



# Using the Carbon Benefits Project Socioeconomic Tools

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## Cost-Benefit Analysis (CBA) Tutorial

### 1. Objective, Scope and Level of the CBA

The main objective of carrying out a cost-benefit analysis (CBA) is to compare how different sustainable land management (SLM) practices that lower carbon emissions might impact or benefit different land users financially. The CBA gives an insight into the land user’s economic rationale for adopting and not adopting certain land management practices and also helps to identify the tradeoffs that occur as a result of SLM interventions that increase carbon benefits.

The financial indicators and outputs (graphs and tables) produced by the CBA are intended to inform the decision-making process which should not be solely based on how profitable a practice is but should also take into account other environmental, social, cultural and political factors which the Driver-Impact-Response Analysis can shed light on. The CBA is a decision-support tool, not a decision-making tool.

This is a simple financial<sup>i</sup> CBA that takes into account costs and benefits of land management practices related to carbon which have a monetary value. Costs and benefits for which there are no monetary values can be

described in the CBA report or accounted for in the Driver-Impact-Response<sup>ii</sup> analysis. Results from the CBA can also be used in the form of qualitative information in the Driver-Impact-Response Analysis.

This online CBA tool is designed to analyse the cost and benefits from a land user's perspective to assess the economic viability of the project intervention or land use system as an investment for the farmer. The costs and benefits entered in the CBA should be those experienced by the land user.

## **2. Timing and Time Scale of CBA**

A fundamental issue to be addressed in a CBA is whether it is an ex ante<sup>iii</sup> or ex post<sup>iv</sup> analysis. An ex ante analysis will usually be employed at a scoping or project proposal stage whereas an ex post analysis will be carried out during the evaluation stage of the project. This online CBA tool gives the project flexibility in conducting a CBA analysis between the ex ante and ex post stage by allowing the project to update their CBA easily by replacing predicted data with actual data as it becomes available.

The time period that this CBA examines is fixed for a duration of ten years. This is usually the maximum time horizon that a land user uses to make decisions. A fixed time period for the CBA gives closer comparability of the CBA outputs between different interventions and between different projects. If the project ends before the ten year duration, continue to predict or record the values of the costs and benefits beyond the project duration till Year 10 and include possible changes to prices after project support has ceased.

## **3. Focus of the CBA**

The CBA can be repeated several times for a different land use system or technology or socio-economic group. Data collected for the CBA on a particular land use system may reflect a range of values as different socio-economic groups may face different costs and benefits<sup>5</sup>. Separate CBAs can be conducted for different socio-economic groups or the average can be taken.

To help you identify which land management practices or technologies to carry out a CBA on, Stage 1 of the CBA Web Tool ranks your project's land use systems according to the impact they have on greenhouse gas (GHG) flux and the associated area with each land use system. Stage 1 of the CBA Web Tool can be accessed by clicking the Start button on the CBA Guidance web page.

## **4. Steps to Carry Out a Cost-Benefit Analysis:**

### **4.1. Step 1: Define the Specific Objective of the CBA**

Define the focus of the CBA in the context of the project and what specific questions does the project hope to address with the CBA.

### **4.2. Step 2: Describe the Baseline and Project Scenario**

Define the baseline scenario, describing what would happen without the project intervention. This could be the most common land use system being practised in that area. A systematic description of the project scenario should be given detailing how the land use system or technology functions, the activities involved and what is needed to carry it out.

### **4.3. Step 3: List the Costs and Benefits**

For both the baseline and project scenario, give a detailed qualitative list of the costs and benefits of the technology, intervention or land management practice in relation to carbon. Field observations and data collected from farmers are important for this listing. Check this list with the CBA Data Template item column and add the costs and benefits that do not fall into the category of CBA items under the Others sections.

5 For example, resource poor farmers usually need to purchase inputs such as animals and means of transporting material required to implement a certain practice which richer farmers might already have. They usually lack the required labour and will need to hire additional labour to implement labour-intensive practices (Tschakert 2004).

#### **4.3.1. Establishment and Recurrent Costs**

Differentiate between initial establishment costs and recurrent costs for both scenarios. Initial establishment costs are costs to a land user only during the first or second year of implementing a specific technology, e.g. cost for land preparation, construction and initiation of the technology. Recurrent costs are costs to a land user that are repeated every year, e.g. cost of seed, tillage labour, operation and maintenance of the technology.

