Training manual

Agroforestry for climate-resilient landscapes

RECOFTC

In cooperation with

Schweizerische Eidgenossenschaft
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Agroforestry for climate-resilient landscapes

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Contents

Preface i

Acknowledgements ii

Abbreviations iii

About the manual 1

Module 1: Introduction 5

Session 1.1: Getting to know each other (Agroforestry Game) 6

Session 1.2: Setting the context 7

Session 1.3: Exploring expectations 11

Module 2: Landscape resilience for climate-change adaptation 13

Session 2.1: What is a landscape? 14

Session 2.2: Landscape resilience for climate-change adaptation 19

Module 3: Roles of agroforestry in the resilient landscape 25

Session 3.1: What is agroforestry? 26

Session 3.2: The roles of agroforestry in a climate-resilient landscape 33

Session 3.3: Agroforestry and food security 44

Module 4: Enabling conditions for the adoption of agroforestry 47

Session 4.1: Key opportunities and challenges for agroforestry practices 48

Session 4.2: Measures to support agroforestry practices 54

Module 5: Stakeholder engagement in agroforestry interventions 59

Session 5.1: Stakeholder mapping 60

Session 5.2: Stakeholder engagement in agroforestry design 64

Module 6: Designing agroforestry interventions for a climate-resilient landscape 69

Session 6.1: Agroforestry interventions for a climate-resilient landscape 70

Module 7: Planning agroforestry interventions for a climate-resilient landscape 75

Session 7.1: Planning agroforestry interventions for a climate-resilient landscape 76

Module 8: Monitoring and evaluation of agroforestry interventions 81

Session 8.1: Criteria for the monitoring and evaluation of agroforestry interventions 82

Session 8.2: Methods and tools for the monitoring and evaluation of agroforestry interventions 86

References 91

Preface

Agroforestry is increasingly seen as a strategic intervention to build resilience to climate change and improve the livelihoods of farming communities. It has also been widely applied as a successful approach in community forestry due to its potential to maximize economic and environmental benefits, including those of smallholders. Agroforestry plays a significant role in supporting forest landscape restoration and filling the livelihood gaps that can occur in the short term during natural regeneration or the restoration of forest land.

For maximum benefits, agroforestry practitioners need to understand the basic principles of agroforestry and how they link to the adaptive capacity and resilience of local communities in dealing with the impact of climate change. Practitioners need to be able to support farmers in designing, establishing and managing agroforestry systems. Good agroforestry practice includes considering different ecological contexts, market opportunities and access to resources. In reality, more extensionists are needed who are able to facilitate communities in the development of agroforestry.

RECOFTC, in partnership with ICRAF, has developed a regional training manual on agroforestry for climate-resilient landscapes with the objective to train future extensionists and practitioners working on agroforestry. To ensure the efficacy of the manual, each training sessions has been tested with a range of audiences at national and international levels. These include mid-level government officers, NGO staff and academics from Thailand, Myanmar and Viet Nam. The authors encourage users to adapt, modify and improve the sessions and handouts in order to suit their specific objectives, audiences and contexts. It is important to note, however, that the effectiveness of the sessions will depend on the personal innovation, field experience and confidence of the trainers.

The manual covers key aspects of agroforestry development in the context of climate-resilient landscapes. Its technical guidelines will help agroforestry practitioners assist farmers in designing, establishing and managing agroforestry systems on their farms and forest lands. The skills and knowledge gained can be applied to peatlands, uplands, lowlands, or other land categories. Additionally, the manual provides basic materials and tools for practitioners to use following the course. These guidelines and tools are particularly useful in the context of community forestry, forest landscape restoration and climate change in ASEAN Member States.

