Capitalization sheet

Environmental impact measures

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March 2019

Capitalization sheets produced within the framework of the Agro-ecological Intensification and Diversification of Peri-urban Agriculture Project in Siem Reap Province, Cambodia (IADA phase 1)

Environmental impact measures

Method sheet N°3

To meet the requirements of the donors, an agro-environmental data collection work and analysis has been initiated. The primary objective is to evaluate the impacts of the activities of the AIDA project on the environment, in order to inform on the technical itineraries to be favored.

This work must also contribute to:

⇒ **Enrich the available databases on the current state and trends of environmental natural ressources in agriculture**

⇒ **Improve the understanding of agro-environmental processes**

⇒ **Provide a tool for monitoring and evaluating agricultural practices and policies to improve their effectiveness in promoting sustainable agriculture**

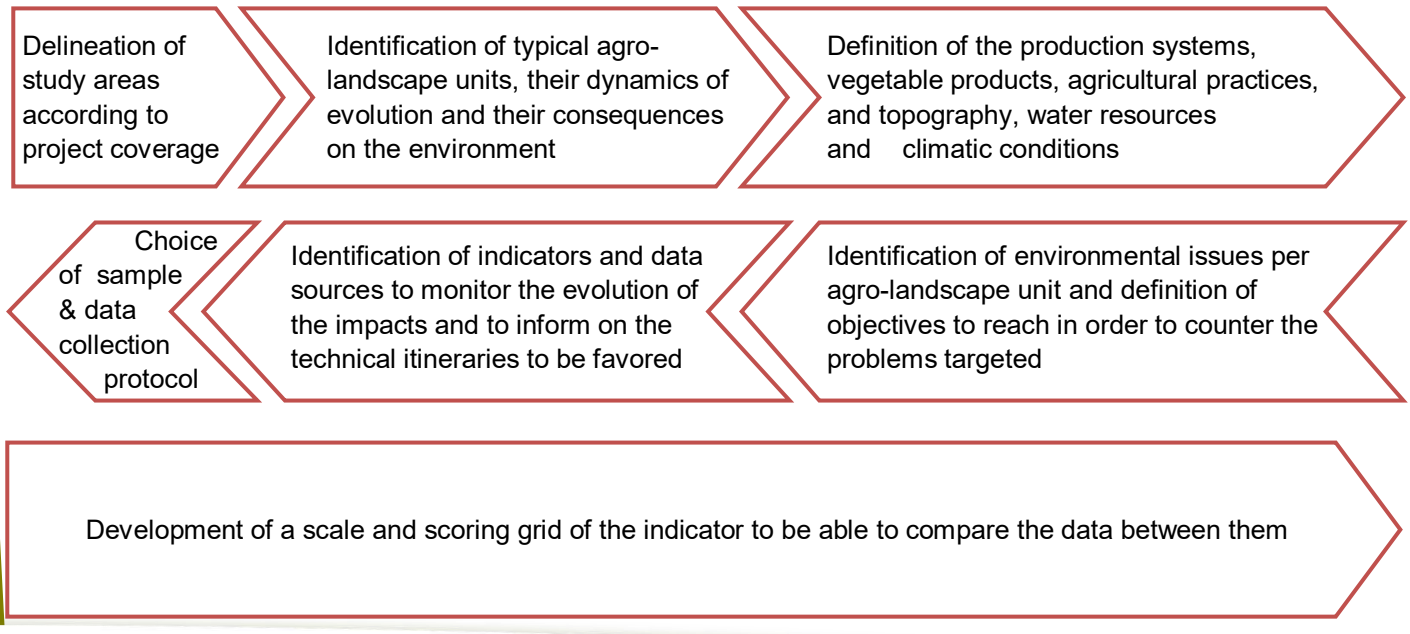
General principle

In order to assess the impact of agricultural practices on the environment, a number of agrienvironmental indicators need to be identified. These are selected according to their practicality and ability to measure the impacts observed in the field. Their choice can be made based on, or inspired by lists of indicators proposed by international organizations (FAO, OECD, ...)

These simple or aggregated indicators make it possible, after analysis, to evaluate the performances of the systems on each identified theme and thus to inform on the technical itineraries to favor, so as to counter the problems initially observed.

Protocol for the definition of indicators

To be able to determine the themes and indicators to be targeted, it is necessary to define beforehand: the topographical, climatic and socio-economic characteristics of the study areas, their problems in terms of use of natural resources and the impacts of the agricultural policies in place on the environment, as well as the objectives to be achieved to counter these problems. A "funnel" diagnosis of the study from global (district) to local (plot) is carried out according to the following scheme:



Criteria for selecting indicators

A good indicator must meet the criteria of operationality ie, be useful for the user, measurable, and relevant in terms of information released.

