status according to the following criteria (level on FIES scale):

Green (desirable): Mild food insecurity: if the probability of a household of the holding to be moderate to severe food insecure is less than 0.5 and the probability to be severe food insecure is less than 0.5.

Yellow (acceptable)*: Moderate food insecurity: if the probability of a household of the holding to be moderate to severe food insecure is greater than 0.5 and the probability to be severe food insecure is less than 0.5.

Red (unsustainable): Severe food insecurity: if the probability of a household of the holding to be severe food insecure is greater than 0.5.

Step 2. calculate the proportion of agricultural area by sustainability status of the household farm

Important note: Acceptable * **here is used to be consistent with FAO terminology used in context of 2.4.1. This level of moderate food insecurity is by no means endorsed by FAO to be acceptable.**

3: CALCULATION OF THE SUSTAINABILITY STATUS OF THE AGRICULTURAL HOLDING:

Step 3. calculate the proportion of agricultural area by sustainability status of the household farm

Sustainability status (sub-indicator #10)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	486.8	95%
Acceptable	17.2	3%
Unsustainable	5.8	1%
Total	509.8	100%

11. SECURE TENURE RIGHTS TO LAND

Dimension: Social

Theme: Land tenure

Coverage: All farms types

Reference period: Last calendar year

Rationale:

This sub-indicator is SDG indicator 5.a.1., contextualised for a farm survey.

- The sub-indicator allows assessing sustainability in terms of rights over use of agricultural land areas. Since agricultural land is a key input for agricultural production, having secure rights over land ensures that the agricultural holding controls such a key asset and does not risk losing the land used by the holding for farming.
- Evidence shows that farmers tend to be less productive if they have limited access to and control of economic resources and services, particularly land. Long-lasting inequalities of economic and financial resources have positioned certain farmers at a disadvantage relative to others in their ability to participate in, contribute to and benefit from broader processes of development.
- As such, adequate distribution of economic resources, particularly land, help ensure equitable economic growth, contributes to economic efficiency and has a positive impact on key development outcomes, including poverty reduction, food security and the welfare of households.

11. SECURE TENURE RIGHTS TO LAND

Step 1. classify farms by sustainability status according to the following criteria:

Green (desirable): has a formal document with the name of the holder/holding on it, or has the right to sell or bequeath any of the parcel of the holding

Yellow (acceptable): has a formal document even if the name of the holder/holding is not on it

Red (unsustainable): no positive responses to any of the criteria listed

THANK YOU

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8. USE OF AGRO-BIODIVERSITY-SUPPORTIVE PRACTICES

Dimension: Environmental

Theme: Biodiversity

Coverage: All farm Types

Reference period: last calendar year

Rationale:

- This sub-indicator measures the level of adoption of biodiversity-friendly practices by the farm at ecosystem, species and genetic levels. This indicator addresses both crops and livestock. Specifically in case of this sub-indicator the scope is the entire area of the farm holding as opposed to the agricultural area that is used for rest of the 10 sub-indicators.
- The Convention on Biological Diversity (CBD) stresses the close relationship between agriculture activities and biodiversity, considering three levels of biodiversity: genetic level diversity; agrobiodiversity at production system level; and ecosystem level (wild) biodiversity. The way agriculture is practiced influences all three levels.
- The importance of addressing biodiversity in the construction of Indicator 2.4.1, it is proposed to develop a sub-indicator that captures the efforts towards more biodiversity-supportive agriculture, by identifying a limited list of practices that are conducive to biodiversity conservation.

USE OF AGRO-BIODIVERSITY-SUPPORTIVE PRACTICES

Practices:

1. Leaves at least 10% of the holding area for natural or diverse vegetation. This can include natural pasture/grassland , maintaining wildflower strips, stone and wood heaps, trees or hedgerows, natural ponds or wetlands.
2. The farm is organically certified or undergoing certification. For farms with no organic certification system, does not use medically important antimicrobials as growth promoters.
3. At least two of the following contribute to farm production: 1) temporary crops, 2) pasture, 3) permanent crops, 4) trees on farm, 5) livestock or animal products, and 6) aquaculture.
4. Practices crop or crop/pasture rotation involving at least 2 crops or crops and pastures on at least 80% of the farm area (excluding permanent crops and permanent pastures) over a period of 3 years. In case of a 2-crop rotation, the 2 crops have to be from different plant genus, e.g. a grass plus a legume, or a grass plus a tuber etc.
5. Livestock includes locally adapted breeds.