#### **4.3.2. Opportunity Cost of Labour**

If farmers used their own labour to implement the land management practice, the labour should be valued at the opportunity cost of the farmer's own labour. For example, if the farmer was not implementing this land management practice, he would have gone into the town to work. The cost (opportunity cost) of his labour on the land management practice should be the wage he would be earning when working in the town. Conversely, for example, if the farmer was not implementing this land management practice, he would be drinking all day, then the opportunity cost of his labour on the land management practice would be the cost of those drinks but as a benefit!

#### **4.3.3. Double Accounting**

Ensure that there is no double accounting of costs or benefits. Land users may have listed several costs or benefits that represent a single impact of the technology. Only one of these should be included in the CBA. For example, either the positive impact of the technology on crop yields or the impact of the technology on decreasing the erosion rate should be accounted for, but not both<sup>6</sup>. Another example is when Napier grass grown for soil conservation is used as fodder for the same farmer's animals, this benefit can be valued either by the producer price<sup>7</sup> from the sale of this fodder or by the live weight gain of the animals being fed by this Napier grass, but not both.

#### **4.3.4. Improved future yields**

If studies have been carried out to predict the improvement in yields due to soil conservation measures, these can be applied to future benefits in the CBA.

#### **4.4. Step 4: Convert the data into common units**

Data collected from land users may be given in different units for fields of different sizes. It is important to convert all data into the same unit area of per one hectare and the unit used for each CBA item should follow that shown in the CBA Data Template spreadsheet under the column, Units.

<sup>6</sup> The impact of the technology on crop yields can be valued using the change in productivity approach (Enters 1998), such as the value of the increase in crop production. The impact of the technology on the rate of erosion can be valued using the replacement cost approach, where the reduction in the cost of replacing soil nutrients lost due to erosion is valued, for example through the reduced need for fertiliser (Stocking & Clark 1997).

<sup>7</sup> Price paid to the farmer for their produce.

#### **4.5. Step 5: List the monetary value for each cost and benefit**

For each cost and benefit related to a land management practice or technology that affects carbon, attach a monetary value to it expressed in the local currency per hectare. Prices entered in the CBA Data Template should be from the perspective of the farmer. For example, crop revenue should be calculated based on the producer price<sup>7</sup> rather than the market price<sup>8</sup>. Give the best estimate for values the project is not certain of.

#### **4.5.1. Exchange Rate**

Enter the exchange rate to convert the local currency into U.S dollars (USD) in Cell B98 of the CBA Data Template. Then, the CBA Data Template will automatically show the monetary values in USD in another column (Column H). USD is used as the common currency for comparison between different CBAs. Refer to Section 6.2 below for more information.

#### **4.5.2. Non-monetary values**

Costs and benefits for which there are no monetary values should be included as qualitative information in the CBA report or Driver-Impact-Response analysis.

#### **4.6. Step 6: Discounting**

Discounting is the implicit weighing of the present over the future, because a sum of money received today has greater value than the same sum of money received sometime in the future. This is the time value<sup>9</sup> of money due to the risk and uncertainty of the future. Therefore, costs and benefits accrued in the later years of the project are discounted more than the earlier years by using a discount factor (related to the discount rate) that expresses how the value of money diminishes over time (Boardman et al 2006).

The CBA Data Template spreadsheet automatically discounts the costs and benefits entered in Rows 72 to 74 when the discount rate is specified in Cell B97.

To learn more about discounting, refer to the book by Gittinger (1982), Chapter 9 on *Comparing Project Costs and Benefits. The Time Value of Money*.

##### **4.6.1. Using a suitable discount rate**

The bank's interest rate for borrowing money is usually used as the discount rate in a CBA. The discount rate should be the interest rate that a land user would face when borrowing money from a bank that he or she would have access to. This could be micro-finance borrowing rates that a land user faces when borrowing money to implement a land management practice.

The discount rate set at the region's bank borrowing rate weighs up whether the land user can still make a profit when borrowing money, and paying interest to the money lender, to invest in the land management practice.

8 Price that produce can be bought for at the market.

9 For example, when faced with the choice of receiving KES1,000 today or KES1,000 in one year's time, the land user would choose to receive KES1,000 today. A person would only choose to receive a sum of money in one year's time instead of today if that sum was more than KES1,000 (Stocking & Clark 1997).

Lower discount rates may be used for interventions carried out at the community or society level, known as the social rate of discount (Barbier 1996). Enter the discount rate to be applied to the CBA in Cell B97 of the CBA Data Template.

