



Food and Agriculture Organization
of the United Nations

SDG Indicator 2.4.1 – The Indicator's Framework

Virtual Training
(September–October 2020)

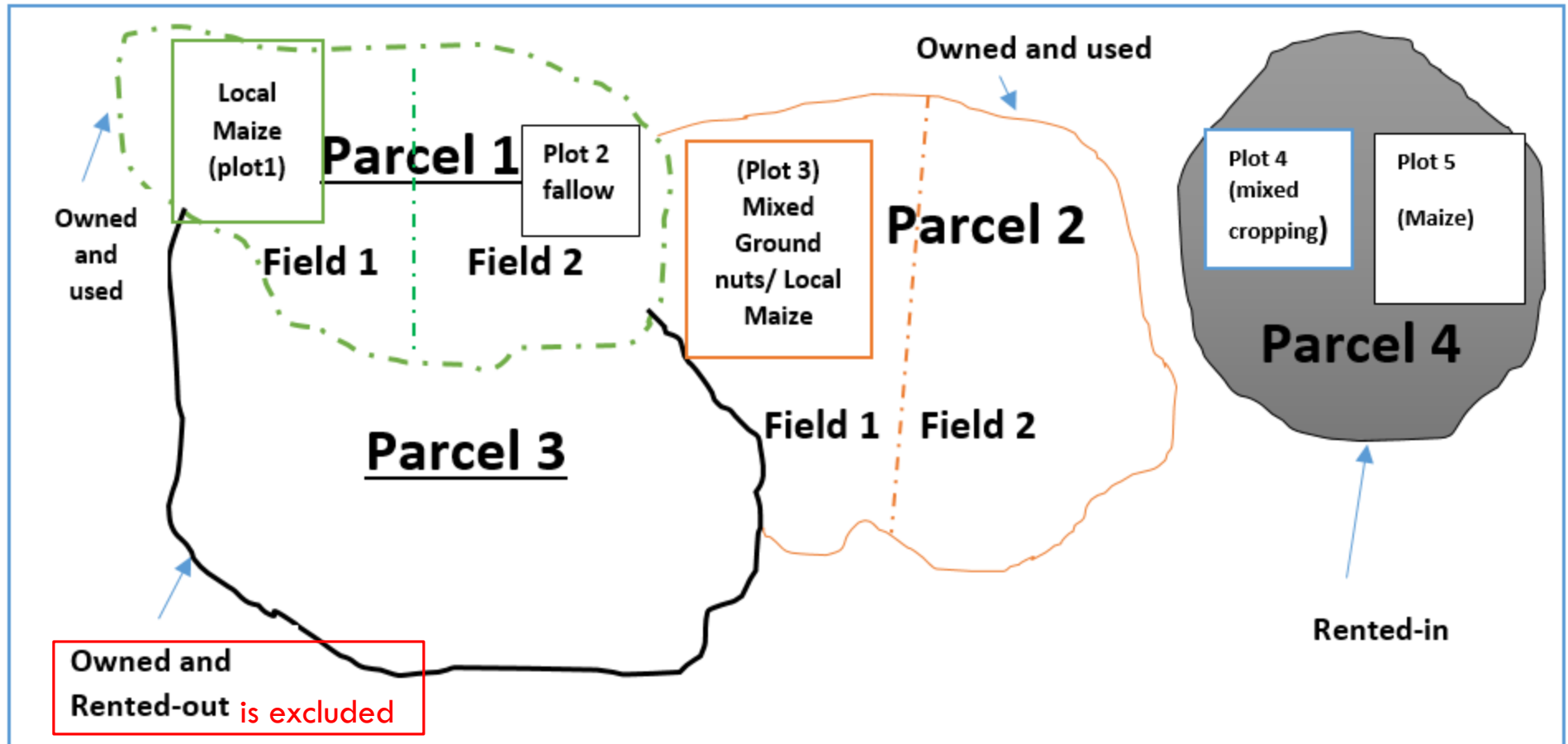
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DENOMINATOR OF THE INDICATOR

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

Land use classes	Aggregated land classes			
1.Land under temporary crops	Arable lands	Crop land	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				
8. Area used for aquaculture				
9.Other area not elsewhere classified				

LAND TENURE



Owned and operated: **Included**

Rented-in: **Included**

Other (occupied, borrowed for free, including common land managed by the holding): **Included**

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 agro-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.

