



Food and Agriculture
Organization of the
United Nations

Quick Guidance on EX-ACT Tool for Monitoring Reporting and Verification

*Towards Sustainable Impact Monitoring of Green
Agriculture and Forestry Investments by NDBs:
Adapting MRV Methodology*



January
2017

Quick Guidance on EX-ACT MRV Tool

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Abstract

Agriculture, forestry production and land use change (overwhelmingly related to agriculture) represent one quarter of greenhouse gas emissions (GHG) (IPCC, 2014).

Three quarters of the world's poor population live in rural areas (where 80% of revenue comes from agriculture) and an increase in GDP contributes four times more effectively in reducing poverty when such increase comes from agriculture, than another sector (WB 2007). In this context, small farmers are especially vulnerable to the effects of climate change.

The financing of agricultural investment is necessary to increase productivity, improve farm incomes and acquire new assets to cope with shocks, allowing improvement of resilience and adaptation to climate change (CC). In general, the development of financial services (credit, savings, insurance) in rural areas allows the establishment of a protective institutional environment that enables rural people to face risks related to climate (decline in agricultural production, e.g. as a result of reduced precipitation or extreme event).

Many investment projects which have "climate co-benefits" in the agricultural and forestry sector are set up by the financial sector of developing countries, particularly by public development banks. National Development Banks are increasingly integrating climate

MRV for NDBs

This Quick Guidance aims to provide National Development Banks (NDB) a project monitoring mechanism of the impact of greenhouse gases and adaptation to climate change on their green bank portfolio.

change considerations in their core operations, and are more and more active in financing climate change interventions. It progressively strengthens the role they play in channeling funds towards low-emission projects and programs (Smallridge D, 2012).

The transformation towards a low-carbon, climate resilient environment requires a large and constant flow of funding, which is not always easily provided by the governments. This is the reason why the mobilization of private sector investments in climate change mitigation is essential and NDBs can play an important role in scaling up private sector investments and help to overcome some of the existing barriers private market will not bear.

Having an MRV system suitable for NDBs' portfolio of projects and in line with the national context allows the institutions to keep track of the mitigation and adaptation impact of their green credit line portfolio for the projects related to the AFOLU sector. Furthermore, it allows them to improve their accountability in order to have access to public incentives.

The MRV methodology for monitoring of green agriculture and forestry investments, developed by FAO in collaboration with AFD, is designed to measure both the impact of mitigation and adaptation projects in the AFOLU sector, specifically for groups of projects belonging to NDBs' portfolio.

In particular, the tool shows the advantageous relationship costs/benefits in its implementation within the institutional system and the easiness of use. Some of its strong points are i) the capacity to appraise not only the mitigation and adaptation impact, but also important economic and social aspects of the projects and the general households' resilience; ii) the possibility to have not only an ex-ante, but also a mid-term and ex-post analysis of the impact of a project or group of projects.

Acknowledgments

The preparation of this publication has been a collaborative effort which was peer reviewed in 14 December 2015 by professionals from different FAO Divisions, ESA and NRC and by experts from IFAD, AFD, FFEM, FIRA, CIPCA and AGROBANCO. Main authors were Louis Bockel, Laura Vian, with the support of Claude Torre from AFD, and the supervision of Leslie Lipper (ESA). Anass Toudert provided editorial support for the text and design. Responsibility with the content lies with the authors.

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Overview

This quick guidance material is structured into two parts: the first part, *Guide for decision makers*, presents the rationale of the tool, it discusses its main logic and use; the then following *Guide for tool users* introduces more technical aspects around the methodology as well as data collection and entry.

Guide for decision makers

More specifically, *chapter 1* provides the background on why it is important to target climate change mitigation as part of agricultural investment planning and, in particular, it presents the link between climate change and National Development Banks, discussing their important role in scaling up private sector investments and their potential towards a low carbon and climate-resilient development. Subsequently *Chapter 2* provides an explanation of mitigation and adaptation concepts, highlighting a set of options and suggestions on GHG effects which might need to be considered when dealing with climate investment projects in the agricultural and forestry sector. *Chapter 3* gives a concise overview of the importance of having a functioning MRV system to estimate the impact of any public investment project in terms of co-benefit or externality on the adaptability and mitigation of climate change. *Chapter 4* briefly presents the MRV EX-ACT Tool in its most essential characteristics.

Guide for tool users

The following *chapter 5* then shortly depicts the methodological background of the MRV EX-ACT, with a focus on the indicators at the basis of the methodology, followed by the description of main data needs (chapter 6) and a short guide to data entry.



https://www.ifad.org/newsroom/press_release/past/tags/y2012/1902319

Part A: Quick Guidance for decision makers



Source: <http://www.ebrd.com/news/2015/joint-report-on-mdb-climate-finance-shows-record-results.html>

1. Climate Change and National Development Banks

The transformation towards a low-carbon, climate resilient environment requires a great constant amount of funding, which is not always easily provided by the governments alone. This is the reason why the mobilization of private sector investments in climate change mitigation is essential and National Development Banks can play an important role in scaling up private sector investments and help to overcome some of the existing barriers private market will not bear.

The majority of climate finance is not distributed directly by governments to end users, but rather through banks and government agencies. Bilateral and multilateral financial institutions play a key role in the distribution of climate finance, accounting for approximately 40% of the total.

Because of their characteristics and their deep knowledge of the national context in which they operate, National Development Banks play a key role in creating the type of financial instruments needed to encourage investment by the private sector and they have the potential to promote market development, creating favorable market structures and

provide the necessary financial instruments to leverage financial resources to mobilize private sector investment in sector programs mitigation.

NDBs can play a dual role in this context, complementing and catalyzing private sector investments. Their great knowledge and consolidated relationship with the local private sector place them in a privileged position to understand local barriers to investment, allowing them to design a financing package tailored to the needs of local investors. In addition to providing financial and non-financial instruments to directly engage the private sector and mobilize it, they can also act as security devices to generate market and investments, providing additional incentives for this sector in order to increase their investment. Compared to commercial banks and investment funds, NDBs have greater potential to take risks that stimulate long-term investments.

There are different types of financial instruments that NDBs can use in order to mobilize climate finance¹:

- 1) Grants: grants can be used for a variety of activities in both the pre-investment stage (for technical assistance or subsidizing insurance premiums) and the investment phase (to lower the interest rate);
- 2) Tier 1 Loans: they are direct loans in which the NDB takes part or total credit risk of the project's obligor. In this case the NDB directly provides the credit to a project or a company.
- 3) Tier 2 Loans: these are granted by NDBs to Financial Institutions (commercial banks or other financial intermediaries), so that they can lend them again. The NDBs take the credit risk of the Local Financial Institution directly, whereas the LFIs assume the credit risk of the project.
- 4) Guarantee funds to cover part of the risks: many time guarantee funds are brought by the State to incentivize the intervention of the NDB in more risky sectors.
- 5) Equity funds: the fund intervenes through a contribution of capital resources in specific companies.
- 6) Funds management: The NDB manages these funds on behalf of the government, given the skills, expertise and reliable systems that enforces.

NDBs cannot operate alone, but they need technical and financial support from their own governments. In this regard, not only the role of NDBs should be strengthened, but also governments should provide them specific support actions such as ensuring the necessary

¹ Smallridge D., Buchner B., Trabacchi C. et al., 2013, *El rol de los bancos nacionales de desarrollo en catalizar el financiamiento climático internacional*, BID, New York

resources to develop their internal capacity, providing technical support and capacity building in order to develop green financing lines².

Therefore, in order to improve green financing, it is important to strengthen the capacity of development banks to invest in green finance, by promoting the creation of “green programs” and “green portfolio” within the banks, by working on a clearer definition , measurement and monitoring of “green finance”; to strengthen the governance of development finance by putting in place the proper monitoring systems to evaluate the social and environmental impacts of both green and non-green financial flows; to increase the operational capacity of development banks and to develop and scale up ‘green bond’ programs³.

2. Agricultural investment projects and their impact on mitigation and adaptation



Agricultural investment projects need to take into consideration the impact they produce on climate mitigation and adaptation. For this reason it is important to understand the difference between these two concepts.

² De Olloqui F., 2013, *Bancos públicos de desarrollo: ¿hacia un nuevo paradigma?*, BID

³ Yuan F., Gallagher K. P., 2015, *Greening Development Finance in the Americas*, Global Economic Governance Initiative, Boston University.

Mitigation to Climate Change is a human intervention to reduce the sources or enhance the sinks of greenhouse gases. The goal of mitigation is to “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”⁴. For example those initiatives that avoid dangerous human interference with the climate system, and that promote the protection of natural carbon sinks like forests and oceans, or creating new sinks through silviculture or green agriculture.

Climate **adaptation** refers to the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. The IPCC defines adaptation as the, “adjustment in natural or human systems to a new or changing environment. Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”⁵ Adaptation seeks to lower the risks posed by the consequences of climatic changes. The goal is to reduce our vulnerability to the harmful effects of climate change (like sea-level encroachment, more intense extreme weather events or food insecurity).

While adaptation actions are necessary in the short-term for limiting potential risks of the unavoidable climate change damages, mitigation actions are necessary for limiting climate change damages in the long-term by reducing anthropogenic emissions or by enhancing carbon sinks.

There are also significant differences in the policy nature underlying adaptation and mitigation actions. The benefits of adaptation choices will be realized almost immediately but will matter most under moderate climate change, perhaps up to about mid-century. By contrast, benefits of mitigation may only be realized decades from now, becoming relevant towards the end of the century.

Another important concept to acknowledge is **resilience**. Resilience is the ability of people, communities or systems that are confronted by disasters or crises to withstand damage and to recover from them in a timely, efficient and sustainable manner. This includes protecting,

⁴ IPCC, 2014, *Summary for Policymakers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

⁵ IPCC, *Glossary*, Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability, (Available at: https://www.ipcc.ch/publications_and_data/ar4/wg2/en/annexessglossary-a-d.html)

restoring and improving food and agricultural systems under threats that impact food and nutrition security, agriculture, and food safety/public health.