The discount rate should be country or region-specific. If a suitable discount rate cannot be found, the Central Bank Rates (<http://www.cbrates.com/>) has a worldwide list of central bank interest rates that can be used as the discount rate for the CBA. To find out more information of your country's central bank and whether they can provide a suitable discount rate, click here: <http://www.cbrates.com/centralbanks.htm>

## **5. Interpreting CBA Financial Indicators**

### **5.1. Net Present Value**

The Net Present Value (NPV) expresses how the net benefits of the land management practice over ten years is valued today. Discounting provides a means to collapse the cash flows over a ten year period into their present value equivalent for comparison which is the NPV of the land management practice or technology.

If the NPV is positive, it indicates that the benefits of the investment exceed the costs at that discount rate, and the land use system or management practice is profitable. If the NPV is negative, the intervention is not profitable at the applied discount rate.

NPV Profitability Rules:

(1) For a particular land management practice:

if  $NPV \geq 0$ , Practice is profitable (at the applied discount rate)

if  $NPV < 0$ , Practice is not profitable (at the applied discount rate)

(2) When comparing different land management practices etc.<sup>10</sup>:

if  $NPV (\text{Practice A}) > NPV (\text{Practice B})$ , Practice A is more profitable

if  $NPV (\text{Practice B}) > NPV (\text{Practice A})$ , Practice B is more profitable

### **5.2. Internal Rate of Return**

The internal rate of return (IRR) is the implicit percentage of return on the investment. The IRR is the implicit discount rate of the investment when NPV is zero. The IRR is useful for comparing different investments as no discount rate needs to be specified.

<sup>10</sup> Comparison could be between different land management practices, technologies related to carbon and also could be further broken down into different socio-economic groups for comparison of the different degrees of profitability faced by the groups.

If IRR is above a threshold that you have set, for example, the bank's borrowing rate, or the IRR of another land management practice, the land management practice is profitable. The same land management practice could also be unprofitable if compared to a different (higher) threshold, where IRR is below it.

IRR Profitability Rules:

if  $IRR \geq r$ , Practice is profitable

if  $IRR < r$ , Practice is not profitable

where  $r$  = the interest rate (cost of capital or cost of borrowing money)

To find out more about how to interpret financial indicators, refer to Campbell and Brown (2003, Chapter 3).

The returns to labour indicator measures the efficiency of the land management practice in bringing financial returns to the land user per human labour day, expressed in terms of net benefits per person day. The higher the returns to labour, the more efficient the land management practice is at maximising the labour input, in terms of financial returns derived from that practice.

## **6. Filling in the CBA Data Template**

The boxes highlighted in yellow are for the user to fill in data that are applicable to the project or land use system that has an impact on carbon. Yellow boxes outline in red are mandatory for the user to fill in (Cells B97, B98, B99).

The first year, Cells A1 to H95, will be used as a reference and example to explain the information required in the CBA Data Template. The same understanding should be applied from Year 2 till Year 10 in the CBA Data Template.

It is important that all data is converted into the same unit area of one hectare.

### **6.1. Step 1: Indicate the Type of Scenario**

Select from the drop down menu in Cell A2 if this is a baseline or project scenario.

### **6.2. Step 2: Enter the Currency Exchange Rate and its Date**

In Cell B98, enter the exchange rate to convert your local currency to U.S. dollars (USD).

For example if,

USD 1 = KES 79 (Kenyan Shillings)

KES 1 = USD 0.0126582

the exchange rate of 0.0126582 should be entered in Cell B98.

Excel converts the monetary values entered in Columns D and F into USD in Column H when the currency exchange rate is entered in Cell B98.

Enter the date of the exchange rate that is being used in Cell B99 in this format: DD/MM/YYYY.

If the date is not known, give the best estimate. Since currency exchange rates can fluctuate greatly, it is important to record the date of the exchange rate that is being applied to the CBA.

Current and historic exchange rates can be accessed here: <http://www.oanda.com/currency/classic-converter>

### **6.3. Step 3: Enter the Discount Rate to be Applied**

In Cell B97, enter the discount rate to be applied to the CBA so that the Net Present Value can be automatically calculated in Cell B94.

### **6.4. Step 4: Specify the Size of the Activity Area**

In Cell B3, enter the size of the activity area for Year 1.

For the following years, record the size of the activity area, reflecting the changes in the increase or decrease of the adoption of that land management practice if any. Also include any loss of cropping area due to space taken up by a conservation technology (e.g. hedges, trashlines, terraces) if any.

### **6.5. Step 5: Fill in the Values for Columns A to F**

#### **6.5.1. Column A: Activity Item**

This is the list of activity items or land management practices that are mostly related to carbon.

If some activities or items related to your project and carbon are not included in this list, please enter its title under the heading of *Other Costs* (Cells A20-A22, Cells A77-A79) or *Other Benefits* (Cells A87-A89) appropriately.