VARIABLE FORMULATION TO COMPUTATION

- Use qualitative information collected through survey questions

Question 1: How much of crop #1 did you produce in Kg?
Question 2: What was the average or latest farm gate price per unit of crop #1?

Compute primary variable: «farm output value»

- Use information from questions # 1 and 2 to compute primary variable on «farm output value»

- $\sum_1^n P_i * Q_i$
- i.e. the summation of all crops (up to 5 crops) multiplied by the corresponding farm gate price of the crop themselves.
- The primary variable capturing the farm output value will look like:

Agricultural holding unique number	Crop produced (in Kg)	Average or latest farm gate price (per Kg)	Farm output value	
1	Maize	50	15	75
1	Wheat	500	1.2	600
1	Rice	231	0.5	115.5
1	Sugarcane	100	2.1	210
1	Total			1000.5

1. FARM OUTPUT VALUE PER HECTARE

Dimension: Economic

Theme: Land Productivity

Coverage: All farm types

Reference period: last calendar year

1. FARM OUTPUT VALUE PER HECTARE

Formula: Variables and data items:

$$\textit{Farm output value per hectare} = \frac{\textit{Farm output value (LCU)}}{\textit{Agricultural land area (in hectares)}}$$

1) Value of output = Quantities x farm gate prices of:

- ✓ 5 main crops and its by-products produced by the holding in a reference period
- ✓ 5 main livestock and its products produced by the holding in a reference period
- ✓ Other on-farm products produced by the holding in a reference period

2) Agricultural land area of the farm

3) Categories of farms

4) Farm output value per hectare the entire distribution of farms selected as part of the sample

CROPS AND BY-PRODUCTS LIST (EXAMPLE)

Crops	
Avocado	Orange
Banana	Paprika
Beans.	Pawpaw/papaya
Cabbage	Peach.
Cassava	Pearl millet
Coffee	Pigeon pea
Cotton	Pineapple
Custade apple	Rice
Finger millet(	Sorghum
Fodder trees	Soybean
Ground bean	Sugar cane
Groundnut.	Sunflower
Guava	Sweet potato
Lemon	Tanaposi
Maize	Tea
Mango	Tobacco
Mexican apple	Tomato
Naartje (tangerine)	Wheat
Onion	Other (specify)

By-products
Wheat - Stalks
Rice – Straw / Husk
Cotton – Sticks
Sugar cane – Tops
Maize – Stalks / straw
Mustard – Straw



OTHER ON-FARM ACTIVITIES

1. On-farm processing of agricultural products:
• Grain milling: production of flour, groats, meal or pellets of wheat, rye, oats, maize (corn) or other cereal grains
• Rice milling: production of husked, milled, polished, glazed, parboiled or converted rice; production of rice flour
• Processing and preserving of fruit and vegetables
• Manufacture of crude vegetable oil: olive oil, soya bean oil, palm oil, sunflower seed oil, cottonseed oil, rape, colza or mustard oil, linseed oil, etc.
• Manufacture of wine
• Distillation of spirit drinks
• Manufacture of tobacco products (cigars, chewing tobacco, etc.)
• Processing and preserving meat
• Manufacture of dairy products
• Manufacture of leather and related products
2. Selling of holding's products at the market/shop (incl. preparation, packaging and transport of processed products)
3. Production of forestry products
4. Production, processing and preserving of fish, crustaceans and molluscs
• Production of fish, crustaceans and molluscs
• Processing and preserving of fish, crustaceans and molluscs
5. Production of renewable energy
6. Contractual work for other holdings using the production means of this holding
7. Accommodation, restaurant, catering and other leisure/educational activities
8. Making handicrafts
9. Training of animals
10. Management and/or administration for the agricultural holding
11. Other (specify)
12. None

CATEGORIZATION OF FARMS

Step 1: Categorize farms by type

HID	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, NON-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:

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

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:

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

HID	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

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 categories 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:

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

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

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): if the farm FOVH is equal to or greater than the value corresponding to 2/3 of the 90th percentile (estimated for the distribution of categories of farms to which this farm belongs)

Yellow (acceptable): if the farm FOVH is equal to or greater than the value corresponding to 1/3 but less than 2/3 of the 90th percentile (estimated for the distribution of categories of farms to which this farm belongs)

