Sustainable Cocoa Production
Farmer Trainers Manual

Conservation Alliance
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Compiled by

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About Conservation Alliance International

Conservation Alliance (CA), an environmental not-for-profit organization that promotes the sustainable use of scarce natural resources. Our multidisciplinary orientation provides a strong platform for discussing rural policy issues and increasing awareness of why investment in natural resources management and rural development is critical to reducing poverty, improving food security and enhancing biodiversity conservation. Our vision is to conserve biodiversity for human development. In order to achieve its mandate, CA works with strategic partners to empower communities to lead in biodiversity conservation and create opportunities for economic growth and improved human wellbeing.

CA has offices in five West African countries including Nigeria, Cote d’Ivoire, Cameroon, Sierra Leone and Liberia. The Ghana office serves at the regional program that supports the successful implementation of programs within the West African sub-region. Partnerships are CA’s main mode of operation. CA works with partners to design innovative programs and projects that fit within national priorities for agriculture, conservation and rural development.

About Biodiversity and Agricultural Commodities Program (BACP)

The expansion of agriculture is the leading cause of habitat destruction and a major threat to global biodiversity. The Biodiversity and Agricultural Commodities Program (BACP) seeks to reduce these threats by leveraging market forces at all levels of the value chain. This will help to mainstream the use of Better Management Practices (BMPs) that decrease the impact of production on biodiversity. BACP works in partnership with major players in three commodity markets (soy, palm oil, and cocoa) who are willing to adopt more sustainable practices.
Contributors and acknowledgements

The BACP provided the financial support under the sustainable cocoa project implemented within the Bia Conservation Area in the Western region of Ghana to develop this manual. Most of the materials were adapted from training manuals developed by Conservation International-Ghana, Sustainable Tree Crops Program (STCP) of the International Institute of Tropical Agriculture (IITA), Cocoa Research Institute of Ghana (CRIG), CABI Bioscience, Rainforest Alliance, Rural Support Network, and Africa Conservation Initiative. Some activities have also been adopted from research outcomes from studies carried out by experts within Ghana, Nigeria, Sierra Leone, and Liberia.
**Preface**

Cocoa has been grown in West Africa and in particular Ghana since the 19th century. Until recently, most of the extension approach used has been the traditional top-down approaches such as the training and visit approach based on the “technology transfer” model. This model focused primarily on promoting the adoption of new technologies such as new planting materials. This method of extension has had very little and often disappointing result with relatively few farmers adopting the promoted practices. By the 1990s, most national cocoa extension systems had virtually collapsed.

In recent times, however, the use of participatory approaches to train cocoa farmers has been found to be most effective. This model encourages the sharing of ideas and experiences and thus speed up the adoption rates. CA agricultural programs have found the use of this approach very effective in disseminating technology and thus finds expression in this manual.

The manual is divided into four sections.

Chapter 1: Growing Sustainable Cocoa
Chapter 2: Good Agricultural Practices
Chapter 3: Monitoring and Evaluation
Chapter 4: Cocoa Certification

The topics discussed within this manual can be adapted for use by trainers to suit farmers’ level of knowledge and skills. The manual is only a guide and can be modified to suit different context and situations. While the activities have been field tested and proven effective, farmer trainers are encouraged to further establish field trials to enhance farmers’ conviction and speed up adoption. The exercises can also be used in cocoa certification training as they satisfy the standards for the Rainforest Alliance certification protocols.
Glossary

**Biodiversity**: the variety of all living things on earth

**Buffer zone**: this is a defined natural or artificial strip of undisturbed area that serves the purpose of separating two land uses from each other

**Chupon**: Vertical stem or shoot (water shoot)

**Cocoa agroforestry**: a shade grown cocoa farm that have timber trees, fruit trees and food crops grown together with cocoa

**Ecology**: the relationship between organisms and their environment

**Ecosystem**: a community of living and non-living things that interact and affect one another

**Endemic species**: Species found only in a particular environment or habitat

**Habitat**: a location that supplies all that an animal, plant or other organism needs to survive – air, light water, food shelter and space.

**Jorquette**: The point at which the vertical stem changes to fan growth

**Natural enemy**: A living organism that kills, injures or causes disease in other living organisms

**Nature Reserve**: this is an area kept for biodiversity conservation. It is important for wildlife, flora, fauna or geological characteristics and other special interest

**Pest**: A living organism that we consider harmful because it attacks and damages crops

**Pesticide**: Any poison that kills a living organism. This includes insecticides (to kill insects), fungicides (to kill fungi) and herbicides (to kill weeds)

**Predator**: An animal that hunts and eats other animals. This is one type of natural enemy

**Population**: the total number of individuals or items that live in a specified area and share one or more characteristics

**Protected area**: this is land especially dedicated to the protection and maintenance of biological diversity, natural and associated cultural resources, and managed through legal or other effective means

**Species**: a group of organisms with special characteristics that enable them to produce young ones. Any given species cannot successfully reproduce with any other

**Systemic fungicide**: Fungicides that are absorbed by the cocoa tree

**Totem**: In traditional African belief systems, anything, being or creature that watches over or assists a group of people such as a family, clan or tribe or individuals
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CHAPTER 1: GROWING SUSTAINABLE COCOA

There are no simple solutions to the diverse and complex problems that currently plague the cocoa industry. This manual focuses on growing a healthy crop in a sustainable way, utilizing management methods that are cheap, practical and sustainable for the small farmer, and reducing dependence on costly inputs such as pesticides and fertilizer.

Over 80% of all cocoa is produced by smallholder farmers. Cocoa provides employment in many rural communities and pays for school fees of farmers’ children. Smallholder cocoa is grown mostly under shade trees and either inter-cropped or grown in a semi-natural agro-forestry setting and hence, is a particularly rich and stable habitat for many species (biodiversity).

A healthy crop is a more productive crop. Growth is more vigorous, yields are generally higher and the plant is better able to resist or compensate for pest attack. Many farmers perceive cocoa farming as a risky enterprise because they have little or no influence over the cultural factors of cocoa growing, as parameters such as the chemical characteristics of the soil available to them, the genetic make-up of the planting material used and the climatic environment are imposed on them by nature and science.

While the farmer may, exercise some latitude in choosing his planting material, this choice is naturally constrained by the diversity and characteristics of the cocoa varieties available to him from research and extension services. In any case, once the choice of planting material is made, there is not much the farmer can do to affect the end result in terms of quality, apart from concentrating on good cultivation and post-harvest practices. Through good husbandry of the cocoa farm, including pest and disease control and harvest and post-harvest handling, farmers can however ensure the production of good quality cocoa.

1. STCP/IITA Farmer Field School Manual, Ibadan, Nigeria 2008

The introduction of recommended practices through farmer participatory approach has been found effective in building farmers’ capacities to make their own crop management decisions, based on
a better understanding of the agro-ecology of their own fields, and according to their own unique set of circumstances and priorities. Participatory approaches facilitate an active learning process and informed decision-making by farming communities.

An introductory manual such as this one will have global relevance, but is not intended to be comprehensive. The exercise protocols should be viewed as guidelines and sources of inspiration rather than as rigid instructions. They can and should be adapted to local conditions, depending on available materials, prevalent pest problems, local knowledge and experience within the farming community. The promotion of any new technology begins with engaging the community that will ultimately become the beneficiary of the program.

1.1 Community Entry

As a development worker wanting to extend your activities in a certain community, it is necessary to make contact with the wider community. It is necessary to talk with local people and services that may be affected by what you do. There are many ways of doing this - through existing links and networks, meeting with groups and organizations, and contacting community leaders and service providers or reading from other related reports. All are important.

This is the time to build relationships and trust by being considerate of community members' time and other obligations, by being open about what you are doing, by treating people with respect and by being seen to be impartial.

Key success factors for entry are:

- Trust
- Accessible and reliable community communication networks
- Resources for action that come with the initiative (money, information, networks, training etc.).