Acknowledgements

RECOFTC and World Agroforestry (ICRAF) have developed this training manual in response to the increasing demand from ASEAN Member States to adopt agroforestry practices for landscape resilience. The manual is one of several collaborations already undertaken by staff of both organizations, with highly appreciated contributions from Ronnakorn Triraganon and Sirichai Saengcharnchai from RECOFTC, and Delia Catacutan, Ingrid Öborn, Hai Tien Nguyen, Endri Martini, Gerhard E. Sabastian, Betha Lusiana, James M. Roshetko, Rachmat Mulia and Robert F. Finlayson from ICRAF.

Critical input from the ASEAN Working Group on Social Forestry (AWG-SF) and its secretariat ensured that the manual is appropriately targeted and relevant to a range of socioeconomic and cultural conditions in the region.

The authors would also like to extend their warm thanks and deep respect to the dedicated and hard-working people from all over ASEAN who joined the test training sessions in Thailand.

Finally, we would like to express our deepest gratitude and thanks for the wisdom, support and unwavering commitment of the staff and consultants of the Swiss Agency for Development and Cooperation through the ASEAN-Swiss Partnership on Social Forestry and Climate Change, who gave us the opportunity to serve the people of ASEAN by promoting a deeper and more widely shared knowledge of agroforestry for landscape resilience.

RECOFTC and ICRAF

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Abbreviations

ADB	Asian Development Bank
AF	Agroforestry
AFTA	ASEAN Free Trade Area
AFRENA	Agroforestry Research Networks for Africa
ASEAN	Association of Southeast Asian Nations
CBD	Convention on Biological Diversity
FAO	Food and Agriculture Organization of the United Nations
FMNR	Farmer-managed natural regeneration
ICRAF	World Agroforestry Centre
IFAD	International Fund for Agricultural Development
IUCN	International Union for Conservation of Nature
MAM	Mangroves and Markets
M&E	Monitoring and Evaluation
NGO	Non-Governmental Organization
NOC	Naturland Organic Certification
PM&E	Participatory Monitoring and Evaluation
RECOFTC	Regional Community Forestry Training Center for Asia and the Pacific
SALT	Sloping Agricultural Land Technology
TEEB	The Economics of Ecosystems and Biodiversity

About the manual

Objectives of the manual

This training manual provides basic guidance for trainers to design and deliver training that will help individuals or organizations increase their knowledge, skills and experience in agroforestry development. In addition, the exercises contained in this manual are designed to help participants foster the understanding and basic skills necessary to support farmers in developing effective and efficient agroforestry practices.

This training manual delivers in two main ways:

- Providing basic materials to help people learn about agroforestry design and practice for climate-resilient landscapes.
- Equipping participants in the training courses with the necessary knowledge, skills and attitudes with regard to agroforestry development, particularly within the context of community forestry, forest landscape restoration and climate change adaptation.

The manual covers key aspects of agroforestry development, theoretical and practical, as well as explaining tools for planning, designing, establishing and evaluating agroforestry interventions towards landscape resilience. It is an important tool for effectively promoting agroforestry in ASEAN Member States, ensuring benefits for communities while also supporting national objectives.

Target groups

The primary audiences for this manual are national or sub-national staff with a mandate to train provincial and district field extensionists in promoting agroforestry development within community forestry, forest landscape restoration and climate resilience. Intended audiences include:

- Officers of forestry departments at central and regional levels
- Landscape planners
- Staff of extension services at central level
- Project trainers with a background in community forestry and agriculture extension
- Agroforestry trainers at universities and development organizations
- Staff at agroforestry research institutions

To ensure the best outcomes of the training, participants should have the following qualifications and experience:

- Basic field background in forestry, agriculture, agroforestry or natural resource management
- Familiarity with community or social forestry
- Understanding of key issues related to natural resources, particularly land-use management, forest landscape management, rural livelihoods and climate change
- Experience as an interactive trainer or facilitator in community forestry, agroforestry and/or natural resource (land and forest) management
- Excellent interpersonal and communication skills

Training approach

The training design has been developed on principles of participatory learning, encouraging contributions from all so that participants can build on their own experiences. A participatory approach encourages mutual respect, confidence, cooperation, and shared decision-making during the training. The aim is for participants to replicate these methods in their own training. Some of the core features are:

- All sessions will be active and practical.
- The emphasis will be on peer support, positive feedback and fun.
- Experienced trainers in facilitation will support interactive learning processes.
- The series of learning sessions will allow participants to practice their skills.
- At regular intervals, participants will be given the chance to extract their own lessons learned.