The table below lists these criteria.

Criteria	Description
⇒ Utility for the user	- reflect changes in the environment and corresponding human activities - be representative of regional problems
⇒ Measurability	- be documented - be accessible at a reasonable cost / benefit ratio - be reasonable in collection time - be adapted to the level of knowledge / skills of the collection agent
⇒ Interpretability	- based on sound theoretical foundations - be easy to interpret - allow identification of trends - be comparable to other results

As an illustration, the table below gives an overview of the constraints, objectives, themes and indicators identified following the field analysis work on the AIDA project.

Constraints	Objectives	Themes	N° and name of Indicator	
On the southern area				
Decrease of wooded areas due to new constructions	Maintain and develop wooded areas	Biodiversity	1.4 Linear of hedges	1.6 Number of trees per exploitation
Exposure to winds and high temperatures causing crops to dry	Protecting plants from wind and high temperatures			
Destruction of Orchards	Stabilize fruit production areas			
Decrease of cultivable areas due to silting and flooding caused by the diversion of rivers	Restoring the immediate perimeters of rivers			
Increase of extreme weather events (droughts, floods ...)	Protect plants from extreme events			
Decrease in exploitable area due to urban densification	Increase productivity	Landscape	1.5 Crop distribution	
Water pollution	Improving Water Quality	Water Quality	1.1 Parcel Treatment Frequency Index	

Constraints	Objectives	Themes	N° and name of Indicator
On the Northern area			
Significant water erosion resulting in the silting up of watercourses and the disruption of aquatic ecosystems.	Conserving the topsoil	Soil Quality	1.3 Risk of water erosion
Loss of soil fertility / low water retention	Improve soil water retention capacity	Use of water resources	1.2 Effectiveness of water resources use

Analysis elements

> The ideal data should be collected at the most detailed level possible and aggregated at the national level with an expression of variation.

> The datas collected are declarative and the project staff must keep a data collection notebook.

> Producers work in an open environment, so there is a possibility of transfer between plots.

Method of data collection work

The data sources defined by the project manager are collected directly by the 9 Agrisud Cambodia technicians through interviews with the producers.

At the rate of one visit per week, each technician collects all the datas on each of the 6 to 8 parcels for which he is responsible. These data collected on paper, are then entered individually on their personal computer base, and later combined and transferred to the final document by a designated technician.

The samples for indicators 1.1 and 1.2 are the same. They consist of two types of producers for each technician: 3 producers supported by the project and 3 others who are not.

For the other indicators, each technician must collect data from 3 producers in his area, who are accompagnied by the project.

Producers are selected based on the experience and field knowledge of the technicians to investigate representative plots of the area in terms of plot size, agricultural practices, and market gardening products.

Data collection applies to flowerbeds composed of the same crops on all the plots studied. Market gardening crops are in place before implementation of monitoring and are representative of main crops.

This data collection is pursued throughout the production cycle and carried out during the dry season and the wet season.

It should be noted that each person responsible for collecting the data is able, at the time of survey, to assign a scoring index to each parcel as defined in the tables below.

In addition to these datas, age and sex are collected.

Description of indicators

<table>
<tr><th>Headings</th><th>Explanations</th></tr>
<tr><td>Title</td><td>1.1 Frequency of plot treatment index (FTI)</td></tr>
<tr><td>Description</td><td>This indicator measures the exposure of crops to pesticides and fertilizers.</td></tr>
<tr><td>Utility</td><td>The indicator reflects a degree of pollution induced by the amount of pesticides and fertilizers spread on the plot. The FTI will inform on the the least pesticide and fertilizer intensive and, most productive agricultural practices</td></tr>
<tr><td>Data sources and choice of sample</td><td>Methodology :
1. Choose 3 unaccompanied producers and 3 producers supported by the project in a similar agro-climatic context.
2. Select from the 6 producers a flowerbed of the same length (minimum of 10 meters) with the same vegetable products (cabbage, salad, cauliflower ...). Calculate exactly the square meter area of the flowerbed for each of the 6 growers.
3. Count the number of times each farmer has treated the bedding and fertilized it with the pesticide or fertilizer, from sowing to harvest.
4. Note the type of treatment (phytosanitary, fertilizer, biopesticide ...), the type of application and the name of the product.
5. Finally, note the dosage applied and the one recommended by the manufacturer.