Knowing the different aspects of climate change and the options for mitigation and adaptation will allow for well-informed decision-making by farmers, policymakers and practitioners. The following chapter will show how climate investment projects in the agricultural and forestry sector can have an impact on climate mitigation and adaptation. For this purpose, a set of mitigation and adaptation options will be presented hereby, and suggestions on GHG effects, that might need to be considered in order to improve climate resilience, will be highlighted.

A. Agricultural Mitigation options

Annual crop management: Project activities to improve crop production are quite diverse, and may have diverse impacts on GHG sinks and sources. Sustainable land management practices (e.g., changes in crop type or variety, nutrient management, water management, crop residue management, tillage practices) may have direct effects on soil carbon stocks. They may also directly affect N₂O emissions from organic manure or synthetic fertilizers, by increasing nitrogen use efficiency and reducing emissions to the environment. Where crop residues are burned, improved management of crop residues may reduce N₂O and CH₄ emissions from burning and also increase soil carbon stocks. In wet rice production systems, the main source of GHG emissions is CH₄, which may be affected by changing irrigation practices. Agroforestry practices may also directly affect woody biomass carbon pools.

Some cropland management practices may increase project emissions, for example if use of synthetic fertilizers, agricultural machinery or pumped irrigation water is increased. Energy used in irrigation pumping will either cause direct emissions (e.g., if diesel pumps are used) or indirect emissions (e.g., if electricity is the main energy source), and it may be determined whether off-site emissions in production of electricity and other agricultural inputs are included in the scope of the GHG assessment.

Grassland and livestock management: Grasslands and other grazing lands are very diverse, both in their initial vegetation types and in their responses to management practices. Where grassy vegetation is dominant, improved management or restoration may primarily be expected to impact on soil carbon pools.⁶ Where bushes or trees are common, the main

⁶ For additional information, see: FAO, 2009. Grassland carbon sequestration: management, policy and economics, *Integrated Crop Management Vol. 11–2010*, Rome. (available at: <http://www.fao.org/docrep/013/i1880e/i1880e00.htm>)

impacts may be on woody biomass carbon pools. Changes in livestock density will affect CH₄ emissions from enteric fermentation and N₂O and CH₄ emissions from manure deposited on pasture. Improved availability and quality of forage after adoption of improved grassland management, or improved livestock management and feeding practices, may also affect CH₄ emissions from livestock enteric fermentation.

However, in extensively grazed systems, because of low livestock densities, these effects may be relatively small. In intensive livestock systems, improved livestock management and feeding practices may affect both CH₄ emissions from enteric fermentation and N₂O and CH₄ emissions from manure management, especially if manure management systems change (e.g., with a shift from grazing to stall-fed systems). Where animal dung is an energy source, change in grazing or manure management practices may also have direct effects on household energy use. Changes in fodder and feed production on-farm will affect direct GHG emissions from land use and crop cultivation.

Table: Main direct GHG effects of common types of activity promoted by AFOLU projects⁷

Types of activity promoted by AFOLU projects	Main carbon pools and GHG sources directly affected	Main GHGs directly affected
A1 Reduction in rate of deforestation	Above- and below-ground woody biomass carbon; forest soil carbon	CO ₂
A2 Reduction in forest degradation	Above- and below-ground woody biomass carbon	CO ₂
A3 Adoption of improved cropland management	Soil carbon	CO ₂
A4 Introduction of renewable energy and energy saving technologies	Fuel combustion, wood or animal manure used in energy production	CO ₂ (CH ₄ and N ₂ O for animal dung)
B1 Improved animal production	Enteric fermentation	CH ₄
B2 Improved management of livestock waste	Livestock waste management, replaced energy sources	CH ₄ and N ₂ O (CO ₂ for replaced energy sources)
B3 More efficient management of irrigation water in rice	Anaerobic decomposition of organic material in flooded rice paddies	CH ₄
B4 Improved nutrient management	Nitrogen nutrients in fertilizer	N ₂ O
C1 Conservation farming practices	Soil carbon	CO ₂
C2 Improved forest management practices	Above- and below-ground woody biomass carbon	CO ₂

⁷ Table from the draft working document on *Guidance for Standardized GHG Assessment of AFOLU Projects*, by Wilkes A., Bockel L., Grever U., 2015.

C3 Afforestation and reforestation	Above- and below-ground woody biomass carbon; forest soil carbon	CO ₂
C4 Adoption of agroforestry	Above- and below-ground woody biomass carbon	CO ₂
C5 Improved grassland management	Soil carbon	CO ₂
C6 Restoration of degraded land	Soil carbon	CO ₂
D1 Increased livestock production	Enteric fermentation	CH ₄
D2 Increased irrigated rice production	Anaerobic decomposition of organic material in flooded rice paddies	CH ₄
D3 Increased fertilizer use	Nitrogen nutrients in fertilizer	N ₂ O
D4 Production, transport, storage and provision of agricultural chemicals	Fuel combustion and energy use	CO ₂
D5 Increased electricity consumption	Fuel combustion	CO ₂
D6 Increased fuel consumption	Fuel combustion	CO ₂
D7 Installation of irrigation systems	Fuel combustion and energy use, embodied emissions in cement or steel production	CO ₂
D8 Building other infrastructure	Fuel combustion and energy use, embodied emissions in cement or steel production	CO ₂
E1 Timber logging	Above- and below-ground woody biomass carbon	CO ₂
E2 Cropland expansion	Above- and below-ground woody biomass carbon in forest	CO ₂
E3 change in crop residue management	Soil carbon	CO ₂

Perennial crops and agroforestry: Trees in agricultural systems, whether perennial crops or other agroforestry systems, may be expected to primarily have direct effects on woody biomass carbon pools, but soil carbon pools may also be affected.⁸ Perennial tree crops are often intercropped with other crops or vegetation, and project activities to improve perennial tree crop management may also impact on the crop structure and management of accompanying crops, having direct effects on related GHG sinks and sources. Project activities to expand the area under perennial tree crops may involve biomass burning for clearing, causing N₂O and CH₄ emissions, and displacing prior agricultural activities (e.g.,

⁸ For additional information, see e.g.

http://library.uniteddiversity.coop/Permaculture/Agroforestry/Carbon_Sequestration_Potential_of_Agroforestry_Systems-Opportunities_and_Challenges.pdf and http://worldcocoafoundation.org/wp-content/files_mf/somarriba2013environmentsustainabilityagroforestrycarbon.pdf

annual crops, livestock grazing), potentially causing leakage emissions. Agroforestry systems closely integrate trees with crop production, and agroforestry activities may affect annual crop management.

Project activities to reduce deforestation and forest degradation: In general, activities to reduce deforestation and forest degradation may be expected to primarily have direct effects on forest carbon pools (i.e., above- and below-ground woody biomass, litter and dead wood, soil carbon, non-tree vegetation and harvested wood products). Depending on site-specific conditions, the main GHG effects may be expected to be on above- and below-ground woody biomass.⁹ If forest fires are a major issue in the project region, project activities to reduce the occurrence of forest fires may also directly affect N₂O and CH₄ emissions from biomass burning. Globally, agriculture is the main proximate driver of most deforestation.¹⁰ In some regions, commercial agriculture is the most important driver, while in others subsistence agriculture is the main driver. Commercial timber extraction and logging are responsible for forest degradation and deforestation in some areas, while in others fuel wood collection, charcoal production and possibly also livestock grazing in forests are important drivers of deforestation and degradation.

Afforestation and reforestation: In general, afforestation and reforestation activities may be expected to primarily have direct effects on forest carbon pools (i.e., above- and below-ground woody biomass, litter and dead wood, soil carbon and non-tree vegetation).¹¹ Depending on site-specific conditions, the main GHG effects may be expected to be on above- and below-ground woody biomass. Afforestation and reforestation will most likely affect land use in the targeted sites, and may induce land use change. Direct effects of land use change may include loss of biomass carbon in vegetation existing prior to afforestation or reforestation. Land clearing by biomass burning may also cause N₂O and CH₄ emissions. Other consequential effects may include land use change outside the newly planted forest locations, such as leakage emissions due to displacement of prior land uses (e.g., livestock grazing, fuel wood collection, timber harvesting or agricultural production).¹²

⁹ For additional information, see e.g. <http://theredddesk.org/sites/default/files/resources/pdf/Module%20EF-D.%20Emissions%20Factors%20for%20Deforestation.pdf>

¹⁰ Kissinger G. et al., 2012, *Drivers of deforestation and forest degradation: a synthesis report for REDD+ policy makers*. (available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/66151/Drivers_of_deforestation_and_forest_degradation.pdf)

¹¹ For additional information, see e.g. <https://cdm.unfccc.int/filestorage/e/x/t/extfile-20140929185122152-draft-field-manual.pdf/draft-field-manual.pdf?t=b2J8bnlraWZ6fDCH7SEcoQL3wuZSSURneD2P>

¹² For additional information on leakage, see e.g. <https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-15-v2.0.pdf>

Forest management: Project activities to support sustainable forest management, change practices or harvest regimes or other forest management activities may be expected to primarily have direct effects on forest carbon pools (i.e., above- and below-ground woody biomass, litter and dead wood, soil carbon, non-tree vegetation, and harvested wood products).¹³ Community-based forest management initiatives may also affect prior forest uses, such as fuel wood collection, charcoal production, livestock grazing, timber harvesting or agricultural production.

Infrastructure: Improvements in agricultural infrastructure are often critical components of initiatives to support agricultural and rural development. Construction of roads, buildings and facilities and irrigation systems all involve direct emissions from energy use by machinery in the construction process, and also cause indirect emissions in the production of cement, steel and other inputs to the construction process.¹⁴ It should be determined whether these indirect effects should be included in the scope of GHG assessment.