8. USE OF BIODIVERSITY-SUPPORTIVE PRACTICES (UBSP)

Step 1. classify the agricultural area of the farm according to the following sustainability criteria:

Green (desirable): The agricultural holding meets at least two of five criteria

Yellow (acceptable): The agricultural holding meets between one of the five criteria

Red (unsustainable): The agricultural holding meets none of the five criteria

Step 2: calculate the proportion of agricultural area by sustainability status

MAIN MODIFICATIONS

Description	First proposal (2017)	Revised proposal (approved by IAEG-SDG in 2018)
Data collection instrument	A combination from multiple sources	Single source (farm survey)
Use of alternative data sources	Not considered	Considered under conditions
Type of sub-indicator	Outcome	Mixed (outcomes, awareness, behavior, practices, perception)
Number of sub-indicators	9	11 (see next Table)
Sustainability conditions	Y/N	Three levels
Aggregation	At farm level	At country level
Reporting	One single aggregate indicator	Dashboard + aggregate indicator

MAIN MODIFICATIONS

No.	First proposal – 2017		Revised and approved proposal – 2018	
	Theme	Sub-indicators	Theme	Sub-indicators
1	Land productivity	Farm output value per farm agricultural area	Land productivity	Farm output value per hectare
2	Farm profitability	Net farm income	Profitability	Net farm income
3	Financial Resilience	Access to financial services	Resilience	Risk mitigation mechanisms
4	Soil health	Soil health	Soil health	Prevalence of soil degradation
5	Water health	Water use	Water use	Variation in water availability
6		Water quality	Fertilizer risk	Management of fertilizers
7			Pesticide risk	Management of pesticides
8	Biodiversity	Heterogeneity of agricultural landscape	Biodiversity	Use of biodiversity-supportive practices
9	Decent work	Wage rate in agriculture	Decent employment	Wage rate in agriculture
10	Well-being	Agricultural household income	Food security	Food insecurity experience scale (FIES)
11	Access to land	Secure rights to land tenure	Land tenure	Secure tenure rights to land

1: PREPARING THE DATA FOR ANALYSIS

To prepare the data collected through the FIES survey module for analysis, each item should be coded, so that: 2 is used for a "no" response; 1 is used for a "yes" response.

HHID	C_C03000	C_C04000	C_C05000	C_C06000	C_C07000	C_C08000	C_C09000	C_C10000
001	1	1	1	2	1	2	2	2
002	2	2	2	2	2	2	2	2
003	1	2	2	2	2	2	2	2
004	2	2	2	2	2	2	2	2
005	1	1	1	2	2	2	2	2
006	2	2	2	2	2	2	2	2
007	2	2	2	2	2	2	2	2
008	2	2	2	2	2	2	2	2
009	2	2	2	2	2	2	2	2
010	2	2	2	2	2	2	2	2
011	1	1	1	2	1	1	2	2
012	1	2	2	2	2	2	2	2
013	1	1	2	2	2	2	2	1
014	1	2	2	2	2	2	2	2
015	1	1	1	1	1	1	1	1
016	1	1	2	2	2	2	2	2
017	1	1	2	2	2	2	2	2
018	1	2	2	2	2	2	2	0

1: PREPARING THE DATA FOR ANALYSIS

A crucial step is to add standard labels for the eight questions on which data is collected

HHID	Worried	Healthy	Fewfood	Skipped	Ateless	Runout	Hungry	Whlday
1	Yes	Yes	Yes	No	Yes	No	No	No
2	No	No	No	No	No	No	No	No
3	Yes	No	No	No	No	No	No	No
4	No	No	No	No	No	No	No	No
5	Yes	Yes	Yes	No	No	No	No	No
6	No	No	No	No	No	No	No	No
7	No	No	No	No	No	No	No	No
8	No	No	No	No	No	No	No	No
9	No	No	No	No	No	No	No	No
10	No	No	No	No	No	No	No	No
11	Yes	Yes	Yes	No	Yes	Yes	No	No
12	Yes	No	No	No	No	No	No	No
13	Yes	Yes	No	No	No	No	No	Yes
14	Yes	No	No	No	No	No	No	No
15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	Yes	Yes	No	No	No	No	No	No
17	Yes	Yes	No	No	No	No	No	No
18	Yes	No	No	No	No	No	No	No

2: PARAMETER ESTIMATION

- The methodology underlying the estimation of parameters for the prevalence of food insecurity is based on the Item Response Theory (IRT), that is used to analyse responses to survey or test questions.

- The IRT is a quantitative measure of a non-observable construction --latent trait-- that can be derived from a set of dichotomous variable (i.e. they can only take on value 1 or 0).