At harvest, each producer will weigh the raw vegetables produced on a square meter. It will then multiply this figure by the total area in m² to obtain the total weight.</td></tr>
<tr><td>Collected datas</td><td><table><tr><th>Scale</th><th>Score</th></tr><tr><td>0 to 0.25</td><td>6</td></tr><tr><td>0.25 to 0.5</td><td>5</td></tr><tr><td>0.5 to 1</td><td>4</td></tr><tr><td>1 to 2</td><td>3</td></tr><tr><td>2 to 3</td><td>2</td></tr><tr><td>> or = 3</td><td>1</td></tr></table>
If a flowerbed is treated n times = n FTI;
Example: if the bed is treated 1/2 times = 1/2 FTI
A treatment with 2 types of products counts for 2 treatments
If using treated seed or localized treatments on the row, divide FTI by 2
One type of product = pesticides (insecticide, fungicide, growth regulator, herbicide) OR fertilizer</td></tr>
</table>

Headings	Explanations
Title	1.2 Water Use Efficiency (WUE)
Description	This indicator makes it possible to measure the soil quality and especially its quantity of organic matter without resorting to physicochemical analyzes.
Utility	The indicator reflects the soil's ability to retain water. WUE will inform on the practices that consume the least amount of water. It will help to determine, thanks to the data of weight produced, the productivity of water.
Data sources and choice of sample	Methodology: 1. Count the number of times each producer has watered the bed from transplanting or sowing until harvest. At harvest, each producer will weigh the vegetables produced on a square meter. He will then multiply this figure by the total surface area in m².
Collected datas	If a flowerbed is watered n times = n ERA; Ex if the flowerbed watered 45 times = 45 ERA

Scale	Score
0 to 10	6
10 to 20	5
20 to 40	4
40 to 60	3
60 to 90	2
> or = 90	1

Headings	Explanations
Title	1.3 Risk of water erosion (RWE)
Description	This indicator measures the degree of exposure of soils to rainfall and to the leaching of these organic elements.
Utility	The indicator reflects the importance of leaching and erosion. The RWE will inform about exposure of soils to rain and runoff factor and will determine the most favorable practices. This criterion makes it possible to better understand the crop management of the farm and especially to limit the risks of erosion.
Data sources and choice of sample	The sample consists of 18 producers supported by the project. Each technician of the project will have to collect the data from 3 producers of his zone. Methodology : 1. Identification of 18 producers (3 per technician) 2. Measure all UAA by producer 3. Measure all of the UAA in bare soil 4. Calculate the% of bare UAA in relation to total UAA
Collected datas	A RWE score will be assigned to each producer in the sample according to the scale.

Barème	Indice
0 to 5%	6
5 to 10%	5
10 to 20%	4
20 to 30%	3
> or= 30%	1

Headings	Explanations
Title	1.4 Linear of hedges
Description	This indicator measures the degree of biodiversity on farm.
Utility	The indicator reflects the place occupied by hedges on the farm. The linear of hedge informs about a natural element that occupies different ecological functions (limits the erosion, favors the infiltration of water, shelters the auxiliaries ...).
Data sources and choice of sample	Methodology : At the edge of the plot: 1. Measure the total area of hedges per farm and record the number and type of species In plot interior: 2. Measure the size of the copses
Collected datas	In the calculation of the linear, incorporate the property boundary hedges but divide the lengths by two. For copse calculate the perimeter. The maximum height of the hedge is 1.5 meters

Scale	Score
0 to 10m	1
10 to 20m	2
20 to 30m	3
30 to 40m	4
40 to 50m	5

Headings	Explanations
Title	1.5 Land Use (LU)
Description	This indicator measures changes in farm size.
Utility	The indicator reflects the change in UAA by farm. The LU index provides information on size variations on farms and identifies pressures and constraints that affect farms
Data sources and choice of sample	The sample consists of 18 producers accompanied by the project. Methodology : 1. Measure all UAA by producer
Collected datas	A LU score will be assigned to each producer according to the scale.

Barème	Indice
> ou = à –30%	7
-30 à -20%	6
-20 à –10%	5
-10 à 0%	4
0 à 10%	3
10 à 20%	2
> ou = à 20%	1

Headings	Explanations
Title	1.6 Number of trees per exploitation (NTE)
Description	This indicator measures the presence of trees on the farm.
Utility	The indicator reflects the environmental dynamics of the exploitation. The NTE index provides information on the presence of the tree. This one occupies various ecological functions beneficial for agriculture and therefore, to know the dynamics associated with its management is relevant.
Data sources and choice of sample	The sample consists of 18 producers accompanied by the project. Methodology : 1. Count the number of trees per farm
Collected datas	A NTE index will be assigned to each producer in the sample according to the scale The minimum size of a tree is 1.7 meters.