Agribusiness support: Support to agribusiness is an important type of intervention to support the development of commercial agriculture. Investments in agribusiness that increase processing capacity may increase total energy use by project beneficiaries, while investment in more efficient technologies in existing firms may reduce energy consumption. Fuel and energy use are likely to be the main direct emissions affected by project activities supporting agribusiness development.¹⁵ Support to agro-processing may cause changes in agricultural production practices among suppliers and thus consequential GHG emissions, and vice versa, support to agricultural production may also cause increased consequential GHG emissions from product transport, storage and processing by agri-businesses, either as intended or unintended project effects.

In agriculture, Climate Smart Agriculture is emerging as an approach to simultaneously address three intertwined challenges: ensuring food security through increased productivity and income, adapting to climate change, and contributing to climate change mitigation.¹⁶ Climate-smart agriculture aims to improve food security, strengthen resilience to climate change, and reduce greenhouse gas (GHG) emissions by promoting adoption of appropriate practices, developing an enabling policy and institutional environment and mobilizing finance. Because of the close interactions between land uses, climate-smart agriculture

¹³ For additional information, see various methodologies at <http://www.v-c-s.org/methodologies/find>

¹⁴ See <http://siteresources.worldbank.org/INTEAPASTAE/Resources/GHG-ExecSummary.pdf>; <http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter6.pdf>;

¹⁵ See, e.g. Notamicola et al., 2015, *Life cycle assessment in the agri-food sector: case studies, methodological issues and best practices*, Springer Verlag.

¹⁶ FAO, 2013, *Climate-smart Agriculture Sourcebook*. FAO: Rome.

should be implemented through a landscape approach that enables the integrated management of agricultural systems and the natural resources that support ecosystem services affecting all land use sectors. Many options for climate-smart agriculture also reduce GHG emissions per unit land area or per unit of agricultural product or increase carbon stocks in the landscape, and thus contribute to mitigating climate change.

B. Agricultural Climate Adaptation options

Regarding the adaptation and resilience practices which contribute to the resilience to climate change shocks, we will present hereby a list of different options, taken from guidances on “*Resilient adaptation to climate change*”, and a recent FAO ESA methodological Working document “*Climate Resilience Assessment of Agriculture and Forestry Projects and Programmes (CRAAF)*” developed by Professor Speranza of University of Bonn, for appraising the incremental capacity of resilience generated by projects. Due to the wide range of adaptation options, it is important to evaluate these in order to determine which adaptation actions should be promoted or implemented under specific circumstances (Dolan et al. 2001). In the following paragraphs, a series of different management practices to face climate change are presented¹⁷.

Water-linked management practices

Adaptation of rainwater management practices: Since climate change will result in increased frequencies of extreme events (droughts, cyclones, floods), and higher rainfall variability in terms of time, space and amounts, a potential adaptation measure would be to secure water availability for crop and livestock production.

One way of doing this is to harvest rainwater and runoff. At a first glance, inadequate water supply is a major challenge to agro-pastoral systems. In this line, three examples of technics are provided below:

- Sand dams trap sand during flooding thereby blocking extra sub-surface water in the sand bed and thus increases available water for harvesting in dry times.
- Micro-catchments water harvesting techniques (contour bunds) are used for planting crops and trees.
- Rainwater harvesting for crop and livestock production is an old farm management technology that is being re-examined due to its potential to address climate change impacts through stabilizing on-farm water supply.

¹⁷ Speranza C. I., 2010, *Resilient adaptation to climate change in African agriculture*, DIE, Bonn

Adaptation of irrigation management practices: In the absence of water or under conditions of increased rainfall variability due to climate change, irrigation of crops from rivers, lakes and shallow groundwater offer opportunities for adaptation to climate change.

Adaptation of soil management practices

The most limiting input in dryland farming is soil water. Climate change will affect soils by changing soil climate (moisture content, temperature) and affecting soil chemical processes, soil fauna and flora.

Adaptation of soil management to climate change will entail:

- *increasing the infiltration capacity of the soil,*
- *increasing water holding capacity,*
- *improving soil structure and conditions for soil fauna and flora,* thereby increasing natural soil fertility.

Depending on the magnitude of soil degradation, *prevention, reduction and rehabilitation measures* can be implemented. Prevention implies use of Soil and Water Conservation (SWC) measures that maintain natural resources and their environmental and productive function on land that may be prone to degradation:

- *Conservation tillage / Zero-tillage* is practiced in many dryland areas and entails the minimization of soil disturbance and exposure by reducing tillage and using crop residues to cover the soil. Conservation tillage also increases the retention of soil water, improves soil structure and biotic activity, reduces soil loss and increases soil fertility.
- *Mulching*, that is using plant residue to cover soils and that way facilitate their incorporation during tillage into the soils as organic matter (soil organic carbon) is another way to improve soil resilience to climate change.
- *Organic manure and composts* are intended to improve soil fertility and simultaneously enhance soil structure (against compaction and crusting) and improve water infiltration and percolation. Studies show that soils with high humus content contribute to increased crop yields.
- *Terracing* controls run-off down a hillside and depending on where it is practiced can increase soil water storage or enhance drainage in areas of excess rainfall.

Adaptation of crop management practices

Crop management practices affect soil health, soil structure, soil nutrient content and soil climate, and can serve as an adaptation strategy to climate change:

- Crop rotations (temporal diversity) and mixed cropping (within field diversity): well managed and synchronized.
- Crop rotations (for example, growing green manure legumes as fallow crops) help revitalize the soil and reduce the persistence and spread of crop pests and diseases.
- Switching to other/high value crops is one form of adapting to climate change provided the crop is tolerant to heat or to dry conditions.
- Fallowing entails non-cultivation of arable lands for a certain period with the aim to restore soil fertility. This can be in terms of bush fallows or improved fallows. Since the soil surface is covered by the crops, soil loss is reduced and soil structure improved. Improved fallowing can be in form of green manure, that is, plants grown for the purpose of reinvigorating the soil, either to use them as manure or for mulching.
- Biologically fixed nitrogen from legumes (green manure) can be used to adapt to climate change. By growing nitrogen fixing crops, soil fertility can be increased without causing emissions as is the case when using inorganic fertilizers.
- Alley cropping increases nutrient cycling through increased total biomass production with or without fertilizer. Alley cropping can improve nutrient cycling whereby nitrogen-fixing trees are planted in parallel rows to crops. Through alley cropping, biomass production can also be increased. Food crops are then planted in between the rows in the "alley" while the trees protect the soil from erosion and fix nitrogen in the soil.
- Use of organic pesticides and insecticides to address uncommon pests and diseases.

Agro-forestry and reforestation as an adaptation measure

Tree management practices can reduce the effects of climate change on the ecosystem by increasing ground cover, improving soil structure and infiltration, decreasing erosion by water and wind. Water erosion, especially under extreme rainfall conditions and in already degraded land is a major hazard:

- Indigenous and improved agro-forestry, that is, the cultivation of trees with crops, pastures or livestock, can address many challenges that farmers face in a variable climate. Agro-forestry can be another way to reduce competition on the use of crop residues for fodder, mulching and burning. If trees planted can provide fodder for livestock, farmers may be more willing to leave the residues to cover the soil after harvests. Planting trees between crops can help prevent soil erosion, restore soil fertility, and provide shade for other crops.

- *Shelterbelts and windbreaks*, that is, trees planted to block or reduce wind speeds, also maintain soil moisture and reduce evaporation.
- *Live fences*, that is, trees planted around homesteads or cultivated land, aim to protect the enclosure from roaming livestock and in many cases to provide fodder for livestock.
- *Reforestation* is another way to adapt to climate change impacts. By reforesting, degraded land is put into new use thereby offering the local communities access to forest resources.

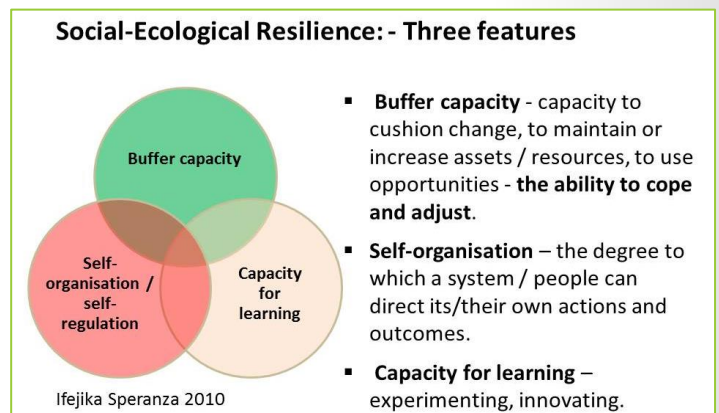
Adaptation of livestock, pasture and rangeland management practices

Climate change will adversely affect pastures and rangelands. Improving the management of livestock production is thus a proposed strategy. Improved management of grazing lands relates to changing control and regulation of grazing pressure. This can be achieved through initial reduction of the grazing intensity through fencing, followed either by rotational grazing, or 'cut-and-carry' of fodder, and vegetation improvement and changes in management.

- *Fodder substitution* addresses fodder shortage. An adaptation to climate change would be to ensure fodder availability for livestock, which can be achieved through fodder banks.
- Grazing and fodder lands can also be conserved through *reforestation, enclosures and zero grazing*.

C. Climate Resilience options¹⁸

Resilience is relative because it depends on interactions between factors and their outcomes. Resilience assessment thus also raises the issue of context specificity as social-ecological conditions are dynamic in time and space. Since the aim is not to have a single measure of climate resilience but to

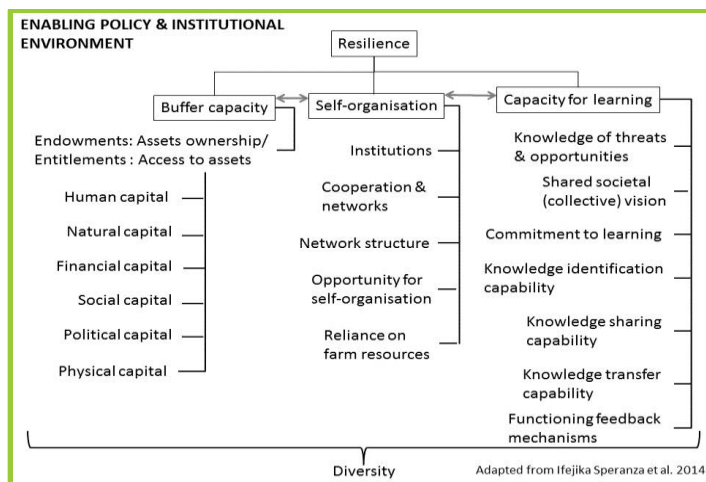


¹⁸ Speranza I. C., Bockel L., 2015, *Climate Resilience Assessment of Agriculture and Forestry Projects and Programmes (CRAAF) – An Expert Assessment Tool*, Centre for Development and Environment, University of Bern, FAO

be able to judge if and in what dimensions a project might contribute to climate resilience, all the resilience dimensions have to be taken into consideration.