- The Rasch model is one of several models in IRT and is applied for the analysis of FIES data.

2: PARAMETER ESTIMATION (CONTI..)

Item Parameters:

Items	Difficulty parameters
Worried	-3.44452
Healthy	-3.15808
Fewfood	-2.58639
Skipped	1.31492
Ateless	-0.30206
Runout	1.88428
Hungry	2.60101
Whday	3.69083

In the table above, the least severe parameter is "**worried**", whereas the most severe is "**whlday**".

2: PARAMETER ESTIMATION (CONTI..)

Respondents parameters:

The raw score is the number of affirmative responses given to the eight FIES questions, i.e. an integer number with a value between zero and eight. This is why the respondents' parameters are nine. A respondent's raw score is the basis for calculating the respondent parameter.

Important note: an essential point to understand is that every respondent who answers "yes" to the same number of questions (irrespective of which ones) will be assigned the same raw score.

The raw score can only be used as an ordinal measure of food insecurity, meaning that we know that someone with a raw score of 4 is more food insecure than someone with a raw score of 2, but we do not know the exact difference in food insecurity severity between these two respondents.

2: PARAMETER ESTIMATION (CONTI..)

Group	Score	Ability parameters	std Err.	Freq.	Expected Score	ll
0	0	-5.093	1.750	292	0.37	
1	1	-3.628	1.175	57	1.15	-58.6220
2	2	-2.586	1.110	32	1.97	-30.8169
3	3	-1.272	1.192	14	2.97	-15.4243
4	4	0.271	1.134	9	4.08	-7.5744
5	5	1.411	1.046	6	5.05	-6.0684
6	6	2.385	1.046	4	5.95	-7.8792
7	7	3.442	1.176	2	6.83	0.0000
8	8	5.024	1.799	4	7.64	

2: PARAMETER ESTIMATION (CONTI..)

Once the item severity, raw score and respondent parameters have been estimated, the standard metric to derive comparable food insecurity prevalence rates can be derived by filling the estimated parameters excel file developed by the FIES team at FAO (here).

Items	Difficulty parameters	std Err.	Rlc	df	p-value	Standardized Outfit	Infit	U
Worried	-3.44452	0.32598	6.117	6	0.4102	0.265	1.410	0.986
Healthy	-3.15808	0.32482	74.523	6	0.0000	2.945	-0.351	5.100
Fewfood	-2.58639	0.32558	10.372	6	0.1098	2.380	0.737	3.008
Skipped	1.31492	0.41843	21.018	6	0.0018	-1.179	-0.872	-0.763
Ateless	-0.30206	0.34940	15.308	6	0.0180	-2.991	-3.218	-1.669
Runout	1.88428	0.45995	14.326	6	0.0262	-1.421	-0.789	-0.306
Hungry	2.60101	0.53205	14.307	6	0.0264	-1.488	-1.067	-0.101
Whday	3.69083	0.71339	39.276	6	0.0000	-0.865	0.340	-1.261
Rlc test			Rlc= 216.118	42	0.0000			
Andersen LR test			Z= 54.889	42	0.0877			

Item parameters and statistics for the 8 FIES items(Country 1)

	* *CELLS B10-B17 in RM.w output*
Item	Severity *
WORRIED	
HEALTHY	
FEWFOOD	
SKIPPED	
ATELESS	
RUNOUT	
HUNGRY	
WHLDAY	

2: PARAMETER ESTIMATION (CONTI..)

Group	Score	Ability parameters	std Err.	Freq.	Expected Score	ll
0	0	-5.093	1.750	292	0.37	
1	1	-3.628	1.175	57	1.15	-58.6220
2	2	-2.586	1.110	32	1.97	-30.8169
3	3	-1.272	1.192	14	2.97	-15.4243
4	4	0.271	1.134	9	4.08	-7.5744
5	5	1.411	1.046	6	5.05	-6.0684
6	6	2.385	1.046	4	5.95	-7.8792
7	7	3.442	1.176	2	6.83	0.0000
8	8	5.024	1.799	4	7.64	

Raw score parameters and errors (Country 1)

	**** CELLS B20-B28 B10-B17 in RM.w output*	*****CELLS C20-C2 B10-B17 in RM.w output*	****** CELLS F20-F28 B10-B17 in RM.w output*
Raw score	Severity ***	Error ****	W cases *****
0			
1			
2			
3			
4			
5			
6			
7			
8			

2: PARAMETER ESTIMATION (CONTI..)