How to strengthen the learning process

This training manual is intended to guide a learning process that draws on ideas based on adult experiential learning (Kolb 1984, Kolb et al 2000) and social learning theory (Buck et al 2001, Cundill et al 2014). The training approach is based on the following essential features:

- Participants are rich sources of information and their individual backgrounds offer a substantial resource for problem-solving and learning.
- Participants should be actively engaged in the process of their own learning, especially in any pre-training assignments and exercises during the training period.
- Learning is activated by motivating participants in training to seek new knowledge, skills and behaviour and to apply the newly learned knowledge and skills in their work and personal environments. Facilitation of such learning occurs only by fully involving participants in new experiences and by having them observe, reflect and draw upon these experiences in order to progress.
- Learning thrives in a setting that encourages collaboration and the exchange of ideas and perspectives. People learn by modelling, observing and imitating others. Establishing learning conditions in which participants can work and learn together is thus crucial in this regard.

In line with this training approach, and to reach the learning objectives, the training sessions in this manual have been organized around the following basic steps:

- An activity that helps participants understand concepts through facilitated and structured experience, both through indirect (such as observation or case studies) and direct (such as role-play) exposure.
- An analysis that allows participants to examine and reflect on the completed activity.
- Integration to help participants synthesize their ideas and perspectives.
- Application, carried out by means of assignments or action plans, in order that participants learn how to practically use their new knowledge and skills. This fourth step helps both participants and trainers evaluate the learning achievements in relation to the expected results.

How to use this manual

This manual can be used as a guide for a one-off training course, short workshop, event or a series of capacity-building activities that are implemented over an extended period of time. In the latter case, the manual is flexible and its modules can be used separately to guide events that stand on their own, for example, when policy-makers convene around a given agenda. Sessions can be selected and tailored to respond more specifically to the objectives of a particular training course, such as one targeted for policy-makers or practitioners.

There are a number of ways that trainers can employ training sessions. For example, in order to complete a full program using all the learning modules, trainers can choose to implement either a five-day indoor training course or a six-day training course with practical field exercises. Four examples of session-based training scenarios are provided on the following page.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Objectives	By the end of the training, participants will be able to: ▪ Explain the concept of agroforestry ▪ Link agroforestry design with landscape resilience ▪ List key principles involved in agroforestry design	By the end of the training, participants will be able to: ▪ Explain the roles of agroforestry in climate change adaptation ▪ Identify key opportunities and challenges for agroforestry application in targeted areas	By the end of the training, participants will be able to: ▪ Describe the links between agroforestry and landscape-level climate-change resilience ▪ Use basic agroforestry principles to design integrated landscape plans ▪ Develop key interventions to support agroforestry within a landscape	By the end of the training, participants will be able to: ▪ Describe the links between agroforestry and climate-resilient landscapes ▪ Use basic agroforestry principles to identify a broad set of interventions within a landscape ▪ Develop a facilitation plan to work with stakeholders, including farmers, to design and implement agroforestry systems that support climate resilience landscapes ▪ Identify criteria and indicators based on agroforestry principles to measure success of agroforestry programs that increase resilience within a landscape
Time	1 day	1 day	4 days	6 days
Target clients	Local leaders, district level officers	Policy makers, provincial directors	District, provincial or landscape-level officers	Field extension officers
Setting	Classroom	Classroom	Combination of classroom and field visit	Combination of classroom and field exercise
Suggested sessions	3.1, 3.2, and 7	3.2, and 4.1	1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 4.1, 4.2, 5.1, 5.2, 6, and 8.1	All sessions and field exercise

Please be aware that while the session plans provide details on how they should be run, these should not be regarded as rigid. The user is encouraged to modify the plans if needed. The training design is flexible and user creativity is welcomed to design an exciting and effective training program for user needs and purposes.