Professor Speranza in her study: “*Climate Resilience Assessment of Agriculture and Forestry Projects and Programmes (CRAAF)*”, identifies three characteristic dimensions of resilience (Figure 1): Buffer capacity; Self-organisation; Capacity for learning. The three dimensions of resilience are further decomposed into indicators and sub-indicators (Figure 2).

Figure 2: The indicators of resilience



a) Climatic hazards

As climate change manifests in multi-faceted ways in specific social-ecological contexts, it is important to determine from the outset which climatic hazards or climate-related hazards are prevalent in the project area and by extension examining to what extent the project is likely to contribute to improving climate resilience in regard to the specific climatic hazards (drought, floods, etc.). An additional aspect to access is the extent to which the proposed project or programme is climate-proof.

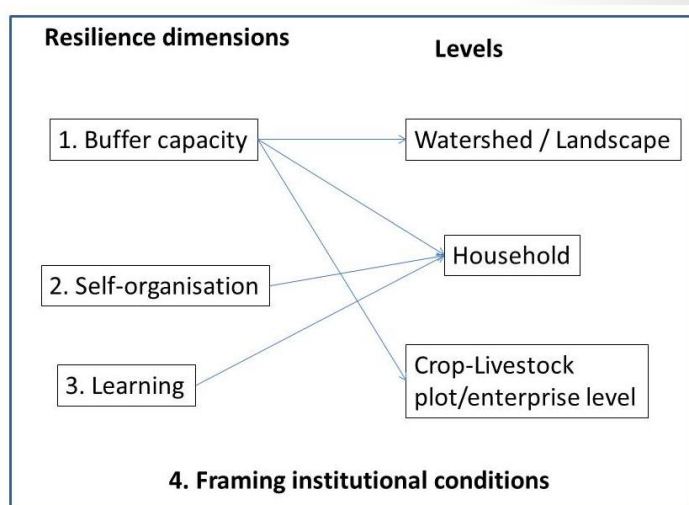
b) Main components of the agricultural system

Generally, an agricultural system can be distinguished into 3 main components: the watershed and landscape level, the plot/enterprise (crop-livestock) level and the operational unit (household) level, which for small-scale agriculture is mostly a household. Analyzing the contributions of projects to the climate resilience at the watershed and landscape level thus entails asking questions about how the project improves the capacity of the watershed to maintain its functions, for example of sequestering carbon through vegetation, storing water or regulating run-off. Similarly at the plot/enterprise level,

livestock and crop conditions, prevalence of crop and livestock diseases as well as other production factors and agronomy are important. At the operational unit level (household), understanding the baseline conditions, for example, in terms of household food availability, income levels, work burden are important for gauging the likely contribution of a project to climate resilience.

c) *Institutional and regulatory environment*

Literature shows that governments have the critical role and duty to foster an enabling environment through adequate policy support and regulation. Thus institutional arrangements (policies, laws and regulations) and socio-political contexts determine to a large extent if farmers or pastoralists have the opportunity in the first place to initiate the practices. To examine the extent to which the institutional arrangements of a target area foster or are likely to foster resilience-building measures the question is: To what extent do government policies, laws and regulations as well as strategic plans address an indicator variable.



To operationalize the livelihood resilience framework for a multi criteria qualitative ex-ante appraisal of projects and national agricultural plans, the resilience framework has been decomposed into questions.

The major question is to what extent the intervention has built or improved climate resilience at the following levels:

1. Buffer capacity of the watershed/landscape
2. Buffer capacity of the household
3. Buffer capacity of crop-livestock production
4. Self-organization of households
5. Capacity to learn of the households

3. A notification system for monitoring and verification (MRV) of the impact of climate-related projects

The adaptation and mitigation of climate change has acquired a central position in government priorities and gradually considered as an essential aspect of any investment decision. As such, it is necessary to estimate the impact of any public investment project in terms of co-benefit or externality on the adaptability and mitigation of climate change. The rapid rise of climate funds and their rational use in the financing of public and private development investments demand a rigorous monitoring and evaluation of impacts both to ensure that the expected benefits of these actions are realized and to better guide investments.

MRV is not a new concept and has been widely used in many contexts at national and international levels to ensure transparency and help in effective implementation of a given activity. In simple terms with regards to the implementation of projects, it is defined as:

- Measurement: collect relevant information on progress and impacts
- Reporting: present the measured information in a transparent and standardized manner
- Verification: assess the completeness, consistency and reliability of the reported information through appropriate fact based review

Measurement enables assessment of the implementation of plans, the achievement of objectives/goals and the taking any necessary corrective steps that may be required. Reporting and verification ensure communication of consistent and reliable information to appropriate authorities in order to facilitate assessment.

MRV is thus a management tool for monitoring achievement of goals and objectives, whether they are of an organization, an institution or part of the governance of a country. Governments typically use MRV to measure a number of economic, social and environmental indicators to enable objective assessment of progress in meeting national development goals as well as the effectiveness of policies, programs and regulations.

Governments also use MRV as a tool for accountability to their constituents. An important aspect of accountability is documentation of benefits of the actual policies and actions deployed and cost-effectiveness of the measures. Such documentation provides governments, budget departments, funding agencies and implementation bodies with the information needed to make objective decisions as well as feedback to improve decision making and implementation strategies.

Monitoring, intended as measurement and reporting, is a continuous or periodic function that uses systematic collection of data, qualitative and quantitative, for the purposes of keeping activities on track. It is first and foremost a management instrument.

MRV should be used during different timeframes: 1) ex ante; 2) mid-term; 3) ex-post. Monitoring may take place on different levels:

- a) **Project and program level**—mainly of implementation processes, including the tracking of activities and financial resources;
- b) **Portfolio level**—mainly of trends in implementation, outputs, outcomes, and progress toward their achievement; and including the monitoring of focal area portfolios, country portfolios, Agency portfolios;
- c) **National and global level**

A good monitoring system combines information from various levels—corporate, portfolio, and project or program—in such a way that it provides a comprehensive picture of performance and allows periodic reports to management that facilitate decision making and learning.

Aside from being an international requirement under the UNFCCC, MRV of mitigation actions is also an important management tool for countries to use to track their progress in moving to a low-emission development path and in achieving sustainable development goals.

MRV systems also provide lessons learned, strengthen national GHG data quality, help identify national priorities, challenges and future opportunities and demonstrate emission reductions to donors.

MRV elements ensure transparency, consistency, comparability, completeness, and accuracy of information with regard to:

- Recognition and visibility of mitigation achievements
- Attribution of quantified impacts to policies
- Accounting of national and international progress
- Identification of gaps and support needs
- Creation of access to public and private finance.

A core component of MRV is the selection of concise and measurable indicators. The judicious use of indicators is considered to be an important part of monitoring and evaluation efforts since they represent a powerful tool both to reduce the complexity of system description and to integrate complex system information. Moreover, MRV methods need to be cost effective and easy to apply so that they can be used in developing countries where accurate information, and capacity, may be constrained.

Indicators should be specific, measurable, achievable, relevant, and time-bound, characteristics that are denoted by the acronym SMART:

- a. **Specific.** The system captures the essence of the desired result by clearly and directly relating to the achievement of an objective and only that objective.
- b. **Measurable.** The monitoring system and indicators are unambiguously specified so that all parties agree on what they cover and there are practical ways to measure them.
- c. **Achievable and Attributable.** The system identifies what changes are anticipated as a result of the intervention and whether the results are realistic. Attribution requires that changes in the targeted developmental issue can be linked to the intervention.
- d. **Relevant and Realistic.** The system establishes levels of performance that are likely to be achieved in a practical manner and that reflect the expectations of stakeholders.
- e. **Time-Bound, Timely, Trackable, and Targeted.** The system allows progress to be tracked in a cost-effective manner at the desired frequency for a set period, with clear identification of the particular stakeholder group(s) to be affected by the project or program.¹⁹

¹⁹ GEF, 2010. *GEF ME Policy 2010*, Global Environment Facility Evaluation Office, Evaluation Document n.4

4. The EX-ACT MRV Tool

A. What is EX-ACT MRV?

The MRV methodology for monitoring of green agriculture and forestry investments, developed by FAO in collaboration with AFD, is designed to measure both the impact of mitigation and adaptation projects in the AFOLU sector, specifically for groups of projects belonging to NDBs' portfolio. The methodology takes into consideration the aspects of mitigation, adaptation, resilience and economic impact. Mitigation indicators measure the project's impact on emissions of greenhouse gases, while adaptation indicators measure the reduction of vulnerability of people, livelihoods and ecosystems to climate change.

The impact on climate mitigation is reflected through quantitative indicators, derived directly from the EX-ACT tool (Ex-Ante Carbon Balance Tool), developed by FAO in 2009, which is a land-based accounting system, measuring GHG impacts per unit of land, expressed in tCO₂-e per ha and year and aimed at providing ex-ante estimations of the impact of development programmes, projects and policies in the agriculture, forestry and other land use sector on GHG emissions and carbon stock changes, constituting the carbon-balance²⁰.