Red (unsustainable): if the farm FOVH is less than the value corresponding to 1/3 of the 90th percentile (estimated for the distribution of categories of farms to which this farm belongs)

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

EXAMPLE

Sustainability thresholds are calculated for each category of farm:

S.No.	Category of farm	90 percentile value	2/3 of the 90 percentile	1/3 of 90 percentile
1	Crop, HH sector, irrigation	600	400	200
2	Livestock, HH sector, irrigation	800	533	267
3	Mixed, HH sector, irrigation	700	467	233
4	Crop, HH sector, non-irrigation	...	...	...
5	Livestock, HH sector, non-irrigation	...	...	...
6	Mixed, HH sector, non-irrigation	...	...	...
7	Crop, non-HH sector, irrigation	...	...	...
8	Livestock, non-HH sector, irrigation	...	...	...
9	Mixed, non-HH sector, irrigation	...	...	...
10	Crop, sector, non-irrigation	...	...	...
11	Livestock, sector, non-irrigation	...	...	...
12	Mixed, sector, non-irrigation	...	...	...

EXAMPLE

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

HID	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
...					

HID	Agriculture area (in hectare)	Sustainability status
001	0.90	Desirable
002	0.20	Acceptable
003	0.20	Unsustainable
...		

2. NET FARM INCOME (NFI)

Dimension: Economic

Theme: Profitability

Coverage: All farms types

Reference period: last three calendar year

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

Y_k = Income in kind

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

Dep = Depreciation

ΔInv = Value of inventory change.

NET FARM INCOME (NFI)

<p>Value of output = Total farm cash receipts + Direct program payments + Income in kind + Change in inventory</p>	<p>Cost = Operating + Fixed cost + depreciation</p>
<ul style="list-style-type: none"> • Value of output = Quantity X Prices <ul style="list-style-type: none"> - Crops - Livestock - Other on-farm activities / products • Direct program payments • Income in kind • Value of inventory change 	<ul style="list-style-type: none"> • Operating Expenses: <ul style="list-style-type: none"> - 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

HID	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 – BANGLADESH 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

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:

$$\text{On – farm diversification} = \frac{\text{Value of production}_{i,c}}{\text{Total value of production}_i}$$

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 of three 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

HID	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%	0	0	0	0	Non-sustainable

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

EXAMPLE: AGRICULTURAL AREA BY SUSTAINABILITY STATUS

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	286.3	56%
Acceptable	148.9	29%
Unsustainable	74.6	15%
Total	509.8	100%

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

4. PREVALENCE OF SOIL DEGRADATION

Dimension: Environmental

Theme: Soil health

Coverage: All farms types

Reference period: last three calendar years

4. PREVALENCE OF SOIL DEGRADATION

4 main threats:

1. Soil erosion
2. Reduction in soil fertility
3. Salinization
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.

BANGLADESH PILOT RESULTS (2018-19)

HID	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

Dimension: Environmental

Theme: Water use

Coverage: All farm types

Reference period: Last three calendar years

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.

BANGLADESH PILOT RESULTS (2018-19)

HID	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

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%

6. MANAGEMENT OF FERTILIZERS

Dimension: Environmental

Theme: Fertilizer risk

Coverage: All farm types

Reference period: last calendar year

6. MANAGEMENT OF FERTILIZERS

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

BANGLADESH PILOT RESULTS (2018-19)

HID	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

REPORTING THE SUB-INDICATOR

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

Sustainability status (sub-indicator #7)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	240.0	47%
Acceptable	108.7	21%
Unsustainable	161.0	32%
Total agricultural area (in hectares)	509.8	100%

7. MANAGEMENT OF PESTICIDES

Dimension: Environmental

Theme: Pesticides Risk

Coverage: All farm types

Reference period: last calendar year

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).

BANGLADESH PILOT RESULTS (2018-19)

HID	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	4	3	Desirable
013	Yes	Highly, extremely hazardous, illegal	4	2	Non-sustainable
014	Yes	Moderately or slightly hazardous	4	3	Desirable

REPORTING THE SUB-INDICATOR

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

Sustainability status (sub-indicator # 8)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	102.9	20%
Acceptable	123.6	24%
Unsustainable	283.2	56%
Total agricultural area (in hectares)	509.8	100%

8. USE OF AGRO-BIODIVERSITY-SUPPORTIVE PRACTICES

Dimension: Environmental

Theme: Biodiversity

Coverage: All farm Types

Reference period: last calendar year

USE OF AGRO-BIODIVERSITY-SUPPORTIVE PRACTICES

Set of criteria for countries with no organic certification:

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. Farm 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 cultivated 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.