Trainer's note

The user may notice that many sessions in this manual contain Trainer's notes. These notes provide additional instructions to help trainers maximize the results of the training sessions. They also provide suggestions on how to run the training sessions.

The development team for this manual believes that it is important for trainers to consider a number of additional points in relation to the topic of agroforestry for landscape resilience. These are given below and should be considered prior to, and throughout, the training program.

Specific English terms

Trainers may find real challenges when adapting the manual to fit specific cultures. It may be difficult to find a word that translates the exact meaning of the original English term, so check the choices made with others who have experience working in community or agroforestry settings.

Specific contexts or conditions

Some of the methodologies presented in this manual may be new in a certain context. Participants may resist new ideas, which may affect how they learn and participate. Some participants may even leave the training program altogether. For example, many cultures do not encourage or even allow people to voice their concerns, so trainers will need to prepare the sessions carefully and sensitively to avoid any difficulties.

Specific cultures

Certain parts of the manual will need to be adapted to suit local cultures. Case studies and energizers should be culturally appropriate.

Who would be best to adapt or translate this manual?

The translation of this manual into other languages should ideally involve an experienced agroforestry facilitator with excellent translation skills and a good understanding of agroforestry development, or an excellent professional translator with substantial experience in translating documents about agroforestry development. If unable to find such a candidate, another option is to build in personal experience to the agroforestry design and implementation by using the key lessons in this training manual and the associated field guide. The user can talk with other agroforesters and share experiences to learn more and more. This informs subsequent work with a translator to develop translations that cater to the specific situation of the target language group.

Module 1: Introduction

Session 1.1
Getting to know each other (Agroforestry Game)

Objectives

At the end of the session, participants will be able to:

- Recognize their strengths and weaknesses, and those of other participants, in supporting agroforestry practices
- Explain the value of knowing the strengths and weaknesses of themselves and others when conducting development work
- Determine possible measures to mobilize their strengths during this training course

Time

1 hour

Materials

- Set of cards with the names of different species of agroforestry. Each species should have about 4-to-5 cards, depending on the total number of participants in the course. Names can be changed so that all participants recognize the species. Examples include: ground nut, chili, coffee, durian and dipterocarpus.
- The trainer must be sure that the training venue has enough space for people to move around.

Steps

1. Introduce the session by explaining how it is important that we introduce ourselves and get to know each other better. Explain that we will use a method that is probably new to most participants but that it is a creative and fun way to help people know each other.
2. Assign one card with a species to each participant
3. Explain that we will form groups according to specific instructions. Each member in a group will introduce their name, where they come from, their role in agroforestry practice, and one favourite fruit or vegetable.
4. In the first round, ask participants to form small groups of monoculture crops. For example, all participants who have a card with ground nut form a group. After the small groups have formed, ask each participant to introduce themselves to the other members of the group until all have done so.
5. In the second round, ask participants to form small groups of two crops, for example, participants who have cards with ground nut and chili form a group. Then repeat the introductions as in the first round.
6. In the third round, ask participants to form small groups of mixed crops, for example, participants who have cards with ground nut, chili, durian and dipterocarpus. Then repeat the introductions as in the first and second rounds.
7. Ask each group to have one representative introduce their whole group to other participants.
8. After all the small-group representatives finish their introductions, ask the whole group:
    a. How many people come from government, development agencies or projects?
    b. How many people have a direct role to support agroforestry?
    c. How many people plan to work on agroforestry development in landscape management?
9. Conclude the session by reflecting how we now know each other's background and how many people have already engaged in agroforestry development or practices. This knowledge will help us maximize the use of all our experience during the training program.