These indicators are used to obtain and analyze the mitigation impacts in terms of tCO₂ of the project and also the equivalent economic return, which could be an important aspect to consider when attempting, for example, to access payments for environmental services. The dimension of climate resilience is assessed using simple quantitative but also qualitative indicators.

The EX-ACT MRV Tool is a structured MRV (Monitoring, Reporting, and Verification) system which aims to track progress of projects' investments and measure the sustainability of green projects in the AFOLU sector and their impact on climate.

In particular, the tool shows the advantageous relationship costs/benefits in its implementation within the institutional system and the easiness of use. Some of its strong points are i) the capacity to appraise not only the mitigation and adaptation impact, but also

Box 1. Practical tips for the easy use of EX-ACT MRV:

- Only modules that are directly impacted by project activities have to be filled.
- Sophisticated main data needs occur only in the focal areas of the project.
- It is normal that many data entry cells will not be used and remain empty.

²⁰ To know more about the EX-ACT Tool, you can refer to the [EX-ACT Quick Guidance](#)

important economic and social aspects of the projects and the general households' resilience; ii) the possibility to have not only an ex-ante, but also a mid-term and ex-post analysis of the impact of a project or group of projects.

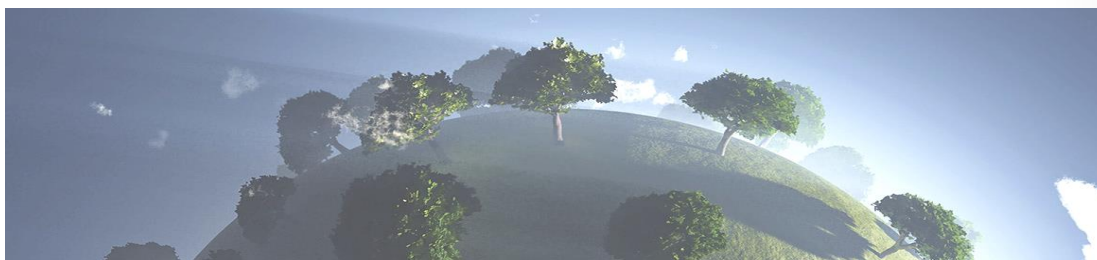
B. Targeted users

The adaptation and mitigation of climate change has acquired a central position in government priorities and gradually considered as an essential aspect of any investment decision. As such, it is necessary to estimate the impact of any public investment project in terms of co-benefit or externality on the adaptability and mitigation of climate change. The rapid rise of climate funds and their rational use in the financing of public and private development investments demand a rigorous monitoring and evaluation of impacts both to ensure that the expected benefits of these actions are realized and to better guide investments.

The identification of investments that are climate smart while leading to equally high socio-economic outcomes, requires an accepted methodology and practical tools for project and programme level greenhouse gas accounting.

The EX-ACT MRV Tool targets investment planners and project designers in International Financial Institutions and national planning institutions, in particular National Development Banks that aim at having a structured MRV system able to track their progress in the financing of green investment projects in agriculture.

Part B: Guide for tool users



5. MRV of Climate Change Impact on Projects Bank Portfolio

Basic Principles

The EX-ACT MRV methodology represents a monitoring system for investment projects in the agricultural sector. It is based on the need for simple mitigation, adaptation and resilience indicators, easy to collect and to aggregate, which develop a measurable and concrete tracking system, in order to elaborate an accurate assessment of the impact of agricultural investments.

The indicators identified are easy to access and to measure versus longer lists of specific and more complex indicators. They are suitable for a monitoring at the level of portfolio, or at the level of project assessment. They can be used to provide ex-ante, mid-term or ex-post monitoring analysis. The approach is based on aggregated indicators which can measure the overall impact performance at the level of the investment portfolio.

The indicators are associated with methods of collection and structured analysis in an Excel file that constitutes an MRV tool designed to simplify the analysis and follow-up by project and aggregation. The file includes a module on Project Data, a module on Carbon Footprint analysis and a module on MRV Results which combines all results.

The Tool has a set of mitigation indicators directly derived from quick GHG accounting appraisal done through a simplified EX-ACT based tool providing results at project level (carbon balance), performance per ha and performance per beneficiary, both per year and for the whole project. It also provides economic values of the benefit generated, allowing to

link results with options of project funding, project subsidy options linked with national climate funds or payments for environmental services. Such indicators are designed to allow at aggregating them for a portfolio of projects.

The Ex-ante appraisal of climate adaptation impact targets the incremental resilience generated by projects. Resilience does not derive from one indicator. As such the relative strengths of the resilience dimensions depends on the social-ecological (including political) framing conditions. While buffer capacity largely captures farmers' endowments and access to various capitals, self-organization and learning include more process-like and practice-like indicators, capturing the agency of the farmers in building resilience. The aim of such resilience appraisal is to judge if and in what dimensions a project might contribute to increase climate resilience of beneficiaries.

5.1 Quantitative Indicators of carbon effects

The MRV methodology is based on the idea of measuring both the impact of mitigation and adaptation generated by the AFOLU projects. Mitigation indicators measure the project's impact on emissions of greenhouse gases, while adaptation indicators measure the reduction of vulnerability of people, livelihoods and ecosystems to climate change.

The impact on the mitigation of climate change is reflected through the following quantitative indicators, derived directly from the EX-ACT tool:

- i. Tons of carbon dioxide equivalent (t CO₂ equivalent) reduced or avoided (including increased removals) over 20 years;
- ii. Mitigation impact in tCO₂ per year;
- iii. Mitigation impact per year per ha;
- iv. Project cost per ton of CO₂ equivalent reduced;
- v. Equivalent value of the impact of mitigation per year (30 US \$ / tCO₂);
- vi. Equivalent value of the impact of mitigation per year per ha (30 US \$ / tCO₂);
- vii. Carbon footprint per ton of production

These indicators allow to obtain and analyze mitigating impacts in terms of the project and also tCO₂ equivalent economic return, which could be an important aspect to consider when seeking, for example, the access to Payments for Environmental Services (also known as Payments for Ecosystem Services or PES).

In EXACT MRV tool, these mitigation indicators appear as follows:

Climate Mitigation dimension of the project (s)		
Tonnes of carbon dioxide equivalent (t CO2eq) emitted (+) / reduced or avoided (-) on 20 years	30,220	Tco2
GHG impact per year in TCO2	1,511	Tco2/ year
Mitigation impact per year per ha	167.89	TCO2/ha
Equivalent project cost per Ton of CO2 reduced	0.00	US\$/TCO2
Equivalent value of mitigation impact per year (US\$ 30/TCO2)	0.00	US\$/year
Equivalent value of mitigation impact per year per ha (US\$ 30/TCO2)	0	US\$/year / ha
Carbon footprint per ton of production	0.48	TCO2/ Ton of product

5.2 Quantitative Indicators of Resilience to Climate Change

EX-ACT MRV quantitative appraisal allows also at deriving some quantitative indicators for resilience generated either in terms of areas or households benefiting from increased resilience:

- i. Increase of hectares of land managed through resilient practices to climate change;
- ii. Hectares with improved coverage of trees and vegetation (reduction of landslides, erosion and flood resistance);
- iii. Hectares with enhanced carbon content in the soil (resilience to drought and erosion reduction);
- iv. Number of households benefiting from improved resilience of watersheds and land to climate shocks;
- v. Number of households benefiting from improved resilience of farming systems;
- vi. Number of households benefiting from improved physical, social and financial capital;
- vii. Number of households benefiting from improved self-organization and learning abilities.

In EXACT MRV tool, these resilience indicators appear as follows:

Climate Resilience dimension of project (s)		
increase in hectares of land managed under climate-resilient practices	5	ha
Number of hectares with improved tree and vegetal coverage (land slide, flood resilience)	0	ha
Number of hectares with increased soil carbon (drought and erosion resilience)	5	ha
Number of HH having become more climate resilient	1	HH

5.3 Qualitative analysis of resilience factors: Global Incremental Resilience Index (GIRI)

A more thorough assessment of the adaptation is based on a multi-criteria analysis of different dimensions of resilience issued from a FAO methodical study work (Chinwe Ifejika Speranza). The three identified resilience dimensions are: buffer capacity; self-organization; learning capacity. These three dimensions of resilience are based on a series of indicators deducted from the project profile. The buffer capacity differs in the three levels of analysis in which an agricultural system can be identified: watershed / area level, households parcel level / agro-pastoral production.

Consequently, the resilience index is based on five resilience factors:

- i. The buffer capacity of the watershed, landscape and project area;
- ii. The absorption capacity of climatic shocks of production systems;
- iii. The absorption capacity of climatic shocks on household food security;
- iv. Strengthening the self-organizing ability of households after the project;
- v. Improving the learning capacity of households following the project.

A general index derived from these factors, gives a first estimate of the climate resilience generated by the project, which is measured as very high, high, medium, low, very low.

To assess the impact of the project on each of these resilience factors, different criteria are used.

Every factor is measured through a set of specific qualitative criteria to be answered. For instance, to assess buffer capacity of the watershed, the landscape and the project area, a series of seven questions are proposed: (i) To what extent does the project improve land cover? (e.g. agroforestry, cover crops etc.), (ii) To what extent does the project reduce soil erosion?, (iii) To what extent does the project improve soil conditions (e.g. soil moisture, soil structure etc.)?, (iv) To what extent does the project improve efficient use of water?, (v) To what extent does the project save water?, (vi) To what extent the project area is protected from climate shocks?, (vii) To what extent the project infrastructure - building investments are climate-proof. The complete detail-list of questions is presented in the tables of data entry provided in chapter 6 paragraph G.

Each question of each of the five dimensions will be evaluated by the project team. The group of experts will assign a value from 0 to 4, on the first column, depending on the level of impact the project has on that single aspect.

Prior to this, on the second column, the project team will have to assign a weight, on a scale from 0 to 3, to each question according to the importance given to that aspect in the project and to the relevance it has on the community or region.

5.4 Performance indicators on income and resources (water, energy)

In addition, complementary indicators on income, employment generated and on other environmental aspects are also included in the result set, as we can see from the table below.