Finally, once the parameters have been added to the excel sheet, we get the following output table:

	Comparable thresholds	Moderate+Severe FI	-0.543		
		Severe FI	3.264		
Raw score	Percentage of individuals	Probability (mod+sev)	Probability (sev)	**Prevalence rate (Mod**	**Prevalence rate (Sev)**
0	71.5%	0	0	**12.208%**	**2.376%**
1	7.9%	0.024882	0.000000		
2	4.5%	0.100227	0.000000		
3	4.7%	0.337889	0.000001		
4	3.5%	0.682742	0.000086		
5	2.2%	0.910726	0.003664		
6	1.9%	0.984718	0.068293		
7	1.1%	0.997586	0.410954		
8	2.6%	0.998628	0.687016		

The above table gives, for each raw score, the probability to be «**moderate** » food insecure and the probability to be «**severe**» food insecure.

3: CALCULATION OF THE SUSTAINABILITY STATUS OF THE AGRICULTURAL HOLDING:

Step 3. calculate the proportion of agricultural area by sustainability status of the household farm

	HHID	score	Prob_mod_p~s	Prob_severe	Sub_indicator~t
1	0001	0	0	0	Desirable
2	0002	1	.022416	0	Desirable
3	0003	2	.094191	0	Desirable
4	0004	4	.707246	.000075	Acceptable
5	0005	4	.707246	.000075	Acceptable
6	0006	0	0	0	Desirable
7	0007	3	.33897	1.00e-06	Desirable
8	0008	3	.33897	1.00e-06	Desirable
9	0009	2	.094191	0	Desirable
10	0010	1	.022416	0	Desirable
11	0011	0	0	0	Desirable
12	0012	1	.022416	0	Desirable
13	0013	8	.996772	.70891	Non-sustainable

CHARACTERIZING AGRICULTURAL HOLDING BY SUSTAINABILITY STATUS

1. **Preparing the data for analysis.** To add label to the 8 FIES questions.

2. **Parameter estimation:** To calculate the level of food insecurity severity associated with each question and each respondent.
   - The FIES questions (item Parameters)
   - The people who answer them (respondent parameters)

3. **Calculation of the sustainability status of the agricultural holding:** Once a measure of severity of the food insecurity condition experienced by each respondent (agricultural holdings households), based on their answers to the eight FIES questions, has been derived, the sustainability status of the household of the holding (desirable, acceptable and non-sustainable) as per SDG 2.4.1 methodology, can be derived accordingly by comparing the individual household probabilities with the overall probabilities of the population of interest of the survey.

CALCULATION OF 90TH PERCENTILE AND THRESHOLDS

Step 3: Once the farm output value per hectare has been calculated, the values are sorted from the lowest value to the highest productivity by category of farms. The value of farm output value per hectare related to the 90th percentile is derived accordingly for each category, using the following formula:

$$90^{th} = 0.9\ x\ total\ number\ of\ observations\ (by\ farm\ category)$$

Percentiles	Number of farms	Farm output value per hectare (in US$, per year)
5%	1	100
10%	2	100
15%	3	100
20%	4	100
25%	5	200
30%	6	200
35%	7	200
40%	8	200
45%	9	400
50%	10	400
55%	11	400
60%	12	400
65%	13	400
70%	14	600
75%	15	600
80%	16	600
85%	17	600
90%	18	600
95%	19	600
100%	20	700

Establish thresholds for sustainability by category	
2/3 of the 90th percentile (in local currency unit)	1/3 of the 90th percentile (in local currency unit)
400	200

THE EIGHT QUESTIONS

During the last 12 months, was there a time when you (or any other member in the household) were worried that you would not have enough food to eat because of a lack of money?
Still thinking about the last 12 months, was there a time when you (or any other member in the household) were unable to eat healthy and nutritious food because of a lack of money?
Was there a time when you (or any other member in the household) ate only a few kinds of foods because of a lack of money or other resources?
Was there a time when you (or any other member in the household) had to skip a meal because there was not enough money or other resources to get food?
Still thinking about the last 12 months, was there a time when you (or any other member in the household) ate less than you thought you should because of a lack of money?
Was there a time when you (or any other member in the household) ran out of food because of a lack of money or other resources?
Was there a time when you (or any other member in the household) were hungry but did not eat because there was not enough money or other resources for food?
During the last 12 months, was there a time when you (or any other member in the household) went without eating for a whole day because of a lack of money or other resources?

REPORTING THE SUB-INDICATOR

Step 2. calculate the proportion of agricultural area by sustainability status

Sustainability status (sub-indicator #6)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	443.0	87%
Acceptable	11.3	2%
Unsustainable	55.5	11%
Total	509.8	100%