#### 6.5.2. Column B: *Quantity (per ha)*

The amount of the item used for the land management practice per hectare in its units.

#### 6.5.3. Column C: *Units*

Delete the unit (if more than one is shown) that does not apply to the land management practice. It is recommended to convert your data to the units given in the spreadsheet for closer comparability between practices and projects.

#### 6.5.3. Column D: *Cost / Benefit of Item (local currency per ha)*

This is the total price of the quantity of inputs per hectare specified in Column B. Do not include the labour and equipment costs associated with the activity item here.

#### 6.5.4. Column E: *Labour (person days per ha)*

Include only the amount of human labour needed for the land management practice here in terms of person days per hectare, excluding animal labour.

#### 6.5.5. Column F: *Cost of Labour (local currency per ha)*

Include the total cost of human and animal labour per ha for the relevant activity item (Column A). Refer to Section 4.3.2 above on how to calculate labour costs.

#### 6.5.6. Column G: *Total Cost / Benefit in Local Currency (per ha)*

Excel automatically calculates the net cost or benefit in the local currency (Column G) by summing up the cost or benefit of the activity item (Column D) with the cost of labour to implement that activity (Column F).

#### 6.5.7. Column H: *Total Cost / Benefit in USD (per ha)*

Excel automatically converts the net cost or benefit of the activity item in the local currency (Column G) into US dollars in Column H. It is important that the currency exchange rate to convert the local currency into US dollars is entered in Cell B98. Refer to Section 6.2 above.

#### 6.5.8. Rows A9-A10: *Equipment / Machinery - Purchase*

If equipment and machinery need to be purchased, include the quantity and cost of their purchase in Cells B10 and D10 and include their operation and maintenance costs etc. in Rows 66-68 (refer to Cells A66-A68). The purchase cost should be the fraction of time that the equipment or machine is used for that land management practice.

For example, if 60% of the time a machine is being used is on the land management practice that is being analysed, and the other 40% is used for another land management practice, then the

purchase cost added in Cell D10 should be 0.6 multiplied by the full purchase cost of the machinery.

The rental or depreciation cost of the purchased equipment or machinery should not be included in Rows A9-A10 as its procurement or purchase costs have already been included here in Cell D10. If revenue is gained from loaning out the purchased machinery to other land users, this should not be included as a benefit but should be accounted for in the total number of hours that the machine is being used.

For example, a machine is used 8 hours a week for the land management practice being analysed, 2 hours a week for another land management practice on the same farm and 6 hours a week being rented out to other farmers. The calculation of the proportion of time spent by the machine on the land management practice being analysed would be 50% (8hours divided by 16hours).

#### 6.5.9. Rows A65: *Rental / Depreciation costs*

If equipment or machinery needs to be hired or rented, include just the rental costs for the time spent on the land management practice being analysed in Cell D65. Operation and fuel costs should be included in Cell D66. Rental costs include the rental of tools, equipment, machinery and manure carts or carts to transport seedlings.

For machinery that the land user already has and did not purchase but is using for this land use system or management practice, include the depreciation cost. The machine depreciation cost can be calculated using the simple Straight-line Depreciation Method below. The Declining Depreciation Method can also be used if the user chooses to.

Straight-line Depreciation Method:

Depreciation cost = (Purchase price . Scrap value) / Life span in years OR

= (Purchase price . Remaining value) / Years of usage before re-selling

## **7. CBA Report Suggested Content**

This is a suggestion on how the CBA Report can be structured, users can decide how to structure their report, but the content of the report should include or address the key points laid out below.

### **7.1. Introduction**

- . Describe what the project hopes to achieve with the CBA
- . Give a description of the scenarios entered into the CBA Web Tool and how they relate to each other

### **7.2. Methodology**

#### 7.2.1. Sampling

- . Provide information on sampling i.e. how many households or land users were sampled, sampling methods

#### 7.2.2. Data Collection

- . Briefly describe data collection methods

#### 7.2.3. Assumptions

- . Discount Rate: Justify the discount rate used
- . Labour: Define how many hours constitute a person day and the gender of the labour
- . Production Estimate: Describe method used to predict yields
- For e.g. was linear interpolation<sup>11</sup> used to estimate crop yields or extrapolation used predict future yields?
- . Equipment and Machinery: Specify how these costs were calculated if any

### **7.3. Results and Analysis**

- . Briefly describe results



- . Comparison of CBA outputs between different scenarios
- . Interpret and compare the financial indicators (NPV, IRR, Returns to Labour)
- . Is there a high initial investment or labour barrier?
- . How will or are different socio-economic groups affected differently by the interventions
- . What needs to be done or mitigated to promote a certain land management practice that is good for carbon?
- . How does the CBA results inform the decision making process to achieve the project's objective?