Income performance of project		
Total incremental income generated	742500	US\$/ year
Average income per ha	82500	US\$ /Ha
Average Incremental income per Household	742500	US\$/ HH
Other environmental performances		
Volume of water consumption reduced per year	-5400	M3/ year
Renewable energy capacity installed	0	MW/ year
employment generated	144	Addit. Jobs created

These economic values allow to have a better understanding of the benefit generated by the project in terms of general households' resilience.

6. Modalities of Data Entry and analysis on EX-ACT MRV Tool

Project data entry for appraising mitigation impact will use the following screens of **project data** entry format derived from the EX-ACT software. It constitutes a simplified data entry format for mostly small public and private investment projects appraised in tier 1 with a baseline scenario considered as constant (no change).

This should allow to immediately appraise a small investment project, once data entry is completed on the project data module (30 minutes is the estimated time required for entering this information; it can be done by either the designer of the project or the investment manager).

A. Entering general data: Project, climate, soil, financing

First general project information: name, country, region, duration

A series of key indicators, climate, water regime, dominant soil :

Some financial information such as budget, type of funding ...

Field	Value
Project Name	QUINUA ORGANICA
Continent	South America
Municipality	PUNO
Project budget	6,634,000 USD
Duration of the Project (Years)	3
Project area	5 Ha
Project beneficiaries	1 Households
Climate	Tropical Wet
Moisture regime	LAC Soils
Dominant Regional Soil Type	Forest Zone 2
Country	Peru
Region / departamento	Agrobanco
Name of Devt Bank - Fund	Agrobanco
Starting year	2015
Public investment	NO
Private investment	YES
Part of gift	
Part of loan	

Zone 1 = Tropical rain forest Zone 2 = Tropical moist deciduous forest Zone 3 = Tropical dry forest Zone 4 = Tropical shrubland

The first data required to be entered concern general information regarding the project, such as the country, region and duration of implementation and a set of indicators, such as climate, moisture regime and dominant regional soil type, which are needed in order to contextualize the project and to put the basis for the impact calculation.

B. Filling Land Use Change data

In the following screenshot, the data entering regarding land Use Change is presented. Land Use Change in terms of affected area with hectares and initial and final use must be filled in. In « other Land Use Change» fire use in plant residues can also be specified.

For the land-use change :

- Area affected,
- Final Land use.

Land use change can be taken into account by specifying the initial employment, the final use and the surface

Landscape management - Land Use change

Area affected (ha)		Type of land		
Deforestation induced by Project Implementation	0	Final Land use after deforestation	Select Use after deforestation	
Deforestation reduced by project implementation	0	Final Land use after deforestation	Select Use after deforestation	
Reforestation activity due to project	0	Initial Land use before reforestation	Select previous use	
Plantation of perennials- conversion to agroforestry	0	Initial land use before plantation	Annual Crop	Yield
Non forest areas converted to other uses	0	Initial land use before	Select Initial Land Use	Land use after
New irrigated areas installed	0	Type of new irrigation system	Please select	
			Select Final Land Use	T/ha

2.3. Other Land Use Changes

Fill with your description	Initial land use	Final land use	Fire Use? (y/n)	Area transformed
	Annual Crop	Perennial/Tree Crop	NO	0
	Select Initial Land Use	Select Final Land Use	NO	0
	Select Initial Land Use	Select Final Land Use	NO	0

we also specify the fire use in plant residues

C. Entering agricultural activities data: annual crops, perennial and rice

For the EX-ACT sub-module on annual crops, it is essential to differentiate between the following improved practices, which contribute to fix carbon in the soil:

- Improved agronomic practices comprise all practices that may increase yields and thus generate higher quantities of crop residues. Examples of such practices reported by Smith et al. (2007) are the use of improved crop varieties, extending crop rotations, and rotations with legume crops.
- Improved nutrient management includes the application of fertilizer, manure or biosolids in a way that improves either efficiency (adjusting application rate, improving timing and location) or diminishes the potential losses (forms of fertilizer with slow release rate or nitrification inhibitors).
- Improved tillage and residue management comprises the adoption of tillage practices of less intensity ranging from minimum tillage to no-tillage. It may include

or not include mulching of crop residues and thus also comprises a key element of conservation agriculture.

- Enhanced water management consists of enhanced irrigation measures that can lead to an increase in productivity and hence augment the quantity of residues.
- Manure application: Manure or Biosolids application to the field as input.

The farming practices can be specified (yes / no) both on traditional and improved crops by the project, as shown below with 5 ha of traditional cultures transformed into organic Quinoa.

Farming - Agriculture practises									Yield per ha (t)	Year 0 Area (ha)	with project Area (ha)
Management options in Annual crops:		Improved agronomic Practices	Nutrient management	NoTill /residues management	Water management	Manure application	Burning residues				
trad crops		?	?	?	?	?	NO		5	5	
organic Quinoa		Yes	?	?	?	Yes	NO				
description 3		?	?	?	?	?	NO				
description 4		?	?	?	?	?	NO				
description 5		?	?	?	?	?	NO				
Total area									5	5	
Perennial systems remaining perennial systems (total area must remain constant)		Residue/ biomass burning	Yield (t/ha/yr)	Area Year 0	Area with project						
Enter description of perennial system		NO		0	0						
Tradit coffee- cacao systems		NO		0	0						
Improved shadow cacao and coffee systems		NO		0	0						
total area						0					
Flooded Rice systems remaining Flooded Rice systems (total area must remain constant)		Cultivation period (days)	Water regime in cropping season	Water regime before cropping	Organic amend Type	Yield (t/ha/yr)	Area year 0	Area With project			
Rice 1		150	Please select water regime	Please select pre-season water regime	Please select type of Organic Amendment		0	0			
Rice 2		150	Wetland and deep water	Non flooded pre-season >180 days	Please select type of Organic Amendment		0	0			
Rice 3		150	Please select water regime	Please select pre-season water regime	Please select type of Organic Amendment		0	0			

D. Entering Livestock and Grassland Management data

For the grassland module users collect data on the size and state of degradation of grassland, the grass yield, practices of grassland burning and the time dynamic of changes in the degradation state of the respective grassland area. The livestock part of the module requires information on the type and number of livestock and the percentage of herds that receive improved feeding practices, dietary additives that reduce CH₄ emissions (Ionophores, vaccines, bST, etc.) or are subject to improved breeding practices.

Information on livestock emissions may be refined by specifying the mean annual temperature as well as regional specific values for the emissions of CH4 and N2O from manure management and the CH4 emissions from enteric fermentation.

Livestock and pasture management

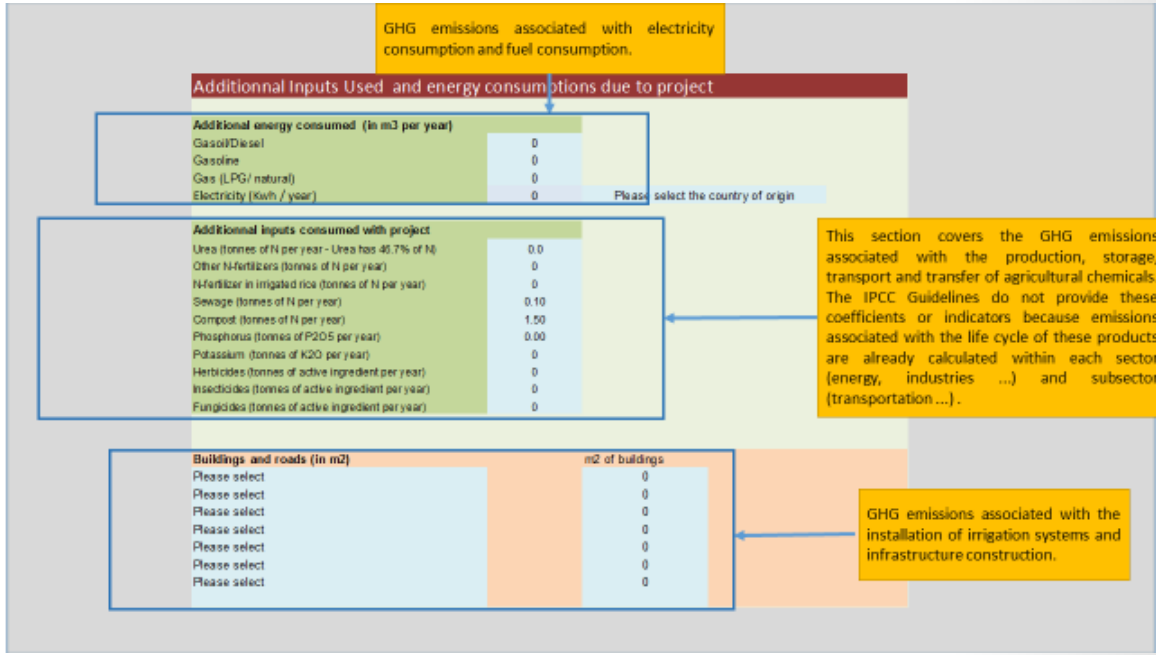
Livestock categories	Head number (mean per year)		Improved practises with project	
	before project	with project	Feeding % heads	Breeding % heads
Dairy cattle	0	0	0%	0%
Other cattle	0	0	0%	0%
Buffalo	0	0	0%	0%
Sheep	0	0	0%	0%
Swine (Market)	0	0		
Swine (Breeding)	0	0		
Please select	0	0		
Please select	0	0		
Please select	0	0		

Evolution of existing Grassland systems

Describe type of grassland	Current status of pasture	evolution with project	Areas Affected ha
	Severely Degraded	Non degraded	
	Select state	Select state	
	Severely Degraded	Non degraded	
	Non degraded	Severely Degraded	
		subtotal	0

E. Entering inputs and Investments data

The following screenshot presents the module concerning additional data on the inputs used and energy consumptions. This section allows to calculate the GHG emissions associated with the production, storage, transport and transfer of agricultural chemicals and the ones associated with electricity and fuel consumption. In the last part, data regarding the installation of irrigation systems and infrastructure consumption can also be entered.