Key inhibiting factors are:

- Dependency on others
- Poor histories within and between organizations
- Lack of time in the community □ Lack of communication networks
- Lack of knowledge about the issues.

The entry phase may need much more work if this is the case.
Module Outcomes
At the end of this module, you should have:

- Gained support for your process from interested community members as well as positional leaders and service providers
- A better understanding of the community
- The beginning of a relationship with the community.

The Process
A. Reflecting
What do we know already?

Questions to ask
- Find out about similar activities in the past. What sort of people were involved?
- Remember, actions need to be guided by values. Think about the personal/group values that guide your work.
- Different communities will need different approaches depending on previous relationships with workers, cultural difference and history with other processes. What has your past experience been?
- Think about power and how you have seen it expressed in this community or others. Who has it and how is it used?

Record your response to these questions.

B. Interpreting
Why is cocoa farming important to us? Questions to ask
- How do the events that happened in the past affect the way you think about this next task?
- How will your own values guide the way you will work?
- How does the way people find out about things affect their involvement?
- How does the way those with power use it affect what happens in this community?
• What are the experiences of others? Can you find some information from them to help guide your work?

• Are there any books, research, professionals or other communities' experiences that may be able to help you think about these issues?

C. Deciding
What will we do?

Questions to ask

• Whom do you need to communicate with? Remember to think about the power base. Sustainability comes with new power structures. Those with positional power such as council, members, and government workers need to support your process but real change will come when decisions are made by the wider community.

• Identify community people who are interested in the future of their community. They have passion, consistency, credibility and sometimes a constituency, that is, a network of others to gather views and suggestions from.

• These community champions will make all the difference to the support the activities get. How will you choose your community champions wisely? How would you like to work with them? How will you identify what they would like to do?

• Decide how you will start to form relationships with interested people outside the community who may be helpful to the community.

• Decide how to gather your groups together to discuss a process of change. Contacts can be built up by asking those you know to contact or recommend others. This is often called a snowballing effect.

Record your response to these questions.

D. Acting

Things to do:
Get a snapshot of the community by following the community snapshot resource. Draw up an action plan for the community. This should be guided by what you have learnt
during the first three processes. Note that this plan is not permanent. It changes as you learn more about the community.

Remember to:

- Speak with a broad range of people to make sure that everybody has the opportunity to have their say, e.g. all age groups, cultural groups and special needs groups.
- Talk with the community at a time that suits them
- Prepare appropriate written information about your activities to be available in the community
- Be flexible in the ways links are made with communities
- Make sure those who live with an issue make decisions about it for change

Do what you say you will do.

Speak with community members and services about the project identifying who else you need to talk to:

- Use personal contacts, e.g. home visits, during communal labor, durbars, marriage and naming ceremonies
- Informal chats with individuals
- Link into any existing community meetings
- Set up meetings around the work you are doing.

E. Evaluating

How did it go?

Questions to ask

- Did you meet your value set in the activities you were involved in? How do you know this? What occurred to encourage you to think so?
- What exactly happened?
- How did the way things were done affect the way things turned out? How do you know this?
• Do you need to keep working on community entry? Is the community ready to progress to the next step? How do you know this?

Record your response to these questions.
1.2 Farmer and Community Mobilization

Introduction

The problem with many planning processes is that no change or action takes place as a result. If action does take place, the community is often not involved. The community must be involved not only in the identification of problems, but also in the actions, which solve them. Communities and other interested parties can agree to work together to plan for the future.

Community mobilization will only happen after a careful developmental process that involves participation of community people in making decisions, establishing common ground (values), and describing and agreeing on everyone's rights and responsibilities in the process.

Sensitization, Education and Awareness Creation workshops and meetings are used in this process to support community action. These workshops:

- Increase the knowledge of and acceptance of different ways of participating within the group
- Change the group and then becomes a facilitation group rather than the power holder
- Place decision making in the hands of those most affected by the decisions. Decisions can't be made for people who aren't represented, e.g. Young people or other cultural groups
- Build a vision from the positives while not ignoring the negatives

Community meeting
Some helpful tips about this stage

• When communities are feeling vulnerable, weak, 'put upon' or under siege, this step may be difficult and take quite a bit of time. Be careful not to let the group slide into negativity at this point. It is important to really value the good things, even if we do not see many of them.

• The information about things that the group treasures in their community will form the basis of their value set.

• The group should start to form and to identify common ground at this point. Communities have very diverse interests, needs and wants and they often disagree on what should happen first. This stage helps the group to see that they all agree on the fundamentals, but just have different views about how to go about things.

The Process

A. Reflecting

Do participants already know what to do to make their production sustainable?

Questions to ask

Establish a shared values base around the need to adopt cocoa production practices that are environmentally friendly by asking the following questions:

• What do you treasure about cocoa farming?

• Do you think you are doing anything wrong that can affect cocoa farming in your locality?

• How do you want to make sure that it is kept for future generations?

• Do you think that it is been done now?

Record your response to these questions.

• Make sure everyone has a say even if you go round the group one by one (however, always respect a person’s decision not to contribute). If the group is large, collect a few answers from a representation of them.

• Record the responses so everyone can see them (you can use a blackboard or a flipchart. The use of a variety of color markers will help with categorization of the answers).

• When no one can think of anything new, read all the responses back to the group and check that everyone agrees.

Interpreting
Why is it important for us to adopt sustainable best practices in cocoa production?

Questions to ask

• Do we think sustainable agricultural practices are alien to the current farm practices we are using?
• What would you like your community to be like in the future - ten years down the track?
• How can current farming practices contribute to this?
• What are the issues and opportunities for the community?

Record participants response to these questions.

Write the responses up in the same way as before, check for agreement and resolve any issues with further discussion. Working as a whole group, think about who is not present and who else we should talk to. Write up the responses for everyone to see.

Helpful tips for this stage

• This stage puts power back into the community. The community becomes a maker of change rather than a victim of change.

• It is important to keep the discussion positive and powerful at this stage. This does not mean that we deny negative impacts on the community but that rather we determine to change them.

  Most participants are not blind to reality and visioning done in this way does not usually produce unachievable plans.

• Identifying who else could be involved allows the group to think about participation in a different way. It also helps the group to see that it does not have to be their sole responsibility to make things happen. Power is also shifted from the facilitator to the group and from the group to the community.

B. Deciding

What will we do?
Things to do

• Working as a whole group look at the responses to the questions in the interpretation stage, such as 'What would you like your community to be like in ten years’ time?'

• Begin to group the responses under categories. For example under social, economic, cultural and environmental

• Do this for all responses. When all the responses have been placed in categories, write each category on a sheet of paper and group the answers. Record your categories.

Helpful tips for this stage

• Be careful not to over-simplify the categories. If the categories are too broad it will be hard to identify something to work on - something to really get your teeth into.

• All responses need to be considered at this point. This means that the group is thinking about the future in a way that will not endanger the things, they value and that it considers who else may like to comment.

Acting

Let us do it!

Things to do

• The categories from the previous stage (Deciding) will form the basis of small action groups.

• Put the category signs at places within the room/farm where people have enough room to stand behind them. Ask people to think about the category they are most interested in and on which they would like to work.

• Ask people to stand behind the category they are most interested in.

• When everyone has chosen, see if there are any categories with fewer than three people interested. Negotiate with the group about these categories and ask if anyone would like to change around. Usually at least three people need to be involved in each action group

• Ask groups to discuss and write down their answers

• Negotiate a time period to work in these small groups. Thirty minutes is usually needed. Ask each group to elect a secretary and a leader.
• At the end of the work time, provide an opportunity for each group to share their plans with the whole group.

Record your categories.

**Helpful tips for this stage**

• This exercise is important because it encourages people to visibly commit to further action.

  Some people have difficulty choosing only one category but this may help them have a more realistic understanding of their time and energy commitment.

• The small interest-based action groups further commit the participants to manageable action. This prevents people being overwhelmed by the enormity of the task. At this stage, the major tasks will be talking to more people and bringing back more information to the larger group.