11 For e.g. if yield data is available for certain years but not for the years in between. Data for the years in between can be estimated using interpolation. A linear relationship can be assumed between the know points of data (it can be drawn as a straight line on a graph).

#### **7.4. Conclusion**

- . Describe the main findings of the CBA and discuss their relevance and possible implications for negotiations, policy and decision-making
- . Give recommendations
- . Identify areas where further more detailed work might be undertaken

#### **8. Bibliography**

Recommended Reading:

1. Campbell, H. & Brown, R., 2003. Benefit-Cost Analysis: Financial and Economic Appraisal Using Spreadsheets. Cambridge: Cambridge University Press.
2. Gittinger, J.P., 1982. Economic Analysis of Agricultural Projects. 2nd ed. Baltimore: Johns Hopkins University Press.

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# DPSIR Tutorial

## Introduction

The socio-economic module is provided to help the user understand and improve the adoption of green-house gas (GHG)-friendly land management measures by land-users. It applies cost-benefit analysis (CBA) and a Drivers-Impacts-Responses (DPSIR) analysis to do this. It is for the user to decide how much emphasis to give the socio-economic module. Available time and resources are factors but the decision to use the module might also be made when there is a need to understand one or more of the following:

The rationale for adoption/non-adoption of sustainable land management (SLM) practices or persistence of less carbon-friendly practices.

How to improve SLM acceptance/adoption rates either during the project or after it has finished. This includes interest in spontaneous adoption of SLM after the project.

The financial sustainability of project interventions and how the profitability/economic rationality of different activities compare.

The pattern of SLM adoption by different socio-economic groups. Do some people engage with SLM or persist with less C-friendly practices more than others? If yes, why?

These guidance notes are intended to help the user with the Driver-Impacts-Response (DPSIR) tool and analysis.

## Why use the DPSIR tool for your project?

DPSIR is a simple framework that helps provide the user with an understanding of the land-user rationale for adoption or non-adoption of specific land management practices. The DPSIR tool helps the user organise and link qualitative information on direct/indirect drivers and constraints to adoption; social and environmental impacts of adoption or non-adoption. It also helps the user identify areas for targeted responses that address adoption constraints Figure 1.

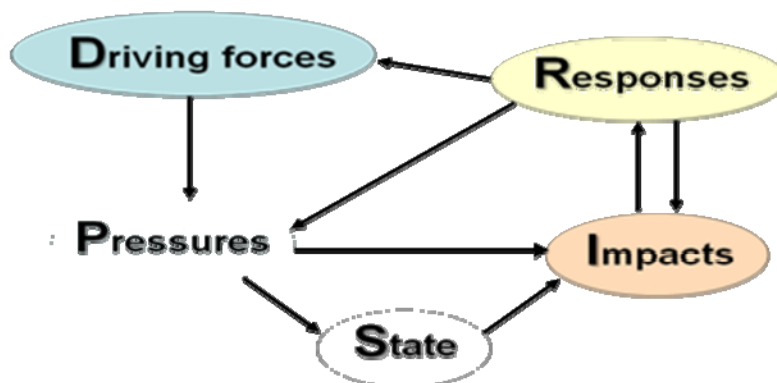


Figure 1. DPSIR

## When might there be a need for the DPSIR tool?

The value of the DPSIR tool depends on the stage of the project<sup>1</sup>. With examples 1 and 2 below a relatively detailed DPSIR analysis might be appropriate. In the third example a basic analysis would be sufficient or the project may decide not to use the DPSIR tool at all.

### Example 1.

This project is in the planning stages and wishes to support land-users in achieving more sustainable and carbon-friendly land management. There are a number of SLM options that are known to work technically but the project is unsure which are most likely to be adopted.

A DPSIR analysis conducted at this early stage should provide the user with an understanding of the rationale and drivers for adoption or non-adoption of carbon friendly practices. If these are understood then the project can ensure that the adoption of these practices is supported and that, where possible, obstacles to adoption are removed.

### Example 2

This ten year project is, among other things, supporting land users with a package of sustainable land management options. After five years, a review picks up a concern that adoption of some of the more C friendly practices and/or practice combinations is very uneven. It might be that the poorer households, those headed by women, or those in a particular location have very low adoption rates and the project is concerned about this. Or it might be that overall adoption rates are very low. At this stage a DPSIR analysis is conducted with a sample of both adopting and non-adopting households to identify the different rationales, obstacles and ways in which they are being overcome. This analysis could lead to changes in the support the project decides to give to specific groups of land-users or regions that are slow to adopt.