Session 1.2
Setting the context

Objectives

At the end of the session, participants will be able to:

- Explain the learning flow and approaches used in this training program
- Review their expectations and decide how to meet them during the training
- Identify their roles and that of the trainer and feel a sense of ownership of the learning process

Time

1.5 hours

Materials

- The learning objectives of the training program written on flip-charts
- The flow of the training program on a series of flip-charts. Each sheet should show one key module. All sheets together should cover all the key modules in the training program.
- Daily schedule and list of logistical matters, if necessary.

Steps

1. Explain that we are going to start by looking at the general context, objectives, training flow and process. We will discuss the why, what, how, who and when in a participatory way.
2. Discuss first the why, posting the background and objectives of the training program in the room where everyone can see them. Leave them there for the duration of the course. Discuss how these were determined and clarify any questions.
3. Explain that we will now move to the what of the training program. Place in the middle of the room the pile of prepared flip-chart sheets showing the key modules of the training program. Ask for volunteers to put the flip-charts in the right sequence and then place the flip-charts on the wall so that all can see them. Explain the flow and clarify participant understanding by asking questions.
4. Explain that the how or approach used will be called the approach taught. There will be few lectures and a lot of facilitation. Emphasise that participants will have plenty of opportunity to experience, reflect, give feedback and talk with each other during the program. Explain other approaches, if necessary.
5. Explain that this training program might ask them to do things differently to what they are used to. Explain the different zones by using the flip-chart labelled with the personal learning model (see handout 1.2). At some points during the program, participants will be asked to move into their stretch zone. Explain that the comfort zone is different for each person, so everyone will have to be honest as to whether they are in their stretch zone.
6. Explain that the who is closely related to the how. Ask participants what they think their role will be as a trainer, and their role as participants in this program. Emphasize that how much they learn during the program will depend on their own attitude and willingness to try new things. Display the flip-chart with the comfort zone and explain.
7. To gain more interactive participation from everyone, this course will allow participants to take responsibility for some specific tasks. The tasks are, social monitoring and action, service provision, and daily feedback and recapture. These are described below.
8. Ask volunteers to join teams that take responsibility for social monitoring and action, service

provision, and daily feedback and recapture. Clarify the tasks and explain that these roles will be rotated every day so that everyone will have an opportunity to contribute.

a. **Social monitoring and action:** This team has the responsibility of monitoring the dynamics of all participants and taking action to motivate social learning. The team could offer energizing activities that stimulate the learning atmosphere.

b. **Service provision:** This team has the responsibility for all services that support the learning process, that is, preparing material, distributing hand-outs, tidying the room, preparing flip-chart stands, time keeping, field coordination and other matters as needed.

c. **Daily feedback and recapture:** At the end of each day, this team conducts an activity to gain feedback from all participants in relation to either lessons learned during the day, the feeling, the process followed, or any particular issues of the day's program. The team helps review the key lessons learned during the day and reports to the plenary the next day.

9. Explain the when of the training course by posting the overall schedule, and reviewing it with the whole group.
10. Discuss any logistical matters, such as food, accommodation or money

Handout 1.2 (a)
Becoming a better agroforestry facilitator

Be prepared! This training program is not about theoretical agroforestry concepts or issues. It is about ourselves!

To be a good agroforestry facilitator you don't need to:

- Have an academic degree or know everything about agroforestry
- Be the smartest person in the group
- Be a good speaker
- Be a good leader

You do need to be:

- Interested in the people around you
- Willing to look critically at yourself
- Willing to listen carefully to what people tell you
- Willing to change yourself

What type of facilitator we are depends on our:

- Identity
- Thinking
- Values
- Beliefs
- Culture
- Personality

How good we are depends on our:

- Qualities
- Capacities
- Strengths
- Weaknesses
- Experiences
- Ability to reflect

Other methods used during this training program

Most courses you have attended in the past have probably used lectures, presentations and guest speakers. This training program will use very few of these methods. If used, those sessions will be very short. You cannot become a better agroforestry practitioner by only listening to lectures.