F. Entering other data required for MRV

Other data concerning aquaculture, water use efficiency, renewable energy, income and labour generated can be included for the analysis, if needed.

Other data required for MRV			
Aquaculture			
Additional Tons of Fish produced per year		0 T/year	
Water use efficiency			
Volume of water consumption reduced per year		0 m3/year	
Fossil Energy use reduction			
Renewable energy capacity installed		0 MW/year	
Additional Income generated			
Banana	6316	US\$/ha	2 Ha
specify agriculture product	0	US\$/ha	Ha
Specify livestock income		US\$/Household	HH benef
specify other Household additional incomes	0	US\$/ Household	HH benef
Additional Labour generated			
Additional Labour	285	Man-days/ ha	0.57 Total 000 MD

G. Filling the series of qualitative resilience criteria

The resilience index is based on five resilience factors: (i) increased buffer capacity of the watershed, landscape and project area;(ii) buffer capacity of crop-livestock production systems; (iii) buffer capacity of household in relation to food security; (iv) strengthening the self-organizing ability of households after the project; (v) improving the learning capacity of households following the project. A general index derived from these factors, gives a first estimate of the climate resilience generated by the project, measured as very high, high, medium, low, or very low. To assess the impact of the project on each of these resilience factors, the specific criteria used are listed below:

<i>by project to be done in light blue cells</i>		Expert group Assessment (0-4)
Buffer capacity of watershed and landscape and project area		
1	To what extent does the project <u>improve land cover?</u> (e.g. agroforestry, cover crops etc.)	0
2	To what extent does the project <u>reduce soil erosion?</u>	0
3	To what extent does the project <u>improve soil conditions (e.g. soil moisture, soil structure etc.)?</u>	0
4	To what extent does the project <u>improve efficient use of water?</u>	0
5	To what extent does the project <u>save water?</u>	0
6	To what extent the project area is protected from climate shocks	0
7	To what extent the project infrastructure - building investments are climate-proof	0
Sub-Result		0

The assessment of the five resilience aspects should be filled by either the team of project design or the team in charge of project implementation. In case of midterm or ex-post evaluation, it could be managed through a participatory appraisal involving beneficiaries or representatives or beneficiaries and other implementing partners.

Buffer capacity of crop –livestock production		(0-4)
8	To what extent does the project <u>reduce crop failure</u> ?	0
9	To what extent does the project <u>improve resistance of crops to pests and diseases</u> ?	0
10	To what extent does the project <u>improve resistance of livestock to pests and diseases</u> ? (e.g. through vaccination)	0
11	To what extent does the project <u>reduce post-harvest losses</u> ?	0
12	To what extent does the project <u>increase practice of mixed cropping/intercropping</u> ?	0
13	To what extent does the project <u>promote on-farm diversity</u> (annuals/perennials, mixed cropping, mixed farm enterprise e.g. livestock-crop)?	0
14	To what extent does the project <u>reduce (crop/livestock) yield variability</u> ?	0
Sub-Result		0
Buffer capacity of households in relation to food security		(0-4)
15	To what extent does the project <u>improve household food availability</u> (e.g. through increased household food production or improved household access to food)?	0
16	To what extent does the project <u>improve household food storage</u> ?	0
17	To what extent does the project <u>improve household income</u> ?	0
18	To what extent does the project <u>increase agricultural production physical assets</u> ?	0
19	To what extent does the project <u>improve access of households to agricultural inputs</u> ?	0
20	To what extent does the project <u>support (existing or new) farmer groups and networks</u> ?	0
21	To what extent does the project <u>increase agricultural skills</u> ?	0
22	To what extent does the project <u>improve access of households to climate-related social safety nets</u> (e.g. climate-index agriculture insurance, cash, vouchers, warehouse receipt systems etc.)?	0
Sub-Result		0

Such criteria are mostly fact-based or action-based to facilitate the answers. They target the content of project actions, project support and specific straight-answer-oriented project aspects.

Self-organisation of households		(0-4)
23	To what extent does the project <u>improve cooperation and networks of farmers</u> (e.g. farmer groups, farmer field schools, farmer organisations etc.)?	0
24	To what extent does the project <u>collaborate with national/sub-national farmer/pastoralist organisations</u> (capacity of farmers/pastoralists to influence decisions)?	0
25	To what extent does the project <u>support farmer-networks across scales</u> (e.g. local farmer groups being connected to national farmer organisations; bridging/linking social capital)?	0
26	To what extent <u>are farmers actively participating in the project</u> ?	0
27	To what extent does the project <u>foster good governance</u> (keeping of records; accounting for exclusion, elite capture and corruption) in farmer cooperation and networks?	0
28	To what extent does the project <u>improve farmer skills to manage groups</u> ?	0
29	To what extent does the project <u>link agriculture value chains</u> ?	0
30	On-farm reliance: To what extent does the project <u>build on local knowledge</u> ?	0
Sub-Result		0

Learning capacity of households		(0-4)
31	To what extent does the project <u>improve farmer knowledge of threats and opportunities to agricultural production</u> (e.g. climate specific awareness programmes)?	0
32	To what extent does the project <u>improve access to extension services</u> ?	0
33	To what extent does the project <u>improve farmer/pastoralist experimentation</u> (e.g. through farmer/pastoralists field schools, climate field schools, exchange visits)?	0
34	To what extent does the project <u>improve access to climate information</u> (e.g. seasonal forecasts adapted for agriculture, workshops)?	0
35	To what extent does the project <u>improve access to market information</u> ?	0
36	To what extent does the project <u>improve access to communication networks</u> (e.g. mobile networking, radio programmes)?	0
Sub-Result		0

H. Set of impact results provided by investment project

MULTI-IMPACT SUMMARIZED RESULTS PER PROJECT

Project impact results are provided as multi-impact report summarized in one-page excel sheet in the MRV Results Module, as follows in the screenshot below.

The results are distinguished according to the different aspects covered by the tool: climate mitigation dimension, climate resilience dimension, resilience index, income performance and other environmental and social performances.



MRV of mitigation and adaptation impact of Agriculture Investments
 FAO-AFD Study on mitigation and adaptation indicators for Development Banks in AFOLU sector 2015

Project:	zero draft Banana Organico Installacion	Year	2015
Bank:	Agrobanco	Budget (US\$)	17235.625
country:	Peru	Households	1
region:		Hectares	2

Climate Mitigation dimension of the project (s)

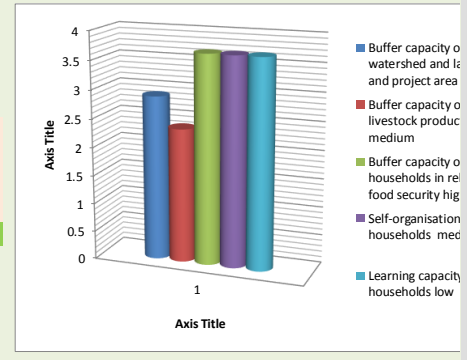
1 Tonnes of carbon dioxide equivalent (t CO2eq) emitted (+) / reduced (-) on 20 years	45	Tco2
2 GHG impact per year in TCO2	2.25	Tco2/ year
3 GHG impact per year per ha	1.12	TCO2/ha
4 Equivalent project cost per Ton of CO2 reduced	0.00	US\$/TCO2
5 Equivalent value of mitigation impact per year (US\$ 30/TCO2)	0.00	US\$/year
6 Equivalent value of mitigation impact per year per ha (US\$ 30/TCO2)	0	US\$/year / ha
7 Carbon footprint per ton of production	0.037	TCO2/ Ton of product

Climate Resilience dimension of project (s)

1 increase in hectares of land managed under climate-resilient practices	2	ha
2 Number of hectares with improved tree and vegetal coverage (land slide, flood resilience)	0	ha
3 Number of hectares with increased soil carbon (drought and erosion resilience)	2	ha
4 Number of HH having become more climate resilient	1	HH

Resilience index of projects

Buffer capacity of watershed and landscape and project area	medium
Buffer capacity of crop –livestock production	medium
Buffer capacity of households in relation to food security	high
Self-organisation of households	medium
Learning capacity of households	low
Global climate resilience generated by project	medium



Income performance of project

Total incremental income generated	12632	US\$/ year
Average income per ha	6316	US\$ /Ha
Average Incremental income per Household	12632	US\$/ HH

Other environmental and social performances

Volume of water consumption reduced per year	0	M3/ year
Renewable energy capacity installed	0	MW/ year
Employment generated	2.28	Addit. Jobs created

DETAILED RESULTS OF GHG IMPACT PER PROJECT

In the following screenshot, the detailed set of GHG results by module is extracted from the EX-ACT MRV tool as a central output of the analysis. This can be found in the Results module. It allows to understand both emission sources and main areas of mitigation.

Project Name	ggg		Climate	Tropical (Wet)		Duration of the Project (Years)	20				
Continent	South America		Dominant Regional Soil Type	LAC Soils		Total area (ha)	2				
Country	Peru		Region	0		Budget (US\$)	17235.63				
Components of the project	Gross fluxes			Share per GHG of the Balance				Result per year			
	Without	With	Balance	CO ₂			N ₂ O	CH ₄	Without	With	Balance
	All GHG in tCO ₂ eq			Biomass	Soil	Other					
	Positive = source / negative = sink										
Land use changes											
Deforestation	0	0	0	0	0	0	0	0	0	0	0
Afforestation	0	0	0	0	0	0	0	0	0	0	0
Other LUC	0	0	0	0	0	0	0	0	0	0	0
Agriculture											
Annual	25	-112	-137	0	-112	-7	-18	1	-6	-7	
Perennial	0	0	0	0	0	0	0	0	0	0	
Rice	0	0	0	0	0	0	0	0	0	0	
Grassland & Livestocks											
Grassland	0	0	0	0	0	0	0	0	0	0	
Livestocks	0	0	0	0	0	0	0	0	0	0	
Degradation & Management	0	0	0	0	0	0	0	0	0	0	
Inputs & Investments	0	182	182			15	167		9	9	
Other (aquaculture...)	0	0	0				0		0	0	
Total	25	70	45	0	-112	15	160	-18	1	4	2
Per hectare	13	35	22	7.5	-55.8	7.5	79.9	-9.1			
Per hectare per year	0.6	1.8	1.1	0.4	-2.8	0.4	4.0	-0.5	0.6	1.8	1.1

Fluxes per component

Balance per component

Total without and with project and balance

Share of the balance per GHG (plus origin for CO2)

MODALITIES OF AGGREGATION BY INVESTMENT BANK PROJECTS PORTFOLIO

Every appraised project will use the same EXCEL format saved as project file. Sets of project indicators could be switched from EX-ACT files to ACCESS or EXCEL portfolio Database. Such portfolio management should be discussed with each Development Bank to assess which cumulated indicators they would expect.