Commonly, questions around adoption, lack of adoption and/or persistence of less carbon friendly practices arise during a project, even towards its end. Also, quite commonly, a project will be interested in predicting continued or further uptake of land management practices after project activities and support have finished. In this way use of the DPSIR tool can be relevant at different stages in the project cycle.

### Example 3

Again this project has been promoting a number of SLM activities over a several year period. The project has finished and there is a need to quantify the carbon change in the system as a consequence of adoption of the SLM practices promoted by the project. The project uses the online model to calculate system carbon change during the period of project activities.

There is, however, no interest in influencing further adoption of practices leading to more positive changes in C as the project is in its final stages, it has been successful and there is no particular concern over adoption rates etc. In this case the basic DPSIR is carried out or the project might decide not to use the DPSIR tool at all.

## What does the DPSIR tool look like?

DPSIR is a simple framework presented in the form of a tool in the CBP tool-kit. Each letter represents one part of the framework:

**D = Driving Forces:** These are the indirect drivers of system change. They may be biophysical, socio-economic or institutional in nature. They are the underlying explanations for the adoption of a particular management

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<sup>1</sup> The word Project is used throughout as it is likely the CBP tools will often be used by projects. They may be used by agencies, NGOs or a variety of other entities interested in carbon benefits.

practice or perhaps the non-adoption of a practice that is being promoted in an area. There may be a single factor responsible or a more complex multi-layered explanation.

**P = Pressures:** These can be viewed as the management practices (e.g. forms of tillage, cropping, livestock management etc.) directly responsible for the observed condition and dynamic of the environment. They are the direct drivers of system change.

**S = State:** This is the “starting point” for DPSIR analysis, it represents the condition and dynamic of the environment. In the CBP context this consists of the elements of the environment (soil, vegetation, atmosphere) that hold, capture and release carbon. Outputs from the CBP biophysical modelling tools provide information on the state and this information linked to adoption information and this will help the user decide whether to do a DPSIR analysis and how to focus it.

**I = Impact(s):** In the CBP context Impacts include those caused by the condition and dynamic of the carbon–significant elements of the environment (e.g. reduced soil organic matter may impact negatively on yield). There may also be Impacts caused directly by the pressures (management practices) that are important to the land-user but not mediated through carbon (e.g. positive impact of overgrazing on perceived wealth). These Impacts can be directly felt by people and/or the environment. They can be positive/negative, short term/longer term, biophysical/socio-economic and can help explain the rationale for adoption or non adoption and the trade-offs land-users make.

**R = Response(s):** These are the interventions, policy Responses etc. the project or authorities might consider in order to reduce incentives to practice damaging land management and/or increase the options and incentives for SLM. These Responses are grounded in the understanding of system drivers and Impacts that DPSIR provides.

### ***Guidance for using the tool***

The default option in the tool is to use it for one or more management practices within the project intervention area. One DPSIR analysis might look up to three of these, potentially associated with different land use categories (LUC) and systems (LUS). The online tool consists of five stages discussed in turn below.

#### **DPSIR stage 1 of 5 Pressures**

In stage 1 of the DPSIR analysis the user is provided with information on green-house gas (GHG) flux and adoption area for the LUSs relevant to the project. This information is drawn from the biophysical model and is presented to help the user decide which LUS(s) to focus on with the DPSIR. For example, if a particular LUS such as over-grazing is associated with a +ve GHG flux and the area of adoption is large or increasing the project might include this in the analysis. Other information on the LUS or management practices might also influence the decision to include them in the DPSIR (e.g. low adoption rates by women).

The user selects up to three Pressures – the land management practices. These may be selected because they are the main, or one of the main, management practices associated with the LUS or because they are interesting to the user for other reasons. The tool provides a qualitative assessment of the contribution each Pressure makes to GHG flux (i.e. ↑ = increases; → = neutral; ↓ = reductions). These assessments are fixed, based on our general understanding of the impacts these practices have on carbon and are consistent with the equations used in the biophysical models.

The user can enter more detailed information describing the Pressure once it has been selected.

#### **DPSIR stage 2 of 5 Driving Forces**

In stage 2 of the DSPIR, for each of the identified Pressures, the user selects the most relevant and significant Driving Forces that they believe encourage or constrain adoption. These are selected from pre-determined lists, though the user can add drivers they feel are not provided on this list. The information on Driving Forces should come from discussions with land-users (see section 2.5 below on data requirements and collection). The user first

selects a pressure, then identifies up to three Driving Forces associated with this pressure and also adds a semi-quantitative measure of significance (--, -, +, ++). The user then enters detailed information on each driving force in the “Detailed information” column. This is where the very important information on precisely how for example “land tenure” acts as a driver for adoption or non-adoption of a specific pressure. It is essential that this detail, derived from discussions with the land users, is included in the data entry as without it the DPSIR will be quite superficial and perhaps not very informative.