USE OF AGRO-BIODIVERSITY-SUPPORTIVE PRACTICES

Set of criteria for countries with organic certification:

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. Farm produces agricultural products that are organically certified, or its products are undergoing the certification process (applies only to countries with certification)
3. Farm does not use medically important antimicrobials as growth promoters.
4. 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.
5. Practices crop or crop/pasture rotation involving at least 2 crops or crops and pastures on at least 80% of the farm cultivated 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.
6. 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:

Sustainability status for countries with organic:

- **Green (desirable):** The agricultural holding meets at least **three of the above** criteria
- **Yellow (acceptable):** The agricultural holding meets at least **one of the above** criteria
- **Red (unsustainable):** The agricultural holding meets **none of the above** criteria

Sustainability status for countries with no organic:

- **Green (desirable):** The agricultural holding meets at least **two of the above** criteria
- **Yellow (acceptable):** The agricultural holding meets at least **one of the above** criteria
- **Red (unsustainable):** The agricultural holding meets **none of the above** criteria

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

9. WAGE RATE IN AGRICULTURE

Dimension: Social

Theme: Decent employment

Reference period: Last calendar year

Coverage: Not applicable to farms that employ only family labour

9. WAGE RATE IN AGRICULTURE

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

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

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

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?

CHARACTERIZING AGRICULTURAL HOLDING BY SUSTAINABILITY STATUS

- 1. Preparing the data for analysis**
- 2. Parameter estimation:**
 - Item Parameters – refer to and derived from the 8 questions
 - Respondent parameters – refer to and derived from the number of people who responded to the questions
- 3. Statistical validation**
- 4. Calculation of the sustainability status of the agricultural holding**

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.

HID	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

Add standard labels for the eight questions on which data is collected

HID	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)
- The IRT is a quantitative measure of a non-observable construction --latent trait
- 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:

A respondent's raw score is used to calculate the respondent parameter.

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.

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		Rlc	df	p-value	Standardized			U
	parameters	std Err.				Outfit	Infit		
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	3.088	
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	11
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+severe**» food insecure and the probability to be «**severe**» food insecure.

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 holder 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 holder 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 holder 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

	HHID	score	Prob_mod_pvs	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	

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

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

HID	Formal document	Name on it	Right to sell	Right to bequeath	Sustainability status
001	Yes	Yes	Yes	Yes	Desirable
002	Yes	No	No	No	Acceptable
050	Yes	Yes	Yes	Yes	Desirable
051	No	No	No	No	Non-sustainable

REPORTING THE SUB-INDICATOR

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

Sustainability status (sub-indicator #11)	Agriculture area in Hectare	Proportion of agriculture area
Desirable	437.0	86%
Acceptable	58.0	11%
Unsustainable	14.7	3%
Total	509.8	100%

THANK YOU

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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

ITEMS, DOMAINS AND FOOD INSECURITY

Items	Variables label	Variable content	Domains of the food insecurity	Assumed severity of food insecurity
1	Worried	Felt anxiety about having enough food at any time during the previous 12 months	uncertainty and worry about food	Mild
2	Healthy	Not able to eat healthy and nutritious food because of lack of money or other resources to get food	inadequate food quality	Mild
3	Fewfood	Consumed a diet based on only few kinds of foods because of lack of money or other resources to get food	inadequate food quality	Mild
4	Skipped	Did not eat breakfast, lunch or dinner [or skipped a meal] because there was not enough money or other resources to get food	insufficient food quantity	Moderate
5	Ateless	Ate less than they thought they should because of lack of money or other resources to get food	insufficient food quantity	Moderate
6	Runout	Household ran out of food because of lack of money or other resources to get food	insufficient food quantity	Moderate
7	Hungry	Felt hungry but didn't eat because there was not enough money or other resources for food	insufficient food quantity	Severe
8	Whlday	Went without eating for a whole day	insufficient food quantity	Severe