More details on data collection and entry of data can be found in the *EX-ACT MRV User Manual*²¹.

²¹ The full reference list of cited literature and further information can be found in the [EX-ACT MRV User Manual](#)

Annex : EX-ACT MRV Biodiversity impact appraisal

A biodiversity module within the EX-ACT MRV Tool has been recently elaborated and developed by the EX-ACT Team. Herewith we will briefly present, as a first draft, the background and the approach used for the elaboration of the module.

Background

Biodiversity conservation is becoming one of the key targets of environmental management, due to the importance of healthy ecosystems on one hand, and to an increase in the rate of biodiversity loss on the other hand (climate change, pollution, deforestation, etc.), which leads to serious environmental threats.

The need to provide more food for a growing population has led to an intensification of agriculture which has become more and more urgent in recent years, as land suitable for agriculture has been declined.

Biodiversity includes different multi-dimensional aspects (socio-cultural, economic, ecological, etc.). Agricultural intensification, combined with the growing homogenization of the global food system, has led to a range of negative impacts, including biodiversity loss and environmental degradation, decreased dietary and nutritional diversity and social impacts such as increased gender inequalities. The simplification of the world's farming and food systems leaves farmers with a decreasing range of resources to draw on to manage threats such as the risks of crop failure due to pests and diseases, declining soil fertility, or the impacts associated with increasing climatic variability. In order to address these and many other issues, sustainable practices are needed, and agricultural biodiversity is a key component of this²².

Agricultural biodiversity contributes to create sustainable food systems as well as healthy ecosystems. In particular, a new model of agricultural system, based on diversifying farms and farming landscapes, is needed.

Agricultural biodiversity is measured in many ways: linked to healthy diets, sustainable land use, agriculture, climate change adaptation, resilience and biodiversity conservation and it provides variety and variability within and among species, fields and landscapes. Besides reducing negative impacts on the environment, using agricultural biodiversity for sustainable intensification can also lead to virtuous cycles of positive impacts upon the environment and the generation of multiple services and functions. Agricultural biodiversity

²² Mainstreaming Agrobiodiversity in Sustainable Food Systems: Scientific Foundations for an Agrobiodiversity Index – Summary. Bioversity International, Rome, Italy, 2016

can contribute to provide multiple benefits to the whole landscape and sustainable intensification in the following aspects: increasing productivity, yield, stability, pollination, pest and disease control, soil structure maintenance, wild biodiversity conservation and climate resilience. It can also substitute for many external inputs such as inorganic fertilizers and synthetic pesticides²³.

Agricultural biodiversity's contribution to sustainable food systems can be analyzed at four scales: within species, between species, field and farm, and landscape. Within-species diversity refers to the diversity of varieties within a species and can help deliver ecosystem services, such as reducing crop vulnerability to pests and diseases and increasing yield stability.

At the species level, diversity can drive a wide range of ecosystem services, such as providing habitat and resources for pollinators and other wild biodiversity.

Finally, at the landscape scale, agricultural biodiversity can provide ecosystem services, from pollination to human nutrition to carbon sequestration.

Agricultural biodiversity-based strategies are thus important for soil erosion control, climate resilience, pest and disease control, productivity, pollination and wild biodiversity conservation. Examples of strategies include:

- Soil erosion can be controlled by matching crop varieties, species or both to land and soil types, and by selecting deep-rooted crops;
- Climate resilience can be addressed by using crop varieties and species that are well adapted to current or projected future climatic conditions (e.g. drought resistant);
- Integrating multiple elements of different land and water uses (e.g. cropping on land, livestock grazing, fish farming) allows recycling of waste, improved nutrient management and improved pest control, as well as diversifying diets and livelihoods;
- Cropping systems that are more diverse (e.g. mixed crops, retained semi-natural habitats, heterogeneous landscapes) provide greater range of habitats for wild biodiversity than simplified and homogenous cropping systems.

²³ LEAP, 2015. A review of indicators and methods to assess biodiversity – application to livestock production at global scale. Livestock Environmental Assessment and Performance Partnership. FAO, Rome, Italy.

The Biodiversity Approach

Rationale at the basis of the module

The biodiversity module aims at providing a quantitative and qualitative appraisal of the impact that the project has in terms of biodiversity generation. It will guide project managers and decision-makers to understand to which extent their project or program is diverse and sustainable.

The biodiversity module within EX-ACT is based on data and information within the tool which are related to biodiversity and which could have an impact on it. Therefore it derives some useful quantitative and qualitative indicators which are conducive to enriching / improving biodiversity.

The analysis is built upon the data already entered into the EX-ACT appraisal. Therefore it easily derives automatically the biodiversity impact and performance of a project from the results coming from EX-ACT.

The module is based on a series of confirmed statements with regard to biodiversity from which a set of indicators is derived:

- Increasing forest and agroforestry areas within a locality-watershed- project area should increase biodiversity;
- Annual crops with compost, manure, crop diversity, rotation, no tillage contribute to high biodiversity; increasing areas of application of such practices will increase biodiversity...
- Decrease of pesticide and increase of compost use do contribute to increase biodiversity;
- Improving pasture does generate both soil carbon and biomass which both drive to enriched biodiversity;
- Additional biomass is supportive to biodiversity;
- Incremental soil carbon does increase biodiversity in soils;
- Scaling up effect of increased biodiversity with wider improved areas.

The biodiversity module within EX-ACT

The module, which is built on IF functions, gives two different types of results: quantitative and qualitative, based on a rating to be given to the indicators. The first set of indicators refer to the amount of area in which the activities implemented have an influence on biodiversity. For example: reforestation, agroforestry and practices implemented on annual

crops impact biodiversity on a certain amount of area. This refers to the relationship between biodiversity and land use.

The second set of indicators are connected with the use of inputs, biomass and soil carbon generated, which can contribute to increase or decrease biodiversity.

Biodiversity impact dynamic analysis	EX-ACT expert-system appraisal	
Incremental forest- agroforestry area with improved biodiversity	2410	Ha
Incremental annual crop areas with improved biodiversity	11595	Ha
Incremental area with improved soil carbon /forestry biomass	14005	Ha
The project did increase the area covered by forest by	2410	ha
Project practises will increase biodiversity in annual crops for	11595	ha
No grassland improvement enriching biodiversity	0	Ha of improved grassland
Total project area with improved Biodiversity conditions	14,005	Ha

As it is shown in the figure above, the first result presents, in quantitative terms, the amount of hectares within the project where the biodiversity conditions have improved.

The second type of result provided refers to the global biodiversity impact which gives a range of the impact of the project on the biodiversity, expressed as “*very bad*”, “*limited positive impact*”, “*medium positive impact*”, “*high positive impact*”, “*very high positive impact*”.

No additional use of compost-sewage to enrich biodiversity	0.00	Tons of addit compost - sewage
Reduced use of pesticide will promote biodiversity	-309	kg of additionnal active pesticide
total additional biomass generated contributing to biodiversity	2,730,771	Tons of additional biomass
total additional soil carbon generated contributing to biodiversity	1,171,720	Tons of additional carbon soil
Part of project area with improved biodiversity	15%	of area with improved biodiversity
Global biodiversity impact	High positive impact	59 /100

The *Global biodiversity impact* is derived from a qualitative assessment based on a weight which can be associated to each indicator in the last column to the right (the rate is from 0 to 3).

Biodiversity impact dynamic analysis	EX-ACT expert-system appraisal			
Incremental forest- agroforestry area with improved biodiversity	2410	Ha	1	3
Incremental annual crop areas with improved biodiversity	11595	Ha	1	3
Incremental area with improved soil carbon /forestry biomass	14005	Ha	1	
The project did increase the area covered by forest by	2410	ha	1	
Project practises will increase biodiversity in annual crops for	11595	ha	1	
No grassland improvement enriching biodiversity	0	Ha of improved grassland	0	2
Total project area with improved Biodiversity conditions	14,005	Ha		
No additional use of compost-sewage to enrich biodiversity	0.00	Tons of addit compost - sewage	0	1
Reduced use of pesticide will promote biodiversity	-309	kg of additionnal active pesticide	1	1
total additional biomass generated contributing to biodiversity	2,730,771	Tons of additional biomass	1	2
total additional soil carbon generated contributing to biodiversity	1,171,720	Tons of additional carbon soil	1	2
Part of project area with improved biodiversity	15%	of area with improved biodiversity	2	3
Global biodiversity impact	High positive impact	59 /100		29

This kind of appraisal allows to measure to which extent the project is able to generate a diverse system contributing to agricultural biodiversity, by taking into account certain activities and management practices which influence biodiversity.



More on EX-ACT MRV Tool

The EX-ACT MRV Tool is based on Microsoft Excel and is freely available from the FAO website:

- EX-ACT Website: www.fao.org/tc/exact
- Free EX-ACT MRV Tool Access: <http://www.fao.org/tc/exact/mrv-ghgguidelines/en/>
- EX-ACT MRV User Manual: <http://www.fao.org/tc/exact/mrv-ghgguidelines/en/>
- EX-ACT Quick Guidance: <http://www.fao.org/tc/exact/user-guidelines/en/>



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