Where there is additional relevant detail on the Driving Forces, perhaps a complex “causality chain” that explains adoption or non adoption of a particular Pressure, this can be added in the text box (part 4 of DPSIR stage 2)

### DPSIR stage 3 of 5 Impacts

In stage 3 the Impacts associated with each of the pressures are identified. These may be direct Impacts or Impacts mediated through changes in the State (the carbon containing elements of the environment: soil, vegetation, atmosphere). For example, over-grazing (linked to high stocking rates) might have a direct positive Impact on social status or perceived wealth. Overgrazing is also likely to reduce vegetative cover and have a negative affect in promoting soil erosion and medium-long term decline in productivity etc. These negative Impacts are mediated through the State, i.e. the over-grazing leads to reduced organic inputs, loss of soil cover and the processes of soil organic matter decline and land degradation will lead to lower productivity (Figure 2). Up to three Impacts can be selected per pressure, again from pre-determined lists and with the option of adding Impacts not on this list. Impacts can be socio-cultural (e.g. related to status), economic or environmental.

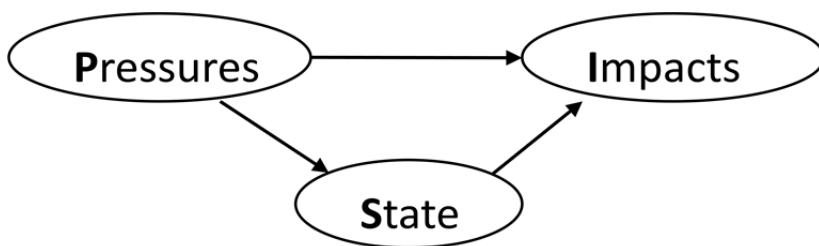


Figure 2. Direct and indirect Impacts of Pressures

A quantitative measure can be added for each Impact (--, -, +, ++). Information should also be entered on the timing of each impact i.e. is it felt in the short-term (up to two years after adoption) or the long-term (not felt until more than two years after adoption)? Detailed information on each impact should also be added in the “detailed information” column.

As with Driving Forces, the information on Impacts should come from discussions with land-users. Only through talking with land-users can the user identify Impacts that motivation or discourage adoption.

The same Pressure might create different Impacts for different users. These differences (e.g. on rich/poor farmers) can be captured in the detailed information column or, if there are marked differences in both Driving Forces and Impacts for different users, separate DPSIR analysis can be carried out for these two groups.

### DPSIR stage 4 of 5: Responses

Stage 4 of the DPSIR tool involves the formulation of Responses targeting the Driving Forces, pressures or Impacts identified in the earlier stages of the analysis. Responses are new initiatives or interventions rather than those already existing. The identification of Responses requires some time, reflection on the information provided by the land-users and discussion between project members. For this reason it is a good idea to generate the DPSIR diagram and summary table at the end of stage 3, without trying to fill in Responses. The diagram, summary table and detailed notes on Driving Forces and Impacts can then be used to facilitate a discussion on

Responses. The Responses can then be added later and can target Driving Forces, Pressures or Impacts. They might range from policy Responses to technical interventions, financial incentives etc. depending on what they are targeting. Brief details of the Responses can be entered into the “describe Responses” column and more detailed information in the “detailed information” column.

### **DPSIR Stage 5 of 5: Report**

This final section of the DPSIR analysis is for the entry of any additional information or elaboration on any aspect of the analysis. A more systematic, in depth write up of the complete DPSIR together with details of possible Responses can be added here.

#### ***Data requirements and collection***

Data requirements depend, to some extent, on whether the user wishes to carry out a basic or more detailed DPSIR analysis. However, in both cases the data and analysis required are qualitative with information on Driving Forces and Impacts in particular collected through discussions with individual or small groups of land-users. Although it is sometimes easier to ask local field officers, project staff or other “experts” for explanations of land-user behaviour this is no substitute for talking to the land-users directly. The information can be gathered from land-users in interviews organized for this purpose or as part of interviews already planned by the project or for the CBA analysis. .