Scale	Score
0 to 5	1
5 to 20	2
20 to 40	3
40 to 60	4
60 to 80	5
80 to 100	6
> or = 100	7

Analysis method of collected data

The aim is both to identify the key trends and to assess the impacts of agricultural practices by comparing the results obtained with national and / or international references.

Analysis elements

Later on, with the informations gathered, it is also possible to illustrate the changes related to technical itineraries and resource management by modeling a before / after project.

Step	Method/Tools
⇒ The collected data are crossed	An experienced agent performs the data analysis. Depending on the type of informations that one wishes to highlight, one uses the pivot tables and / or bases of computation of a spreadsheet.
⇒ The results obtained are compared between systems to identify the preferred technical itineraries	A high score is generally synonymous with good performance, however, it is important to pay attention to the meaning of the raw datas during calculations.

We propose the following data crossings:

⇒ applied dosage x dosage recommended by the manufacturer = respect of the dosage (under / over or just dosage)

It is noted that for the raw data, an underdosing will have a low numerical value but it is not synonymous with bad practice (unlike scores determined according to the scales). You have to be careful about the use of raw values or scores when aggregating datas.

⇒ frequency of the phytosanitary treatment x infos on toxicity from the manufacturer x respect of the dosage = real toxicity

⇒ frequency of treatment x applied dosage x number of trees on the farm = crop protection related to trees

⇒ quantity produced x frequency of treatment x dosage applied = productivity related to treatment

⇒ quantity produced x frequency of watering = water productivity

⇒ amount produced x linear of hedgerows = productivity of hedgerows

⇒ age x sex x respect of the dosage = influence of the identity factor on the respect of doses

⇒ age x sex x treatment frequency = influence of the identity factor on the treatment frequency

⇒ age x sex x type of treatment (phytosanitary/biopesticide/fertilizer) = influence of the identity on the type of treatment

To remember...

A selection of agri-environmental indicators that measure the impacts of agricultural practices, in order to determine the technical practices to be favored.

A choice of indicators that must be done according to the operationality criteria.

Sensitive data collection and analysis work in terms of time and accuracy.

A mission that required 3 years of discontinuous work from the beginning of its agro-landscape diagnostic to its results analysis phase.

Key results

Overall, the protocol has enabled the collection of a large number of data of rather good quality.

Nevertheless, a certain number of remarks and points of vigilance are to be integrated.

⇒ The field team considered that the risk of water erosion was not necessarily a relevant indicator for assessing soil quality, and that it was more interesting to evaluate the "fertilizing" quality of soil. As a result, indicator 1.3 has only been partially completed and can't be analyzed.

⇒ Similarly, indicator 1.2 was not collected, this time because producers were not able to respond appropriately due to lack of follow-up. It is noted that a discussion with the technicians during the project makes it possible to readjust the indicators to the reality of the field.

⇒ During the analysis, the average score of the FTI 1.1 indicator is higher for the unaccompanied parcels, even though the opposite result would be expected. This inconsistency is related to the difficulty of collecting accurate information from non-project producers, either due to mistrust or lack of knowledge. The bias makes the comparison between producers inadequate. However, data collected from agroecology producers are comparable to international reference of FTIs. It appears that on average on the mango, the FTI from producers followed by the project is 5 times lower than Mauritius.

⇒ The field team reports a lack of precision on some units of measurement, which should be clarified for future collections.

⇒ Finally, an important point to consider is the time required to collect information estimated at 1 day / week on average.

In conclusion, the sample size does not allow statistical processing of the data, as collection is limited by the number of staff, the time available and the knowledge of the teams and producers.

However, despite the difficulty of working on a simple, and not time-consuming method, we recall that thanks to the large amount of data collected on some of the indicators, it is possible to identify interesting trends.

Capitalization sheets produced by Agrisud International

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With the participation of :

SRER KHMER | A&D FOUNDATION

And the financial support of :

AFD AGENCE FRANÇAISE DE DÉVELOPPEMENT | Coopération INTERNATIONALE hauts-de-seine | 1% FOR THE PLANET – MEMBRE – | A&D FOUNDATION | PLANETE URGENCE VOLONTARIAT & DEVELOPPEMENT | GROUPE SOS |

Agro-ecological Intensification and Diversification of Peri-urban Agriculture Project in Siem Reap (Cambodia) Agrisud & partners (IADA phase 1)