Handout 1.2 (b)
Self-reflection

Self-reflection is an important method for self-development. It is a process where people think for themselves and use their own experiences to refine their own ideas. This can lead to personal change that may include new experiences, feelings, insights and abilities. This is why we will ask you to assess your own strengths and weaknesses regularly throughout this training program.

Receiving feedback

Although we can learn a lot through self-reflection, we can learn even more about ourselves and how we behave from the feedback given by our peers.

Observation

Another effective way to learn is by observing other participants. Participants can learn important lessons about agroforestry, such as what to do or what not to do when designing agroforestry practices, by actively watching and discussing with others.

Practicing

The most powerful way to learn, however, comes from practicing particular skills yourself. There will be plenty of opportunity to do so during this training program.

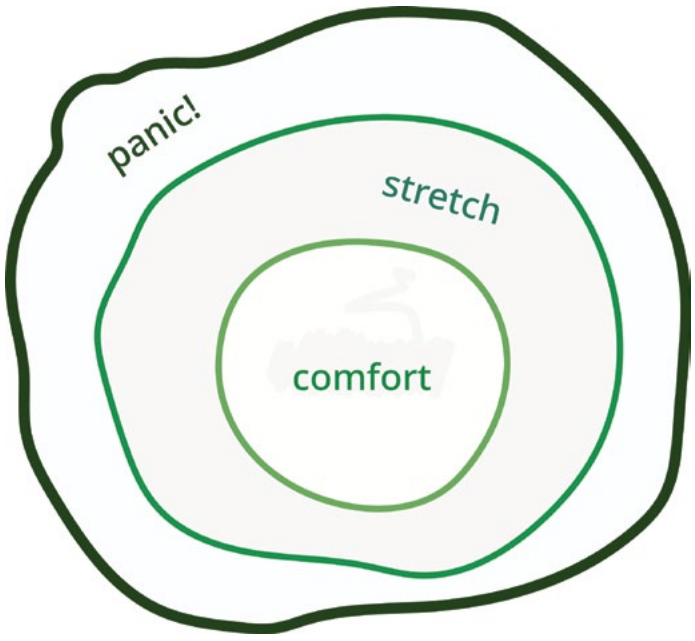
Don’t panic

Although this training course might be different from what you are used to, it will likely be more fun because you will be actively involved. Sometimes you will be challenged to do things you have not done before and to stretch and extend your mind. But there is no need to panic as it will be done gradually.

The choice is yours

Comfort zones are very personal and only you will know if you are stretching yourself. If you are afraid of thinking about and doing things differently from what you are used to, you will not learn much. However, if you open yourself up to new ideas and methods you will learn a lot from this program.

Figure 1.1 Personal learning model



Session 1.3
Exploring expectations

Objectives

At the end of the session, participants:

- Will have formulated their expectations about the course
- Can explain why they think their expectations will or will not be met

Time

30 minutes

Materials

Flip-charts with the following captions:

- I am here because I want to learn more how to select suitable species for agroforestry when working with villagers.
- I am here because I want to see the best agroforestry practice for landscape resilience.
- I am here because I want to get better ideas how to work with local people and design agroforestry in the context of climate change.
- I am here because my boss told me to be.
- I am here because I like to meet people from other places and share ideas with them about agroforestry practices.
- I am here because I have never practiced agroforestry before and want to learn how to do it.
- I am here because...

Steps

1. Place the flip-chart sheets with captions in various corners of the room. Then refer to the training agenda and explain that this agenda has been developed based on past experience. Explain that now that participants have gone through the agenda in detail, they might have more specific expectations of things they want to happen or not want to happen.
2. Draw attention to the flip-chart sheets with the captions and ask participants to walk to the one that captures best why they came to the course.
3. After everyone has chosen their spot, invite participants to share their specific expectations with the group and write them on the sheet. Give them ten minutes to do this.
4. Ask groups to go to the other posters and read the expectations of the other groups.
5. Give participants an idea as to what will be happening in the program and when, linking these to certain days or sessions. Explain what is beyond the context of the training program, and why.