A semi-structured land-user interview is the main method required. The purpose is to understand the rationale of the land-user hence there is a need to interview a sample of land-users, ideally 3-5 in number. If the project is interested in differences in management behaviour between two or more land-user groups (e.g. “adopters” and “non-adopters” of carbon friendly practices as in example 2 in section 2.1 above) then 3-5 should be interviewed from each group to make a comparative analysis possible. This will give the user information to run a DPSIR analysis for each group, using the tool provided. Where two DPSIRs are comparing adopters with non-adopters it is usually best to start with the non-adopters. This is because it is usually quite easy to focus a discussion with a land-user on factors that constrain adoption of a particular practice. The user can then ask the adopters how they have overcome the constraints that non-adopters are experiencing.

The questions should be formulated by the project before the interview and will vary depending on the context though should be designed to get the land-user to give reasons for persisting with practices that are perceived to have a negative impact on system carbon and /or lack of interest in more carbon-friendly options.

Examples of relevant questions are given below in a hypothetical situation where **practice A** is a traditional management practice, increasing GHG emissions and **practice B** has been introduced by the project and reduces GHG emissions.

(if A is practiced)

Why do you carry out practice A?;

Have you carried out practice “B”

*If “No”*

Why do you not adopt practice B? *constraints or lack of interest may be the response.*

**N.B.** *Ask follow up questions to obtain the detail on direct and indirect drivers, causality chains etc.*

If yes ....

Why did you adopt practice “B”;

*If you are aware of the barriers to adoption (X, Y, Z etc.) that some experience ...*

How did you overcome constraint X, Y, Z etc.?

Do you use practice A on all of your land (if not then why not?)?

If no ....

Would you like to use practice "B" (if not then why not?)? If yes .....

Why do you not use practice "B"? (i.e. what are the adoption constraints)

What would have to change/what support would you need in order to adopt practice B?

These are just example questions. They will usually need to be modified to fit the circumstances and in all cases follow up questions will be required to get the important detail. The objective is to uncover the underlying causes of non-adoption including socio-economic and policy-related factors. Also information on positive Impacts that might incentivise or dis-incentivise adoption and on changes or increases in support that might incentivise adoption of C-friendly practices.

This type of questioning might reveal, for example that there is a low rate of adoption of a particular C-friendly practice e.g. agro-forestry, despite strong demand. Adoption might be constrained by low availability of required inputs such as planting material, advice on planting etc. Or some sections of the community might be effectively excluded due to gender, cultural or wealth status, lack of links to community leaders, social networks etc. Once this information has been collected the user and/or project team can discuss it to see if there are possible Responses that could improve adoption. It may be that the level of support the potential users claim is required is beyond the resources of the project or unrealistically high. The appropriate Response in this case might be to look for other, less demanding practices to promote that have the potential to reduce GHG emissions but also are within the means of the land-users to implement.

### ***Depth of DPSIR analysis***

As has been made clear in section 1. it should be for the project/user to decide whether there is value in using the DPSIR tool and the level they wish to engage with it. We can think of two broad levels, a simple DPSIR analysis and a detailed DPSIR analysis:

- i) The simplest requires limited discussion with a small number of land-users (3-5 individuals representative of the community) on their rationale/constraints for adoption/non adoption of the key practices promoted by the project and important in carbon terms. The user would look at a relatively small number of Pressures, select Driving Forces and Impacts from the drop down menus and add limited extra detail. The outputs would be the DPSIR diagram and summary table produced after stage 3 of the data entry process described above with limited additional comments or reflections on Responses from the user.
- ii) Those users interested in a detailed DPSIR analysis (examples 1 and 2 in section 2.1 above) would spend more time talking to land-users and enter more detail on the Driving Forces and Impacts associated with each Pressure in the text columns and boxes available. They would then generate the preliminary DPSIR diagram and summary table after Stage 3 and use this to help identify and discuss possible Responses with the project team. They could develop a "DPSIR report" supplementing the figure and summary table with text elaborating important Driving Forces and Impacts that incentivise or dis-incentivise adoption and possible Responses aimed at removing adoption constraints.

This more detailed DPSIR analysis and report is beyond the scope of the CBP tools but is suggested as an option if the project feels it to be worthwhile and resources are available.



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<sup>i</sup> A financial analysis is a private CBA taken from the perspective of a land user. An economic analysis is a social CBA taken from the perspective of a society, where price distortions and market externalities are incorporated into the analysis (Enters 1998).

<sup>ii</sup> Also known as the DPSIR (Driving Force-Pressure-State-Impact-Response) Analysis.

<sup>iii</sup> An ex ante analysis is carried out *before the event* using predicted prices faced by the land user.

<sup>iv</sup> An ex post analysis is carried out *after the action* using actual prices incurred or gained by the land user.