• Because the groups have developed from the vision, they do not have to be prioritized. This allows people to work on the things they are passionate about and they will find the energy to act while fitting in with the community's vision.

**Winding up: before the group leaves**

  **Explain:**

• Tell farmers that sustainable agriculture is the production of food, fiber, or other plant or animal products using farming techniques that protect the environment, public health, and human communities.

• Some of the practices that should be adopted include good agricultural practices (e.g. pruning, weeding, and sanitation), soil fertility management, safe and responsible fertilizer and pesticide application, good postharvest management, good environmental practices (e.g. water management, wildlife and forest protection, waste management), good social practices (health and safety, child labor, working conditions) and record keeping.

• Adopting sustainable practices also means that some practices are not allowed anymore. Tell participants that all these topics would be discussed in separate sessions.
Evaluating
How did it go? Are community members ready to own the Project?

Questions to ask
• What was the feeling in the group?
• How did the participants feel about the workshop? How do you know?
• What happened in the community as a result of the workshop?
• Are the original fields of action still valid for this community? How do you know?
• Do you need to do this bit again? What would you do differently next time and why?
• What difference will it make to how you go on?

Record your response to these questions.

Things to avoid
• Do not make any false promises.
• Do not pander to the community. You are there to do a job and other issues and problems are not your concern.
• Do not request any gifts or accept any favors - they may be conditional.
• Do not provide undue services or favors, as this will be expected of you, and may cloud the message of the project.
• Do not engage in long speeches about moral issue such as why it is important to tell the truth. Rather demonstrate it and they will learn the importance of telling the truth all the time.
• Do not over-theorize: what is needed is practical solutions to a practical problem.
• Work with an encouraged people who are enthusiastic. Others may be persuaded by example.

Project Implementation
• Do not leave the community with the project after the implementation phase.
• Aim to select and train community facilitators who are well motivated.
• Ensure farmers acquire knowledge and skills in doing. Ensure adoption of best practices
• Visitation encourages farmers – plan to visit every farmer on his/her farm at least once before the project ends.
• Observe ‘landmines’ and avoid them; relationship with people’s wives/daughters/sons

• Show respect to participating farmers and do not reprimand them in the presence of others. This may discourage others from showing commitment.

• Undertake periodic monitoring to assess progress of work.
CHAPTER 2: GOOD AGRICULTURAL PRACTICES

2.1 Farm Establishment- Deciding to Plant or Replant

Introduction

If a cocoa farm is old and has low yields, the farmer may have to decide to renew or regenerate his plantation. As a rule of the thumb, a healthy cocoa tree produces a minimum of 25 pods per year, which yield at least one kg of dry cocoa beans per tree. Trees producing ten or less pods a year are unproductive and should be replaced. In addition, if trees have reached an age of over 30 years, they should be replaced.

Variety and sources of cocoa planting materials

When replanting or establishing a new plantation it is very important to do a proper planning especially with regard to the source of the planting material. The farmer has to make a living from his plantation for most of his life. Therefore, the selection of the planting material will affect the farmer’s income and the well-being of his family for many years to come. Using unknown seeds or planting material (from own farm) are likely to lead to higher expenditures on agrochemicals, lower yields and hence lower income.

Cocoa pods on farms may have been produced from natural or uncontrolled pollination. The sources of the pollen are not known. Using seeds from such pods as planting material may lead to poor quality and reduced yield of the cocoa plants. It is better to obtain cocoa planting materials from accredited seed producers or the Seed Production Unit, SPU of COCOBOD. Planting materials from accredited institutions guarantee a high rate of quality fruits and yield.

Learning Outcomes

At the end of this module, you should have:

• Understand what it means to plant and also to replant cocoa
• How to assess and decide when to plant or replant cocoa
• How to plant or replant in the best way
The Process

A. Reflecting

What do we know already? **Questions to ask**

- What is the age of your farm? (Be sure to collect a series of answers from participants)
- How many pods can we expect from a healthy cocoa tree per year?
- What will happen if the pods decrease to 10 per year?
- What do you do with cocoa pods after harvesting them? Record your response to these questions.

B. Interpreting

Why do we need to maintain only productive and healthy trees on our farms?

**Questions to ask**

- What will happen to our farm if the trees do not produce more pods?
- What do you do to old, unproductive and unhealthy trees on your farm?
- How do you know what to do and when to do it?

C. Deciding

What will we do to get more healthy and productive pods on our farms?

**Questions to ask**

- Where do we get good and approved planting materials?
- What are the advantages of getting the improved variety over the old traditional ones we know of?
- Can anyone tell the characteristics of a good and healthy seedling? Collect answers and note them down.
D. Acting

**Things to do:**

Explain

- Seedlings can be planted through
  - **Under-planting** (This is planting new cocoa trees in an existing farm whilst removing some of the trees but not all. This is best done when trees are over 30 years)
  - **Gradual replanting** (This is blocking the farm with each block been replace with new plantings with time resulting the complete replacement of trees on the farm with time. Avoid this method on very old farms so as not to carry on diseases and pest on to new plantings)
  - **Complete Replanting** (Removing all existing trees and replacing them all with new plantings. This method is used when plants are completely very old and unproductive)
  - **New Planting** (planting on a piece of land that was fallow or has not been planted with cocoa before)

- When replanting or establishing a new plantation it is very important to do a proper planning especially with regard to the source of the planting material.

- Using unknown seeds or planting material (from own farm) are likely to lead to higher expenditures on agrochemicals, lower yields and hence lower income.

- It is better to obtain cocoa planting materials from accredited seed producers or the Seed Production Unit (SPU) of COCOBOD

- The hybrid seeds have advantages over the native varieties because:
  - They establish easily
  - They are early bearing (two years after transplanting)
  - They are high yielding
  - They have better resistance to black pod and cocoa swollen shoot virus disease. They are highly resistant to capsid bugs (leaf bugs)

- Characteristics of good and healthy seedlings for planting include seedlings which are
  - 3-6 months old
  - Two leaf storey
  - Have rigid stems
  - Have no signs of pests and diseases
E. Evaluating

How did it go?

Questions to ask

• Are farmers convinced as to the sources of planting materials for cocoa?
• Will farmers face any issues in acquiring the appropriate planting materials?
• Are farmers aware of the required planting spacing?
• Was the training information adequate?

Write participants response to these questions
2.2 Soil Conservation

Introduction
Soils have many important functions. One of the major functions is that it serves as a medium for crop growth. This is because the soils natural processes ensure that the soil can provide adequate physical, chemical and biological qualities for crop growth. Hence, when farmers manage the soil well it enhances the natural processes to facilitate adequate conditions to improve crop growth and yield.

Therefore, soil conservation is a set of management strategies for prevention of soil being eroded from the earth’s surface or becoming chemically altered by overuse, acidification, salinization or other chemical soil contamination especially through the use of inappropriate chemicals and leaching.

Learning Outcomes
At the end of this session, participants should know:

- The effect of bad farming practices that causes contamination in the soils
- Know the different types of methods that are used to conserve the soil □ Know when and how to apply each of these methods

The Process
A. Reflecting
The processes that destroy the soils that we plant cocoa on.

Questions to ask
- Give example of land preparation methods that are available? (Be sure to collect a series of answers from participants). Categorize these answers under YES or NO categories
- What type of land is appropriate for planting cocoa? (Categorize just as above) (be sure that participants mention slopes, hills and mountain sides)
- How does rain and water affect the methods that have been mentioned here?

B. Interpreting
The need to use practices that conserve the soils and maintain its fertility?
Questions to ask

• What can we do to increase the fertility of our soils? (Categorize them into organic and inorganic means)
• What natural processes are enhanced as a result of soil conservation practices?

C. Deciding

What are some of the good practices we can adopt to conserve the soils?

Suggested methods

Some suggested good practices that conserve the soils include:

• Conservation tillage: This simply means to leave a portion of vegetation on the ground, instead of stripping everything away.

• Contour farming: Do not plant cocoa on steep slope (slopes beyond 15º) since this will hasten soil erosion. However, if the land happens to be on a slope practice contour faming since it helps to prevent and control soil erosion by water runoff. This is done by planting trees or hedges along the slope of a hill, following the natural contours of the land, instead of straight up and down or across.

• Planting cover crop: This protects the soil and sometimes provides nutrients to the soil when nitrogen-fixing crops are used.

• Planting windbreak: This protects the soil against strong winds. It involves planting rows of trees, and hedges around the field or in the field.

• Improving soil nutrient: improving the soil fertility prevents soil erosion. Soil that is rich in organic matter has better structure and is less susceptible to being washed or blown away. To keep your soil healthy, add plenty of compost each year and do not over-till when you are planting.

• Adding mulch to the soil: putting a layer of mulch on the surface of the soil prevents the soil from being blown away or washed away by erosion.

• Whatever it is, it is better to prevent soil erosion than to control it. This is because once an area of land has been eroded, it is sometimes impossible to correct it.
D. Acting

**Things to do:**

Explain

- Soil erosion occurs when wind or water washes away the topsoil from an area of land because it is bare. It is important to prevent soil erosion, because land that has been stripped of its topsoil will not support any kind of plant life.

- When the topsoil is washed away, it takes with it nutrients that plants need to grow well. It can also cause gullies in the field, which makes it harder to create a level planting area. The surface of the soil that is left will crust more easily, which makes it hard for seeds to germinate, and hard for rainwater to be absorbed by the soil.

- Plants protect topsoil in many ways, allowing for soil to be conserved. This is because they reduce the heavy impact of raindrops on soil. Plants also prevent the soil from drying out as quickly, thereby protecting soil particles from being blown away by strong winds. The roots of the plants hold the soil in place, so it is not washed away as easily.

- Soil fertility can be managed on farms using the following methods-
  - **Composting**- You can make compost with a mixture of many materials including cocoa pod husks, empty oil palm fruit bunches, wood ash, charcoal dust, rice straw, poultry dropping, cattle manure, sheep manure, corn stubble or any other waste available in large quantities.
  - **Mulching**- Mulch is any cover or item placed on the surface of the soil in order to reduce evaporation (loss) of water from the soil, prevent soil erosion and control weed growth. Mulching is important in young cocoa farm (up to 3 years) but is not necessary in mature farms where fallen leaves act as mulch.
  - **Chemical Fertilizers**- A healthy, fertile soil, rich in organic matter, will assure sustainable cocoa yields even during times when prices of mineral fertilizers are high and farmers are reluctant to use these. The promotion of natural soil fertility is therefore important to maintain acceptable yield levels. In order to increase the yields, additional nutrients in form of recommended mineral fertilizers may be added according to soil characteristics and properties or based on recommendation of an authority like CRIG. This subject will be treated in much detail later.
E. Evaluating
How did it go?

Questions to ask
- Are farmers convinced as to the sources of planting materials for cocoa?
- Will farmers face any issues in acquiring the appropriate planting materials?
- Are farmers aware of the required planting spacing?
- Was the training information adequate?

Record your response to these questions
2.3 Fertilizer Application

Introduction

Plants and trees need several nutrients to grow properly. If a plant does not receive enough of a nutrient, it will not grow optimally, no matter how much of other nutrients the plant has access to.

Plant nutrients exist naturally in, on the soil, and in the atmosphere. The natural environment sometimes does not provide adequate amounts of nutrients for growing crops, or the crops use up the existing nutrients. Therefore, missing nutrients need to be added to replace the missing nutrients. These nutrients should be added in the right quantity and type.

Continuous cropping on the same piece of land, without fertilization, can cause loss of soil fertility. When the soil is eroded by water or by wind, the nutrients are removed, worsening still the loss of soil fertility. You can find out what nutrients are missing in your soil by conducting soil analysis. Based on the analysis, you can apply adequate fertilizers to supplement the missing nutrients in the soil.

As a result, an increase in yield is achieved to ensure sustainability in cocoa production. To maximize the benefits of fertilizer use, farmers have to understand that the demand of cocoa trees depend on their growth stage. The existing soil health conditions also affect the nutritional demand of the soil.

Fertilizers are available in organic form (from plant or animal products, e.g. cocoa husks, compost, manure) and inorganic form (man-made, e.g. NPK, MOP, TSP). Each of them has its advantages and disadvantages. While the basic soil fertility should come from organic material (also called biomass), additional mineral fertilizer might be necessary to increase the yield. Whenever possible, a soil analysis should be made by the extension service to measure the nutrient level of the soil and recommend the best fertilization regime.
Learning Outcomes
At the end of this session, participants should know:
• Know that the key times of applying fertilizers are the start of the wet season, and the start of pod formation
• Know that recommended dosages of fertilizers and the implications of over dosages and misapplications

Safe Storage of Fertilizers

The Process
F. Reflecting
The role of Nutrients in plant growth.

Questions to ask
• What makes plants grow? Guide them to tell you where plants get food to grow from.
• When the plant takes up nutrients where does it go?
• What is the implication of nutrient loss or unavailability to cocoa plants?

G. Interpreting
How can we improve or maintain the nutrients in the soil?

Questions to ask
• What can we do to increase the fertility of our soils? (Categorize them into organic and inorganic means)

H. Deciding
What can we add to the soil to increase the nutrients in the soil?
Tell them:
• Nutrients in the soil are constantly been used by plants to grow and also to bear fruits. If the organic matter in the soil is not enough then the soil is said to not to be fertile. It is better to find out the amount of nutrients in the soil though examining the soil or leaf sample from your farm and then based on this analysis apply fertilizers.
• Show participants an example of soil poor in organic matter and ask them if the soil looks fertile and whether plants would grow in it. They will tell you that the soil is not
good. Ask them what we can do to improve the soil in the bag. Allow few answers. Make sure that answers include fertilizer application.

- Fertilizers can be obtained from various sources. When living things like soil microorganisms die, they decompose together with dried leaves to become humus. This is organic matter because it was obtained from living sources like animal waste, compost, crop residue and other natural products. Ask: How many of you use this kind of fertilizer? Count the number of the participants that use this type of fertilizer.

- When fertilizers are made from chemicals or non-living products they are called inorganic or chemical fertilizers. These are also the commonest found on the market today. Ask participants to mention some of the chemical fertilizers that they know of.

- Ask Participants: How do we know the quantity of fertilizer to apply? Collect some answers. It is important to know how to read the label on fertilizers. If you are not able to read it ask someone who is literate to assist you read it. If you have a fertilizer label, pas it round for participants to have a look at it. Guide the participants to know the important sections of the label and how to make meaning of it. For inorganic fertilizer, you should ask a qualified person like the Extension Agent, Field Trainer or the retailer for the application dosage.

- There are three categories of inorganic fertilizers:
  - **Single fertilizer**: This type of fertilizer should only be used if you know exactly what type of nutrient your trees need. Some examples of single fertilizers are: urea, ammonium sulphate, super sulphate (SP36), TSP, KCL.
  - **Mixed fertilizer**: This type of fertilizer consists of a mix of two or more single fertilizers and should only be used if you know exactly what type of nutrients your trees need. Popular mixed fertilizers include: urea + KCl, KCl + SP 36.
  - **Compound fertilizers**: These fertilizers are mixed by fertilizer factories. Well known compound fertilizers include: nitrogen-phosphate-potassium (NP-K), or nitrogen phosphate-potassium-magnesium (N-P-K-Mg) in various dosages.

I. Acting

**Things to do:**

- Plants are able to use fertilizers well if it is applied at the right time. Ask participants: When is the best time to apply fertilizer? Collect answers from the participants. Fertilizers are best applied at the beginning of the RAINY SEASON to allow the nutrients to be dissolved in water so that the roots can absorb them. Also fertilizers are applied
when the PODS START TO GROW. This ensures that the pods get enough nutrients to grow big and healthy.

• Chemical fertilizers are chemicals just as pesticides. Therefore, they need to be treated and stored with care.

Tips for safe handling and storage of Fertilizers:
- Keep fertilizers in a room that is dry and locked away from children
- Fertilizers should be packed on stacks to prevent direct contact with moisture. They will dissolve and lose its effectiveness when it comes into contact with moisture.
- If you are not ready to use fertilizers do not buy them and store them over a long period of time.
- Some fertilizers (such as chicken manure or chemical fertilizers) can damage plant leaves when there is direct contact between the fertilizer and the leave.
- The overuse of chemical fertilizers can harm useful microorganisms in the soil.
- Applying them when there is no rain may cause burning effects on the leaves of plants.
- Using more than the recommended dosage is a waste of money.

J. Evaluating
How did it go?

Questions to ask
• Are farmers convinced about the role of nutrients in plant growth?
• Are farmers aware of the different sources of plant nutrients and how to replace these nutrients?
• Are farmers aware of the required dosages for the application of these fertilizers?

Record your response to these questions
2.4 Pruning

Importance

Cocoa trees produce more branches and leaves than they need in order to be strong enough to compete with other trees. The more branches a tree grows the more energy and “food” it must provide to these branches, which reduces the size and number of pods that reach maturity.

- The best cocoa tree has one main stem only and two or three main branches, with enough side branches and leaves to capture most of the sunlight. Removing unnecessary branches by pruning is therefore important for increasing production and reducing pests and diseases.

Benefits of Pruning:

- Reduced pests and diseases and therefore increased production: Tall trees with many branches attract rats and squirrels. Black pod disease spreads quickly in the warm, humid atmosphere found in unpruned cocoa farms. In addition, there are often more diseased and dead pods in unpruned farms where the disease can live. Pruning reduces the number of unnecessary branches, and allows more light and wind to pass through the branches, which reduces pest and disease levels.

- Easier harvesting: You will get more profit from your farm if you harvest all pods on a regular basis. It is difficult to harvest pods that are very high up in an unpruned tree.

Constraints

Farmers think that cutting branching decreases the number of pods. Therefore they are not willing to cut healthy branches

- Trees have been neglected for so long that it is difficult to know where to start
- Farmers have a lack of good pruning equipment and therefore use the cutlass that easily damages the cocoa tree.

Best practices

There are three types of pruning: architecture, shape and maintenance pruning.

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2 STCP: Farmer Training Guide on ICPM Cocoa
• Architectural pruning is done when trees are young (up to 4 years of age).

The purpose of this type of pruning is to make sure the trees do not grow too tall, and have the right shape. If trees are not properly pruned at this age, they will become too tall for you to properly manage.

• The purpose of shape pruning is to give cocoa trees a shape that allows them to capture the most sunlight with the fewest branches, without leaving holes in the canopy. This is done by removing branches that trees do not need.

Shape pruning is best done at the beginning of the rainy season, after most leaves have dropped and trees have no pods yet. Leave enough branches and leaves to make sure little or no sunlight reaches the ground, as this will increase weeds. You can prune cocoa trees more severely when there is shade from other trees.

• Removing new shoots and new branches that are not needed for the health and strength of the tree throughout the year is called

Maintenance pruning.

Maintenance pruning can be done at any time of the year.

• Tall trees take more effort to prune than small trees, but it is worth the effort. If trees are too tall to prune (or even to harvest), consider rehabilitation options. Trees that have not been pruned for a long time need to be “reshaped”.

• If the main stem is still healthy and its main branches are still bearing pods, remove all the unwanted side branches that have grown later, including watershoots.

• If the main stem and branches are too old and unproductive, choose a watershoot that can develop into a new main stem. Progressively cut/saw all the other branches and the main stem away. A suitable watershoot that can be used for rejuvenation is a watershoot that is still low at the time of pruning. It needs to get a lot of light quickly so that it will develop the first jorquette at a height of about 1 to 1.5 meters. If it does not get enough light it will grow too high and thin and will not form a properly shaped tree.
2.5 Shade management

Importance

Shade trees have an important function in the cocoa farm. The more shade, the more humidity. If there is not enough shade, the farm gets too dry in the dry season. If there is too much shade, the farm gets too humid in the rainy season. Shade suppresses the level of capsid attack but increases the incidence of black pod disease. It is therefore very important to balance the level of shade.

Farmers should know what the right level of shade is.

Best practices

If your farm has too much shade, you must remove some of the shade trees or remove some branches of the shade trees

First step:
Are there any trees that are harmful to cocoa trees?
- Remove them first!

Second step:
Trees that remain smaller or of equal height as cocoa trees – even when fully grown - do not provide any shade and only get in the way.
- Remove trees that are not really shade trees

Third step:
Select the other shade trees you want to remove.
- Try to select them in such a way that the remaining shade trees will have an evenly distributed canopy above the cocoa trees that will provide an even layer of shade.

How to remove big shade trees?

Felling shade trees with a chain saw may harm the cocoa trees:
- The shade tree may fall on the cocoa trees
- The shade is removed too abruptly and the cocoa trees do not have time to adapt to the increased levels of sunlight.
It is better to let shade trees die slowly. The amount of sunlight in the farm will increase slowly and the cocoa trees have time to adapt.

- The best way to let shade trees die slowly is by ring barking.
  Avoid the use of fire: fire may damage the cocoa trees.

**Where the shade regime is low**

Cocoa trees require some amount of shade trees especially during the early stages of growth. Traditionally, cocoa is grown in Ghana in conjunction with a diverse selection of trees that provide shade and habitat for a variety of wildlife forms thus enhancing biodiversity. It is recommended that an acre of cocoa farm should have 6-8 shade trees for optimum performance.
2.6 **Cocoa crop protection**

**Introduction**

Disease is one of the major reasons for loss of cocoa production in the world. Controlling it is therefore a key part of efficient management of a cocoa farm.

To be able to better control diseases on their farms, growers need to be able to recognize the symptoms, understand the causes of the diseases and know how the disease organisms operate.

**Best practices**

In controlling cocoa diseases, all trees should receive individual attention, as a single infected plant is likely to act as a source of infection for all the other trees on the farm. If left unattended, one sick tree will eventually lead to all the others also contracting the disease.

There are four methods used to prevent diseases developing and/or controlling them if they do become established.

These methods are: regulatory, cultural, biological and chemical.

- In regulatory control, measures are taken, usually by law, to prevent material contaminated with a pathogen from being transported from one area that already has a particular disease to another area, which does not yet have the disease.
- Cultural control is a broad approach that involves preventing the pathogen from coming into contact with and infecting the cocoa trees or eradicating the pathogen or significantly reducing its numbers in an individual plant or within an area.
- Biological control involves a range of measures that include directly introducing other microorganisms that are enemies of the pathogen.
- Chemical control usually seeks to remove the pathogen from the disease location. Chemicals that are toxic to the pathogen are applied to the cocoa or shade trees, either to prevent pathogen inoculum from establishing in a host, or to cure an infection that is already in progress.

Minimize the use of pesticides as much as possible to protect the crop. More emphasis should be placed on resistant varieties, cultural and biological control of pests and

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3 ICCO Manual of Best Known Practices in Cocoa Production
diseases. Where possible, apply early warning mechanisms for pests and diseases i.e. pests and diseases forecasting techniques.

Adoption of Integrated Pest Management (IPM) regimes should be encouraged. Farmers should seek professional advice on IPM to control pests and diseases. The use of agrochemicals should be restricted to the officially registered ones and should be in accordance with legal, scientific and technical requirements. Only appropriate agrochemicals at the prescribed doses, timing and intervals of applications should be used.

Use only pesticides that are target specific with minimal effect on the agro-ecosystem and minimal negative environmental implications.

Agrochemicals should only be applied by adequately trained adults who are knowledgeable on the safe and proper use of the products. Equipment used for the handling and application of agrochemicals must comply with safety and maintenance standards.

Routine application of broad-spectrum insecticides to prevent pests from establishing themselves should not be carried out for the following reasons:

- Insecticides are expensive, and potentially dangerous/hazardous for the health of the person carrying out the spraying.
- Furthermore, it can contaminate the local environment (soil and water streams) and the cocoa tree and pods with unacceptably high levels of chemical residues.
- In addition, excessive use of chemicals can create resistance in the target pests, and can reduce the population of useful predators. If chemical control is overused, it can lead to yet greater pest problems that may not be controllable even with the recommended insecticide applications.
- Agrochemicals must be stored in accordance with local regulations and secured away from other materials in a well-ventilated and well-lit location.
2.7 Cocoa harvest, post-harvest, on-farm processing and storage

Pods should be harvested as soon as they are ripe. Harvesting should be done every two weeks if there are not many ripe pods, and every week during peak periods. Likewise, it is important to do a separate round of the farm every week to remove sick pods and cherelles with a cocoa hook that is used only for removing diseased material.

It is essential that the pods do not become over-ripe as they are more likely to become infected with diseases, and the beans inside over-ripe pods will germinate. It is equally important not to harvest unripe pods. The beans inside unripe pods will not be ready for fermenting. Unripe beans are hard, without mucilage, and they will neither separate easily nor ferment properly. Beans from unripe pods must not be included in the wet beans for fermentation.

Harvesting must be carried out using specific techniques and tools. Farmers should always use a sharp cocoa hook on a stick. Secateurs can be used to harvest pods within easy reach. These tools should be kept clean - ideally disinfected every day and sharpened regularly with a file. They should not be used for removing diseased pods or cherelles as this will spread the fungus to healthy trees. If a grower only has one longhandled cocoa hook, it is essential that it be disinfected after being used on diseased pods. A bush knife should not be used.

2.7.1 Pod breaking
Pod breaking should be conducted in an appropriate manner to avoid damage and contamination to the beans. Once a sufficiently large quantity of pods has been harvested, the pods must be broken and the beans extracted. It is best to do this straight away or within a couple of days after harvesting in order to avoid losses from diseases. While machetes have been widely used in Ghana, clubs are also recommended to reduce the incidence of damage to the beans.

2.7.2 Fermentation
Fermentation of wet beans should be done in accordance with recommended practices. It is recommended or preferable to conduct the fermentation process for a period of five to seven days during which the heaped beans should be turned a number of times depending on the quantity to enhance air circulation.
In areas where fermentation is done in boxes, only approved fermenting boxes should be used.

The wet beans should be poured into the boxes and “turned” once a day. This process of turning is important as it ensures the even heating of the beans, allows air to enter the ferment, breaks up any lumps and prevents the formation of mould on the beans. If beans are not “turned”, they will not ferment properly and will become mouldy and bad-smelling. The length of the fermentation process is usually five to seven days.
2.7.3 Drying

After fermentation, the cocoa beans must be taken out and immediately spread on adequate surfaces to dry, preferably under direct, natural sunlight. If the drying is not started immediately, the cocoa beans will keep fermenting and rot.

Good drying is as important as good fermenting. The beans will only develop the right brown colour inside if they are properly dried. While on the drying bed, the beans must be turned several times each day. When the beans are completely dry, they must be sorted to remove the flat beans, shriveled beans, black beans, and mouldy beans, small and/or double beans, beans with insect damage, etc.

2.7.4 Packaging and storage

Cocoa beans should be packaged in clean bags, which are sufficiently strong and properly sewn or sealed. The bags should be made of non-toxic materials, preferably food grade hydrocarbon-free jute bags.

Once the drying and sorting out process has been completed, the cocoa beans must be put into appropriate bags and stored. Proper bagging and storage of the processed beans is just as important as proper fermentation and drying. Incorrect or careless bagging and storage can lead to rejection of the beans, meaning that time and efforts as well as money have been wasted.

The bagged cocoa beans must be placed in storage sheds that are weatherproof, well aired, and free from damp and insect pests and away from smoke and other smells that would contaminate the cocoa. The bags must be kept above ground level and away from walls. The storage areas must be kept locked and clean at all times. Following proper fermentation, drying and bagging, the cocoa beans are ready to be sold. Any infestation must be dealt with by proper and approved methods of fumigation.

2.7.5 Quality control

Using the appropriate equipment (moisture meters, knives for cut-test, weighing machine, etc.), the quality of the cocoa beans in the bags must be checked before the cocoa is sold. This process is a crucial one as it can considerably affect the final price paid to the farmer.
At this stage, the cocoa beans must fulfill certain criteria to the satisfaction of the buyer, including the following:

- The cocoa must be properly fermented and dried;
- The cocoa must be free from any foreign odours;
- The beans must comply with limits in contents of slaty, flat, double, broken, mouldy, insect-damage, foreign matter and germinated beans;
- The cocoa must conform to the required moisture level; and
- There have to be a number of cocoa beans per unit weight.

While under the present circumstances, quality control is mostly carried out by officials from the Quality Control Unit of COCOBOD, it is highly desirable that, in the context of sustainable and more modern cocoa production and marketing, farmers would play a larger role in the marketing of their cocoa. Eventually, they should take over quality control and carry it out at farm level before selling the cocoa beans, thus taking more responsibility for the quality of their cocoa and enabling them to command higher selling prices. In such an approach of closer involvement of farmers in the cocoa production and marketing process, current important issues such as traceability could also be addressed.
3.0 Human-Elephant Conflict Management

Why do elephants visit farmers’ fields to DESTROY their crops and sometimes aggress people?

Farmers make farms close to National Park boundaries

Corn farm close to boundary of forest reserve

- Farmers grow crops that are attractive to elephants e.g. maize, yams, cassava, pineapple, rice, millet, etc. close to boundaries of forest reserves and National Parks.

Corn

Some people destroy the habitat of elephants by cutting down trees in forest reserves or establish farms in areas where elephant used to live. In the process they destroy some of the trees that provide food for elephants and decrease the area where elephants can graze

Cutting trees from forest reserve

Some people shoot to kill elephants in forest reserves. Elephants have a good memory and will become aggressive to people once they have been shot at.

A hunter shooting an elephant

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3.1 What can farmers do to PREVENT elephants from visiting their farms and aggressing people?

**Avoid**

- Avoid making farms close to forest reserves and National Park boundaries.

- Avoid growing crops eaten by elephants. Grow crops that are not eaten by elephants, such as pepper, ginger and cotton and which can give you good returns if you have to grow crops near to a forest reserve boundary.

  *A young chilli pepper farm*

Avoid cutting down trees in forest reserves and avoid destroying the habitat of elephants

- Avoid settling close to forest reserve boundaries.

  *Settlements close to a forest reserve*

- Avoid shooting to kill elephants. A wounded elephant may attack and hurt or even kill you.

  *A hunter attached by an elephant*
Use a combination of these old and new methods on your farm to drive away elephants.

**Old Methods:**

Use all the old or traditional methods known in your community such as:

- beating the bark of trees,
- beating empty cans,
- bamboo blasters,
- setting fire at edge of fields,
- night patrols,
- burning palm kernel,

*Beating bark of tree to make noise*

- Use rope to fence off your farm.

*A group of farmers preparing a fence*

Hang alarm bells on fence round your farms to warn you of the presence of elephants. The noise from bells can also drive elephants away.

*A farmer hanging a bell on rope*
**HILLI-FENCE**

Some new methods you may want to try on your farm are based upon using chilli pepper. Elephants do not like the smell of pepper and their skin is sensitive to it as well. So using chilli pepper to protect your farm is helpful to keep elephants away!

- Grind chilli into powder.
- Mix grease and the powdered chilli.
- Smear the mixture on rags and hang these on the rope around your farm.
- When the elephants smell the Chilli, it will hurt their nose and they will not come closer to your field.

**UNG BRICKS**

The smoke of burning chilli pepper goes faraway, and elephants will not come close to your farm if you burn these chilli dung bricks in your field.

- Prepare and burn chilli-dung bricks at points around your farms when the crops are ripe

**EDUCATE AND PATROL**

- Form community scouts to assist with putting up the fence, guarding the fields and patrolling the boundary of forest reserves or conservation areas to drive away elephants. See the Wildlife Officer nearest to you for assistance
- Report the presence of elephants in your area to the Wildlife Office nearest you.
FINALLY

- Remember to follow the rules in driving away elephants from your farms:
  
  **A** - Avoid  **B** - Be alert  **C** – Chilli pepper  **D**- Dung bricks  **E** – Educate and Patrol

- The materials you need are chilli-pepper, used oil, rope, rags and bells
- They are easy to obtain and cost less money
- The methods are easy to make and give good result
- They worked for farmers in Zimbabwe, Ghana, Uganda, Zambia and can work for you too!!
4.0 MONITORING AND EVALUATION

Introduction

Monitoring of field activities help to track the performance of the project. The Geographic Information System (GIS) approach has been found to be an effective tool for gathering and analyzing field data. GIS is a computer system that collects, stores and manipulates data with the aim of displaying geographically referenced information (data identified by their locations). The output of most GIS systems is the visual representation of the real world on a piece of paper in the form of a map. The ability to identify farms by location and to link each geographic feature with its attribute makes monitoring and evaluation with GIS a very convenient approach. Maps are used to depict and analyze clusters of geographically-dependent phenomena. Maps have moved from hard paper drawn maps to high advanced maps produced using specialized computer software.

GIS represents data on a map using points, lines, and polygons. Features that can be represented as points include schools, hospitals, and points of interest (POI). Streets and rivers are usually represented using lines; districts, towns and villages are depicted using polygons and sometimes points for non-area representation. GIS is designed to capture, store, manage, integrate and manipulate various layers of data, allowing the user to visualize and analyze that data in a spatial environment.

4.1 Advantages of Using GIS in Monitoring and Evaluation

GIS and spatial mapping allows managers and resources planners to have a quick overview of an entire area and the spatial distribution of objects and resources in order to take meaningful and quick decisions. The exact location and a good description of objects captured on the ground makes it possible for a manipulation of the data captured to produce new and exciting results that will help in decision making. Geographic representation of features allow for a future reference to those features in order to monitor how those features have changed over time. GIS systems allow managers to capture all sorts of data and store such data in a form that will persist overtime. That data captured in a GIS system can be updated daily, monthly or yearly in a systematic manner that will capture the changes in the attribute in the feature under investigation.
GIS allows the linking of one feature from one area to another feature from a different area through a system of common attributes. Based on continuous data collection and updating of the system, a change in one feature relative to the other feature from a different area can be established. Farm maps and records from different project areas can be monitored over time through regular updates of key indicators of healthy farm. This data will allow managers of such projects to decide if efforts at improving farm health and increasing productivity is working at all projects sites.

### 4.2 GIS Database of Cocoa Farms

In order to successfully integrate GIS in the monitoring and evaluation system, a geodatabase of biodiversity on cocoa farms has to be established to collect basic biodiversity data on farms. The database should be designed to be continuously updated by field staffs and selected farmers. The routine farm inspection by field staffs should also be incorporated into the system. The database should be created in ESRI ArcGIS and Microsoft Access Database. The Access Database is used by field staffs that do not have ready access to the ArcGIS software on their computers. The database is made up of forms that allow the field staff to enter data collected on sheets of papers and then send the data to the GIS data manager who then updates the database.

#### 4.2.1 Method and Process of Data Collection

The ultimate aim of building a geodatabase of cocoa farms is to enable managers of the respective projects to evaluate the performance of individual farmers and their farms and to ensure that biodiversity in these farms are conserved. In order to achieve our objective, the field staff should collect information by

- identifying the key indicators/attributes of farm productivity
- identifying the key attributes of biodiversity within cocoa farms.

<table>
<thead>
<tr>
<th>Attribute Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>General area where the farm is located</td>
</tr>
<tr>
<td>Farm Size</td>
<td>The approximate size of the farm given by the farmer</td>
</tr>
<tr>
<td>Age of Farm</td>
<td>The approximate age of the farm as given by farmer</td>
</tr>
<tr>
<td><strong>Cocoa type</strong></td>
<td><strong>Type of cocoa planted e.g. hybrid and Tetteh Quarshie</strong></td>
</tr>
<tr>
<td>----------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Number of Native trees</strong></td>
<td><strong>Number of indigenous tree species found on the farm</strong></td>
</tr>
<tr>
<td><strong>High Yielding Trees</strong></td>
<td><strong>Number of high yielding cocoa trees found on the farm</strong></td>
</tr>
<tr>
<td><strong>Yield</strong></td>
<td><strong>Cocoa produced per hectare (in Kg) within the past production year</strong></td>
</tr>
<tr>
<td><strong>Farm Maintenance</strong></td>
<td><strong>Requires a yes/no answer to answer whether the farmer performs good farm maintenance</strong></td>
</tr>
<tr>
<td><strong>Harvest and Post-harvest</strong></td>
<td><strong>Requires yes/no to answer whether the farmer applies good harvest and postharvest practices to ensure good and consistent quality product</strong></td>
</tr>
</tbody>
</table>

**Attribute Data (Biodiversity/Native Trees)**

<table>
<thead>
<tr>
<th><strong>Data</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local Name</strong></td>
<td>Local name of tree as given by the farmer</td>
</tr>
<tr>
<td><strong>Genus</strong></td>
<td>Scientific name of tree at the Genus level</td>
</tr>
<tr>
<td><strong>Species</strong></td>
<td>Scientific name of tree at the species level</td>
</tr>
<tr>
<td><strong>Canopy Cover</strong></td>
<td>Estimated canopy cover of tree in percentage</td>
</tr>
<tr>
<td><strong>DBH</strong></td>
<td>Diameter at breast height measured using a diameter tape by the field staff</td>
</tr>
<tr>
<td><strong>Natural/Planted</strong></td>
<td>Naturally occurring tree species are those which were not planted by the farmer but left on the farm to produce shade during the farm formation stages</td>
</tr>
</tbody>
</table>
Ask these questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you observed any wild animal on your farm over the past year?</td>
<td></td>
</tr>
<tr>
<td>If yes, can you tell me the names of the animal you have been observing?</td>
<td></td>
</tr>
<tr>
<td>When is the last time you harvested snails from your farm?</td>
<td></td>
</tr>
<tr>
<td>How often do you see insects such as bees and butterfly on your farm?</td>
<td></td>
</tr>
</tbody>
</table>

4.2.2 Equipment Used

The data collection process involves the use of the following equipment:

1. Hp Ipaq
2. BlueNext GPS
3. Diameter Tape
4. Digital Camera
5. Tape measure

4.2.3 Process of Data Collection

Farm mapping should be done with the consent of farmers. At the beginning of every data collection:

- Explain the data collection process to the farmer
- Indicate to the farmer what he/she is required or expected to do during the process of mapping.

Three levels of activities are carried out on every farm during the data collection process.
4.3 Establishing the boundaries of the farm

This requires the use of the GPS and the Ipaq by the enumerator.

- Walk the entire boundary of the farm with the Ipaq and GPS in order to digitize the boundary to form a polygon of farm.
- Allow the farmer to lead the enumerator into walking on the exact boundary of the farm.

4.3.1 Tree data collection

- Collect GPS coordinates of native trees and all associated data after mapping the boundary of the farm. The position of all identifiable shade tree species within the farm is collected using the hand-held GPS.
- Measure the diameter at breast height of each tree species using the diameter tape.
- Estimate canopy cover by the percentage of canopy the enumerator can see overhead standing directly under the tree. This is a subjective method and only gives a perception of how much shade is provided by the trees.

4.3.2 Mapping Areas of Interest (AOI) by Field Staff

- The field staff also collects data on any other feature found on the farm including: streams or pools of water within the farm,
  - areas with specific siting of wildlife species, marshy areas etc.

Marshy areas are normally digitized into polygons whiles streams are represented by lines. Appropriate forms have been created on the Ipaq to store the various layers.

4.4 Connecting Ipaq and Bluetooth GPS for Data Collection

The system of mapping is designed to use a hand-held PDA (Personal Digital Assistant) together with a Bluetooth enabled GPS to collect data. The PDA is installed with Arcpad (a mobile mapping software from ESRI). Each ipaq has a compact flash card installed on them. The CF cards hold the various layers to be updated. A complete map document with all the various layers is also installed on the card ready for editing. This complete map document is done in order to reduce the process of loading layers into an empty map
document and its associated complexities. The following processes are adopted in connecting and starting farm mapping:

- The process of mapping begins with the loading of the Arcpad 10 software on the Ipaq.
  - Start > Arcpad 10
  - Wait for it to load
- Load the map document
  - Click on this to load the Arcpad Map (Farm_mapping.apm)
  - Browse to the storage card and look for Farm_mapping.apm
  - Click on it to load the various layers for mapping

After loading the layers in Arcpad, the next step is to connect the Ipaq to the Bluetooth GPS through the Bluetooth wireless connection on the ipaq. The following process will be carried out to ensure that the hp ipaq start receiving data:

1. Click on the start button of the Ipaq
2. Click on the on Ipaq wireless
3. Turn on the Bluetooth of the Ipaq by clicking on the Bluetooth icon
4. Click on Manager
5. A new window is opened containing all the available Bluetooth wireless devices already configured on the Ipaq
6. Click and hold BT-GPS COM7
7. Click on connect in the drop down menu that appears (This will connect the ipaq to the GPS)
8. Close all the wireless windows by clicking on the close button and subsequently ok.
9. The Arcpad window with the maps appears. Click on the Main Tools icon
10. Click on the GPS Active icon. This will start the GPS. Wait for the GPS connection to have a fix. When the GPS has a fix the coordinates of the current position appears at the button of the window like this

   ![Coordinates](image)

   The coordinates of the current position ends in S and E representing South and East respectively. The accuracy of the GPS signal is given by Position Dilution of Precision (PDOP). The smaller the value of the PDOP, the better the signal received. Several factors may affect the PDOP. When the GPS is connected very early in the morning, it will take a while in order for the accuracy to reach an acceptable figure. A PDOP value of between 1 and 2.2 is acceptable
for the purposes of the mapping exercise. When a good fix is obtained, then the ipaq and the GPS are ready for mapping.
4.5 Capturing Data using the Ipaq and the Connected GPS

Once the GPS connection to the Ipaq is working and receiving data from the satellites, the next step and the most important is to capture data and edit the existing database on the Ipaq. Three layers of shapefile is part of the data uploaded onto the Ipaq. These layers are made up 1) the Farm Information Layer (Polygon) 2) Shade Tree layer (Points) 3) Line layer which allows for the capturing of features that are represented by lines.

1. To digitize a farm boundary, start the by clicking on the Editing Toolbar button.
2. Click on the small arrow just below the feature type button. The default feature is a Point. In order to digitize a farm boundary which will form a polygon, a polygon feature would be selected. The digitizing process must begin at a starting point which would be on the boundary of the farm. The process ends at the Endpoint which is normally the starting point of the digitizing process. When a starting point has been identified, the field staff then starts the digitizing by clicking on this icon. As soon as the icon is clicked, the field start together with the farmer must traverse the boundary of the farm until they reach the starting point.

3. To end the polygon digitizing and save the digitized farm, the Proceed to Attribute Capture icon found at the bottom of the Arcpad window is clicked. This opens the attribute table window with fields which requires the filling in of the farm details.

4. After completing the filling in click OK, to save the digitized farm.

Tree Data Capture

1. To capture a trees within the farm, the point feature type is selected.
2. When the field staff reaches a shade tree, he/she then clicks on the Capture Point Using GPS button in order to pick the location of the tree.
3. This process is repeated for all the shade trees found on the farm.

Stream/River and Road Data Capture

1. To capture a stream flowing with the farm, the polyline feature type is selected.
2. The field staff upon reaching a stream starts digitizing by clicking on the Add GPS Vertices Continuously icon.
3. The staff then traverses the entire length of the stream that falls within the farm under consideration.
4. The staff ends the data capture process by clicking on the Attribute Capture icon. The attribute window is opened and the various fields are then filled.
5. Click OK to save.
4.6 Data Gathering and Management

Field trips are organized regularly to collect data. A typical field trip to collect data involves at least three field staffs who collect data simultaneously from different farms. The data from the different GPS devices are downloaded onto the computer by the database administrator. The GIS database is then updated with the new records captured. Attributes data are particularly edited to ensure that database integrity is maintained. Each farm is presented with a Farm Identity which is a combination of farm location, farmer's name and number of farms owned by the farmer. The tree data follows a similar process of identification but with number of tree included to make a unique identification.
5.0 COCOA CERTIFICATION

Importance

Certification is a procedure by which an independent body gives written assurance that a farm, farmer group or processing facility has been assessed and is adhering to specific standards. The certification is intended to guarantee that the cocoa sold under the seal of the standard organization (e.g. FLO, UTZ, and Rainforest Alliance) does actually originate from a farm or operation that produces according to the relevant standards.

Certification thus guarantees the authenticity and the integrity of sustainably produced cocoa being purchased by consumers. Increasing consumer awareness of the environmental consequences of food production (deforestation, soil erosion, contamination with pesticides) results in a growing demand for environmentally-friendly produced cocoa products. Similarly, the cocoa sector’s labor practices have received public attention, particularly since the international media began reporting of child labor in West Africa resulting in increased consumer demand for cocoa products originating from socially sustainable producers who respect international social standards.

Driven by the consumer demand, but also by recognizing that only a sustainable cocoa sector in the producing countries will be the guarantee for a thriving cocoa and chocolate industry abroad, multinational companies have engaged themselves in initiating projects to improve sustainability and make this visible by certification. The certification systems described here conforms to the Rainforest Alliance system and Sustainable Agriculture Standards.

5.1 The Sustainable Agriculture Network and Rainforest Alliance

The Sustainable Agriculture Network (SAN) is a coalition of independent non-profit conservation organizations that promote the social and environmental sustainability of agricultural activities by developing standards. The new standard structure covers the following:

1. Ecosystem Conservation
2. Wildlife Protection
3. Water Management
4. Soil Conservation
5. Integrated Waste Management
6. Integrated Crop Management
7. Community Relations
8. Fair Working Conditions
9. Occupational Health and Safety
10. Farm Management Systems
11. Producer Crop Management

The objective of the standard is to encourage farms to analyze and consequently mitigate environmental and social risks caused by agriculture activities through a process that motivates continual improvement. The standard is based on the themes of environmental soundness, social equity and economic viability (Refer to Sustainable Agriculture Standard, SAN).

5.2 Field Personnel

The certification process requires documentation and strict adherence to well defined standards. The documentation is led by the documentation officer and the entire process led by the project coordinator.

5.3 Guidelines for the trainer

By the end of the training, the beneficiary farmers would have acquired knowledge and skills in the certification system. The trainer should support the farmers to adopt the recommended practices outlined in the manual. This should be followed by the adoption of the principles within the certification program.
CONCLUSION

In order to ensure high quality cocoa, no effort should be spared to implement recommended best known practices. Every step in the process contributes to the final quality of the cocoa produce. From choosing the structure and texture of the soil, preparing and establishing the farm, selecting the planting material, managing the farm (good husbandry), harvesting, through to processing and quality control, all are vital factors and therefore should be taken very seriously by the producers.
For further reading


Rainforest Alliance (2009) .Interpretation Guidelines - Indicators for Sustainable Cocoa Production in Cote d’Ivoire (Ivory Coast)