   *At the end of the whole training program, summarize these main expectations on a flip-chart sheet using keywords. Then initiate a discussion in order to see which expectations were met and which were not, and why.

Trainer's note

- If the expectations are well formulated and specific enough, you can paste them onto the program agenda. This will show participants when their expectations should be met and will remind you to refer to certain expectations during different sessions.
- Participants who are unfamiliar with facilitation or who come from a background in agricultural or forest extension work may have expectations that the course will focus on the technical issues of agroforestry or suitable agroforestry species. It is important to address this issue by explaining that the technical focus of this course is the process of how to design agroforestry systems within a landscape. That is, participants will not learn how to select species and plant trees and crops. Instead they will learn how to prepare a plan for working with farmers to design agroforestry based on farmer needs and ideas as well as being suitable for landscape resilience.
- To encourage self-directed learning, ask participants to write down and place their expectations on a wall. Encourage them to focus upon, and monitor, their learning during the training.

Module 2: Landscape resilience for climate-change adaptation

Session 2.1
What is a landscape?

Objectives

At the end of the session, participants will be able to:

- Discuss different definitions of landscape for different purposes
- Determine key aspects to define the meaning of landscape
- Identify key potential stakeholders in a landscape based on participant experiences

Time

1.5 hours

Materials

- Flip-charts with different definitions of landscapes. Each flip-chart should have one definition, excluding the definition's source. Place thee flip-charts on the wall or where all participants can see them.
- Index cards of different colours
- One big flip-chart made up of four A0 sheets taped together
- Flip-charts, markers and masking tape

Steps

1. Start the session with a short brainstorming about what comes to mind when participants think of landscape. Answers could include different land uses, ecosystems, natural features, infrastructure, administrative boundaries, interaction between people and natural resources.
2. Write all the key ideas on flip-chart sheets so everyone can see them. Ask for clarifications if necessary.
3. Explain that within this session we will be working together to determine key aspects of landscape and develop a working definition of landscape for our learning process.
4. Introduce different definitions of landscape by taking participants through those posted on the wall. No questions are allowed yet.
5. Ask all participants to choose the definition they like the most.
6. After they all chose, ask participants who chose the same definition to make a group. Within each group, ask each participant to share the reason they selected that definition. Give participants 5 minutes to exchange their reasons.
7. Invite participants who have the same choice to share their reasons to other groups. Ask other participants for questions or comments.
8. Ask participants to capture the key aspects learned from these definitions. Note these down and compare them with what was written at the beginning of the session. Some key aspects could be: space, visible and non-visible features, functions, time, people, interaction, trade-offs, scale. Emphasize that a landscape is not always necessarily defined by its size but rather by an interacting mosaic of patches and elements, as well as social elements, within its space.
9. Explain that for this training program we can use these key aspects to make our own working definition of landscape. Ask for a volunteer to start developing our working definition.
10. Keep developing the working definition until everyone seems to be fine with it. Write a clean version of the working definition on a flip-chart sheet and post it on a wall. This definition will be referred to from time to time during the program.
11. Invite volunteers to use the big flip-chart made up of four A0 sheets to draw a landscape that features the key aspects discussed earlier.

12. Run a short brainstorming to identify the stakeholders who are involved in managing or working in a landscape. Write down each stakeholder on an index card and place them on the big landscape flip-chart sheets.
13. If time allows, run another brainstorming on why these stakeholders are interested in a landscape. Note each interest on another colour index card and place them in the same landscape drawing. Ask questions to clarify if necessary.
14. Tell participants that we can see a number of stakeholders having different stakes or interests in a landscape. In this program, we will have the opportunity to assess their roles in the landscape and how they can support agroforestry development and implementation in order to increase climate resilience. We can also discuss how agroforestry supports stakeholder interests in a landscape.
15. Summarize key lessons from this session.

Exercise 2.1
What is a landscape?

Trainers write out the following definitions, using one definition per flip-chart sheet. Do not include the source.

1. A landscape is the visible features of an area of land, its landforms and how they integrate with natural or man-made features (Wikipedia 2017).
2. A landscape is a socio-ecological system that consists of a mosaic of natural and/or human-modified ecosystems, with a characteristic configuration of topography, vegetation, land use, and settlements that is influenced by the ecological, historical, economic and cultural processes and activities of the area (Scherr et al 2013).
3. A landscape is a holistic view of managing resources. (Global Landscapes Forum 2016).
4. A landscape can refer to either spatial and ecological characteristics that help define conservation and development targets or it can refer to governance and other social interactions and mechanisms that minimize conservation and development trade-offs (Redford et al 2003).
5. Landscapes are place-based systems that result from interactions between people, land, institutions (laws, rules and regulations) and values. These interactions shape the dimensions of people's lives and either produce the food, fuel, fiber they need or generate the income to buy these from elsewhere. Landscapes shape ecological services and the social and economic relationships on which people depend (Frost et al 2016).
6. Landscapes can be defined by their potential to promote mental well-being through attention restoration, stress reduction, and the evocation of positive emotions; physical well-being through the promotion of physical activity in daily life as well as leisure time and through walkable environments; and social well-being through social integration, social engagement and participation, and through social support and security (Abraham et al 2010).
7. Landscape can be defined as the combination of three essential interactive aspects: functional interactions, negotiated spaces, and multiple scales (World Agroforestry Centre 2015).
8. A landscape is a socio-ecological system that consists of natural and/or human-modified ecosystems, and which is influenced by distinct ecological, historical, economic and socio-cultural processes and activities (Denier et al 2015).

Handout 2.1
What is a landscape?

Defining the term landscape can be problematic because of the different functions, roles, values and stakeholders connected to the term.

World Agroforestry (Minang et al. 2015) highlights three essential interactive aspects that define a landscape, namely functional interactions, negotiated spaces and multiple scales.

Functional interactions

Ecological, economic and social processes in a landscape interact. Landscapes can be seen as a mosaic of components, named land units by Zonneveld (1989), who defined these as ecologically homogenous areas of land with associated variation in land use. The management of the various land units is linked to multiple and different sectors of a national economy (including agriculture, forestry, water management, infrastructure, rural development), and also to actors' interests and biophysical characteristics.

Negotiated spaces

Landscapes typically have a diverse set of stakeholders with different perspectives, interests, power and ambitions, which can conflict with each other. Hence, negotiations are needed for the different actors to reach mutual acceptance of each other, and live within collective decisions that shape the landscape. Therefore, landscapes are negotiated spaces, differing in the degree by which stakeholders can achieve harmony.

Multiple scales

Landscapes often contain households, farms and other institutions, such as community-based organizations and the private sector, that may potentially engage in collective action. Landscapes interact with neighbouring landscapes and are nested in coarser-scale sub-national units, watersheds/basins or eco-regions. A convenient landscape scale is one that is large enough to contain the heterogeneity of biophysical characteristics as well as social, economic, political and cultural dimensions

but small enough to be socially coherent.

The main reason for a landscape approach is that existing land-based sectors usually have a poor history of seeking collective solutions across their institutional territories. Most often, each sector has implemented their individual activities, which is defined by their own economic activity, professional community, geographic boundary or government structure.

The basic landscape hypothesis is that we can find better collective solutions if we explore opportunities that cut across disparate economic sectors, disciplines and territories. That is, we will find combined solutions that are better than the combination of individual sector-specific solutions.

In economic terms, a landscape approach seeks to reduce or even remove externalities between land-based sectors.

In planning terms, a landscape approach looks at a more complete set of options, avoiding solutions that are too narrow or have a high potential of causing conflict. It encourages a broader set of stakeholders to consider a wider set of landscape objectives. This is not to say that a landscape approach will always result in win–win opportunities but rather that it can help us find smarter trade-offs between objectives.

Session 2.2
Landscape resilience for climate-change adaptation

Objectives

At the end of this session, participants will be able to:

- