Food and Agriculture Organization of the United Nations

Learning tool on Nationally Appropriate Mitigation Actions (NAMAs) in the agriculture, forestry and other land use (AFOLU) sector

Learning tool on Nationally Appropriate Mitigation Actions (NAMAs) in the agriculture, forestry and other land use (AFOLU) sector

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Mitigation of Climate Change in Agriculture (MICCA) Programme
Food and Agriculture Organization of the United Nations (FAO)

Rome, 2015

Disclaimer

ISBN 978-92-5-108786-2

Contents

Abbreviations and Acronyms

AFOLU	Agriculture, Forestry, and Other Land Use
BUR	Biennial Update Report
CDM	Clean Development Mechanism
CH_4	Methane
CO_2	Carbon dioxide
COP	Conference of Parties of the UNFCCC
CSA	Climate-smart Agriculture
CSO	Civil Society Organizations
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GEF	Global Environment Facility
GLEAM	Global Livestock Environmental Assessment Model
GHG	Greenhouse gases
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
LCDS	Low Carbon Development Strategy
LEDS	Low Emission Development Strategy
LULUCF	Land Use, Land Use Change, and Forestry
MICCA	Mitigation of Climate Change in Agriculture Programme
MRV	Measurement/monitoring, Reporting and Verification
N_2O	Nitrous Oxide
NAMA	Nationally Appropriate Mitigation Action
PES	Payment for environmental services
QA/QC	Quality Assurance/Quality Control
SOM	Soil organic matter
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VCS	Verified Carbon Standard

Nota Bene

Agriculture and AFOLU: For the most part, the tool follows FAO terminology, which uses the term ‘agriculture’ to refer to agriculture, forestry, aquaculture and fisheries. For GHG estimates however, the learning tool follows the categorization used in the 2006 Intergovernmental Panel on Climate Change (IPCC) guidelines, in which agriculture as well as land use, land use change and forestry (LULUCF) are grouped into one sector - Agriculture, Forestry and Other Land Use (AFOLU).

In the LULUCF sector, the focus is on carbon dioxide (CO_2) emissions and removals, whereas in the AFOLU sector, methane (CH_4) and nitrous oxide (N_2O) are also taken into account as many agricultural practices emit these greenhouse gases (GHGs).

Guidance on how to use the tool: The tool includes a number of hyperlinks leading to slides with additional information within the tool or on the external website. To follow these links, the tool must be viewed in full screen mode.

Executive summary

Actions to reduce emissions and remove GHGs in the AFOLU sector provide valuable opportunities to build on and increase synergies with activities related to sustainable intensification, improved farm efficiency, climate change adaptation, food security and rural development (Module 1).

NAMAs are a fast-emerging vehicle for countries that want to voluntarily carry out actions to reduce GHG emissions in the context of national sustainable development (Module 2). In-depth or fast-track assessments can be used for NAMA prioritization (Module 3). FAOSTAT, EX-ACT, GLEAM and Collect Earth are supporting tools for NAMAs implementation in the AFOLU sector. At all stages of NAMA development the engagement of all stakeholders is vital.

Developing monitoring systems that provide robust activity data is a fundamental requirement for successful MRV processes (Module 4). While the Tier 1 methodological level is the starting basis of a reporting process, for significant GHG sinks and sources Tier 2 and Tier 3 methodological levels are encouraged. Tier 1 data can provide needed information for verification. To receive financing for NAMAs development, a NAMA proposal should show the effectiveness of the proposed actions, indicate that they are socio-economically and environmentally sustainable, and provide robust operational and financial plans (Module 5).

Despite the challenges facing NAMAs in the AFOLU sector, many countries are advancing with their NAMA planning. Other sectors may be more advanced with regards to NAMAs and the implementation of mitigation actions. It is important to learn lessons from these sectors, especially concerning MRV.

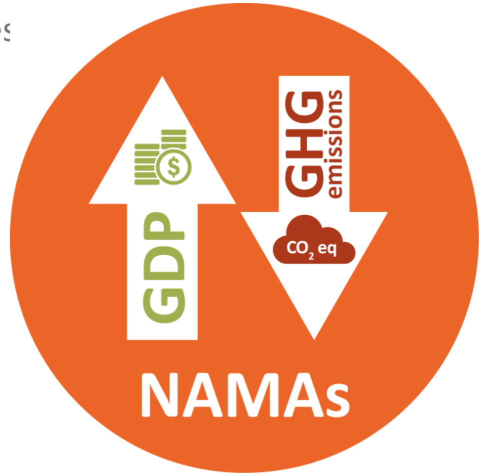
Structure of the tool

This tool has five modules. The modules do not need to be followed in chronological order. Each module can be studied individually.

Module 1	**Climate change and agriculture**: Module 1 provides an overview of the impacts of climate on agriculture and the AFOLU sector's contribution to the total global net GHG emissions. The module also indicates the synergies between climate change mitigation, food security, rural development and climate change adaptation.
Module 2	**Overview of Nationally Appropriate Mitigation Actions (NAMAs)**: Module 2 introduces the concept of NAMA and situates NAMAs in the context of global climate change negotiations. Examples of NAMA initiatives in the agriculture sector are also given.
Module 3	**Step-by-step NAMA development**: Module 3 describes the step-by-step processes for developing NAMAs. It covers the preparations for concept notes and proposals. It also addresses topics such as feasibility, technological choices and the differences between a fast-track NAMA development and a more thorough NAMA preparation process.
Module 4	**Measurement, Reporting and Verification (MRV) for an AFOLU NAMA**: Module 4 looks at different aspects of monitoring systems and MRV processes for NAMAs. It reviews how MRV systems assess a NAMA's impact on the GHG emissions and the sustainable development benefits it delivers.
Module 5	**Financing mechanisms and sources**: Module 5 focuses on NAMA financing questions. It covers domestic, international, public and private financing and elaborates different criteria attached to NAMA financing by donors, climate funds and financing institutions.

Introduction: Rationale for and objective of the tool

Agriculture is a crucial socio-economic sector. In many developing countries it accounts for a **significant portion of the gross domestic product (GDP)** and employs a large part of the population. Agriculture is central to food security, makes a major contribution to livelihoods and employment and is a driver of economic growth. Climate change is likely to have a strong impact on agriculture and poses a threat to food security.



Agriculture also generates a substantial share of the total GHG emissions in many developing countries. **Actions to reduce net GHG emissions in the AFOLU sector provide valuable opportunities to build on and increase synergies with activities related to sustainable intensification, improved farm efficiency, climate change adaptation, food security and rural development.** The **NAMA framework** is one of the possibilities that exists to unite actions to reach these goals into one coherent package.

NAMAs provide an opportunity for countries to maintain and enhance agricultural productivity while reducing GHG emissions.

NAMA is a relatively new concept in the agriculture sectors. For this reason, substantial awareness raising and readiness building is needed. **The objective of this learning tool is to guide national policy makers, advisers, researchers, private sector and other stakeholders in developing countries to identify, design and implement NAMAs.**

MODULE 1: Climate change and agriculture

Learning outcomes

At the end of this lesson, you will:

1. be familiar with the impacts of climate change on agriculture;
2. have an overview of the contributions the AFOLU sector make to total global GHG emissions; and
3. recognize the synergies that exist between climate change mitigation, food security, rural development and climate change adaptation.

Table of contents Module 1

1.1. Food security and climate change

The world's agricultural sectors face many challenges in meeting global food requirements .

805 million people are chronically undernourished –
about one in nine of the world's population (FAO *et al.,* 2014).

Climate change affects the four dimensions of food security:

- food availability,
- food accessibility,
- the stability of food supply, and
- the ability of consumers to adequately utilize food including food safety and nutrition.

Smallholder farmers, forest dwellers, herders and fishers will be the most affected by climate change because of their limited capacity to adapt to its impacts.

1.1.1. Examples of climate change impacts on agriculture

Crops and livestock production are affected by:
- increasing temperatures,
- changing precipitation patterns and
- more frequent and intense extreme weather events.

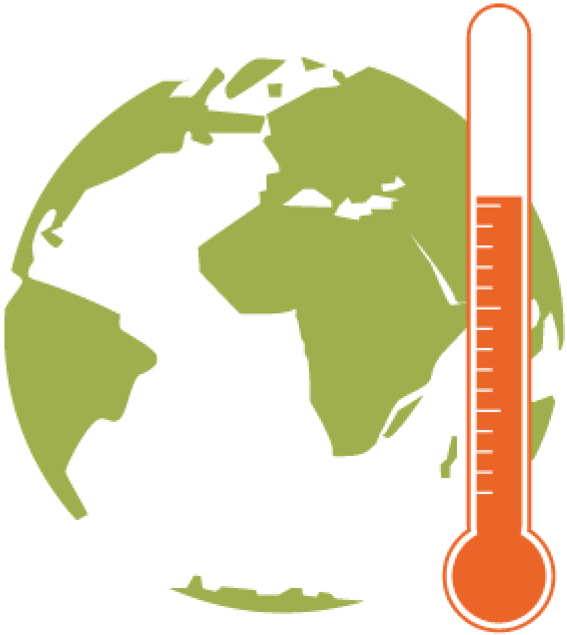
Fisheries production systems are affected by:
- increasing water temperatures,
- decreasing pH and
- changes in current sea productivity patterns.

Examples of climate change impacts and consequences on agriculture include:

- yield reductions, animals and crops shifting to new areas, declines in agro-biodiversity and ecological services;
- loss of agricultural incomes;
- humanitarian aid dependency; and
- increases in food prices, trading costs and other costs.

1.2. Rationale for future actions: avoid global warming

Food production will need to increase **by 50–70 percent** by 2050 to meet the needs of the expanding global population.



Growing population and changes in food consumption patterns (e.g. higher demand for milk and meat)

will lead to

increased GHG emissions from agriculture.

At the same time,

to avoid the most serious impacts of climate change, major GHG emission cuts are required to hold the increase in global average temperature below 2 degrees Celsius above pre-industrial levels.

The reduction of GHG emissions:

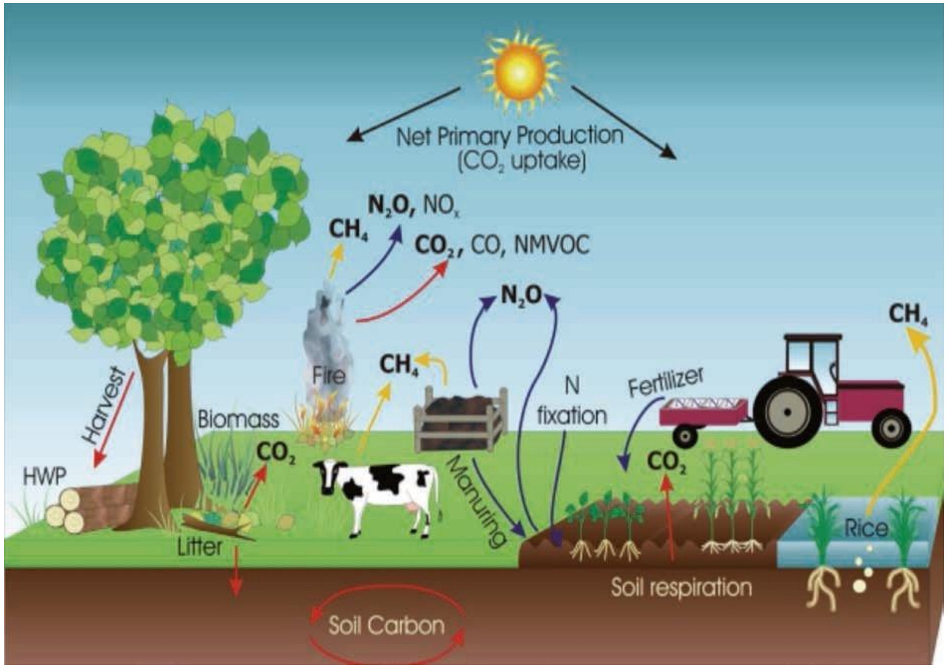
- **limits the impacts of climate change by addressing the its root causes; and**
- **reduces the extent and cost of adaptation to climate change.**

1.3. Main sources of GHG emissions in agriculture and land use

There are a number of sources of GHG emissions in agricultural ecosystems. The main sources include:

Carbon dioxide (CO_2)	• microbial decomposition of soil organic matter (SOM) and dead organic matter (i.e. dead wood and litter) • deforestation • burning of organic matter
Methane (CH_4)	• enteric fermentation from livestock • methanogenesis under anaerobic conditions in soils (e.g. during rice cultivation) and manure storage • burning of organic matter
Nitrous oxide (N_2O)	• nitrification and denitrification due to application of synthetic fertilizers and organic amendments (e.g. manure) to soils • burning of organic matter (IPCC, 2006).

GHG sources in AFOLU



Source: IPCC, 2006.

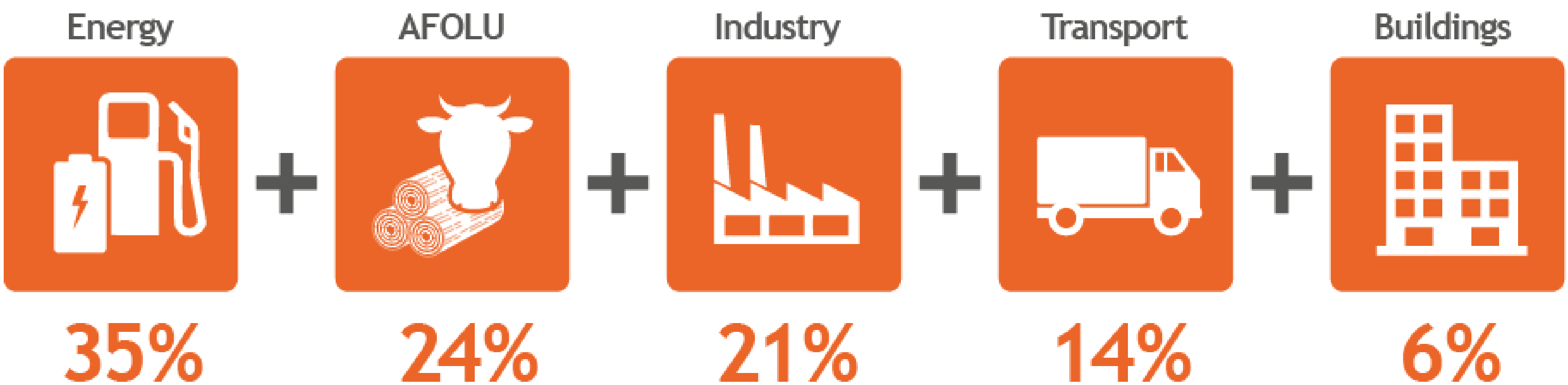
Along with CO_2, N_2O, CH_4 emissions, burning of organic matter generates emissions of GHG precursors, such as:

- oxides of nitrogen (NOx),
- non-methane volatile organic compounds (NMVOC) and
- carbon monoxide (CO).

Volatilization losses of ammonia and NOx from manure management systems and soils leads to indirect GHG emissions.
Harvested wood products (HWP) also contribute to CO_2 emissions and removals.

1.4. Direct GHG emissions from AFOLU

Distribution of GHG emissions by economic sector



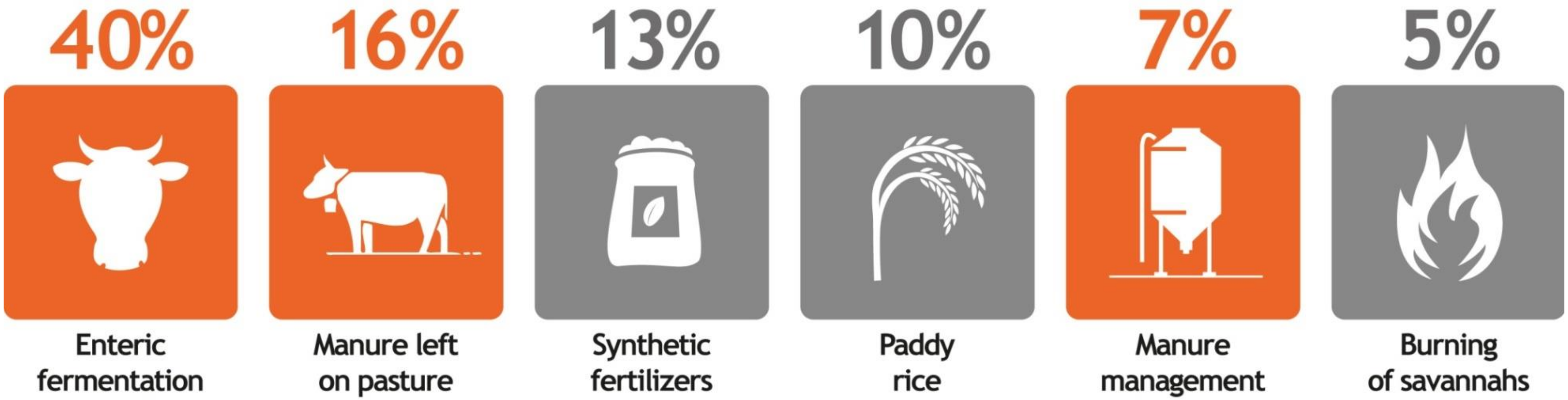
Data source: IPCC, 2014a.

GHG emissions from the AFOLU sector account for **24 percent** of the total emissions (IPCC, 2014a). The AFOLU sector is the **largest emitting sector after the energy** sector.

1.5. Global GHG emissions from agriculture by source

Agriculture alone contributes **10–12 percent of global GHG emissions** (IPCC, 2014a).

Below is breakdown of agriculture emissions globally by sector:



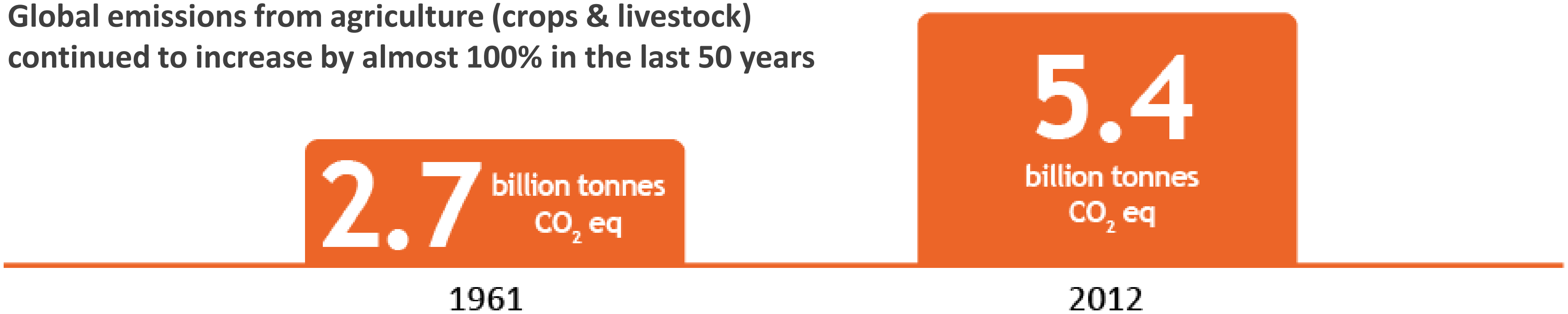
Source: FAOSTAT, 2014.

For further details, click here.

1.6. Increasing GHG emissions from agriculture

Over the last few decades, there has been a significant **increase in global GHG emissions from agriculture**, while emissions from deforestation are decreasing (IPCC, 2014a).

Global emissions from agriculture (crops & livestock) continued to increase by almost 100% in the last 50 years



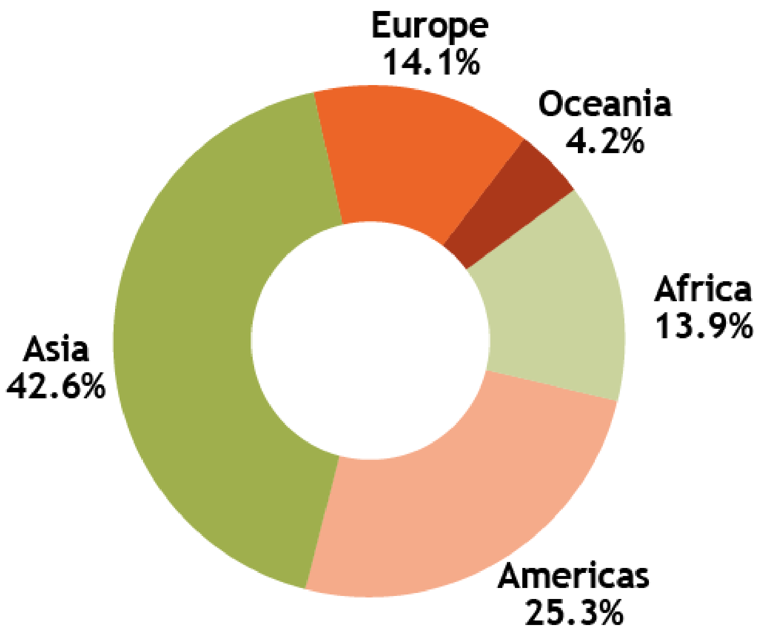
Source: FAOSTAT, 2014.

Examples of increases in emissions from 1961 to 2010	
Source	**Percent (%)**
Synthetic fertilizers	900
Manure (either organic fertilizer on cropland or manure deposited on pasture)	73
Enteric fermentation	50
Paddy rice cultivation	41

Source: Tubiello *et al.*, 2013; FAOSTAT, 2014.

1.7. Net GHG emissions from agriculture by continent

By Average 1990–2010



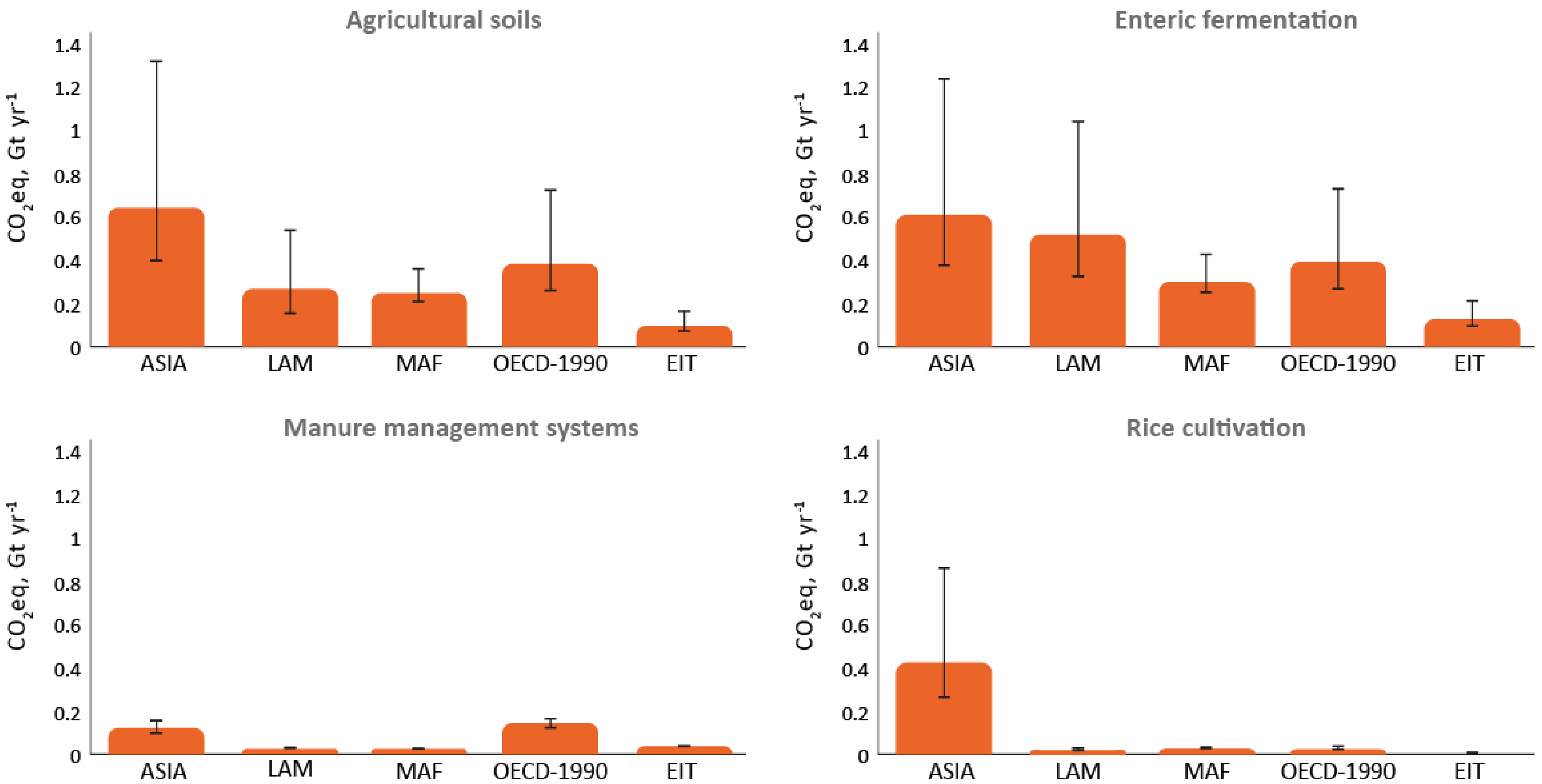
Based on estimates, Asia contributes the highest proportion of GHG emissions from agriculture.
However, some countries that are large emitters can have relatively low per capita emissions, whereas others can have high per capita emissions but contribute a relatively small share of global emissions.

By continent in 2012

Asia	Latin America and the Caribbean	Africa
2012	2012	2012
2,459 million tonnes CO_2 eq	903 million tonnes CO_2 eq	798 million tonnes CO_2 eq

Source: FAOSTAT, 2014.

1.8. Regional GHG data comparisons



ASIA: Non-OECD Asia, **LAM**: Latin America, **MAF**: Middle East and Africa, **OECD**: Organisation for Economic Co-operation and Development, **EITs**: Economies in Transition

- The distribution of emissions from important categories varies between regions.
- Similarly, depending on the country key emitting agricultural subsectors vary by region.
- National estimates produced by FAO for agriculture and land are available in FAOSTAT.

Source: Graph modified after IPCC, 2014a, data source FAOSTAT.

1.9. Role of agriculture practices in GHG reduction and other benefits

The economic mitigation potential of agriculture is high

- **3 to 7.2 gigatonnes of CO_2eq per year** in 2030 at 20 and 100 USD per tonne of CO_2eq.
- **70 percent** of economic mitigation potential is in developing countries (IPCC, 2014a).

A number of agricultural practices can not only reduce and remove GHG emissions, but can also deliver many other important benefits, such as:

- supporting **climate change adaptation**;
- addressing **agriculture as a driver of deforestation and other land use changes**;
- reducing **agriculture's contribution to non-point pollution of water sources**;
- increasing the potential for **scaling up climate-smart agriculture (CSA) practices**;
- promoting **access to energy in rural areas**; and
- fostering **food security**.

With appropriate mitigation actions it is possible to not only reduce GHG emissions **but also to strengthen food security and rural livelihoods**.

1.10. Mitigation and adaptation synergies

There are many activities that deliver both climate change mitigation and adaptation benefits. For instance:

Practices that increase SOM enhance soil carbon sequestration and improve nutrient supply and soil water-holding capacity, which strengthens the resilience of agricultural systems and increases productivity.

Agroforestry in silvopastoral systems can raise livestock productivity by reducing heat stress for animals. In addition, trees increase carbon storage in soils and biomass.

Watershed rehabilitation increases carbon stored in forests and rehabilitated land, reduces flood recurrence and improves resilience to natural disasters.

Improved institutions for land tenure can support soil conservation by providing incentives for long-term soil fertility improvement and nutrient-cycling measures.

Mitigation

addresses the root causes of climate change by decreasing GHG emissions and increasing carbon sinks

Adaptation

enables agricultural systems to be more resilient to the consequences of climate change

…both can and should be implemented together

1.11. Mitigation as a part of climate-smart agriculture (CSA)

Climate change mitigation is also one of the essential pillars of CSA.

CSA is an integrative approach to address the interlinked challenges of food security and climate change. It explicitly aims to:

- sustainably improve agricultural productivity, increase farm incomes, strengthen food security and promote development in an equitable manner;
- adapt and build the resilience of agricultural and food security systems to climate change at multiple levels; and
- reduce and/or remove GHG emissions from agriculture whenever possible.

To learn more about CSA, click here, or consult the Climate-Smart Agriculture Sourcebook by FAO, 2013.

1.11.1. Example: No-tillage farming - a climate-smart practice

Practice	Resilience benefit	Adaptation benefit	Mitigation benefit
No-tillage farming, in which ploughing is replaced by direct seeding under the mulch layer of the previous season's crop	Significant financial benefits as farmers can save between 30–40 percent of time, labour and fossil fuel inputs	Minimizes soil disturbance, provides permanent organic soil cover and diversifies crop species, which are grown in sequence and/or association	Reduction of GHG emissions from soil disturbanc e and from fossil-fuel use of farm machinery

Source: Cited in UNEP, 2013.

1.12. Supply-side and demand-side mitigation options

Opportunities to reduce GHG can be divided in two groups: **supply-side and demand-side options**.

Supply side options include:

- reducing emissions from land-use change, land management and livestock management;
- increasing terrestrial carbon stocks by sequestering and storing carbon in soils, biomass and wood products;
- reducing emissions from energy production through the substitution of fossil fuels with biomass; and
- increasing production without a commensurate increase in emissions reduces emission intensity (i.e. the GHG emissions per unit of product).

Demand side options include:

- cutting GHG emissions by reducing losses and waste of food and recycling wood;
- changing diets; and
- modifying wood consumption.

Demand-side options are difficult to implement as they call for changes in consumption patterns.

A combination of supply-side and demand-side options can **reduce up to 80 percent** of the emissions from the AFOLU sector by 2030 (IPCC, 2014a).

1.13. Cropland cultivation and livestock management practices with potential to reduce net GHG emissions

GHG reductions and removals can be achieved through a variety of cost-effective agricultural practices (IPCC, 2007; UNEP, 2012). These actions can be divided into four main groups.

Group	Examples
Increasing carbon stock	• agroforestry practices • improved crop varieties, which require less land for cultivation and at the same time produce higher yield and larger quantities of plant residues for carbon sequestration • restoration of cultivated organic soils • afforestation • improved cropland management, including agronomy, nutrient management, tillage and residue management • improved water management, including irrigation and drainage • improved post-harvest practices and irrigation
Decreasing carbon loss	• restoration of cultivated organic soils • prevention of deforestation • improved agronomic practices • tillage and residue management • zero burning • restoration of degraded lands (e.g. using erosion control, organic amendments and nutrient amendments)
Reducing non-CO_2 emission	• change of fertilizer type • improved rice cultivation practices • improved livestock management practices (e.g. improved feeding practices, breeding and other structural changes , or if meat-producing animals reach slaughter weight at a younger age, lifetime methane emissions can be reduced) • improved manure management (e.g. improved storage and handling and anaerobic digestion) • zero burning • restoration of cultivated organic soils
Increasing production efficiency	• improved post-harvest practices and irrigation • improved crop varieties and livestock management • reduced food losses and waste

To learn more about mitigation practices, consult: Technologies for Climate Change Mitigation: Agriculture Sector, 2012, UNEP-DTU.

1.13.1. Example: Alternate wetting and drying (AWD) for rice cultivation

- Rice cultivation contributes more than 10 percent of global anthropogenic GHG emissions (FAOSTAT, 2014).
- AWD is a cropping practice that not only reduces methane emissions but also improves the management of water and nutrients in rice cultivation.
- In AWD, the rice fields are intermittently left dry instead of being kept continuously flooded.

  - Through AWD, farmers can achieve 5–30 percent water savings, lower labour costs and increase profits with no significant loss in yield.
    In Bangladesh, yields have risen by more than 10 percent, raising incomes by USD 67–97 per hectare.
    In Rwanda and Senegal, rice yields increased from 2–3 tonnes per hectare to 6–8 tonnes due to the adoption of a system of rice intensification similar to AWD.

  - Compared to continuously flooded rice production, AWD can reduce annual methane emissions by 40 percent on China's rice paddies.
    Source: Cited in UNEP, 2013.

1.13.2. Example: Large-scale application of balanced feeding of livestock in India to reduce enteric methane and increase farmers' income

Enteric fermentation from livestock contributes 32–40 percent of total agricultural GHG emissions (IPCC 2014a). Indian livestock production contributes approximately 13 percent of the global methane emissions from enteric fermentation. On most smallholder farms in India, the animal feed does not provide the proper balance of protein, energy and minerals. The objective of the 'Ration Balancing Programme' was to increase livestock productivity by giving the animals more balanced diets (FAO, 2012). Approximately 11 500 animals in seven locations in India were monitored during the programme.

Special software developed by the Programme allowed for the preparation of a balanced feed ration using local resources. This provided an optimum supply of nutrients and delivered several benefits.

Environmental benefits:

- a 15–20 percent decrease in methane emissions per kg of milk produced; and
- reduced nitrogen excretion into the environment.

Health benefits:

- improved animal immunity due to a reduction in the parasitic load.

Improved livelihood benefits:

- significant decrease in average cost of feeding;
- increased average milk yield, milk protein output and fat content;
- improved growth rate of calves, leading to early maturity and earlier calving; and
- 10-15 percent increase in the net daily income per animal for farmers.


© FAO/ M.R. Garg

Because of the benefits achieved by the Ration Balancing Programme, it is a good candidate for large-scale implementation through a NAMA.

To learn more about the 'Ration Balancing Programme', consult: FAO, 2012.

1.13.3. Example: Biogas production from manure

In developing countries, small-scale decentralized biogas digesters have the potential to meet the electricity needs of rural communities and promote rural development.

Biogas is more beneficial when it is deployed not as an additional land-use activity spread over the landscape, but is integrated into existing land uses and influences the way farmers and forest owners use their land.

Methane digesters are particularly appealing because they:

- add revenue;
- cut waste management costs;
- provide cost-efficient electricity;
- reduce deforestation;
- reduce manure odour by as much as 95 percent;
- reduce pesticide costs;
- reduce surface and groundwater contamination and prevent infectious diseases;
- help minimize run-off and other water quality issues;
- capture methane, sulphur compounds and other gases, which would otherwise be released into the atmosphere;
- create nutrient-rich fertilizer, compost, livestock feed additives, and cow bedding from by-products; and
- partially free women from housework.

Schematic representation of biogas production

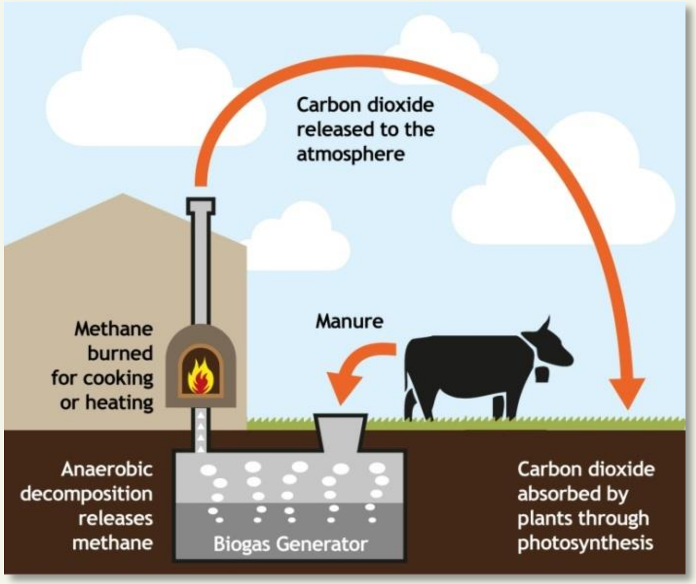


Image source: Modified after www.seco.cpa.state.tx.us

The negative side effects include methane releases through leakages and intentional venting.

1.13.4. Example: Livestock diet intensification through agroforestry

Higher quality diets for ruminants reduce the methane output per unit of milk and meat and increase meat and milk productivity.

Livestock production can be intensified through agroforestry by feeding animals the leaves of trees such as *Leucaena leucocephala,* which is widely grown in the tropics.

Adding even a small amount of *Leucaena* leaves to dairy cattle can:

- treble daily milk yield;
- quadruple daily weight gain;
- increase farm income considerably;
- reduce the amount of methane produced per kg of meat and milk by factors of 2 and 4, respectively; and
- increase carbon sequestration.

Widespread adoption of this option has substantial mitigation potential, because intensified diets would considerably reduce the number of ruminants needed to satisfy future demand for milk and meat.

Source: Campbell *et al.*, 2014.

Agroforestry includes different management practices that deliberately incorporate woody perennials on farms and in the landscape. This increases the uptake and storage of carbon dioxide from the atmosphere in biomass and soils.

1.13.5. Example: Agroforestry for reducing deforestation

The United Republic of Tanzania is among the leading countries in Africa to embrace the Participatory Forest Management (PFM). By 2008, 4.1 million ha of the country' s forests were under PFM with 2 328 villages participating in the management of their forests. By combating deforestation and forest degradation, PFM in the United Republic of Tanzania has contributed to the reduction of GHG emissions.

PFM interventions have advocated for the sustainable use of forests with a clear focus on ensuring increased carbon stocks and augmenting forest ecosystem services. Some of the adaptation and mitigation activities have included:

- encouraging agroforestry;
- establishing community-based income generating activities;
- promoting ecotourism; and
- increasing the use of non-timber forest products.

Though PFM lacks a well elaborated MRV system to gauge its contribution towards reducing GHG emissions, the practices in place have ensured protection of the forest resources even in areas that were previously subjected to intensive exploitation.

Source: Cited in Majule *et al.,* 2014.

1.13.6. Example: Improved cooking stoves

Ethiopia's Climate Resilient Green Economy Strategy notes that replacing open fires and rudimentary cooking stoves with more efficient stoves that need only half as much fuelwood or stoves that use other fuels has the potential to bring about an estimated 20 percent annual reduction in the country's total GHG emissions (about 50 Mt CO_2eq) by 2030.

The government has prioritised plans to deploy 9 million more efficient stoves by 2015. Using better stoves would not only save energy and reduce emissions, it would also:

- save USD 270 million in opportunity costs for fuelwood;
- increase rural household income by 10 percent;
- create many more jobs in making stoves;
- reduce severe health risks from smoke inhalation, and
- decrease hours spent gathering fuelwood, which is traditionally done by women and children, often in risky areas.

The government has therefore developed an investment plan to support the scaling up of these activities. The plan includes programmes to improve production, distribution and financing, ideally through access to carbon credits.

For further details, consult: Federal Democratic Republic of Ethiopia, 2012.

1.14. Mitigation options for aquaculture and fisheries

- In the fisheries sector, the primary source of GHG emissions is **fuel usage** during fishing.
- In the aquaculture sector, the primary sources are **feed production and excavation of mangrove forests.**

For both sectors **energy saving** and **developing regional trade** is important for reducing GHG emissions .

Additional options for reducing GHG emissions include:

Fisheries

- improving energy efficiency (e.g. improved fishing vessel design and operation);
- aquatic biofuel production and use;
- reducing overfishing and excess capacity;
- implementing fishing activities that are linked with improved fisheries management and healthy stocks; and
- installing and maintaining low-cost inshore fish aggregating devices in fisheries.

Aquaculture

- improving feeding and reducing losses from disease in aquaculture;
- improving energy efficiency (e.g. improved aeration pumping systems);
- increased production efficiency;
- enhancing sequestration by expanding the planted areas of mangroves and floodplain forests;
- developing integrated multi-trophic aquaculture; and
- culturing low-trophic-level species.

At its current annual growth rate, aquaculture is expected to account for early 6 percent of anthropogenic N_2O and other nitrogen emissions by 2030 (Hu *et al.* 2012).

For references and further information, consult: Climate-Smart Agriculture Sourcebook, FAO and Guidelines for Integrating Climate Change Adaptation into Fisheries and Aquaculture Projects, IFAD.

1.14.1. Example: Culture of low-trophic-level species

Cultured Indian major carp, Chinese carp, tilapia and sea cucumber (scavenger echinoderms feeding on debris) do not require fish oil and use small amounts of fish meal as feed and have a low carbon footprint.

For example, only **1.67 kilograms of CO_2** are released per kilogram of tilapia compared to shrimp farming which releases **11.10 kilograms of CO_2** per kilogram of shrimp.

Cultured molluscs and bivalves, such as clams, mussels and oysters, can remove substantial amounts of carbon from coastal oceans and also do not need fish oil or fish meal.

- Mussels could assimilate and remove up to **80 metric tonnes of carbon per hectare per year**.
- The carbon footprint for mussels and oysters is **0.01 kilogram of CO_2 per kilogram** of production.

Source: IFAD, 2014, Guidelines for Integrating Climate Change Adaptation into Fisheries and Aquaculture Projects.

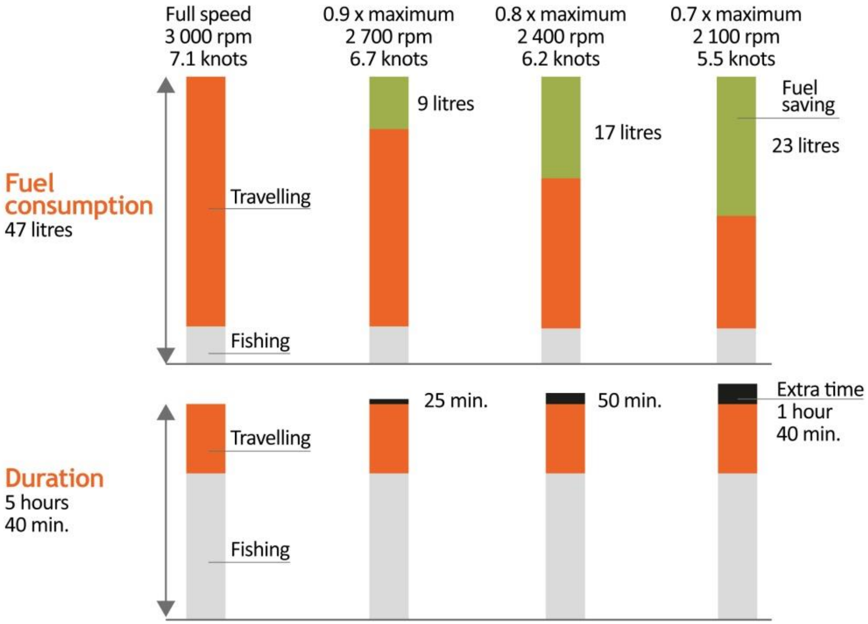
1.14.2. Example: Fuel savings for small fishing vessels

Saving fuel is important for reducing GHG emissions. The potential for savings is greatest when planning a new boat. For example, the engine can be matched to the size and weight of the boat and the hull can be designed to give minimum resistance. Additionally, fuel usage can be reduced by:

- reducing speed;
- carrying out multiday fishing and mothership operations;
- servicing the engine and giving it air;
- using inboard instead of outboard engines;
- deploying sails;
- selecting the right size propeller; and
- keeping the bottom of the boat clean.

Hull fouling with slime, weeds and barnacles will slow down a boat. In the tropics, the increase in fuel consumption due to hull fouling can be 7 percent after only one month and 44 percent after half a year if antifouling paint is not used.

Fuel savings by reduced speed



Source: Gulbransen, 2012.

For guidance, consult the FAO publication Fuel savings for small fishing vessels, by Gulbransen, 2012.

1.15. Complete life-cycle approach for GHG reduction

Apart from implementing GHG reduction strategies directly at the field level, it is also important to reduce net GHG emissions through all the stages of a product's life, including post-harvest storage, transportation, processing, retailing, consumption and disposal.

Transportation

- product transport
- suppliers transport
- international freight

Processing

- refrigeration
- packaging/processing
- factory energy

Retailing, consumption and disposal

- packaging and retail distribution
- delivery and customer transport
- waste disposal

1.15.1 Example: Life-cycle analyses of pig production in East and Southeast Asia

Over the past three decades, pig production has increased fourfold in East and Southeast Asia and is expected to further expand and intensify.

The main sources of emissions in pig production systems are:

- **feed production**, which alone represents about **60 percent** of total emissions from commercial systems;
- **manure**, which accounts for **14 percent** of total methane emissions in industrial systems; and
- **on-farm energy use and post-farm activities** (**6 percent**).

The following mitigation options were explored using the FAO Global Livestock Environmental Assessment Model (GLEAM):

- **improved manure management** (through increased use of anaerobic digestion);
- **adoption of more energy efficient technologies and low-carbon energy**; and
- **improved feed quality, animal health and animal husbandry in intermediate systems**.

The results of GLEAM modelling demonstrated that with feasible improvements in manure management, feed quality, animal health and animal husbandry, and the adoption of more efficient technologies and low-carbon energy, emissions in commercial pig production could be **reduced by 20 to 28 percent** from baseline emissions with stable production.

Results also demonstrated that the interventions could lead to a **7 percent** increase in pig meat production. In this scenario, the technical mitigation potential would reach **14 to 23 percent** (Gerber *et al.*, 2013).

For further details read the FAO report Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities, by Gerber *et al.,* 2013

1.16. Quiz: Climate change mitigation in agriculture

True or false?

Statement	True	False
The AFOLU sector is the largest emitting sector after transport.		
In many developing countries the AFOLU sector is the main GHG emitting sector.		
The only source of CH_4 emission is enteric fermentation.		
GHG emissions from synthetic fertilizers increased by 900 percent from 1961 to 2010.		
A growing population and changes in food consumption patterns (e.g. increasing demand for milk and meat) will increase GHG emissions.		
Adaptation and mitigation are always conflicting goals.		

To see the correct answers, click here.

1.16.1. Correct answers for quiz 1 - Climate change mitigation in agriculture

Statement	True	False
The AFOLU sector is the largest emitting sector after transport.		x
In many developing countries the AFOLU sector is the main GHG emitting sector.	x	
The only source of CH_4 emission is enteric fermentation.		x
GHG emissions from synthetic fertilizers increased by 900 percent from 1961 to 2010.	x	
A growing population and changes in food consumption patterns (e.g. increasing demand for milk and meat) will increase GHG emissions.	x	
Adaptation and mitigation are always conflicting goals.		x

1.17. Exercise: GHG emissions in agriculture

Task: For one of the agriculture categories (e.g. croplands, livestock, fisheries, aquaculture, forestry) insert into the matrix for the relevant practices: the types of emitted GHG (e.g. CO_2, CH_4, N_2O), the sources of emissions (e.g. enteric fermentation, manure decomposition, anaerobic soil organic matter decomposition) and the variables affecting emissions (e.g. age of animals, feed, temperature, water table height).

Category	Emissions sources	Types of GHG	Influencing variables

MODULE 2: Overview of Nationally Appropriate Mitigation Actions (NAMAs)

Learning outcomes

At the end of this lesson, you will:

1. know about the state of climate change mitigation in the context of UNFCCC negotiations;
2. be familiar with the NAMA concept;
3. recognize NAMAs’ relation to other UNFCCC climate instruments; and
4. have an overview of UNFCCC NAMA registry and its AFOLU entries.

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2.1. UNFCCC climate change negotiations and road to NAMAs

United Nations Framework Convention on Climate Change

UNFCCC 1992	Kyoto Protocol 1997	Bali Action Plan 2007	COP 15 in Copenhagen, Denmark,2009	COP 16 in Cancún, Mexico, 2010	COP17/CMP7 UNITED NATIONS CLIMATE CHANGE CONFERENCE 2011 DURBAN, SOUTH AFRICA	DOHA 2012 UN CLIMATE CHANGE CONFERENCE COP18·CMP8
In 1992, countries joined an international treaty to address climate change. (195 Parties)	In 1997, the Kyoto Protocol legally bound developed countries to emission reduction target (192 Parties)	In the 2007 Bali Action Plan, the NAMA concept was introduced.	In 2009, 114 Parties committed to undertaking mitigation actions as part of a shared responsibility to reduce GHGs. Also, the NAMA concept was specified.	In Cancun in 2010, developed countries agreed to provide USD 30 billion in fast-start financing and mobilise USD 100 billion per year by 2020 to finance mitigation and adaptation in developing countries.	In 2011, the Green Climate Fund (GCF) was launched and the NAMA registry was established.	In 2012, a as a part of the agreed outcome, developing country Parties will undertake **NAMAs** in the context of sustainable development. The UK and Germany announced the establishment of the 'NAMA Facility' to facilitate financial flows for NAMAs.

To reduce GHGs to a level 'below the 2°C objective', forty-two industrialized countries have already submitted quantified economy-wide emission targets for 2020 to the UNFCCC, and forty-three developing countries have submitted NAMAs for inclusion in the Appendices to the 2009 Copenhagen Accord.

2.1.1. Reporting to UNFCCC
National Communications and Biennial Update Reports

- National Communications include information on national GHG inventories, mitigation actions and their effects, and the support received by all Parties of UNFCCC.

- At the 17th Conference of the Parties (COP-17) in Durban it was decided that **Biennial Update Reports** (BURs) should be submitted every two years. BURs will provide an update to the information presented in NCs and include information on mitigation actions, needs and support received. The complete guidelines for BURs are available here.

Examples of mitigation options for agriculture presented by Viet Nam

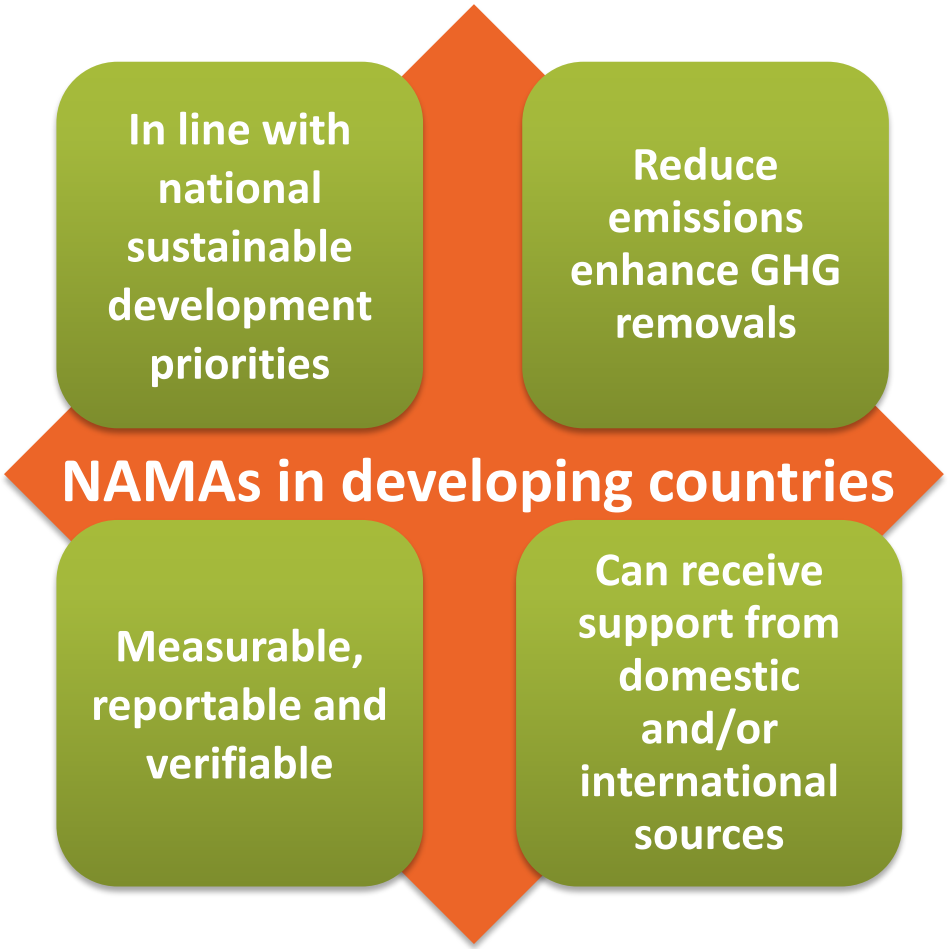
2nd National Communication: 2010
Option 1: Biogas replacing cooking coal in lowlands
Option 2: Biogas replacing cooking coal in mountain areas
Option 3: Rice paddy field water drainage in the Red River Delta
Option 4: Rice paddy field water drainage in the South Central Coast
Option 5: Molasses urea block cattle feeds

BUR: 2014
Option 1. Alternate wetting and drying irrigation or system of rice intensification
Option 2. Re-using rice crop residues as composts.

2.2. Background on NAMAs

In the UNFCCC's Bali Action Plan (2007), it was decided to launch mitigation actions for developing countries *" […] Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity building, in a measurable, reportable and verifiable manner."*

(Decision 1/CP.13, paragraph 1 (b) (ii))



Note: In the decision Decision 1/CP.13 it was also agreed that developed country Parties should address their measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emission limitation and reduction objectives, while ensuring the comparability of efforts among them, taking into account differences in their national circumstances.

2.3. Types of NAMAs

NAMAs are defined in two contexts.

1. At the **national level,** the NAMA is as a formal submission by Parties declaring intent to mitigate GHG emissions in a manner commensurate with their capacity and in line with their national development goals.
2. At the **individual action level,** the NAMA consists of detailed actions or groups of actions designed to help a country meet their mitigation objectives within the context of national development goals. These NAMAs are diverse, ranging from project-based mitigation actions to sectoral programmes or policies.

Based on the source of support, two types of NAMAs can be differentiated:

- **Domestically supported NAMAs** are actions that use only domestic resources of developing countries.
- **Internationally supported NAMAs** are actions in which developing countries receive international support, for example in the form of technology transfer, financing and capacity-building.

Since 2010, developing countries have provided information on the NAMAs they intend to implement.

- Original submissions are available at the UNFCCC website.
- UNFCCC also compiled submitted NAMAs in an official document FCCC/SBI/2013/INF.12/Rev.3.
- Currently, the number of NAMAs are entered in the NAMA registry of the UNFCCC.

The UNFCCC encourages countries to share information on their NAMAs and facilitates the matching of NAMAs with financial, technological and capacity-building support.

For further information, click here.

2.4. Description of NAMA elements and development pathways

NAMA elements can be grouped by their technical, policy and institutional dimensions.

Policy dimensions	Clarify development policy piorities	Climate policy alignment	Set priorities and targets	Secure domestic support
Technical dimensions	Baseline scenarios	Understand barriers to adoption	Identify policies and measures	Estimate mitigation potentials
Institutional dimensions	Institutional arrangements for coordination	Engaging stakeholders	Financial institutions	MRV systems

Source: Wilkes *et al.*, 2013a.

There are two options for developing NAMAs: **the fast track development option and the in-depth option.** In both options, the elements are the same, but the processes differ.

- In the **fast track development option**, the actions build on an already existing agriculture or sustainable development programme by adding climate change elements.
- In the **in-depth option**, the actions are developed from scratch.

For further information on fast track and in-depth development options, see Module 3.

2.5. Sources of information on NAMAs

NAMA registry: During the UNFCCC's COP-16 it was that a registry would be set up *"to record NAMAs seeking international support and to facilitate matching of finance, technology and capacity-building support for these actions".*

Participation and data entry into the registry is voluntary.

The registry contains:

- information on NAMAs that are seeking support for:
  - implementation,
  - preparation and
  - recognition; and
- information on available support (financial, technical and capacity-building).

The NAMA registry is operated by the UNFCCC Secretariat and allows only national focal points from developing countries to submit NAMA entries.

For further information, click here.

Along with the NAMA UNFCCC registry, the NAMA pipeline and the NAMA database share information on NAMAs around the world. The NAMA database collects publicly available information on NAMA-related activities, whereas the NAMA pipeline contains all submissions to the UNFCCC.

2.5.1. Templates and layout for the NAMA registry

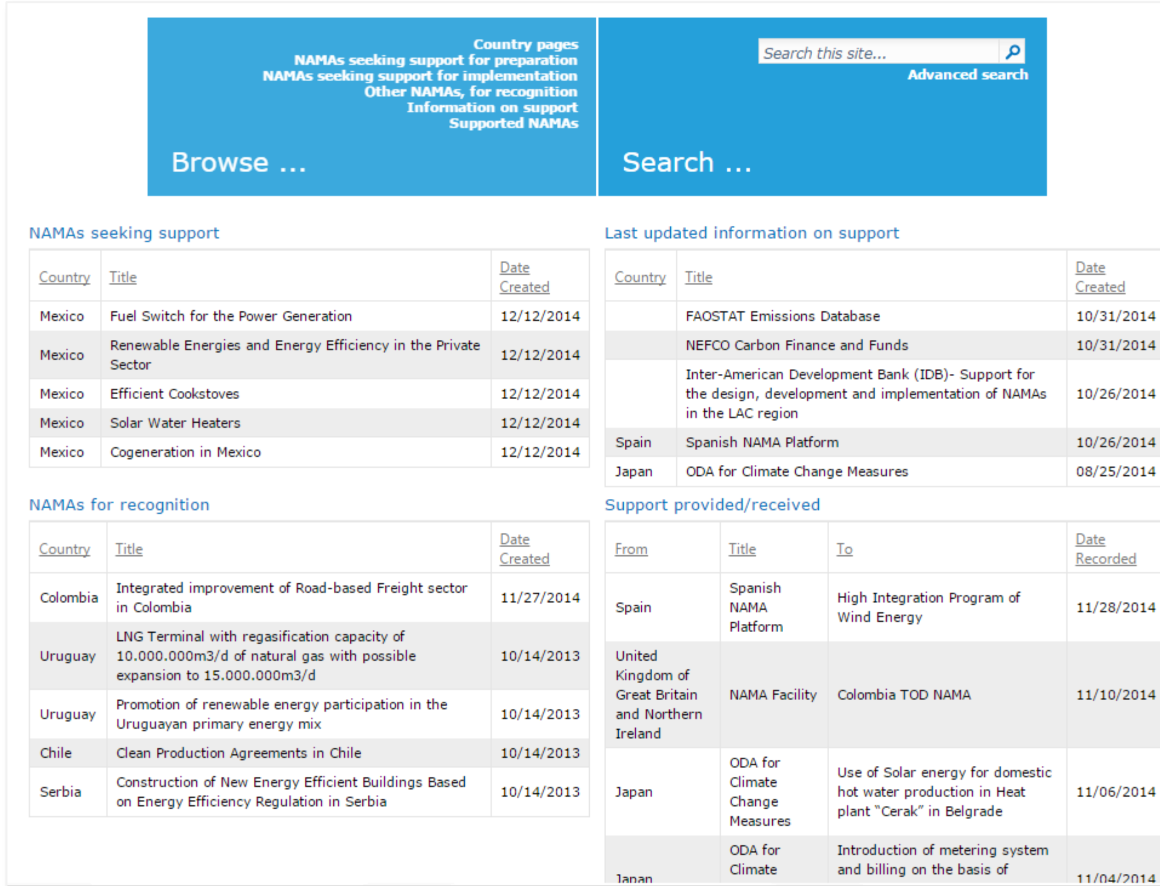
To submit a NAMA to the UNFCCC NAMA registry the following information is required:

- a title;
- a brief description of the action;
- estimates on timeframe and costs;
- an estimate of emission reductions; and
- information on sustainable development benefits.

Listed below are links to the templates for submitting NAMAs to the UNFCCC NAMA registry:

- NAMA seeking support for preparation
- NAMA seeking support for implementation
- NAMA seeking support for recognition

Layout of the NAMA registry



NAMAs seeking support

Country	Title	Date Created
Mexico	Fuel Switch for the Power Generation	12/12/2014
Mexico	Renewable Energies and Energy Efficiency in the Private Sector	12/12/2014
Mexico	Efficient Cookstoves	12/12/2014
Mexico	Solar Water Heaters	12/12/2014
Mexico	Cogeneration in Mexico	12/12/2014

Last updated information on support

Country	Title	Date Created
	FAOSTAT Emissions Database	10/31/2014
	NEFCO Carbon Finance and Funds	10/31/2014
	Inter-American Development Bank (IDB)- Support for the design, development and implementation of NAMAs in the LAC region	10/26/2014
Spain	Spanish NAMA Platform	10/26/2014
Japan	ODA for Climate Change Measures	08/25/2014

NAMAs for recognition

Country	Title	Date Created
Colombia	Integrated improvement of Road-based Freight sector in Colombia	11/27/2014
Uruguay	LNG Terminal with regasification capacity of 10.000.000m3/d of natural gas with possible expansion to 15.000.000m3/d	10/14/2013
Uruguay	Promotion of renewable energy participation in the Uruguayan primary energy mix	10/14/2013
Chile	Clean Production Agreements in Chile	10/14/2013
Serbia	Construction of New Energy Efficient Buildings Based on Energy Efficiency Regulation in Serbia	10/14/2013

Support provided/received

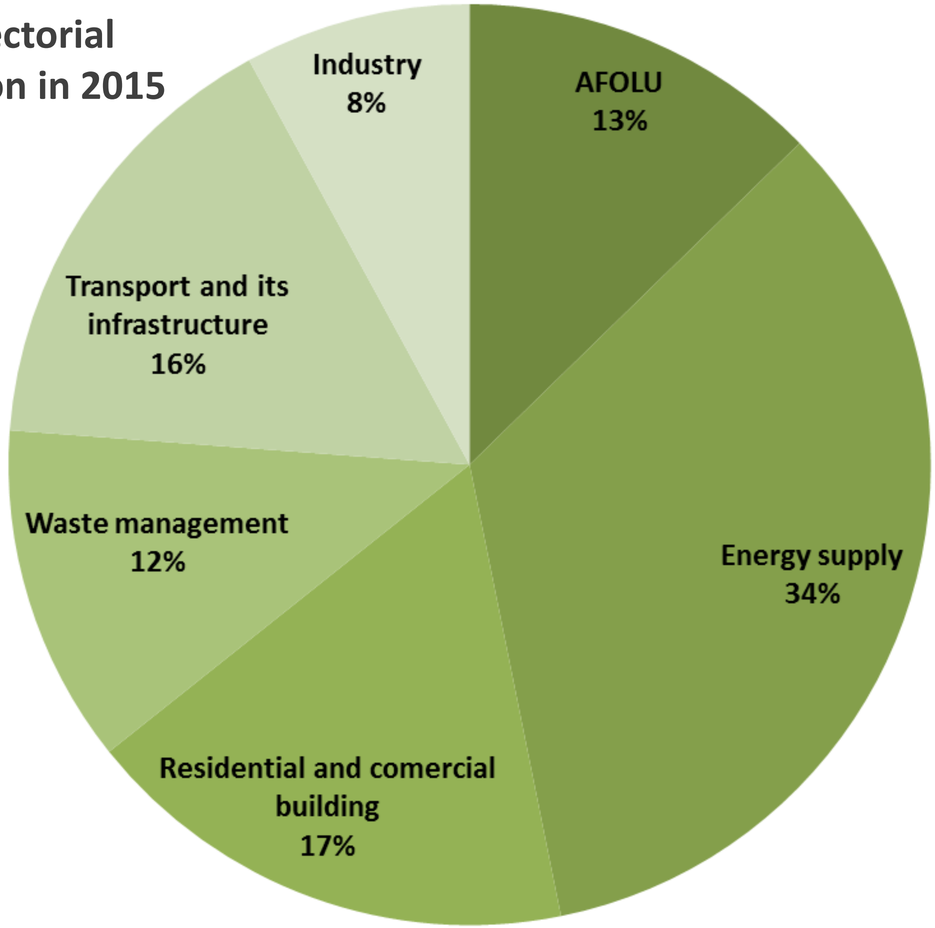
From	Title	To	Date Recorded
Spain	Spanish NAMA Platform	High Integration Program of Wind Energy	11/28/2014
United Kingdom of Great Britain and Northern Ireland	NAMA Facility	Colombia TOD NAMA	11/10/2014
Japan	ODA for Climate Change Measures	Use of Solar energy for domestic hot water production in Heat plant "Cerak" in Belgrade	11/06/2014
Japan	ODA for Climate	Introduction of metering system and billing on the basis of	11/04/2014

Guidance and templates for NAMA submissions to the registry and contact details of national focal points for access to the registry can be found on the UNFCCC website.

2.6. NAMAs sectorial distribution

In the NAMA UNFCCC registry as of April 2015, 101 NAMA entries were registered. Thirteen percent of these were in the AFOLU sector.

NAMAs sectorial distribution in 2015



Data source: UNFCCC NAMA registry.

2.7. Examples of NAMAs in AFOLU

Title	Country	Estimated reduction	Timeframe	Status
Livestock NAMA	Costa Rica	6 000 MtCO2eq	15 years	Seeking support for implementation
Developing appropriate strategies and techniques to reduce methane emissions from livestock production	Uganda	-	6 months	Seeking support for preparation
Bio-energy generation and GHG mitigation though organic waste utilization	Pakistan	-	3 years	Seeking support for preparation
Adaptive Sustainable Forest management in Borjomi-Bakuriani forest district	Georgia	-	3 years	Financial support received
NAMA in the forestry sector	Mali	-	-	Seeking support for preparation
Expansion of electricity generation from sustainable forestry biomass by-products	Uruguay	622 MtCO2eq	13 years	NAMA for Recognition

Data source: UNFCCC NAMA registry.

2.7.1. Example: NAMAs for the sustainable management of peatland in Indonesia

Currently, not all NAMAs included in the original submissions to UNFCCC are entered in the NAMA registry. This is the case for the NAMAs for the responsible management of peatlands in Indonesia.

Conserving peatlands, or re-wetting and restoring degraded peatlands to preserve their carbon store are potential mitigation strategies according to the IPCC (2014b).

Indonesia is developing a NAMA for peatlands under its comprehensive 'National Action Plan For Reducing Greenhouse Gas Emissions' (Rencana Nasional Penurunan Emisi Gas Rumah Kaca, RAN-GRK), which targets different sectors such as forestry, peatlands, agriculture, energy, industry, transportation and waste.

In total, Indonesia has voluntarily committed to reduce its GHG emissions by **26 percent by 2020** through domestically supported NAMAs.

If these NAMAs receive international support, the Indonesian government is willing to increase their emission reduction target to **41 percent** (Hänsel, 2012).

Mitigation, particularly in LULUCF, presents a good opportunity for GHG reductions, as this sector contributes approximately **67 percent of total national emissions**. However, funding for re-wetting and restoring peatlands is required to match the short-term gains from the conversion of peatlands (e.g. to oil palm cultivation).

If the long-terms costs to society from the loss of land, flooding (due to soil subsidence), land degradation and the increased number of fires are added on top of the costs of high emissions, this provides strong incentives for conserving the remaining undrained peatlands.

2.8. Regional and global initiatives working towards mitigation

There are a number of initiatives worldwide working towards climate change mitigation.

NAMA Partnership: During COP 18 in Doha, the NAMA Partnership was launched to provide support to developing countries in the preparation and implementation of their NAMAs. The Partnership aims to help coordinate multilateral organizations, bilateral cooperation agencies and think tanks working on NAMAs, it enhance their collaboration and improve the complementarity of their activities.

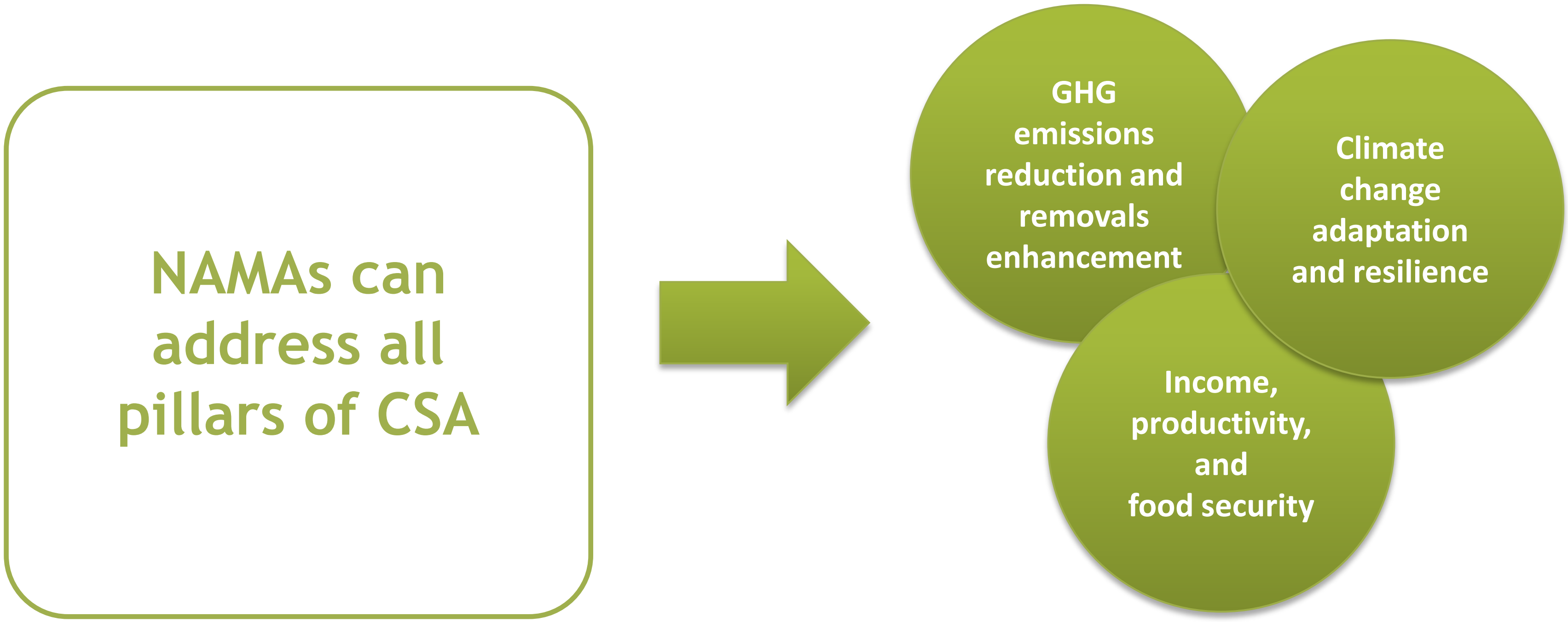
International Partnership on Mitigation and MRV: The aim of the Partnership is to support a practical exchange on mitigation-related activities and MRV between developing and developed countries and help close the global ambition gap. The Partnership organizes meetings back-to-back with UN negotiations to ensure regular exchange between the partnering countries and coordinates it national implementation and international negotiations.

Mitigation Action Plans and Scenarios (MAPs): MAPS is a collaboration among developing countries to establish the evidence base for long-term transition to robust economies that are both carbon efficient and climate resilient. In this way, MAPS contributes to ambitious climate change mitigation that aligns economic development with poverty alleviation.

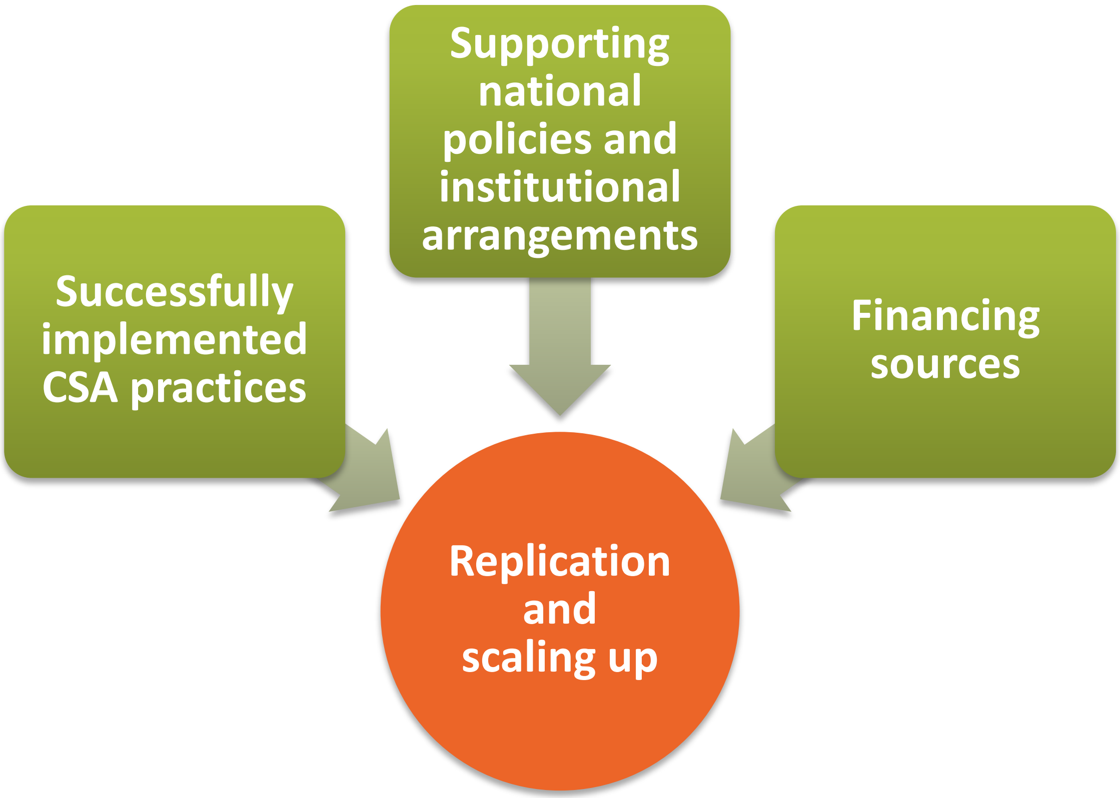
The Regional Platform for Latin America and the Caribbean (LEDS LAC): LEDS LAC is a community of practice that brings together leaders in low-emission development from Latin America and from international institutions. It is part of the Global Partnership on Development Strategies of Low Carbon and Low Emission Development Strategies Global Partnership (LEDS-GP) founded in 2011.

2.9. NAMAs and climate-smart agriculture

There are a range of NAMA options that can **deliver both mitigation and adaptation benefits** and can help countries meet their **sustainable development** and **food security** objectives (see Module 1).



2.10. NAMAs support for scaling-up and replication of CSA practices



NAMAs can help scale up tested and successful CSA practices by:

- supporting appropriate policies and institutional arrangements; and
- opening access to financing.

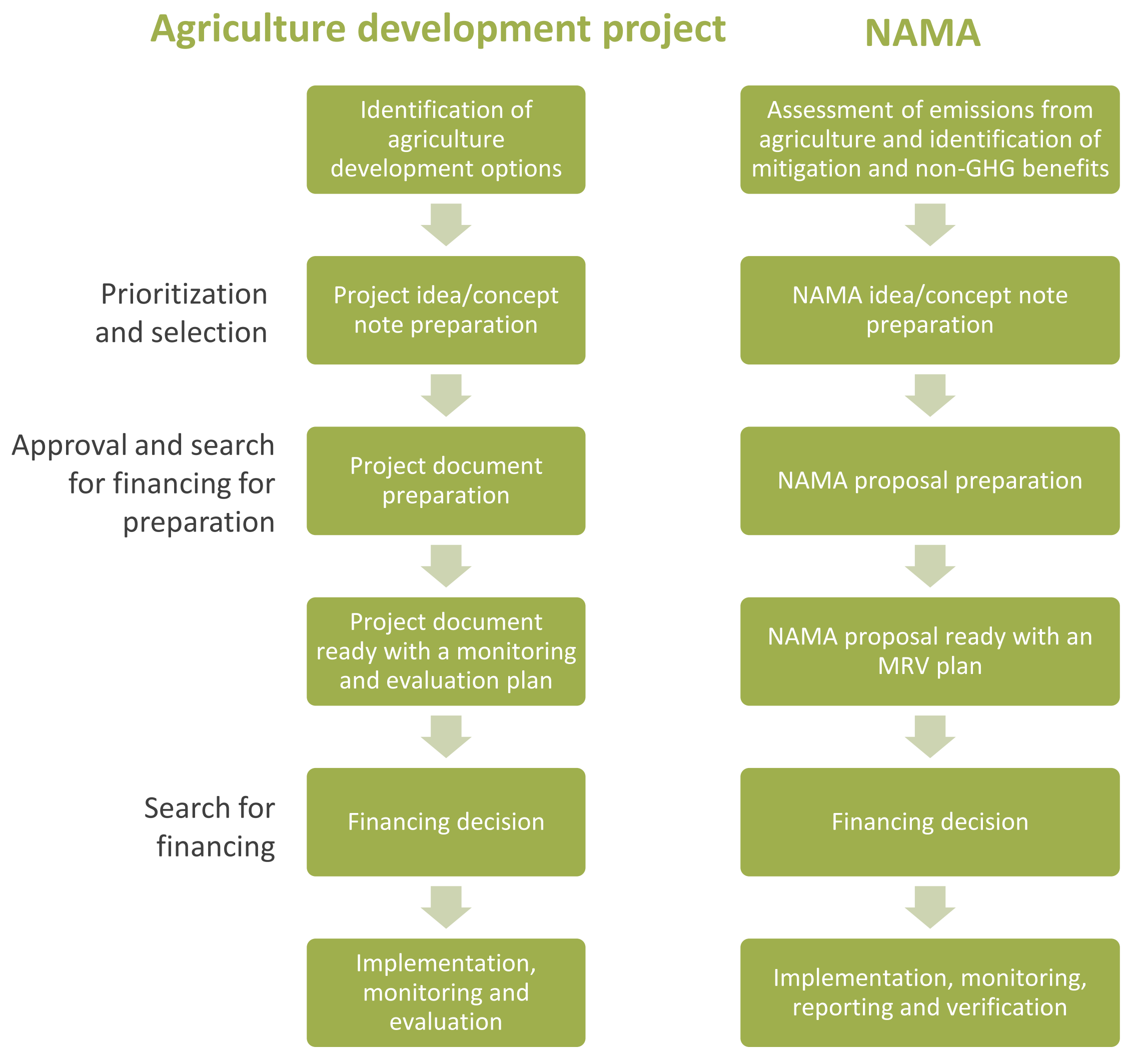
2.11. Agriculture project planning and NAMA planning

Similarities and differences in the two processes

At the project level, there are similarities and differences between NAMAs and agriculture development projects.

In both processes, the main steps are the same. The differences relate to:

- the requirements for identification, prioritization and proposal preparation;
- the sources of financing; and
- additional MRV requirements for GHG emissions monitoring.



A detailed description of NAMA planning is presented in Module 3.

2.12. Comparison of NAMAs with the Clean Development Mechanism (CDM), National Adaptation Programmes of Action (NAPAs) and National Adaptation Plans (NAPs)

CDM

- CDM is a mechanism through which developed countries can purchase Certified Emission Reduction units from developing countries to achieve their emission reduction targets under the Kyoto Protocol.

NAMAs vs CDM

- In contrast, NAMAs are a mechanism for countries to reduce their own GHG emissions in one or multiple sectors.
- The option to issue carbon credits from NAMAs has not been decided under international climate negotiations.
- NAMAs also involve a wider range of activities with broader time horizons. They provide more opportunities for large-scale GHG reductions than the CDM, which follows a project/activity-based approach.

Differences and synergies between NAMAs and NAPAs and NAPs

- Prepared by developing countries, NAPAs and NAPs present adaptation actions and strategies that are designed to reduce and manage risks posed by the negative impacts of climate change.
- Although the primary focus of NAMAs is mitigation, they can also deliver adaptation benefits.

For further information, consult: De Vit *et al.*, 2012.

2.13. Interrelation of NAMAs with Low-Carbon Development Strategies (LCDS) and Intended Nationally Determined Contributions (INDCs)

LCDS/Low-Emission Development Strategies (LEDS)	LCDS/LEDS are economy-wide strategies aiming at long-term mitigation. LCDS/LEDS may also be called Green Growth Strategies. In contrast to LCDS/LEDS, NAMAs are often sector specific.
	LCDS/LEDS provide a policy framework or strategic context for NAMAs, and a NAMA can support specific LCDS/LEDS objectives in given sectors through actions on the ground. NAMAs may also be elaborated independently of LCDS/LEDS.
INDCs	The Conference of the Parties (COP), by its decision 1/CP.19, invited all Parties to initiate or intensify domestic preparations for their INDCs towards achieving the objective of the Convention to limit global warming to below 2 degrees Celsius relative to pre-industrial levels.
	In decision 1/CP.20, the COP also invited all Parties to consider communicating their undertakings in adaptation planning or consider including an adaptation component in their INDCs.
	NAMAs may be an instrument and basis to operationalize and achieve INDCs mitigation goals.

2.14. Comparison of REDD+ and NAMAs

REDD+ stands for Reducing Emissions from Deforestation and Forest Degradation and includes the conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

Design Elements	NAMAs	REDD+
Scope	Any activity from any mitigation sector, including a project, programme or policy.	Only activities related to deforestation, forest degradation, forest conservation, sustainable forest management and enhancement of forest carbon stocks in developing countries are accepted. Activities may be implemented in the form of projects, programmes or policies.
Scale	Anything from project-level activity to a sectoral activity at the subnational to national level or a full country-wide initiative.	National-level reporting with subnational reporting allowed while countries scale up their reporting capacities.
MRV	Domestically supported NAMAs: domestic MRV Internationally supported NAMAs: domestic MRV with international verification.	Full national MRV including remote sensing and ground-based measurements is required in the third phase of REDD+. This allows countries to report emissions by sources and removals by sinks for REDD+ activities in a manner that is consistent with its national GHG inventory for the LULUCF/AFOLU sector.
Socio-economic	Information on social and environmental safeguards to be collected and reported. Existing donor safeguard policies can be applied for internationally financed NAMAs.	Information on social and environmental safeguards to be collected and reported.

2.15. Quiz: NAMA characteristics

True or false?

Statement	True	False
NAMAs should focus on mitigation aspects only, without addressing national sustainable development priorities.		
NAMAs can receive support only in the form of financing.		
NAMAs should be performed in a measurable, reportable and verifiable manner.		
NAMAs can be an instrument and basis to operationalize and achieve INDC commitments.		
It is obligatory to issue carbon credits from NAMA activities.		
It is obligatory for countries to add their NAMA options into the UNFCCC registry.		

To see the correct answers, click here.

2.15.1. Correct answers for quiz 2 - NAMA characteristics

Statement	True	False
NAMAs should focus on mitigation aspects only, without addressing national sustainable development priorities.		x
NAMAs can receive support only in the form of financing.		x
NAMAs should be performed in a measurable, reportable and verifiable manner.	x	
NAMAs can be an instrument and basis to operationalize and achieve INDC commitments.	x	
It is obligatory to issue carbon credits from NAMA activities.		x
It is obligatory for countries to add their NAMA options into the UNFCCC registry.		x

MODULE 3: Step-by-step NAMA development

NAMA ideas, concept notes and proposal preparation

Learning outcomes

At the end of this lesson, you will know how to:

1. identify mitigation options and supportive policies for NAMAs;
2. describe stakeholder involvement;
3. evaluate risk and barriers; and
4. implement selected NAMA proposals.

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3.1. Initiating NAMA development

Before developing a NAMA, it is recommended to consider:
- aspects that will make the NAMA useful to the agriculture sector and national development;
- GHG and non-GHG benefits;
- institutional requirements (who is going to do what?);
- the tools, resources and planning required for implementation;
- the potential to replicate and scale up the actions; and
- methods for estimating mitigation potential of the actions and monitoring, reporting and verifying progress.

NAMAs in the AFOLU sector need to:

- be aligned with and support the achievement of the short- or long-term objectives of national and agriculture development priorities; and
- contribute to the implementation of the national climate change strategies and action plans and low-emission development strategies (LEDS).

NAMA's role in a national development framework

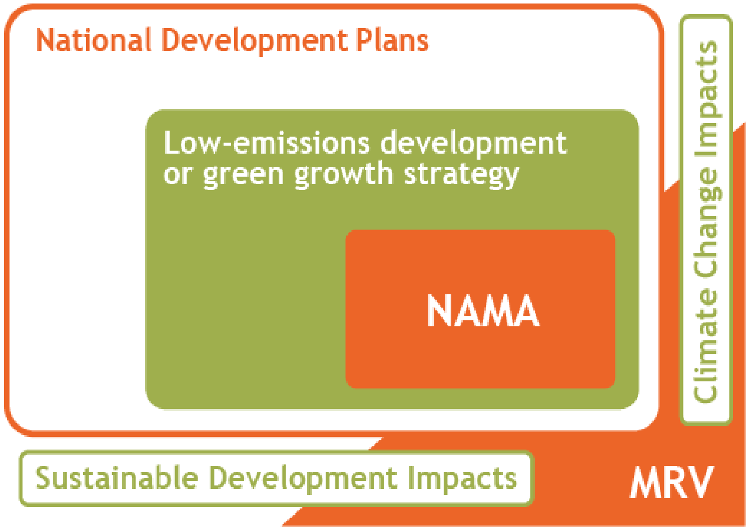

Image source: Adapted after Sharma *et al.*, 2014.

3.2. Steps in NAMA development

The main steps for NAMA development are:

1. **Identify NAMA options in the agriculture and land use sector: in-depth or fast-track**
2. **Evaluate and prioritize NAMA options**
3. **Identify stakeholders**
4. **Engage key stakeholders and agree on institutional roles and responsibilities**
5. **Identify potential financing sources for selected NAMA activities**
6. **Develop a concept note and, if necessary, secure funds for designing a full NAMA proposal**
7. **Design the NAMA and apply for funding for implementation (See Module 5)**
8. **Implement**
9. **Collect data for monitoring (See Module 4)**
10. **Evaluate, report and verify (See Module 4)**

1

3.3. Step 1: Identifying NAMA options

Mitigation planning in agriculture must ensure that the mitigation measures contribute to the achievement of the policy priorities outlined in national strategies and plans.

Two pathways can be considered when identifying NAMA options for AFOLU sector to deliver national development benefits: **in-depth assessments** or **fast-track assessments**.

For **in-depth assessments**, the different AFOLU activities are separately screened for NAMA identification.

Screening takes into account:

- the framework of national policies and sustainable development goals; and
- socio-economic needs and environmental conditions.

For identifying NAMA options in the national development framework, it is recommended to analyse:

- climate change strategies, commitments and positions contained in :
  - LEDS
  - National Communications to UNFCCC
  - Biennial Update Reports (BURs)
  - National and regional development and sectoral strategies, policies and targets for achieving Green Growth;
- GHG inventories and national reporting; and
- investment plans and national budget which give an overview of the sectoral or sub-sectoral priorities.

3.3.1. Fast-track assessment

In the **fast-track approach**, already existing programmes and projects are used as a basis to which elements of climate change mitigation actions are added. Examples include:

- existing agriculture development programmes that are already aligned with national development goals, or
- activities of Clean Development Mechanism (CDM) projects that can be scaled up.

There are advantages and disadvantages to building a NAMA component on an existing programme for land management, livestock development or a similar area.

Advantages

- reduces the number of steps needed for NAMA development
- secures the alignment with sectoral and national development priorities and policies
- makes it easier to deliver sustainable development benefits
- demonstrates in-country capacity to implement wider mitigation actions

Disadvantages

- may not result in the highest possible emission reductions and removals enhancement within the sector in contrast to the in-depth pathway

1 3.3.2. Examples of national priorities for reducing net GHG emissions

The **United Republic of Tanzania's** climate change strategy lists four priority interventions for mitigation in agriculture:

- agroforestry;
- agriculture waste management;
- efficient fertilizer utilization; and
- better agronomic practices.

In **Viet Nam**, the 2011 Master Plan of the Ministry of Agriculture and Rural Development sets a national target of a 20-percent reduction in agricultural GHG emissions by 2020 without compromising development goals. The Technology Needs Assessment document for climate change adaptation and mitigation of Vietnam, a set of country-driven activities that identify and determine the country's mitigation and adaptation technology priorities, provide useful information about policy and technology priorities (see the table below).

Example of prioritized mitigation technologies to reduce emissions and enhance GHG removals from the AFOLU sector in Viet Nam

Sector/Technology	Availability	Scale
Biogas	Short term	Small and Medium
Nutrition improvement through controlled fodder supplements	Short and Medium term	Small
Wet and dry irrigation in certain rice growth stages	Short and Medium term	Medium
Sustainable forest management	Short term	Large
Afforestation and reforestation	Short term	Large
Rehabilitation of mangrove forests	Short term	Large

Source: Tat Quang *et al.*, 2012.

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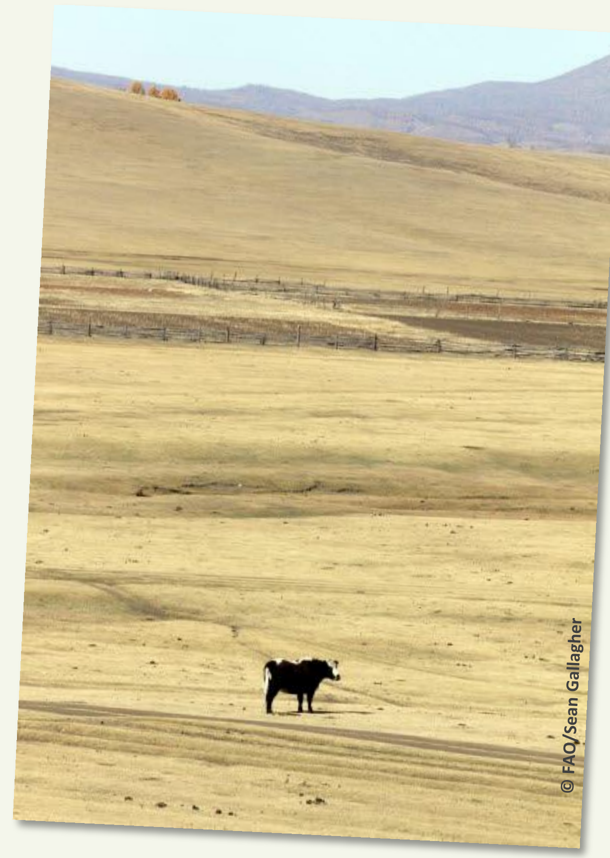
3.3.3. Example: Policy alignment of a grassland and agriculture NAMA in Mongolia using the fast track

The Parliament of Mongolia approved the National Action Programme on Climate Change (NAPCC) in 2011. It is aligned with the country's 2008 Millennium Development Goals-based Comprehensive National Development Strategy.

The Ministry of Environment and Green Growth and the Ministry of Industry and Agriculture are jointly developing a grassland and agriculture NAMA within the NAPCC's framework. The NAMA will be integrated into the National Livestock Programme (NLP), a nationwide programme with substantial domestic funding. The NLP was deemed to be a suitable programmatic framework for a NAMA because it:

- has been **approved by the Parliament**, which is an indication of formal political support;
- is closely **aligned with the national development strategy and national policies on food security and herders**;
- is aligned with several objectives of the NAPCC in that it provides **support to reduce the vulnerability of herders and grassland to climate change**; and
- improves productivity and reduces the GHG intensity of livestock production.

Through the NLP, the NAMA's specific actions would provide assistance to herders to address animal health, livestock productivity and livestock marketing constraints. These actions would support a gradual shift from extensive, risk-prone grazing systems to semi-intensive, more remunerative management systems. It would also increase herders' resilience to climate risks and provide incentives for good land stewardship.



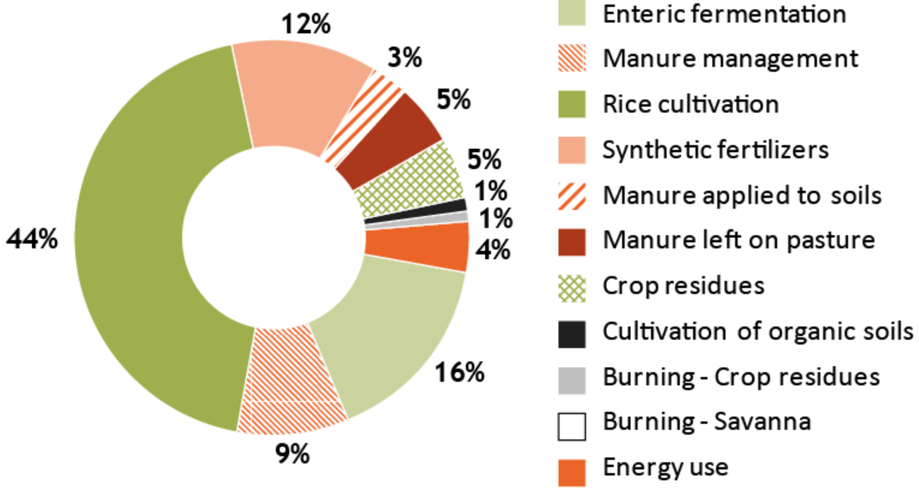
Source: Cited in Wilkes *et al.*, 2013b.

3.3.4. Identify GHG emissions caused by the AFOLU sector

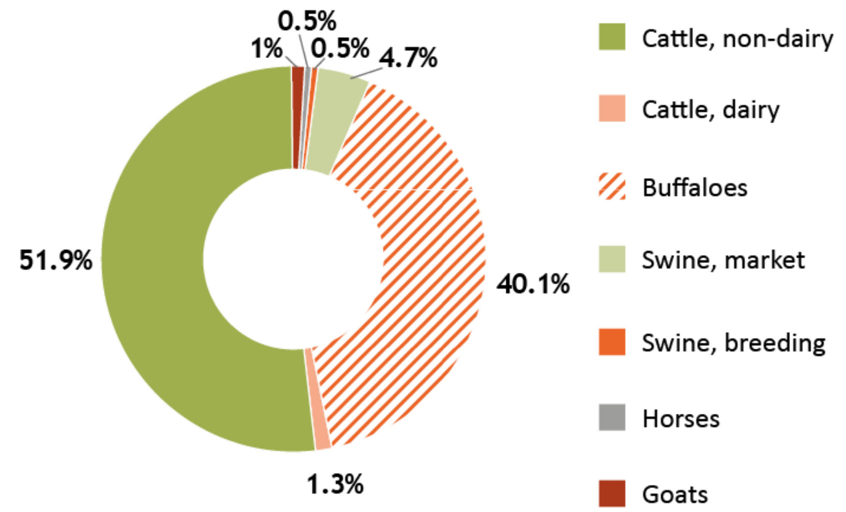
- National GHG inventories can help to identify the 'hotspots' or main GHG emitting categories in the AFOLU sector.
- When national data are not available, global databases, such as **FAOSTAT**, can be used.
- The FAOSTAT Emission database provides GHG estimates of historical emissions and removals from agriculture and land-use activities based on Tier 1 default emission factors provided by the IPCC and activity data reported by FAO member countries. When the official data has gaps or is missing, time series are completed with data from international sources in a way that is consistent with reporting requirements.

Examples of FAOSTAT outputs for Viet Nam

GHG emissions from agriculture



Breakdown of enteric fermentation emissions by animal



Data source: FAOSTAT.

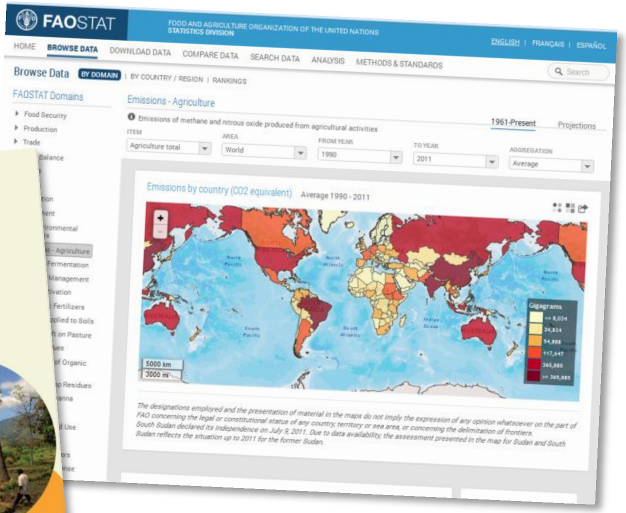
3.3.4.1. FAOSTAT

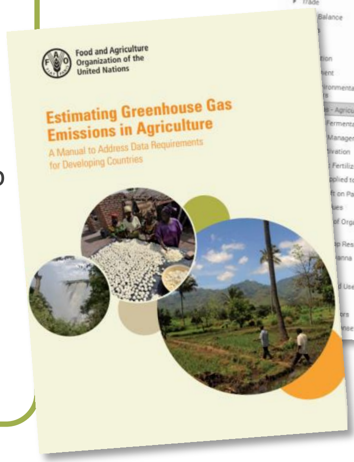
The FAOSTAT database:

- contains country and regional data, and
- covers domains on agriculture (production, consumption, trade, prices and resources), nutrition, fisheries, forestry, food aid, land use, population and agro-environment.

Users can access FAOSTAT to query, preview and download GHG emissions resulting from:

- enteric fermentation;
- manure management;
- rice cultivation;
- agricultural soils (synthetic fertilizers, manure applied to soil crop residues, cultivated organic soils, manure left on pastures);
- prescribed burning of savannahs and burning of crop residues; and
- forestry, deforestation and forest fires.

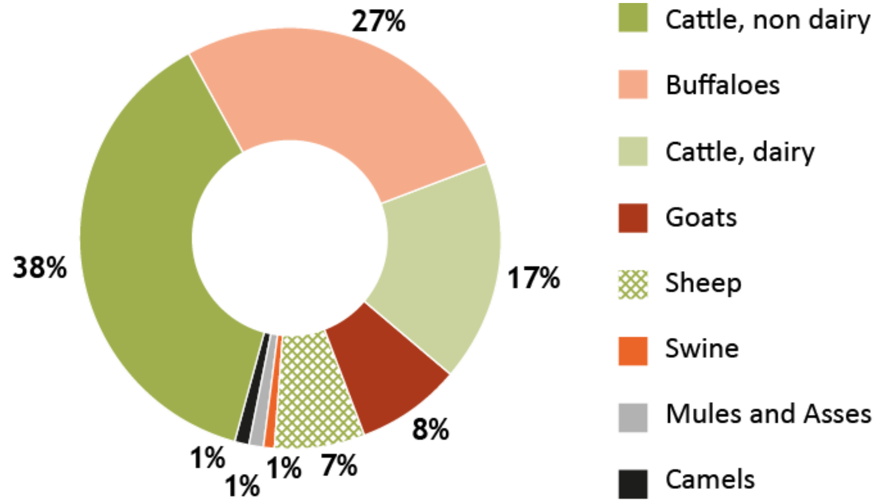




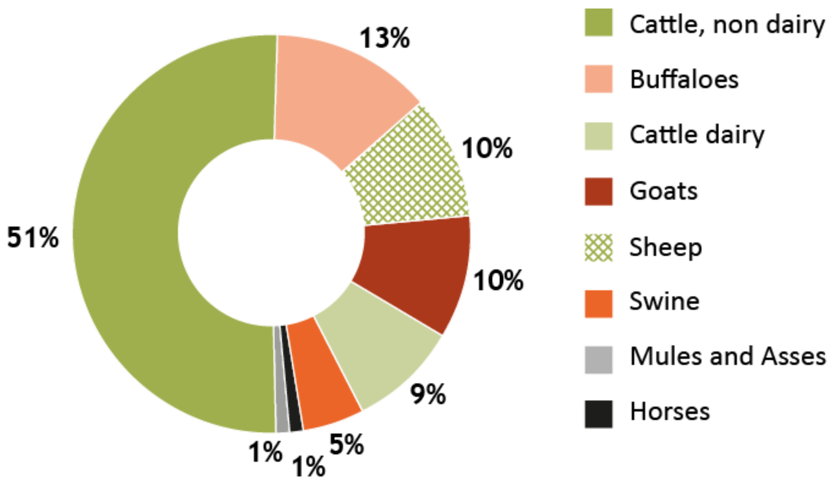
FAOSTAT data, which can be retrieved at global, regional and national levels, can also serve as a reference for quality assurance purposes.

3.3.4.2. Example of detecting emissions 'hotspots' using FAOSTAT regional and country data

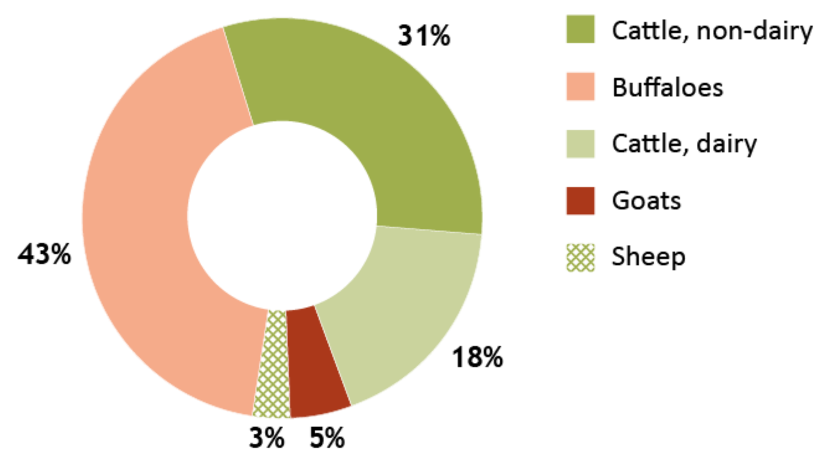
Asia: Enteric fermentation by animal type, 2012



China: Enteric fermentation by animal type, 2012



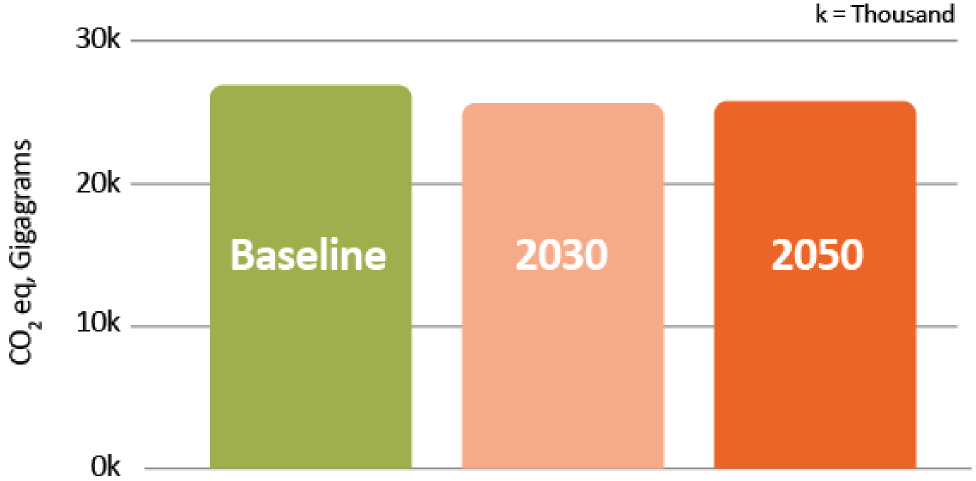
India: Enteric fermentation by animal type, 2012



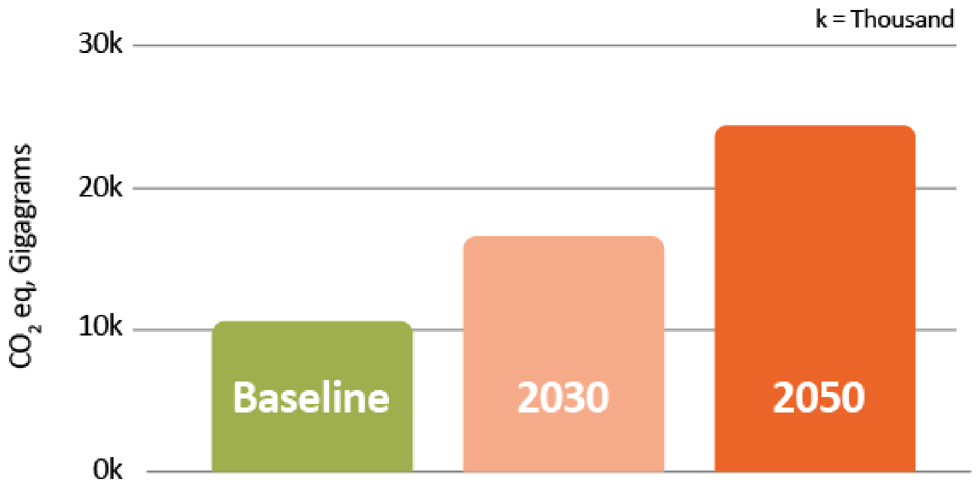
Data source: FAOSTAT.

3.3.4.3. Projections of GHG emissions

GHG emissions projections from rice cultivation in Viet Nam



GHG emissions projections from enteric fermentation in Viet Nam



FAOSTAT also produces projections of GHG emissions to 2030 and 2050.

In Viet Nam, for example, FAOSTAT projections indicate:

- emissions from rice cultivation under a business-as-usual scenario will remain stable, whereas,
- emissions from enteric fermentation will strongly increase by 2050.

*baseline is defined as the 2005 – 2007 average estimate of the corresponding FAOSTAT activity data multiplied by Tier 1 emission factors.

Data source: FAOSTAT.

3.3.4.4. Identification of mitigation hotspots with GLEAM

Identified emission hotspots do not always coincide with **mitigation potential hotspots**. In addition, default Tier 1 emission factors and a sectoral approach to GHG emission quantification may not reflect most of the mitigation efforts in agriculture. Therefore, it is recommended that **Tier 2** calculations are used for assessing the mitigation potential of technical interventions.

Modelling packages of options can support the identification of mitigation hotspots and priorities.

For instance, the **Global Livestock Environment Assessment Model (GLEAM),** a Tier 2 livestock sector specific biophysical model based on Geographic Information Systems (GIS) which adopts a life cycle assessment approach, has been developed to quantify GHG emissions in livestock supply chains and to assess the impact of mitigation and adaptation options on a national, subnational, regional and global scale.

- It differentiates emissions and emission intensities from livestock supply chains;
- assesses technical mitigation potential of interventions and their impact on productivity; and
- covers 11 main global livestock commodities and predominant livestock production systems.

GLEAM supports countries in the development of NAMAs by:

- ✓ Defining a baseline scenario and supporting countries in identifying and setting priorities for the livestock sector.
- ✓ Measuring impacts of mitigation actions on the livestock sector.
- ✓ Quantifying sustainable development benefits e.g. productivity gains.

To learn more about GLEAM, click here.

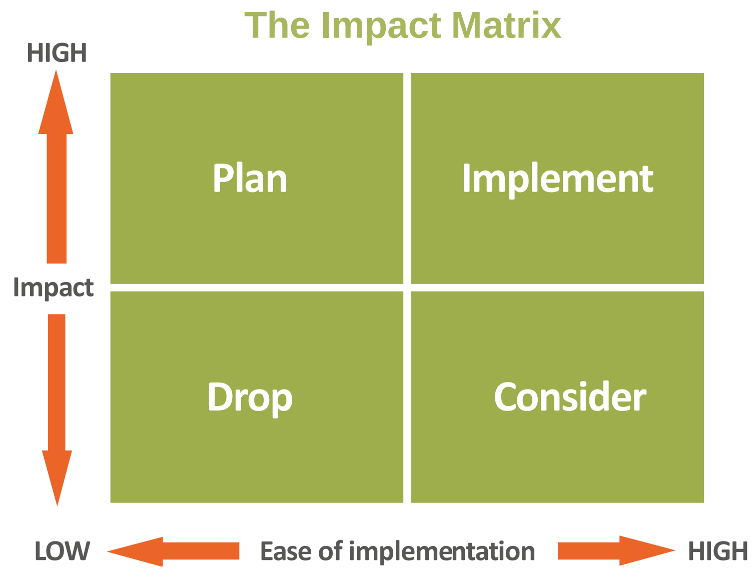
3.4. Step 2: Evaluation and prioritization of NAMA options

The mitigation priority setting is usually done through a political process. It is also influenced by the evaluation of technical and economic mitigation potentials and other characteristics of the possible actions, including their technical, political and cultural feasibility, trade-offs with other policy objectives, donor's financing priorities and MRV requirements.

Scoping can be used to make decisions on policies, technologies or practices to be promoted and the appropriate level of intervention (e.g. policy, programme or project; primary production or the entire value chain). Short-listed NAMA options can be prioritized and scored through a basic screening based on qualitative or rough quantitative data. This rough screening would assess:

Screening

- **GHG impacts: technical mitigation potential, permanence, risk of leakage**
- **time scale and ease of implementation**
- **non-GHG benefits supporting national development**
- **MRV feasibility and sustainability**
- **transformational impacts**
- **capacity for implementation** (economic feasibility, availability of technology and institutional framework)
- **risks and barriers to adoption**
- **implementation costs**
- **donors' financing priorities and private sector investment potential**

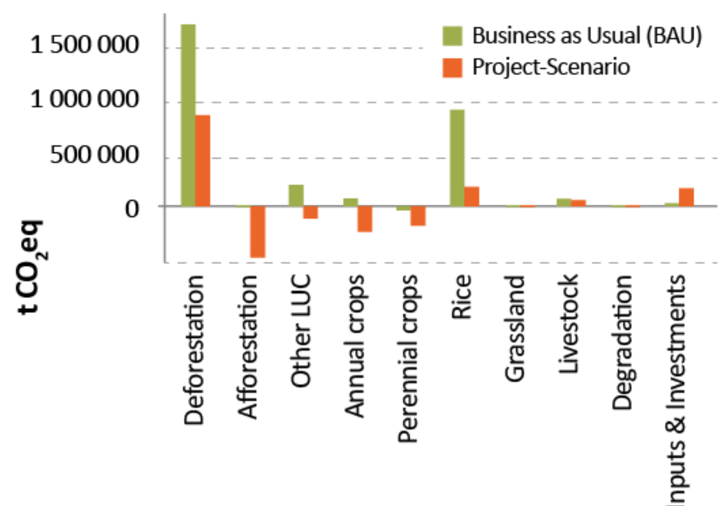


3.4.1. Screening technical mitigation potential: The FAO EX-ACT tool

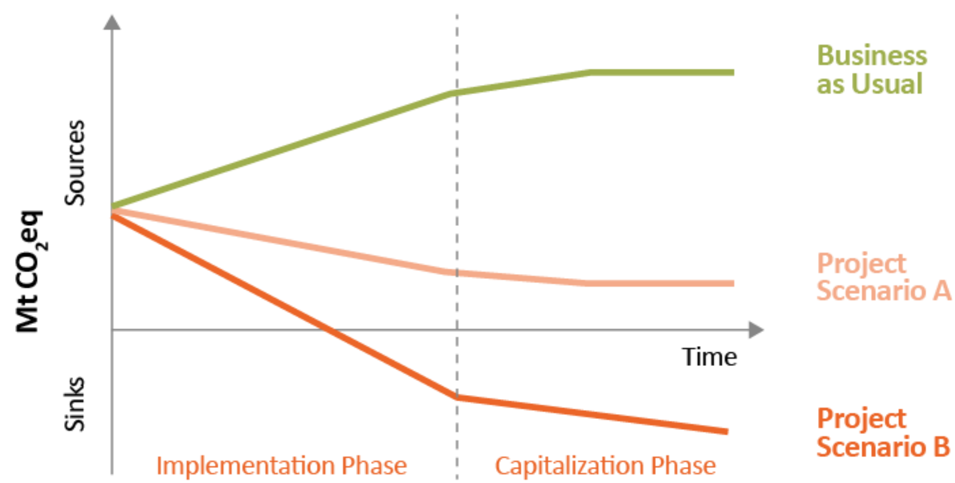
- Technical analyses are needed to identify potential agriculture activities, policies and measures for mitigation and their **technical mitigation** potential.
- Several tools are available for screening the technical mitigation potential of different actions. For instance, the FAO EX-Ante Carbon balance Tool (**EX-ACT**):
  - calculates ex-ante estimates of the impact of agriculture and forestry development projects, programmes and policies on the carbon balance; and
  - specifies the type of carbon pool (biomass, soil, other) or GHG that is involved.

EX-ACT output example

EX-ACT GHG-Balance of Project- and BAU-Scenario



GHG Emissions and Sequestration



- Also process-based models such as DayCent, DNDC, Roth C and GLEAM provide refined net GHG reduction estimates. They require more elaborated data inputs and advanced technical skills.

2 3.4.1.1. Example of screening based on technical mitigation potential of agricultural practices

Country	Climate change mitigation actions	Emission reduction potential by 2030 (in Mt of CO_2eq)
Ethiopia	Changed herd mix for more efficient feed conversion	18
	Improved feed, breed and management	17
	Reduced draught animal population	4
	Improved agronomic management of soils	40
	Increased yields through improved seeds, fertilizers and agronomic practices	27
Kenya	Agroforestry	4.2
	Conservation tillage	1.1
	Fire reduction in crop and grasslands	1.2
Brazil	Reduction of Amazon deforestation	564
	Reduction of Cerrado deforestation	104
	Restoration of grazing land	83-104
	Integrated crop-livestock system	18-22
	No-till farming	16-20
	Biological nitrogen fixation	16-20
	Planted forests	8-10
	Animal waste management	6.9

Source: Cited in Wilkes *et al.*, 2013b.

3.4.1.2. Example: Evaluation of mitigation potential, time scale and ease of implementation

Activity	Practices and Impacts	Technical Mitigation Potential	Ease of Implementation	Timescale for implementation
Livestock – feeding	CH_4: Improved feed and dietary additives to reduce emissions from enteric fermentation, including: improved forage, dietary additives (bioactive compounds, fats), ionophores/antibiotics, propionate enhancers, archaea inhibitors, nitrate and sulphate supplements.			
Livestock – breeding and other long-term management	CH_4: Improved breeds with higher productivity, which lower emissions per unit of product, or with reduced emissions from enteric fermentation; microbial technology such as archaeal vaccines, methanotrophs, acetogens, defaunation of the rumen bacteriophages and probiotics; improved fertility.			
Manure management	CH_4: Manipulate bedding and storage conditions; anaerobic digesters; biofilters; dietary additives.			
	N_2O: Manipulate livestock diets to reduce nitrogen excreta, soil applied and animal fed nitrification inhibitors, urease inhibitors, fertilizer type, rate and timing; control manure application practices, grazing management.			

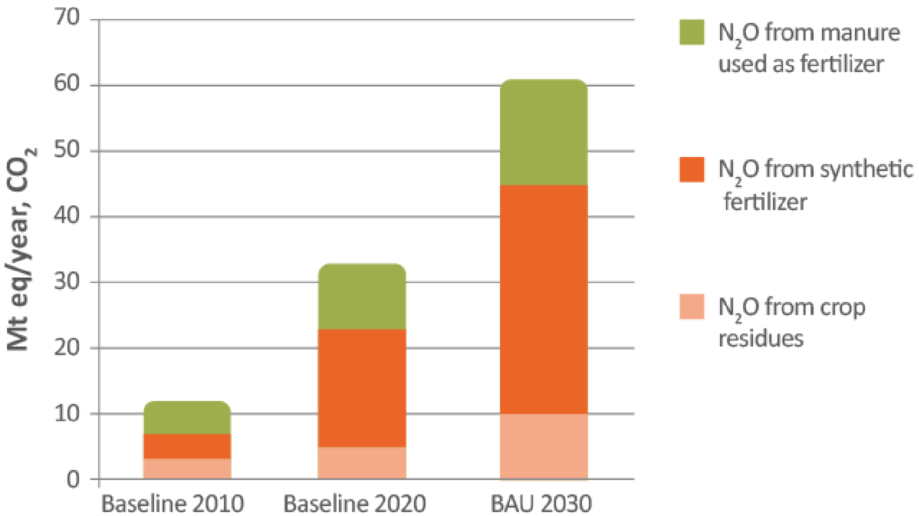
Technical Mitigation Potential: Area = (tCO2eq/ha)/yr; Animal = percent reduction of enteric emissions. Low = < 1; <5% (light color), Medium = 1–10; 5–15% (medium color), High = >10, >15% (dark color); Ease of Implementation (acceptance or adoption by land manager): Difficult (light color), Medium (medium color), Easy, i.e., universal applicability (dark color); Timescale for Implementation: Long-term (at research and development stage; light color), Mid-term (trials in place, within 5–10 years; medium color), Immediate (technology available now, dark color). Source: IPCC, 2014b.

2

3.4.2. Define scenarios and assumptions

- NAMAs in agriculture seek to reduce emissions compared to the business-as-usual (BAU) or baseline scenarios.
- Mitigation options are mainly evaluated on the basis of the incremental costs and benefits relative to the baseline scenario.
- To define future emission scenarios, different types of data are needed, including historical data and trends on production and/or consumption and emissions.
- The scenarios, supplemented by projections for population and economic growth and consumption patterns help estimate the anticipated future production trends, the land required and production practices.

Example of scenarios projection of GHG emissions from soils and cropland under BAU scenario in Ethiopia



This figure illustrates the projected trend in emissions from synthetic fertilizers in Ethiopia.
The major driver of increased emissions is the greater use of synthetic fertilizers (more applied per hectare and more fertilized cropland under cultivation).
The projections suggest that soil nutrient management practices that increase yields while reducing emissions could be one of the priorities for reducing GHG emissions from agriculture in Ethiopia.
Source: Federal Democratic Republic of Ethiopia, 2011.

3.4.3. Assessment of non-GHG benefits

NAMAs do not aim only at reducing and removing GHG from agriculture and land use. They should also deliver sustainable development benefits that are not related to the carbon balance and are in line with national development priorities.

Examples of non-GHG benefits against which NAMA ideas can be assessed:

Economic benefits	• increased farmers' and fisherfolks' household income level • improved energy security • number of jobs created in agriculture
Social benefits	• enhanced food security • decreased time for fuelwood collection • improved indoor air quality
Environmental benefits	• improved local air quality • improved water quality • enhanced biodiversity
Climate resilience	• improved water availability • reduced soil erosion • reduced deforestation and forest degradation.

2

3.4.4. Assessment of MRV

During the prioritization process it is important to consider carefully the **feasibility and sustainability, including the cost-effectiveness , of the foreseeable MRV system**. The MRV process allows for the monitoring of the NAMA 's performance towards its goals. The different components of the MRV process are:

M — **MEASUREMENT/MONITORING**
the collection and monitoring of relevant information and data on progress and impacts

R — **REPORTING**
the documentation of information in a transparent manner

V — **VERIFICATION**
assessments of the completeness, consistency and reliability of the reported information through an independent process

MRV indicators should be **specific, measureable, attributable, realistic and timed**.

For further information on MRV, go to Module 4.

3.4.5. Assessment of transformational impacts

Transformational actions trigger a fundamental shift towards greater sustainability. These actions promote widely replicable behavioural changes in a sector or country, or include measures that can be significantly scaled up to bring about profound changes in a sector's GHG emissions pathway (Wilkes *et al.*, 2013b).

- During NAMA prioritization, the transformational impacts of NAMAs are important to consider. Some donors prefer to finance NAMAs that bring transformational changes to the entire agricultural sector.

- A single project-level NAMA that is geographically limited in scale will not qualify for this sort of financing.
- In the AFOLU sector, where there is a high number of stakeholder groups and individual stakeholders, achieving sector-wide transformation can be challenging. It may require substantial changes at the policy level or in the operations of private companies. Examples of such changes are the introduction by the government of subsidies or a tax that will support the adoption of climate-friendly practices, or the decision of private companies to purchase only products that are produced in a carbon-neutral way.
- One option is to visualise the impact pathway from a single project or programme to the transformation of the whole sector (e.g. how the lessons from a project will be learned and up-scaled to the sector level).
- Costa Rica's Low-Carbon Coffee NAMA is a an example of an attempt to transform the entire coffee sector (see Module 5).

2

3.4.6. Assessment of economic and financial feasibility

The most common approach for assessing the potential NAMA ideas is to look at their economic costs and benefits. They can be calculated, for example, through **marginal abatement costs (MAC)**. MAC is the ratio of mitigation costs to emission reduction estimates for a given year.

There are limitations of MAC analyses, including:

- abatement costs per tonne of CO_2eq. may differ from investment costs and provide a poor guide as to which measures can easily be adopted by farmers
- the analysis is sensitive to the types of costs that are considered
- MAC curves do not capture many non-GHG benefits that NAMAs are expected to generate.

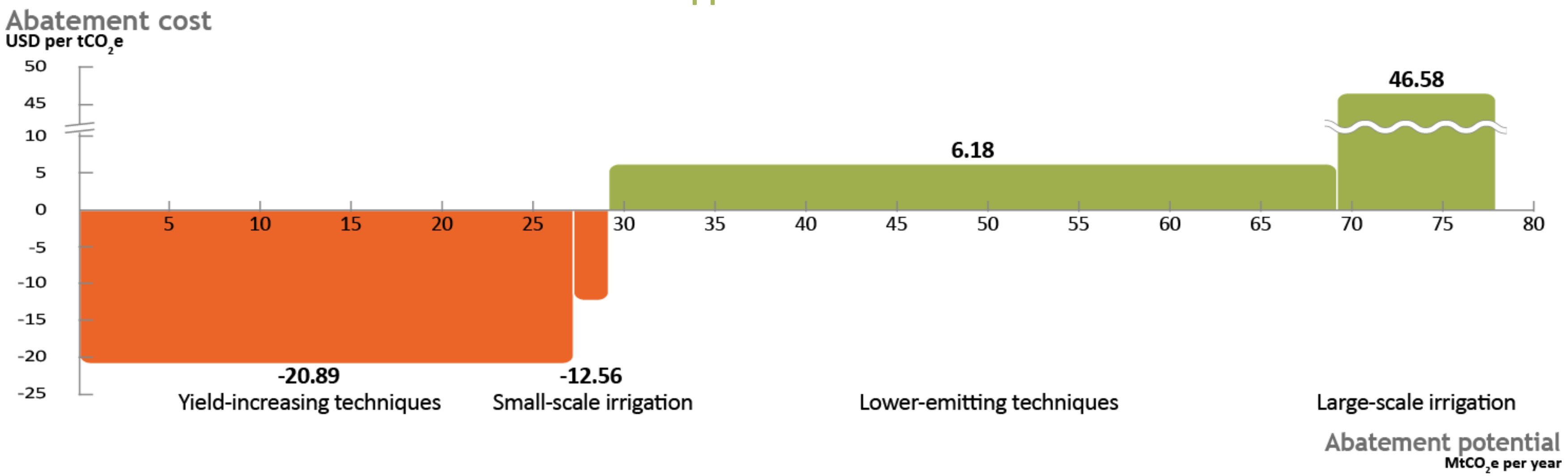
The EX-ACT tool allows for the calculations of marginal abatement costs for all AFOLU categories.

3.4.6.1. Example of assessment of economic feasibility

In Ethiopia, as in many other countries, mitigation options in agriculture have been ranked by the average cost per tonne of CO_2eq. reduced by each management option and the total amount of GHG emission reductions that each option could achieve.

For example, the figure below shows that the abatement costs (USD per tCO_2) of yield-increasing techniques and small-scale irrigation are negative and for lower-emitting techniques the costs are below the average carbon price (10 USD) that would make the implementation of these options economically feasible. The low cost is due to the increasing economic return per hectare of cropland and the estimated economic benefit from preserving forests instead of clearing them for agricultural production. The higher cost of achieving mitigation through large-scale irrigation is due to significant infrastructure investment required.

Abatement opportunities cost curve



Source: Federal Democratic Republic of Ethiopia, 2011.

3.4.7. Evaluation of risks and barriers

Assessing the risks and barriers is important not only for prioritizing NAMAs, but also for identifying required interventions for overcoming obstacles.

Unless the barriers are addressed, they may turn into **risks** to NAMA implementation.

Potential financing agencies also want to understand the risks attached to NAMA financing and implementation. Risks related to financing may hinder or delay NAMA implementation.

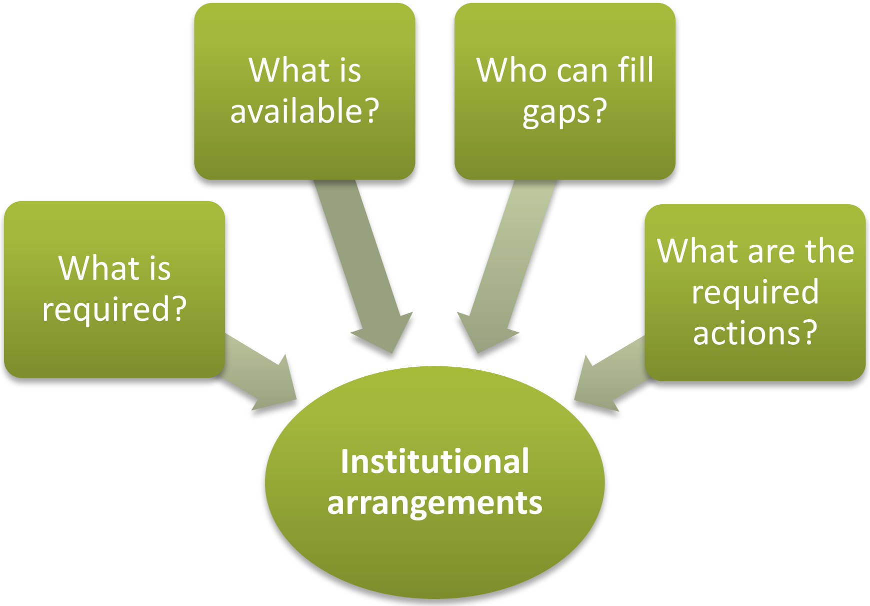
The limited number of agricultural NAMAs is due to a range of barriers. These can be grouped in 3 categories:

- **investment and cost barriers;**
- **technical capacity and data availability; and**
- **institutional barriers**

All the barriers and risks and their related remedies that have been identified during the development of the concept note can be listed in the NAMA proposal.

As soon as barriers are identified, it is important to identify required interventions for overcoming them.

Scoping for overcoming barriers



References and further reading: McCarthy *et al.*, 2011; FAO, 2012.

3.4.7.1. Investment and cost barriers

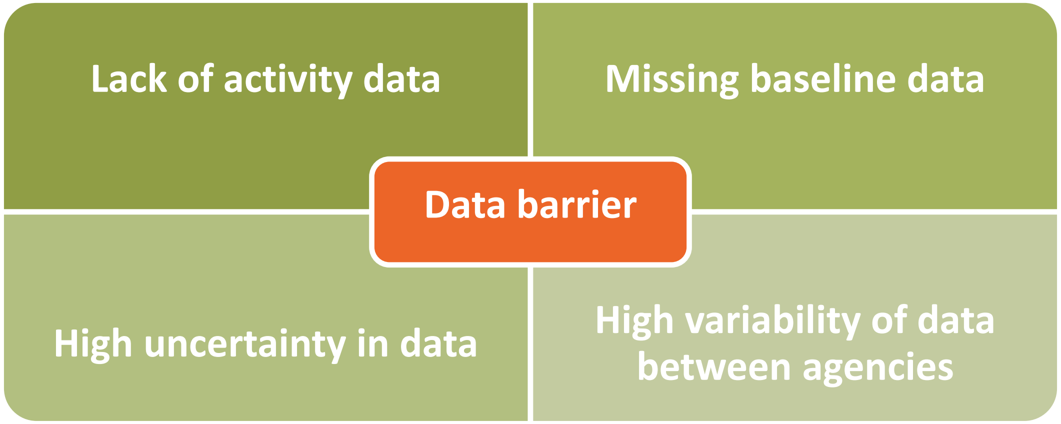
Investment and cost barriers for farmers include:

- limited financing and access to affordable capital;
- high currency risk due to fluctuation of foreign exchange rates;
- upfront investment costs (e.g. costs of investment in equipment, machinery, materials and labour);
- maintenance costs;
- opportunity costs of household assets;
- transaction costs (e.g. the time and travel costs of accessing technical advice or physical inputs); and
- risk-adjusted returns related to the uncertainty of the likely benefits, which may discourage farmers.

The high transaction costs of NAMA projects and their relatively low anticipated profit compared to risks may restrict international or private investors' interest.
Different guarantee mechanisms or special entities may need to be created to reduce risks.
Public co-financing may also help.

References and further reading: McCarthy *et al.*, 2011; FAO, 2012.

3.4.7.2. Main technical barriers for realizing NAMAs in AFOLU



Even though missing data or variability in data are barriers, it is possible to receive financing for NAMA preparedness to overcome these barriers.

Apart from incomplete data, technical barriers also include:

- non-availability of appropriate technology, capacity and equipment; and
- low detectability of short-term changes (e.g. for soil carbon the magnitude of annual changes is difficult to distinguish from measurements noise).

3.4.7.3. Institutional barriers

Institutional barriers include:

- insecure land tenure;
- national policy regulations;
- imperfect markets and low risk-taking capacity;
- weak inter-institutional coordination;
- gender-related cultural conventions;
- limited research and extension services; and
- an emphasis only on mitigation benefits without considering non-GHG benefits.

Examples of barriers related to imperfect markets and low risk-taking capacity include:

- poor market access and market risks due to culture and consumption habits; and
- farmers’ unwillingness or inability to take risks because climate change mitigation is seen as a lower priority compared to food security and income.

References and further reading: McCarthy *et al.*, 2011; FAO, 2012.

3.4.7.4. Example: Potential obstacles to implementation of a grassland and livestock NAMA in Mongolia

There are a number of potential barriers to the implementation of the Grassland and Livestock NAMA in Mongolia.

• In general, **the NAMA barriers** include the MRV requirements as defined by the climate financing mechanism and the coordination of the different public programmes with private sector investments.

• The **specific barriers related to the** National Livestock Programme are region-specific and depend on the intervention.

•For example, a survey conducted in the eastern steppe region revealed that poor access to water resources is the main reason why herders did not adopt rotation grazing.

Proportion of herders citing reasons for not rotating use of summer pastures

Reason	Proportion (%)
Poor access to water resources	63
Shortage of pasture resources	14
Poor cooperation among herders	12
Lack of transport and/or funds for transport	5
Other	7

Source: Adapted from Wilkes *et al.* 2013b.

3.4.7.5. Examples of interventions to overcome barriers

Barrier	Intervention
Weak coordination capacity between national and subnational institutions	Establish coordination mechanism between different levels
Lack of clarity on the roles and responsibilities	Develop a solid organizational structure with clearly defined responsibilities
Limited technical and analytical capacity	Implement capacity development and identify funding and resources for training
Lack of country specific activity data and emission factors for GHG accounting	Develop new data collection systems or augment existing systems
High investment risk	Provision of risk guarantees or insurance schemes
Low (or no) return on investment	Contribution to investment and operational costs **Up-front grant** **Funding during operation (e.g. carbon market)**
High up-front costs and lack of access to capital	Facilitating access to finance **Provision of credit** **Providing incentives to the existing financing system**

Source: Modified after MRV GIZ tool.

3.4.7.6. Example: Policy support for adopting agroforestry

Kenya: The government of Kenya has adopted policies to promote agroforestry. Key actions include the relaxation of restrictions on harvesting and marketing of tree products, tax incentives for growing trees on farms, and the creation of contract farming schemes to enhance trading of tree products between landholders and companies. Wangari Maathai's Green Belt Movement has also been instrumental in raising awareness about the importance of trees and for mobilizing thousands of women to plant millions of trees. This mix of regulation and incentives has resulted in a 215 000-hectare expansion of agroforestry over the last 30 years. Other national policies have promoted tree planting on Kenyan farms by supporting the training of extension service staff, establishing tree nurseries and prohibiting the harvesting of trees in public forests.

Reference: Cited in The Emissions Gap Report, 2013, UNEP.

India: In northern India, beginning in the late 1970s, poplar trees have been added to irrigated wheat and barley farms and now cover about 280 000 hectares – or 10 percent of irrigated agricultural lands in the area. Poplars provide timber and other benefits to farmers and do not significantly compete with crops for light and water. In addition, the Forest Conservation Amendment Act of 1988 prohibited cutting timber from state forests, which increased the price of wood and created an economic incentive to plant trees on farms. Agroforestry was further encouraged through credits for tree planting from the National Bank for Agriculture and Rural Development and through support provided by the timber industry in the form of higher quality planting material, such as seeds, fruit or aggregate fruit, training in agroforestry, and guaranteed timber prices.

Reference: Cited in The Emissions Gap Report, 2013, UNEP.

3.5. Step 3: Stakeholder identification and mapping

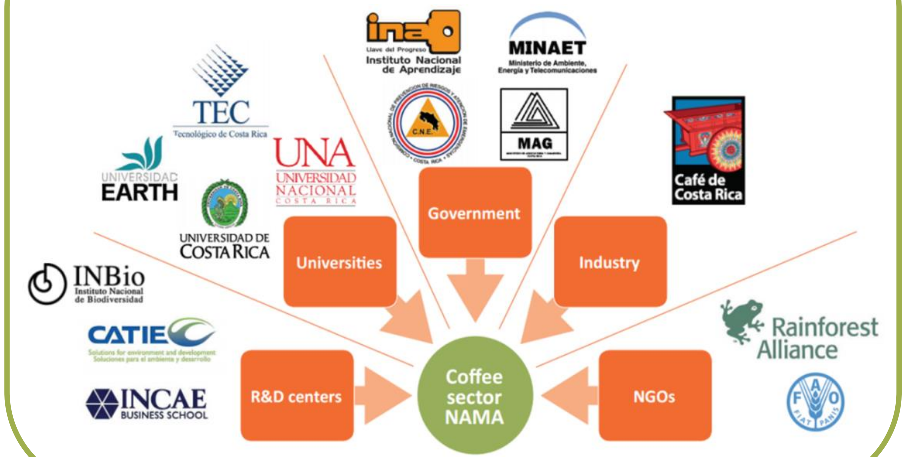
As NAMAs address several aspects of agriculture and land use development, the buy-in and support of a range of actors is needed for their successful implementation. The identification, planning and implementation of mitigation actions must involve several stakeholders.

> Stakeholder mapping can take place during the development of the concept note.

In the agriculture sector, examples of stakeholder groups include:

- smallholders and large-scale farmers, fisherfolk and forest dwellers (female and male) and their organizations;
- civil society organizations (CSOs);
- value chain actors (e.g. processors, transporters, wholesalers and retailers);
- domestic financing agencies;
- agriculture, forestry and fisheries research and extension or development institutions;
- national and local governments;
- policy makers and administrators;
- climate change focal points and coordination units;
- international partners; and
- national and international financing agencies.

Example of mapping of stakeholders for coffee sector NAMA



3.6. Step 4: Processes for involving stakeholders

- Leadership, cross-government involvement and stakeholder support are critical to develop a well-informed NAMA implementation plan.
- Stakeholder engagement throughout the process serves several functions:
  - it enables data collection;
  - garners the support and buy-in of different government departments and sectorial stakeholders;
  - promotes government coordination;
  - raises broader public awareness; and
  - generates agreement on principles and priorities.
- Stakeholder involvement can take different pathways depending on:
  - the existing consultation mechanisms; and
  - decision-making structures of the country.

For practical reasons, it is best to:
- start with a few key stakeholders; and
- gradually increase the scope when the NAMA becomes more concrete.

- During planning it is recommended that:
  - government bodies at different levels of governance cooperate and that all stakeholders share responsibility for the technical, policy and institutional dimensions of the planning process; and
  - stakeholders from outside the government are also involved.

3.6.1. Defining stakeholders roles and responsibilities

It is vital to clearly define and agree on the roles and responsibilities for all stakeholders. Joint working groups for AFOLU stakeholders in the national climate change coordination mechanisms provide a platform for a discussion and create opportunities for sharing knowledge.

Examples of potential roles of stakeholders in AFOLU mitigation planning

Stakeholder grouping	Potential role in agriculture sector NAMAs
Government ministries and agencies	• lead the process and provide the policy and legal framework • allocate domestic public resources and apply for international financing • provide adequate institutional structures (e.g. for reporting and verification)
Farmers, pastoralists, fisherfolk, forest dwellers' and their organizations	• prioritize practices with mitigation potential • implement and provide feedback • raise awareness and lobby on behalf of farmers
Agribusiness and other private business	• adopt mitigation practices • provide feedback to the government • invest in profitable mitigation initiatives
Civil society organizations	• monitor for accountability and raise awareness • provide feedback to government and private sector • lobby for constituents' interests
Research and development institutions	• carry out awareness raising and capacity development research on mitigation options including GHG emissions measurement and monitoring • analyse policy needs and options and economic and social aspects of mitigation
International organization	• provide funding • support MRV systems development • provide institutional capacity development

Source: Adapted after Wilkes *et al.*, 2013b.

3.6.2. Describing NAMA ownership

As already mentioned, mitigation actions will often involve actors from many different sectors. For example, Rwanda's Green Growth strategy identified 14 programmes of action, with some programmes targeting the agriculture sector. The table below provides examples of cross-sectorial actions. Rwanda's strategy also highlights the fact that although the lead responsibility can be assigned to individual ministries, the programmes cut across sectors and require cooperation across ministries and with stakeholders outside the government.

! It is important to identify the government entity that will lead and own the NAMA and coordinate and engage all stakeholders.

Examples of cross-sectorial actions in Rwanda

Cross-sectorial actions	Sector										
	Agriculture	Water	Land	Transport	Forestry	Mining	Energy	Industry	Health	Education	Local government
Sustainable intensification of small-scale farming	√	√	√		√					√	√
Agricultural diversity for local and export markets	√	√	√	√			√	√		√	
Integrated water resource management and planning	√	√	√		√	√	√	√	√	√	√
Sustainable land use management and planning	√	√	√	√	√	√	√	√		√	√
Sustainable forestry, agroforestry and biomass energy	√	√	√		√		√	√	√	√	√
Disaster management and disease prevention	√	√	√	√	√	√	√	√	√	√	√
Climate data and projections	√	√	√	√	√	√	√	√	√	√	√

Source: Adapted from Wilkes *et al.* 2013b.

3.6.3. Example: Grassland and livestock NAMA in Mongolia: stakeholder identification and involvement

In Mongolia's grassland and livestock NAMA, stakeholders have been identified and are involved at the interministerial level, the technical and political level and at the district (Soum) level for implementation.

• At the **interministerial level,** the Ministry of Environment and Green Development (MEGD) has the primary mandate for action on climate change in Mongolia. Implementation of the proposed NAMA is the mandate of the Ministry of Industry and Agriculture (MIA). A national technical working group (NTWG) will strengthen capacity for NAMA implementation. The NTWG is chaired by the MEGD and has representation from the MIA, as well as from other closely related agencies, such as the Administration of Land Affairs, Construction, Geodesy and Cartography under the Ministry of Construction and Urban Development; and the Institute of Meteorology and Hydrology under the MEGD. It is recommended that for the further development of a grassland and livestock sector NAMA there should be wider participation of representatives of other relevant ministries (e.g. the Ministry of Finance); the Parliamentary Agriculture and Environment Committee; related coordination bodies (e.g., the National Committee for Combating Desertification); civil society groups (e.g. the Citizens' Council on Environment, an umbrella organization for CSOs); and representatives of business and other stakeholders.

• At the **technical and political level,** stakeholders will coordinate technical support with decisions being made at the district level and driven by stakeholder demand. Both aspects of the decision-making process are equally important in the design of a NAMA. Experts in grassland management and rural policy have already been involved in the activities of the NTWG, including experts from the Research Institute of Animal Husbandry, the Mongolian State University of Agriculture and the Mongolian Academy of Sciences. Development partners with large projects in related areas (e.g. the Global Agriculture and Food Security Programme grant managed by FAO and the World Bank) have additional roles to play in ensuring that past experiences in project implementation inform the design and implementation.

• The **implementation at the district level** requires comprehensive stakeholder consultations and coordination in the framework of local planning initiatives. Many activities prioritized for the NAMA have previously been implemented in Mongolia. Therefore, site-specific experience and the inclination of interest among herder associations and their members to adopt the proposed practices is crucial for successful implementation.

Stakeholders have been involved throughout the process, starting at the interministerial level. Gradually stakeholders at all levels have been consulted and have participated in the feasibility and planning stage.

3.7. Step 5: Identification of potential financing sources

Identifying financing sources begins with an analysis of the national and subnational budgets. This analysis must address the following questions:

- What are the resources allocated to the sector?
- How much is allocated to different subsectors and actions?
- What is the level of climate change-specific financing?
- Is there flexibility to redirect existing funds to low-emission agriculture development?

After reviewing public sources, it is recommended to consider international and private financing options. For further details, see Module 5.

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3.8. Step 6: Concept note development

After prioritizing and selecting NAMA options, a concept note can be developed. The writing of the concept note, as is the case for the whole NAMA development process, is usually led by the government. NAMA implementation requires, however, commitment, substantial investments and leadership from the private sector and related actors.

It is recommended in a concept note to give a concise overview (2–3 pages) of the proposed activities. Existing examples of NAMA concept notes cover a range of different aspects, but in principle a NAMA concept note can describe the main characteristics and impacts of the proposed action. It can include the following elements:

- title,
- country,
- implementing party and contact details,
- a brief description of the a selected NAMA,
- proposed activities and the economic mitigation potential,
- time frame,
- expected impact of proposed activities, and
- expected costs, investment requirements and financing sources.

- Once the concept note is ready, it can be submitted to the UNFCCC NAMA registry to attract donor attention.
- The government can also directly approach financing agencies.

For guidance on submissions to UNFCCC NAMA registry, see Module 2.

3.9. Step 7: Designing NAMA activities

The development of a NAMA activity follows a step-by-step approach. Each activity should contribute to the achievement of the NAMA's overall objectives. The first step is to raise awareness and build readiness for NAMA planning and implementation among the stakeholders. The next set of activities are those that help put the main NAMA building blocks in place in a relatively short time frame with limited resources. This is followed by another set of activities that usually require additional funding. The final set of actions is implemented over the medium term and brings about significant changes, for example, in policy or legislation.

Actions	NAMA awareness raising, readiness building	+	Short-term actions with limited additional resources	+	Main short- and medium-term actions with domestic and/or international financing	+	Medium- and long-term actions (e.g. policy changes)
Examples	Stakeholder engagement, planning for NAMA actions		Preparing training material and capacity development		Pasture improvement, animal breeding and health programmes and value chain development		Changes in agriculture, livestock and marketing policies, taxes and incentives

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3.9.1. NAMA proposal vs concept note

It is recommended to describe all NAMA activities in a NAMA proposal. In contrast to the concept note, the NAMA proposal should provide more detailed information on NAMA activities and implementation.

Additionally, it can:

- demonstrate strong government commitment;
- identify financing sources; and
- include information on MRV, especially if the proposal is for NAMA implementation, rather than capacity development and monitoring system development.

NAMA proposals can include the following elements:

- title;
- country;
- implementing party and contact details;
- time frame;
- introduction and background, including:
  - country overview,
  - national GHG emissions overview,
  - overview of vulnerability to climate change,
  - national government policies and priorities;
- general description of the sector;
- overview and scope of NAMA, including:
  - objectives,
  - action plan and list of NAMA activities,
  - list of stakeholders groups;
  - impacts: including:
    - estimated net GHG emissions reduction potential, and
    - sustainable development and climate resilience benefits;
- costs of the actions and information on required financial support; and
- external non-financial support required.

In many cases, the proposal structure will follow the donor's requirements.

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3.10. Step 8: Implementation - Putting a NAMA into action

During the inception phase, the project team in cooperation with other stakeholders, including youth and women, establishes the practical arrangements for implementation. Usually, key stakeholders and financing agency representatives are invited to a launching seminar or kick-off meeting.

It is recommended to finalize the detailed operational plan at the end of the inception phase. During the inception phase, it is also possible to further survey GHG emissions and removals and other ancillary data, and develop indicators and plans.

The implementation steps, usually described in the NAMA document and/or separate work plan, include the:

- operational plan;
- financial management plan;
- MRV plan;
- organizational arrangements, including roles and responsibilities as well as steps for additional staff recruitment;
- decision-making system; and
- information dissemination plan.

Depending on the NAMA, work plans will be updated annually, semi-annually or quarterly. Project implementation needs to be flexible and adjustable to changes in the project environment.

The implementation steps may be different for a fast-track NAMA that is built on an existing programme than they are for a NAMA that is an entirely new project or programme.

For further details on implementation, see:

The basics of project implementation. A guide for project managers, published by CARE; and

Guidance for NAMA Design, 2013 prepared by UNDP, UNFCCC, UNEP Risø

3.11. List of guidebooks for NAMA development

Title	Year	Description	Organization
Building blocks for Nationally Appropriate Mitigation Actions	2012	The guidebook provides key principles and building blocks for the selection of NAMAs and the development of a proposal for a selected NAMA. It also deals with aspects of implementation.	African Development Bank (AfDB)
Developing Financeable NAMAs: A Practitioner's Guide	2013	The guidebook presents a step-by-step methodology for screening NAMA opportunities, with the Quick Screen designed specifically for developing NAMA concepts and the Deep Screen for developing NAMA proposals.	International Institute for Sustainable Development (IISD)
Guidance for NAMA design: Building on country experience	2013	The publication aims to support developing countries in developing and implementing NAMAs by providing guidance and best practice examples on key aspects of NAMAs, including financing, institutional arrangements and roles of different actors, MRV, policy frameworks and potential actions.	UNCCC, United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP)
Understanding the concept of Nationally Appropriate Mitigation Action	2013	This book describes how the concept of NAMA emerged in the context of the negotiations on climate change. It also addresses MRV, institutional arrangements and financing issues.	UNEP Risø Centre
National Planning for GHG mitigation in Agriculture: A guidance document	2013	The guidebook describes in details the policy, technical and institutional dimensions that need to be addressed during national mitigation planning processes.	FAO and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)
Nationally Appropriate Mitigation Actions (NAMAs) Steps for Moving a NAMA from idea towards implementation (in French, English and Spanish)	-	The NAMA-Tool provides developers and implementers of NAMA with brief step-by-step instructions on how to develop a NAMA. The tool navigates users to the relevant information, knowledge, instruments and publications available.	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

3.12. Quiz: Step-by-step NAMA development

True or false?

Statement	True	False
An AFOLU NAMA should be aligned with and support the achievement of the short- or long-term objectives of national and agriculture development priorities.		
During in-depth assessment already existing programmes and projects are analysed for NAMA development.		
The fast-track approach always results in the highest possible emission reductions within the sector in contrast to the in-depth approach.		
For identifying NAMA options National Communications and BURs can provide information.		
NAMAs should aim to bring transformational changes to the entire agricultural sector.		
Leadership, cross-government involvement and stakeholder support are critical in the development of a well informed NAMA implementation plan.		

To see the correct answers, click here.

3.12.1. Correct answers for quiz 3 – Step-by-step NAMA development

Statement	True	False
An AFOLU NAMA should be aligned with and support the achievement of the short- or long-term objectives of national and agriculture development priorities.	x	
During in-depth assessment already existing programmes and projects are analysed for NAMA development.		x
The fast-track approach always results in the highest possible emission reductions within the sector in contrast to the in-depth approach.		x
For identifying NAMA options National Communications and BURs can provide information.	x	
NAMAs should aim to bring transformational changes to the entire agricultural sector.	x	
Leadership, cross-government involvement and stakeholder support are critical in the development of a well informed NAMA implementation plan.	x	

3.13. Exercise: Prioritization matrix

Task: For a selected agricultural category identify NAMA options and evaluate from 1 to 5 (1=low, 5=high) the benefits it delivers with regards to GHG reduction and/or removal, and food security and adaptation; its ease of implementation; its replicability; the feasibility of MRV; and its economic profitability.

Actions	GHG reduction	Food security	Adaptation	Feasibility of implementation	Replicability	MRV feasibility	Economic profitability

3.14. Exercise: NAMA idea for a concept note developme

Task: For the selected NAMA options insert information on available data sources, relevant stakeholders, funding sources, barriers and possible interventions to overcome barriers.

Actions	Available data sources	Stakeholders	Funding sources	Barriers	Interventions to overcome barriers

MODULE 4: Measurement, Reporting and Verification (MRV) for an AFOLU NAMA

Learning outcomes

At the end of this lesson, you will:

1. know about methods for monitoring GHG and non-GHG benefits;
2. be familiar with guidance for reporting and verification procedures; and
3. receive a list of availaible resources for supporting MRV performance.

Table of contents Module 4

4.1. Measurement, Reporting and Verification (MRV)

Measurement/monitoring activities and collecting data on GHG fluxes and on non-GHG impacts, as well as on financial flows and overall implementation progress.

Reporting in a transparent manner and sharing information on the NAMA's impacts on GHG fluxes and non-GHG, its support for national development, and its financial status by providing background data, data sources and methodologies applied for data quantification.

Verifying the completeness, consistency and reliability of the reported information through an independent process.

The objective of MRV is to assess the progress of a NAMA towards its mitigation and national development goals.

4.2. MRV status

As of today, there are no official guidelines for developing and implementing monitoring systems for NAMAs.

When developing monitoring systems, it is important to consider:

- feasibility,
- sustainability,
- cost-effectiveness and
- the possibility of monitoring multiple impacts.

It is recommended to build MRV systems on existing agricultural national monitoring systems and assess the extent to which they are able to provide information for credible estimates in national and international climate policy contexts.

Methodologies for measuring and reporting the impact of mitigation actions have been designed for Clean Development Mechanism (CDM) projects or Verified Carbon Standard (VCS) and may provide a basis for developing monitoring and reporting systems for NAMAs. However, these methodologies do not encompass the diverse aspects of NAMAs. Adjustments may need to be made depending on the NAMA's scope. For instance, the cost of using these methodologies can be too high for agricultural projects. Also, MRV requirements for NAMAs can be less restrictive than those related to carbon markets.

Donors may have additional MRV requirements for NAMAs for which they provide support.

4.2.1. Existing MRV schemes

Scheme	Primary focus	Relevance for NAMAs
National Communications	Climate change mitigation and adaptation	Information on programmes containing measures to mitigate climate change, meteorological information, adaptation and GHG emissions
GHG inventories	GHG emissions and removals	Information on GHG emissions by sources and removals by sinks by sectors and categories
Biennial Update Reports (BURs)	Climate change mitigation, adaptation and support	Information on mitigation actions planned and under implementation, including national GHG inventories
Reporting for CDM and other carbon market projects	Emission reductions from projects	Information on emission reductions and removals enhancements from projects
National Forest Monitoring Systems	Forests	Information on forest cover and associated carbon stocks and their changes
Policy monitoring and evaluation	Depends on the policy objective	Information on a range of subjects (e.g. livestock, breeding practices)

4.2.2. Gap analysis between existing monitoring schemes and NAMA MRV requirements

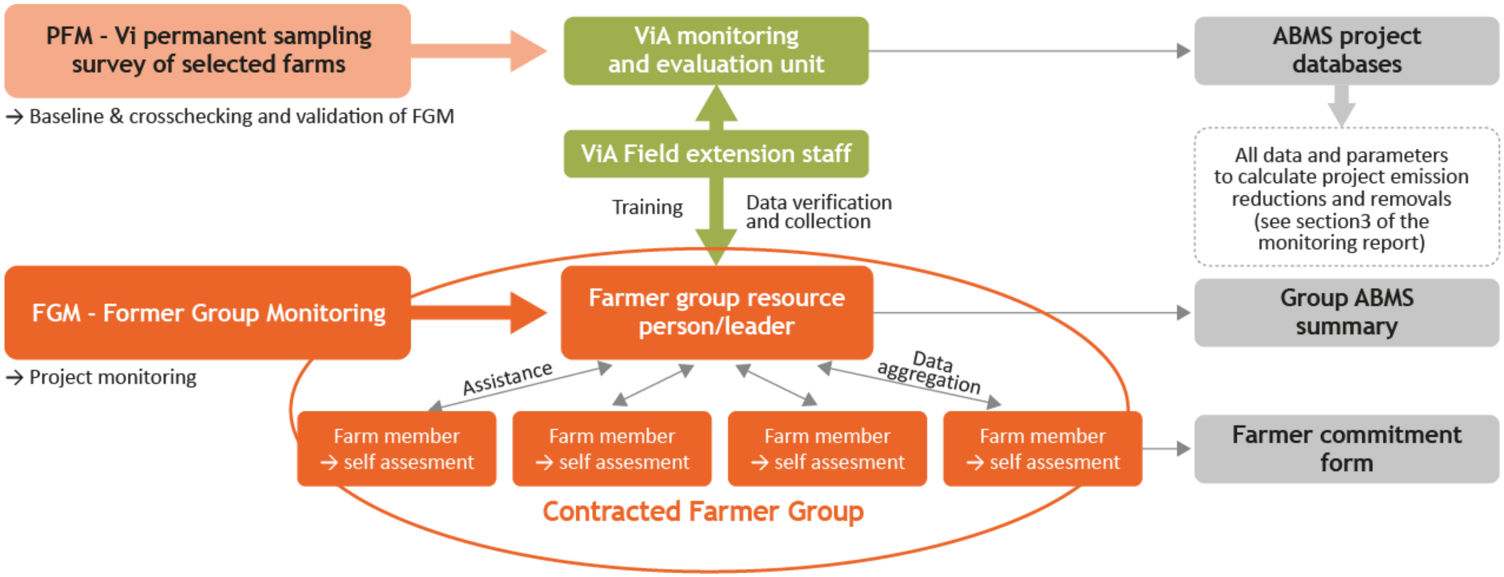
- Take stock of current monitoring schemes
- Assess whether GHG and non-GHG benefits can be measured and streamlined into the existing schemes
- Analyse which aspects of these schemes could be adapted to monitor GHG and non-GHG indicators
- Check their functionality and cohesion with stakeholders
- Evaluate whether donor requests for additional MRV actions can be integrated easily

4.2.3. Example: Monitoring of carbon sequestration of Kenya's Agricultural Carbon Project

The Kenya Agricultural Carbon project is using the Sustainable Agricultural Land Management methodology to monitor carbon sequestration in the tree biomass and the soil. This methodology was approved by the VCS. The methodology is based on an activity baseline and monitoring survey (ABMS) and an estimation of soil carbon stock changes using the Roth C model. Tree biomass is monitored by counting trees per strata considering diameter and use.

Activity data consist of information on the project area, management practices and crop yields per area. After receiving training, the farmers collect the information as part of their farm records to monitor inputs, outputs and profits over time. It also helps extension staff in benchmarking different practices and provides specific extension support. The activity data is combined with emission factors to quantify emissions or removals per unit of activity following good practice guidance of the IPCC.

The ABMS monitoring system collects field data using two different monitoring approaches: Permanent Farm Monitoring (PFM) by project extension staff and Farmer Group Monitoring (FGM). The basic distinction between the two monitoring components is that the PFM is entirely implemented by the field officers from Vi Agroforestry (the project implementer) on permanent sample farms and provides a representative survey. The FGM is conducted by the farmers themselves. The figure below illustrates how the system works.



4.3. Objectives of monitoring

From the start of the monitoring design procedure, it is important to define the objectives of the NAMA's monitoring system and MRV processes.

Scoping the objective(s) of the MRV system for a NAMA will help define the data needs. It will also help assess the feasibility and cost effectiveness of the system.

The following questions need to be addressed:

- What variables can be monitored for estimating GHG emissions and removals associated with the NAMA and are those variables enough for preparing credible estimates?
- Which indicators can be monitored for detecting and possibly quantifying non-GHG impacts?
- What is the current and the preferable timing for collecting data for preparing GHG estimates and for indicators of non-GHG impacts?
- What is the uncertainty of information collected?
- Is the information needed for preparing GHG estimates and for indicators of non-GHG impacts already being collected?
- Who is going to collect the data?
- Who is going to use the results?
- Is it to respond to donors' requirements?
- Is it to monitor a policy's performance and guide policy making?
- Is it to comply with UNFCCC requirements?
- Through which channels will the results be reported (i.e. how can local project-level data collection be organized in a consistent manner with other projects, and how can the local data can be centrally stored and utilised)?
- Is it going to inform farmers and extension staff or private companies for tracking performance and benchmarking production systems?

4.4. MRV plan components

The MRV plan should **help guarantee the NAMA's credibility by ensuring its results are consistent, complete, accurate and transparent**.

The MRV plan for NAMA implementation should include the following aspects:

- objective(s) in terms of the GHG benefits (targeted quantity of GHG reductions and removals) (e.g. reduced emissions from agriculture by 20 percent) and non-GHG benefits (e.g. agriculture production and productivity increased by 20 percent).
- actions start and end dates (e.g. 5 years);
- geographical scope, (e.g. 3 provinces);
- list of NAMA activities;
- indicators (GHG estimates of emissions and removals as well as non-GHG based indicators) for all activities;
- frequency of performance of separate MRV actions (e.g. data is collected every 3 months, reported every 6 months, verified every year);
- responsible entities for all actions;
- information on how collected data will be reported, centrally aggregated and stored; and
- details on quality verification.

Criteria of credibility of MRV	
Consistency	The same methodology is used for different years and consistent data sets are used for sinks and sources.
Completeness	All GHG sinks and sources are reported.
Accuracy	There is no systematic bias and uncertainty is reduced as far as is practical.
Transparency	Assumptions and methodologies used are clearly explained to allow for informed consideration.

4.5. Selection of monitoring methodology

There is great variation in GHG estimation requirements. For example, financing agencies have their own requirements and national GHG reporting systems also require specific types of data.

The monitoring methodology may also differ between policy-level NAMAs and project-level NAMAs.

Examples of sources of input data for setting the baseline and monitoring implementation include:

- official statistics,
- GHG inventories,
- emission factors (Tier 1, Tier 2 or Tier 3) depending on measurement requirements,
- economic and population growth projections,
- consumption data,
- changes in commodity prices, and
- sector-specific data, such as livestock populations and area of cultivated land.

Sometimes, **biophysical data** is required, which may demand that actual emissions and removals measurements from different management practices be carried out or that the existing data be analysed. This is the case especially if the aim is to develop country-specific emission factors, instead of using the generic IPCC Tier 1 factors for estimating emissions and removals.

Data needed for monitoring NAMA impacts and setting the baseline may have been collected for other purposes. That is why it is important to identify existing MRV schemes, such as GHG inventories or national forest monitoring system as well as other data collection/reporting systems at both the national and international level.

4.6. Determine the baseline

A baseline provides a reference level to assess the actual changes of GHG emissions and removals, and non-GHG benefits resulting from NAMA activities.

- Setting a baseline is a data-intensive exercise.
- The main challenge for establishing the baseline lies in the availability of data. The data may be non-existent, incomplete, outdated or of unknown accuracy.
- Rectifying such shortcomings may require technical capacity development and/or national or international technical assistance.
- If the baseline is based on assumptions, these assumptions have to be transparently documented and their quantitative impact assessed.

The following sources of information can be considered for the input data when setting the baseline and monitoring NAMA implementation:

- GHG inventory,
- sector-specific data,
- consumption data,
- IPCC emissions factors,
- economic growth projections and
- population growth projections.

4.7. Monitoring indicators

The indicators define what gets measured, reported and verified. They also define what kind of monitoring methodology needs to be applied.

The GHG impacts of NAMAs are quantitative (e.g. GHG emissions from the baseline compared to GHG emissions resulting from the NAMA).

NAMA non-GHG benefits can be either:

- quantitative (e.g. number of jobs created, changes in income levels) or
- qualitative (e.g. changes in soil and pasture quality, soil structure, animal health, women's workload).

Ideally, qualitative impacts should be based on quantitative data.

Two types of indicators can be used to monitor the progress of the NAMA towards its objectives :

- activity indicators (e.g. number of persons trained) and
- GHG-specific indicators (e.g. amount of fertilizer multiplied by the emission factor).

For each indicator (GHG based and/or non-GHG based indicators), decide on the following:

- baseline;
- monitoring frequency (e.g. livestock population: every year; animal health improvements: every 3 years; job creation: every 4 years);
- parameters and sources of information (e.g. livestock population census: statistics of the Ministry of Agriculture);
- description of methods for monitoring variables, including assumptions and data sources;
- uncertainty associated with background data and with estimates;
- responsible entity for each indicator; and
- reporting modality (e.g. database, central reporting authority).

UNDP's Sustainable Development Evaluation tool is an example of a tool NAMA developers and policy makers can use to evaluate the sustainable development performance indicators and sustainable development results achieved over the lifetime of the NAMA.

4.8. Estimation of GHG emissions and removals

Generally, the amount of GHG emissions and removals is calculated by multiplying the **activity data** by the **emission factor**.

Activity data: Data describing the magnitude of a human activity that results in emissions or removals of GHGs during a given time period and over a specified area (IPCC, 2006, FAO, 2015).

Emission factors: A coefficient quantifying the emissions or removals of a GHG per unit of activity (e.g. emissions per ha). Emission factors are often based on a sample of measurement data, averaged to develop a representative rate of emission for a given activity under a given set of management practices.

GHG emissions and removals are multiplied by the respective Global-Warming Potential to convert them into CO_2 equivalent units (IPCC, 2006, FAO, 2015).

Emission calculators (e.g. EX-ACT, Cool Farm Tool, Carbon Benefit Tool) and estimation models (e.g. DayCent, DNDC, GLEAM) provide GHG emission and removal estimates and help compare the different management options and their mitigation potential.

4.8.1. Activity data

To estimate GHG emissions and removals, the priority is the collection of activity data.

Examples of activity data include:

- data on livestock type and numbers;
- area extent of lands managed as cropland, pastures and forests;
- amount of synthetic or organic fertilizer applied; and
- area of burned land.

These data can be obtained through the usual project monitoring mechanisms, remote sensing or from agricultural statistics and surveys.

International sources, such as FAOSTAT, can be used when national information is not available.

In FAOSTAT, activity data are taken mainly from FAO surveys and the Forest Resources Assessment and complemented by other international sources. Other activity data are generated using geo-referenced data. Data on burned areas is obtained from Global Fire Emission Database 4, and data on organic soils area from the Harmonized World Soil Database.

These data can be accessed through FAOSTAT Emissions database as national aggregates and will soon be available for download through FAOSTAT's Emission Analysis Tools in a geo-referenced format.

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4.8.2. Emission factors

GHG measurements are necessary if the country wants to develop country-specific emission factors. To start with, the MRV system can be constructed relying on the IPCC emission factors (Tier 1 monitoring). A gradual move to at least Tier 2 data based on statistically robust national surveys is recommended.

GHG monitoring: Tier levels

The IPCC-2006 Guidelines present three tiered approaches for emissions monitoring. Generally, moving to higher tiers improves the inventory's accuracy and reduces uncertainty, but the complexity and resources required for conducting inventories also increase.

Tier 1	Tier 2	Tier 3
• Tier 1 is designed to be the simplest to use. Equations and default parameter values (e.g. emission and stock change factors) for these methods are provided by IPCC guidelines. Country-specific activity data are necessary, but for Tier 1 the sources of activity data estimates are often globally available (e.g. deforestation rates, agricultural production statistics, global land cover maps, fertilizer use, livestock population). These data are usually spatially coarse.	• Tier 2 can use the same methodological approach as Tier 1, but applies emission and stock change factors that are based on country- or region-specific data for the most important land-use or livestock categories. Country-defined emission factors are more appropriate for that country's climatic regions, land-use systems and livestock categories.	• Tier 3 uses higher order methods, including models and inventory measurement/monitoring systems tailored to national circumstances, repeated over time, and driven by high-resolution activity data and disaggregated at the subnational level. Higher order systems may include comprehensive field sampling repeated at regular time intervals and/or GIS-based systems of age, class and production data, soils data, and land-use and management activity data.

Source: FAO,2015.

4.8.2.1. Direct measurement of GHG emissions and carbon stocks

Field and laboratory monitoring techniques can be used to measure GHG emissions and carbon stock changes in a given soil sample with a high degree of accuracy. The results of field and laboratory analyses are used for developing emissions factors. However, these methods are relatively laborious and expensive and in some cases have limitations.

For example, annual changes in soil organic carbon are small compared to the soil carbon stocks, and these stocks are highly variable throughout the landscape. Changes in the carbon balance attributable to projects can be only detected after 5–10 years (FAO, 2009a). On the other hand, direct measurement of GHG emissions can detect immediate changes in GHG fluxes. However, in order to detect seasonal variability in GHG emissions under different practices, a two-year period of measurements is desirable. Appropriate sampling frequency and design plays an important role in reducing costs of the direct measurements.

4.8.2.2. Examples of direct measurements methods

The loss-on-ignition method is generally used to measure total soil carbon.

The chamber method and eddy covariance or 'flux tower' method are used for direct measurement of CO_2, CH_4 and N_2O emissions.

The waterborne carbon loss is determined by multiplying the carbon content (derived with high-temperature combustion or persulfate oxidation methods) by the amount of total discharged water from a defined catchment area.

To estimate direct emissions from livestock respiration chambers, the SF6 technique, the CO_2 technique (use of CO_2 as a tracer gas) and in vitro gas production techniques are available.

4.8.2.3. Indirect GHG monitoring techniques

Indirect methods include proxy, modelling and remote sensing methods.

Proxy methods and modelling are used as cost-effective alternatives to direct measurements. They can be based on factors including land use type; tree diameter and height; water table depth; spectrophotometric properties; and vegetation types and soil properties for estimating emissions and removals (e.g. from grasslands, croplands and forests).
For estimating emissions from livestock, proxies like fatty acids or fats in the milk or faeces can be used. Estimates produced through modelling have varying levels of accuracy, depending on available data. The model outputs have to be periodically verified by direct field measurements.

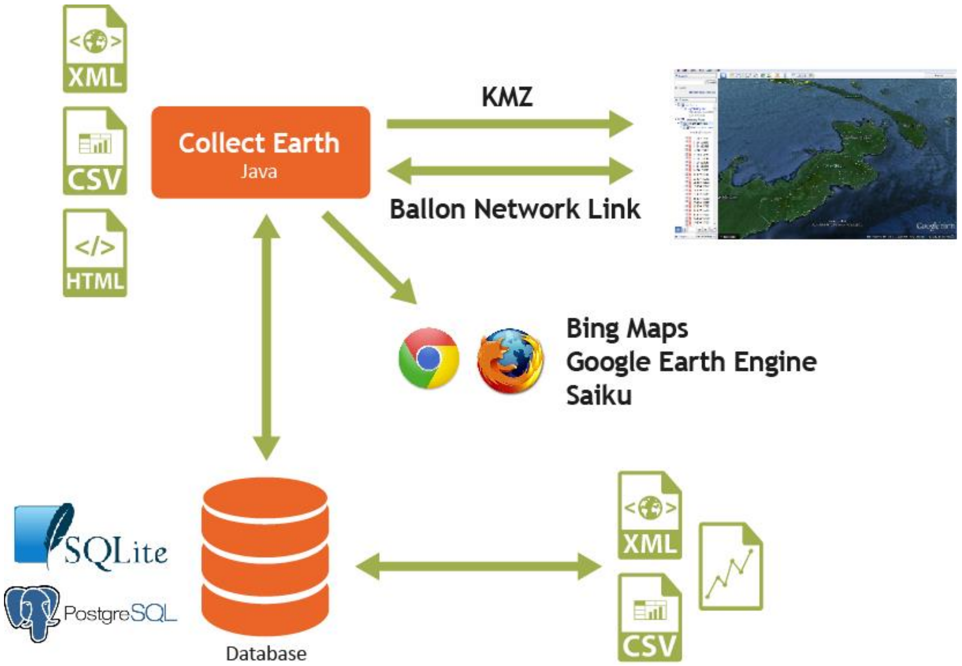
Remote sensing tracks changes in the land cover over time. It uses aerial sensor technologies to detect and classify objects on Earth. Land-cover data need to be classified and converted into land-use classes for reporting. This method is an efficient tool for detecting land-use change for large-scale deforestation projects, but can also be applied to detect some agricultural land types (e.g. paddy rice cultivation).

4.8.2.4. Example of FAO tools for processing remote sensing data - Collect Earth

Collect Earth is a FAO land assessment tool that makes use of freely available satellite imagery.

This land assessment tool:

- supports multi-phase National Forest Inventories;
- collects spatially explicit socio-economic data;
- quantifies deforestation, reforestation and desertification;
- makes AFOLU assessments;
- monitors agricultural land and urban areas; and
- validates existing maps.



This tool uses very high resolution multi-temporal images from Google Earth and Bing Maps; Landsat 7 and 8 datasets from Google Earth Engine; and data analysis through Saiku.

To download application and further information click here.

4.8.3. Examples of GHG calculators

To select the appropriate calculators for landscape-scale GHG assessment for AFOLU categories web-based selection tools can be used.

EX-ACT is commonly used to monitor GHG impacts from AFOLU activities.

EX-ACT's advantages include:

- maximised coverage of the AFOLU subsectors, which reduces the need to use multiple methodologies for a single project assessment;
- relative ease of use;
- application of IPCC Guidelines and categories;
- the possibility to be used in different geographic zones; and
- asessments under different scenarios.

For further information, see: Review of GHG Calculators In Agriculture And Forestry Sectors: A Guideline for Appropriate Choice and Use of Landscape Based Tools by Colomb *et al.,* 2012.

To learn how to use EX-ACT log in a self-paced FAO-World Bank course, click here.

4.9. Assessing GHG impact of policy level actions

When an agriculture NAMA is designed at the policy level, GHG monitoring and estimation need a different approach from a project NAMA. Several policy NAMAs can be assessed through the activities considered to have resulted from specific policies (e.g. number of agreements signed for renewable energy projects). However, the impacts of other policy NAMAs (e.g. technology standardization for effective energy use) are impossible to be directly measured. Understanding the causal chains of the policies is important, as all changes are not immediately apparent.

It is important to define the assessment boundaries and try to attribute changes in emissions to policies and policy changes. A business-as-usual scenario is also needed.

It is also important to assess the cost-effectiveness of the policies and policy changes (e.g. laws, regulations, standards, taxes, subsidies, incentives, tradable permits and research investments).

Examples of measures for reducing net GHG emissions from agriculture via policies include:

- market-based programmes
  - the reduction and reform of agricultural support policies
  - the use of nitrogen fertilizers
  - emissions trading and
  - subsidization of production
- regulatory measures
  - guidance on the use of nitrogen fertilizers
  - improved fertilizer manufacturing practices and
  - cross-compliance of agricultural support to environmental objectives
- voluntary agreements
  - soil management practices that enhance carbon sequestration in agricultural soils
- international programmes
  - support for technology transfer in agriculture.

Source: Challenges and opportunities for mitigation in the agricultural sector, 2008, by UNFCCC (FCCC/TP/2008/8).

For references and further details on accounting for the GHG effects of policies and actions, see: Policy and Action Standard. 2014 by World Resources Institute.

4.10. Ex-post assessment of the NAMA impacts against the baseline

It is recommended that NAMA impacts are assessed not only before (ex-ante) implementation, but also during and after (ex-post).

Ex-post assessments can be done on a regular basis. These assessments offer the opportunity to refine the baseline and adjust assumptions if new data or data of better quality become available.

4.11. Required information to report NAMA impacts

Reporting is the delivery of monitoring results. Depending where the NAMA impacts are reported, the requirements may vary.

The requirement of financing agencies are specific to each donor. Generally, the required reporting information includes data on GHG and non-GHG impacts.

GHG relevant data:

- GHG emission sources (e.g. enteric fermentation)
- types of GHG targeted (e.g. methane)
- unintended effects and significance (e.g. increased GHG from transportation)
- effects outside geographic scope and significance (risk of leakage)
- risk of double-counting (data on actions that target the same emission sources or sinks and significance)

Non-GHG relevant data:

- economic benefits (e. g. improved livelihoods)
- social benefits (e.g. enhanced food security)
- environmental benefits (e.g. enhanced biodiversity)
- climate resilience (e.g. improved water availability, reduced soil erosion)

For efficient reporting, it is important to use standardized formats and a well defined institutional set up. Reporting should also consider how local project-level data collection can be organized in a consistent manner with other projects, and how the local data can be centrally stored and utilised for national reporting.

4.12. Aligning reporting requirements for NAMAs with international reporting requirements

If the estimates and projections for GHG emissions and removals derived from AFOLU sector are categorized according to the 2006 IPCC guidelines, they will better fit into the national UNFCCC reporting requirements for GHG inventories.
Net GHG emissions reductions from NAMAs activities should also eventually be reflected in the national inventories.

Understanding the reporting requirements of the international climate change mechanisms and financing agencies helps agricultural stakeholders to provide adequate responses and data. For instance,

The UNFCCC's BURs require:

- the name and description of the mitigation action, including information on the nature of the action, coverage (i.e. sectors and gases), quantitative goals and progress indicators;
- information on methodologies and assumptions;
- objectives of the action and steps taken or envisaged to achieve that action;
- information on the progress of the mitigation action's implementation and the underlying steps taken or envisaged, the results achieved, such as estimated outcomes (metrics depending on type of action) and, to the extent possible, estimated emission reductions;
- information on international market mechanisms; and
- information on the description of domestic MRV arrangements.

4.13. Verifying NAMA impacts: quality control (QC) and quality assurance (QA)

Verification refers to the process of independently checking the accuracy and reliability of reported information or the procedures used to generate that information. By providing feedback on measurement/monitoring methods and procedures and improvements in reporting, verification also provides quality assurance and quality control that improves the entire MRV system. Verification modalities have to be agreed upon with the financing agency. Depending on national arrangements, a national verification process may need to be established.

Two types of verification can be considered:

Internal verification

QC is required for internal quality assessment of monitoring and reporting processes. It is performed by the project personnel and is designed to:

- provide routine and consistent checks to ensure data integrity, correctness, and completeness; and
- identify and address errors and omissions.

QC activities also include technical reviews of categories, activity data, emission factors, and other estimation parameters and methods. QC should be done not only for data providers but also for entities responsible for compiling the data (GIZ NAMA tool).

QA is a planned system of review procedures conducted by third parties not directly involved in the monitoring and reporting process. It is done after the assessment has been completed following the implementation of QC procedures.

With its **new Quality Control and Quality Assurance Module FAOSTAT** allows the user to compare the data available in FAOSTAT with data presented in the National Communications of each country for each of the agriculture sector's subdomains.

External verification

If the NAMA results will be reported within BURs, the results will need to be subject to an 'international consultation and analysis' performed by a team of experts under the UNFCCC. The data can be also verified against international statistics, such as FAOSTAT, and the Emission Database for Global Atmospheric Research (EDGAR).

Verification can also be done by comparing observed estimates against data from satellite imagery.

4.14. Institutional arrangements for MRV

Even though there are no official requirements from UNFCCC for a specific institutional framework for MRV, the following components should be established:

1. the lead institution that coordinates the MRV process and directs the activities of other actors;
2. a steering committee that promotes coordination among key stakeholders and among ministries; and
3. technical coordinator(s) responsible for the technical outputs of the MRV system.

Institutional arrangements for data management can be arranged by:

- top-down integrated MRV systems that cover multiple reporting needs (e.g. Kenya's integrated national MRV system); or
- bottom-up systems that focus on a specific policy, action, or region (e.g. Chile's MRV system to track specific policies/NAMAs).

For references and further information, see: Knowledge Product Institutional Arrangements for MRV, 2013, International Partnership on Mitigation and MRV.

4.14.1. Example: Roles and responsibilities in MRV+ system for Kenya

The common core components of the system (see Figures 4.15.2 and 4.15.3)are:

- Data Supply and Reporting Obligation Agreements (DSROAs) that ensure that all relevant parties to the system provide the data required;
- Climate Change Relevant Data Repository (CCRDR), which stores the data required for estimating GHG emissions and for monitoring progress towards mitigation, adaptation and synergy indicators and reports, and other outputs produced by the system (these data will be geo-coded where possible);
- Indicators and Baselines Working Group (WG), which is responsible for determining indicators required to monitor performance; and
- The data and QA/QC WG, which is responsible for setting up the CCRDR, defining the DSROAs, and setting out data specifications and processes and quality control procedures.

Components of the system that focus on particular technical areas include:

- Technical Analysis Groups (TAGs) for Adaptation (TAGA), Mitigation (TAGM), Development (TAGD) and GHG inventory (TAGGHGI); Synergies and Project Interface (SPI); and a GHG Technical Team comprising Focal Units (FUs) and Thematic Working Groups (TWGs) for different sectors.

It is proposed that the MRV+ system will be overseen by a steering committee. There should be a reporting line up to Cabinet Affairs through the National Climate Change Commission. This will ensure the system and its performance has high visibility. It will also help harness sufficient political will to make sure the system is set up and implemented according to the required timelines. The underlying principles of the design of the MRV+ system are to build on existing institutions and skills wherever possible and to take into account the planned climate change governance structures.

Source: National climate change action plan 2013–2017 by Government of Kenya.

4.14.2. Example: Elements and actors in the MRV process in Kenya

Kenya's system covers areas such as national and subnational planning and monitoring, international reporting obligations and climate finance readiness.

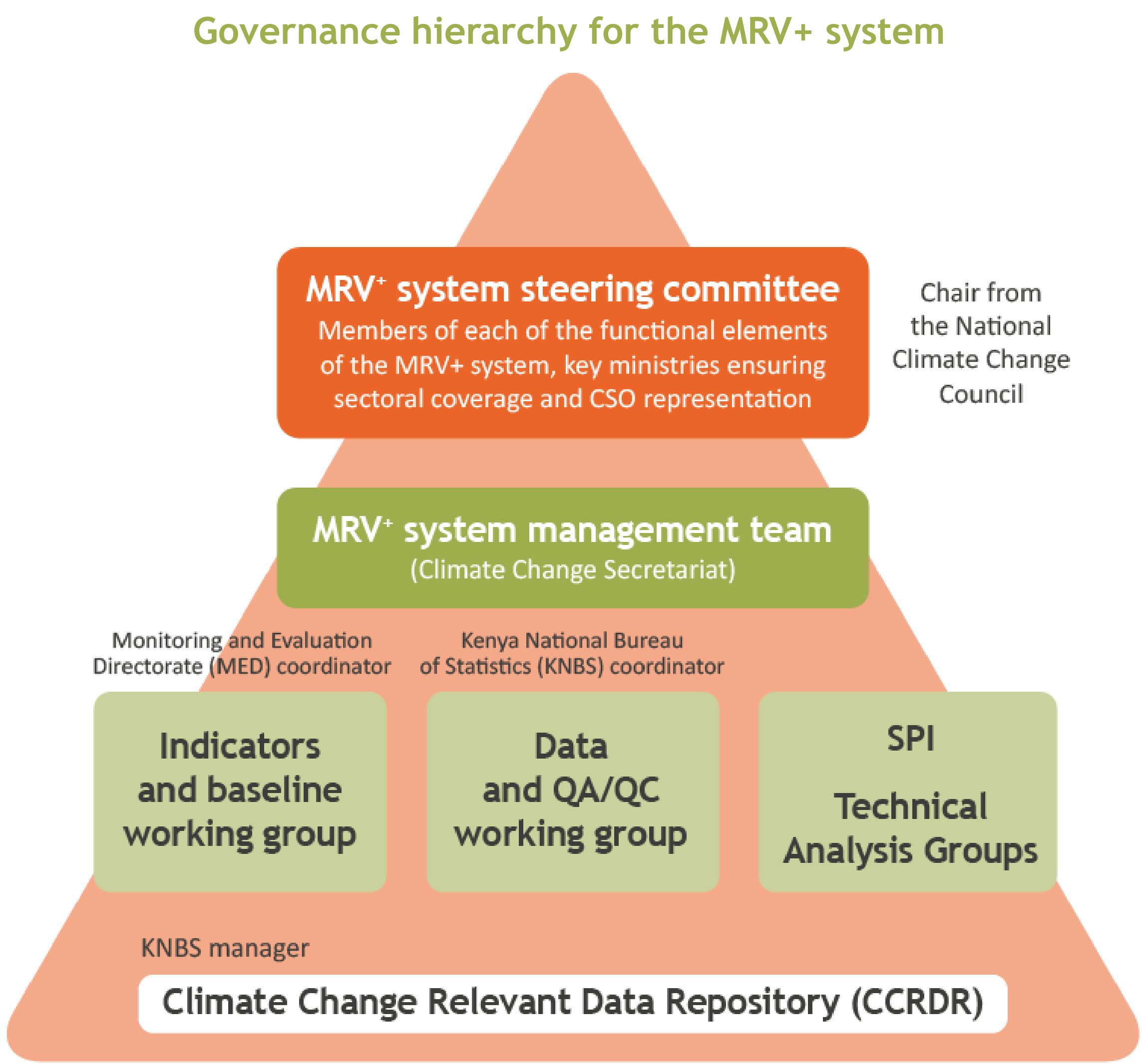
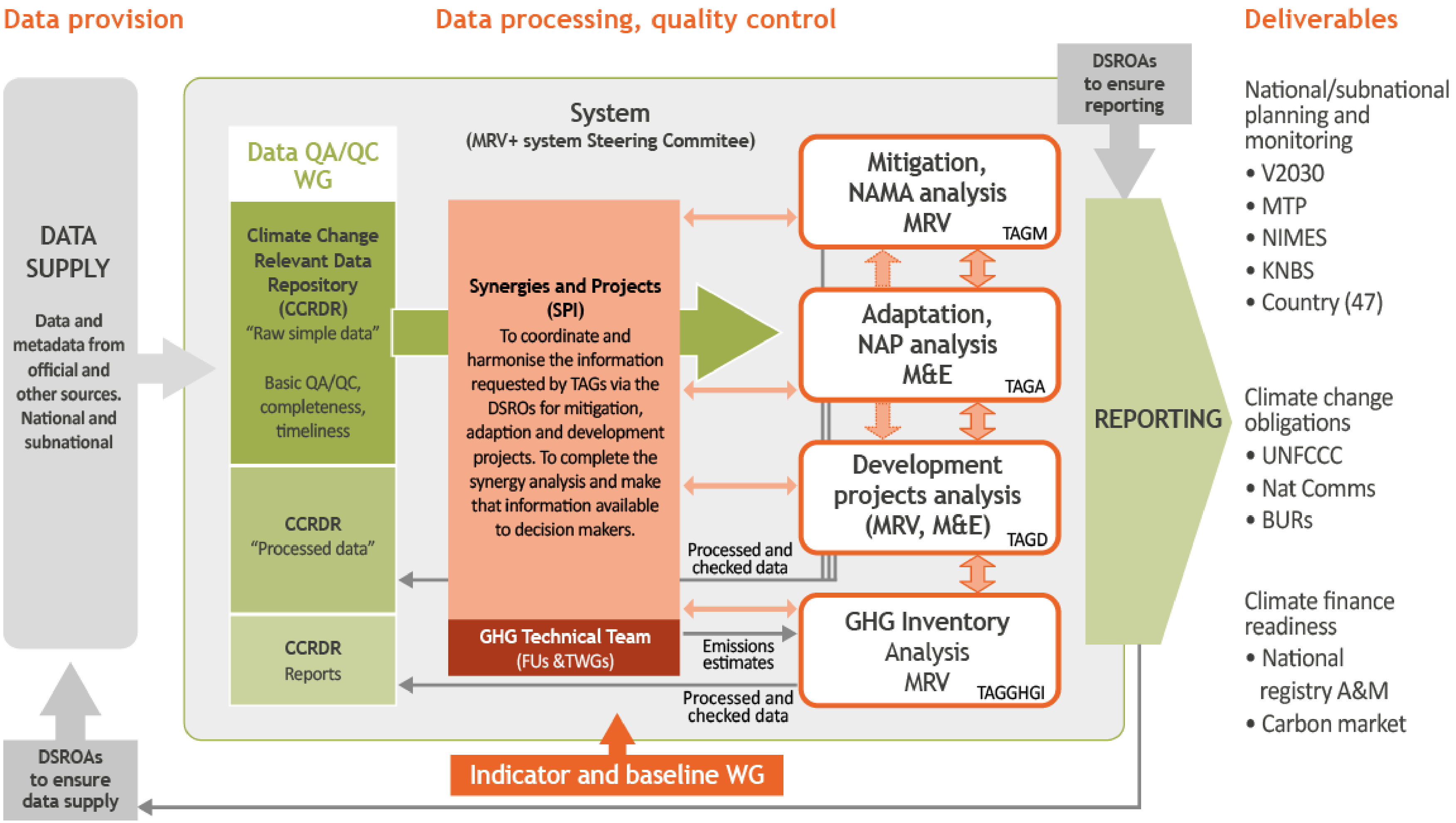


Image source: Adapted from National climate change action plan 2013–2017, Republic of Kenya.

4.14.3. Examples: The proposed MRV+ system for Kenya



Source: National climate change action plan 2013–2017, Republic of Kenya.

4.15. Resources: Methodologies and tools

Name	Source/Year	Description
2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 4	IPCC, 2006	Provides general methodologies on data collection, uncertainties evaluation, time series consistency, QA and QC, and reporting for the AFOLU sector.
Clean Development Mechanism tools and methodologies	CDM	Presents baseline and monitoring methodologies for determination of GHG reductions by a mitigation project
FAOSTAT emissions database manual	FAO, 2015	The manual offers a step-by-step guide on how to estimate GHG emissions from AFOLU, following the Tier 1 approach of the 2006 IPCC Guidelines for National Inventories, and using FAOSTAT, Forest Resources Assessments and other geo-referenced data available at FAO.
GHG Protocol Agricultural Guidance, World Resources Institute	WRI, 2014	Provides guidance to measure GHG emissions for the agriculture sector.
Good Practice Guidance for Land Use, Land-Use Change and Forestry	IPCC, 2003	Provides supplementary methods and good practice guidance for estimating, measuring, monitoring and reporting on carbon stock changes and GHG emissions from LULUCF activities.
MRV tool, GIZ	GIZ	Presents developers and implementers of NAMAs with brief step-by-step instructions on how to develop a MRV System.
Report of Greenhouse Gas Accounting Tools for Agriculture and Forestry Sectors	USDA, 2012	Contains tools (calculators, protocols and guidelines, and process-based models) related to GHG accounting for agriculture and forestry sectors.
Verified Carbon Standard (VCS) methodologies, algorithms, and tools	VCS	Describes methodologies and tools related to project-level accounting. Many of the components are adapted for policy-level accounting.
JICA Climate Finance Impact Tool	JICA, 2014	Provides methodologies and calculations sheets for accounting mitigation impacts of forest and natural resources conservation and renewable energy.
REDD+ Cookbook	FFPRI, 2012	An easy-to-understand technical manual that provides basic knowledge and technologies required for REDD+ with the main focus on forest carbon monitoring methods.

4.16. Resources: Tools

Name	Description
EX-ACT, FAO	Provides ex-ante estimates of the impact of agriculture and forestry development projects, programmes and policies on the carbon balance.
Emissions Database for Global Atmospheric Research (EDGAR), European Commission	Provides global past and present anthropogenic emissions of GHG and air pollutants by country and on spatial grid.
GLEAM	GLEAM is a Tier 2 livestock sector specific biophysical model based on Geographic Information Systems (GIS) which adopts a life cycle assessment approach.
FAOSTAT Emissions Database, FAO	Provides GHG emissions for the AFOLU sector at global, regional and national levels.
SimaPro, PRé	Is a life-cycle analysis tool, which can be used for analysing and monitoring the sustainability performance of products and services.
UNFCCC non-Annex I Greenhouse Gas Inventory	Is an Excel-based software created to support developing countries in the compilation of their GHG inventories and National Communications. In general, the Software uses Tier 1 methodologies for estimating GHG emissions and removals.
Marginal Abatement Cost Tool (MACTOOL), Energy Sector Management Assistance Program	Provides an easy way for building marginal abatement cost curves and for calculating break-even carbon prices.
IPCC software	Implements the Tier 1 methods in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. It is of use to users of all versions of the IPCC Guidelines.
ALU tool, Colorado State University	The software guides an inventory compiler through the process of estimating GHG emissions and removals related to agricultural and forestry activities. The software also has internal checks to ensure data integrity.

4.17. Quiz: MRV

True or false?

Statement	True	False
The objective of MRV is to assess the progress of a NAMA towards its mitigation goals and national development goals.		
During monitoring only data on GHG impacts are collected.		
A baseline provides a reference level to assess the actual changes of GHG emissions and removals, and non-GHG benefits resulting from the NAMA.		
To estimate GHG emissions and removals, the priority is the collection of activity data.		
UNFCCC requires a specific institutional framework for MRV.		
Tier 1 reporting methods use default emission factors developed by the IPCC.		

To see the correct answers, click here.

4.17.1. Correct answers for quiz 4: MRV

Statement	True	False
The objective of MRV is to assess the progress of a NAMA towards its mitigation goals and national development goals.	x	
During monitoring only data on GHG impacts are collected.		x
A baseline provides a reference level to assess the actual changes of GHG emissions and removals, and non-GHG benefits resulting from the NAMA.	x	
To estimate GHG emissions and removals, the priority is the collection of activity data.	x	
UNFCCC requires a specific institutional framework for MRV.		x
Tier 1 reporting methods use default emission factors developed by the IPCC.	x	

4.18. Exercise: Measuring plan

Task: For each of the NAMA ideas prepare a draft MRV plan with the indicators, methods, frequency and responsible entities for the monitoring plan. Also indicate the frequency and responsible entities for reporting and verification.

Actions	Monitoring				Reporting	Verification
	Indicators	Methods	Frequency	Responsible	Frequency/ Responsible	Frequency/ Responsible

MODULE 5: Financing mechanisms and sources

Learning outcomes

At the end of this lesson, you will:

1. know about the financing options for NAMAs;
2. recognize multiple donors' financing criteria; and
3. be familiar with examples of agricultural NAMAs that have received financial support.

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5.1. NAMA finance: history and status

It is clear that net GHG emissions urgently need to be reduced and that the potential to achieve significant emission reductions exists.

To realize this potential, new policies and financial mechanisms are needed.

In 2009, Parties to the UNFCCC agreed on new and additional funds for combating climate change, including:

- USD 30 billion as fast-start finance for 2010–2012;
- USD 100 billion expected to be mobilized annually by 2020 through a number of channels, such as the Green Climate Fund;
- USD 10 billion was pledged for the Green Climate Fund in 2014 during COP 20 in Lima, Peru.

The number of financing sources for NAMAs is increasing. See Section 5.6 for further details.
NAMA finance currently focuses on building readiness (e.g. proposal development, feasibility studies and capacity development), rather than on implementation.

Examples of agriculture and land use NAMAs receiving support include:

- Georgia’s Adaptive Sustainable Forest Management NAMA, which has received a grant of USD 1.9 million;
- Costa Rica’s Low-Carbon Coffee NAMA, which has received a grant of EUR 7 million; and
- Tajikistan’s Forestry Support NAMA, which has received EUR 13 million.

5.2. Financing and revenue of NAMAs in agriculture

During the initial period of adoption, most agricultural mitigation practices capable of transforming agricultural production systems will incur more costs than business-as-usual scenarios.

Funds will be required in a number of areas including, the adoption of new technologies, training and the purchase of equipment.

Several financing instruments can be considered for NAMAs, such as:

- loans and soft loans,
- grants,
- risk cover instruments,
- blending mechanisms (a combination of grants, credits and guarantee mechanisms),
- direct carbon payments to farmers,
- equity shares and
- payments for ecosystem services (PES).

Analysis for the identification of mitigation actions in Ethiopia

In Ethiopia, an analysis to support the identification of mitigation options concluded that none of the options in the livestock sector have positive net balance over a 20-year period. This implies that promoting the adoption of this practice not be done with normal loans, but would require subsidized loans, grants or performance-based PES.

In contrast, improving soil management included a number of options, such as small-scale irrigation initiatives, that deliver positive returns in the first 5 years (calculated at 6 percent discount rate). These options could potentially be supported with commercial or subsidized credit, while other options would also require grants (Wilkes *et al.,* 2013a).

See for further information Federal Democratic Republic of Ethiopia (2011).

5.2.1. Payments for ecosystem services (PES)

PES are incentives offered to farmers or landowners in exchange for managing their land to provide ecosystem services. According to Wunder (2007) four types of environmental services have been widely used:

1. carbon sequestration and storage,
   (e.g. northern electricity companies paying tropical farmers to plant or maintain additional trees)
2. biodiversity protection,
   (e.g. conservation donors paying landholders for creating set-aside areas for biological corridors)
3. watershed protection,
   (e.g. downstream water users paying upstream farmers for adopting land uses that limit soil erosion or flooding risks)
4. protection of landscape beauty,
   (e.g. tourism operators paying a local community not to hunt in a zone used for wildlife viewing)

5.3. Mitigation cost of NAMAs in agriculture

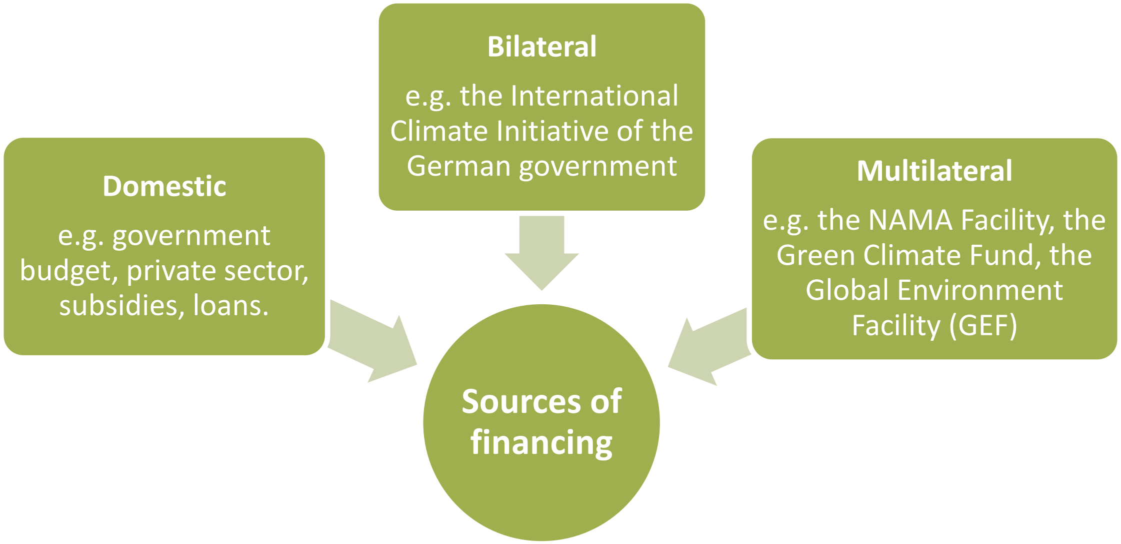
- Cost estimates of climate change mitigation actions and potential benefits of these actions are not always available for individual agricultural practices.
- Implementation costs are always context-specific.

Uncertainties and sensitivities around mitigation costs and potential are caused by:

- the variability in biophysical and climatic conditions
- existing management heterogeneity (or differences in the baselines)
- the extent of leakage or displacement (i.e. a change in land use or land management that causes a positive or negative change in emissions elsewhere)
- differential impact on different GHGs with a particular mitigation option
- the time frame for mitigation activities and issues of permanence of the mitigation benefits
- the variable impact on different GHGs associated with a particular mitigation option
- carbon price

5.4. Sources of financing

NAMAs can be financed from domestic, bilateral and multilateral sources.



Based on financing sources, NAMAs can be separated into unilateral, supported and hybrid categories.

Unilateral NAMAs

Financed by the host country

Supported NAMAs

Receive international financial support

Combined or hybrid NAMAs

Financed by domestic and international sources

When offering international financial support, donors may prefer to select NAMAs with **hybrid financing**.

5.5. Public and private financing

Domestic financing can be separated into two main groups: **private and public**.

Incentives should be provided to the private sector to participate in implementing climate change mitigation practices.

Private investment both national and international can be attracted by:

- Stable political situation and clear commercial mechanisms
- Provision of incentives (e.g. soft loans and guarantees)
- Elimination of barriers
- Demonstration of profitability and low risk

- Public financing is also needed to **leverage international financing**.
- For example, Indonesia has voluntarily committed to reducing its GHG emissions by 26 percent by 2020 through domestically supported NAMAs and is willing to increase its target to 41 percent, if their NAMAs receive international support.

5.5.1. Example: Grassland and livestock NAMA in Mongolia - Role of the private sector

The private sector is expected to play a key part in implementing the grassland and livestock NAMA in Mongolia. Its main role is to invest in sustainable grassland management practices (e.g. water wells, fodder banks, hay storage facilities, improved breeds and value-adding activities). Public investment is required to leverage or enable private sector investment.

Current sources and mechanisms for funding include:

- A resolution of the Mongolian parliament that requires that three percent of the state budget be allocated to the National Livestock Programme.
- The district (Soum) development fund also provides public funds to encourage small and large private sector investments.
- The new Integrated Budget Law implemented in 2013 will provide local government with substantial budgets to attract private sector investments in the livestock sector through public co-investments.

Further potential funding sources for this NAMA include:

- The Green Climate Fund;
- Multilateral and bilateral climate finance (e.g. from UNDP and Germany); and
- The Japanese Joint Crediting Mechanism.

Source: Timm Tennigkeit (personal communication).

For further information see the FAO/MICCA webinar recording "Nationally Appropriate Mitigation Actions for Grassland and Livestock Management"

5.6. International financing

The first funding dedicated specifically to NAMAs was the NAMA Facility. The number of countries and organizations providing funds for NAMAs is increasing. The Green Climate Fund will also provide NAMA funding. Many do not provide funds specifically for NAMAs but support mitigation actions in general.

Below are examples of additional potential sources for international financing.

Source	Type of the support
Global Environment Facility (GEF) Fund	Grants, concessional loans
International Climate Initiative (ICI)	Grants, loans, technical assistance through GIZ
Austrian NAMA Initiative	Grants, carbon finance
Latin American Investment Facility	Grants, loans
Climate-related ODA funding	Grants, concessional loans
BNDES Amazon Fund	Grants
ADB Climate Change Fund (CCF)	Co-financing , grant , technical assistance
Climate Development Knowledge Network (CDKN)	Funding for technical assistance
ClimDev-Africa Special Fund (CDSF)	Co-financing, grants
NEFCO Carbon Finance and Funds	Grants

Additional information about NAMA funding sources is presented by donor agencies on the UNFCCC NAMA registry website.

5.6.1. Global Environment Facility (GEF)

- In 2014, the 6th GEF programing period (GEF-6) began with funding set at USD 4.4 billion for the next four years.
- GEF's goal is to support developing countries to make transformational shifts towards low-emission, resilient development.

GEF-6 Climate mitigation strategy

Objective	Programs
1. Promote innovation and technology transfer	• **Program 1**: Low-carbon technologies and mitigation options • **Program 2**: Innovative policy packages and market initiatives
2. Demonstrate systemic impacts of mitigation options	• **Program 3**: Integrated low-carbon, urban systems • **Program 4**: Forests and other land use, and climate-smart agriculture
3. Foster enabling conditions to mainstream mitigation into sustainable development strategies	• **Program 5**: Convention obligations for planning and mitigation contributions

For more information, click here.

5.7. Timing for funding application

Application for funding is possible at various steps.

5.8. Criteria for NAMA support considered by climate finance institutions

Effectiveness	• amount of GHG reductions • transformational change • sustainable development benefits • overcoming barriers • sustainability and replicability • MRV of GHG and other performance metrics
Implementation plan	• NAMA description with clear boundaries and plans • consistency with national development plans • high-level political support and country ownership • support from sector stakeholders • capacity to implement
Financing plan	• budget with national contributions • catalytic impact of international finance contribution • leveraging private-sector investment • no duplication with other finance sources • risk mitigation

Source: Adapted from Wilkes *et al*. 2013b.

5.8.1. Financing criteria of the Green Climate Fund (GCF) and NAMA Facility (NF)

Criteria	Details
Impact potential (GCF) Mitigation ambition (NF)	• GHG emission reductions (direct and indirect)
Paradigm shift potential (GCF) Potential for transformational change (NF)	• long-term mitigation impact and replication potential • transformative impact • promotion of sectoral policy changes
Sustainable development potential (GCF) Sustainable development benefits (NF)	• job creation • energy access improvement • gender-sensitive development impact
Needs of the recipient (GCF)	• economic and social development level of the country and the affected population • absence of alternative sources of financing • need for strengthening institutions • implementation capacity
Country ownership (GCF)	• coherence with existing policies • capacity of implementing entities • intermediaries or executing agencies to deliver • engagement with CSOs and other relevant stakeholders
Efficiency and effectiveness (GCF) Financial ambition (NF)	• catalysing private sector investment • economic leverage • amount of co-financing • financial viability

5.8.2. Example: The first financing for an AFOLU NAMA (Costa Rica)

Costa Rica was the first country to receive international financing from the NAMA Facility (7 million Euro) for a NAMA in the agriculture sector. Costa Rica's NAMA, Low-Carbon Coffee Project (2014 – 2018), is a sector-wide project designed to bring a climate-friendly transformation of the entire coffee value chain. The NAMA Project offers technical and policy advice to transform the production and processing practices in the sector. The project will:

- provide aggregated **1.85 million tonnes of CO_2eq** emission reduction potential to over 20 years from which **250 000 tons of CO_2eq** are directly attributable to the NAMA;
- contribute to enabling farmers and millers to develop sustainable livelihoods, potentially improving the standard of living of more than **400 000 people**; and
- provides incentives to the private sector to make investments in climate-friendly innovations by providing grants, loans and guarantees for coffee farmers and millers to acquire GHG-efficient fertilizer and milling technologies.

Success in accessing financing was due to:

- the demonstration of transformational impacts,
- the full endorsement and support by the national government,
- significant GHG reduction potential and
- the provision of improved livelihoods.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Source: www.nama-database.org

5.9. Quiz: NAMA financing

True or false?

Statement	True	False
To receive financial support for NAMAs a government should demonstrate strong country ownership and commitment.		
NAMAs can be supported by domestic and international sources.		
So far, none of the AFOLU NAMAs have received support.		
PES cannot support NAMA implementation.		
Domestic financing is needed to leverage international financing.		
It is possible to apply for financing only during NAMA implementation.		

To see the correct answers, click here.

5.9.1. Correct answers for quiz 5 - NAMAs financing

Questions	True	False
To receive financial support for NAMAs a government should demonstrate strong country ownership and commitment.	x	
NAMAs can be supported by domestic and international sources.	x	
So far, none of the AFOLU NAMAs have received support.		x
PES cannot support NAMA implementation.		x
Domestic financing is needed to leverage international financing.	x	
It is possible to apply for financing only during NAMA implementation.		x

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Acknowledgements

This learning tool is the outcome of a coordinated effort of the Mitigation of Climate Change in Agriculture (MICCA) Programme of FAO. Development of the tool was inspired by the GIZ NAMA tool. Funding for development was provided by the Government of Finland to the MICCA Programme, in FAO's Climate, Energy and Tenure Division. The examples of GHG emissions are based on the data from the FAOSTAT Emissions database, which was created with funding from the Governments of Germany and Norway to FAO.

The authors are Armine Avagyan, Kaisa Karttunen, Caroline DeVit and Janie Rioux. Harinder Makkar provided inputs for a case study on 'Large-scale application of balanced feeding of livestock in India to reduce enteric methane and increase farmers" income. The tool was peer reviewed by FAO staff (Rocio Condor, Benjamin DeRidder, Sandro Federici, Pierre Gerber, Adam Gerrand, Uwe Grewer, Matieu Henry, Heather Jacobs, Laura Meza, Yuji Niino, Maria Nuutinen, Mirella Salvatore and Francesco Tubiello) and external reviewers who provided useful suggestions Le Hoang Ahn from the Ministry of Agriculture and Rural Development of Viet Nam Ulrich Apel (GEF) and Timm Tennigkeit (Unique). Ulrich Apel provided additionally information on GEF-6 strategy. Timm Tennigkeit provided information for the livestock NAMA in Mongolia. Brent Simpson and Julien Vallet provided comments for Module 5. Anne Mottet reviewed "Example: Life-cycle analyses of pig production in East and Southeast Asia" and "Identification of mitigation hotspots with GLEAM" sections. Uwe Grewer provided inputs on EX-ACT. Doris Soto and Ari Gudmundsson provided materials on GHG reduction strategies for aquaculture and fishery sectors. Francesco Tubiello and Heather Jacobs together with other members of Monitoring and Assessment of Greenhouse Gas Emissions (MAGHG) team of MICCA Programme provided inputs on FAOSTAT and the slide on 'Gap analysis between existing monitoring schemes and NAMA MRV requirements'. Gordon Ramsay (FAO) proofread the text, while Fabrizio Puzzilli (FAO) was responsible for the design and layout.

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I4642E/1/05.15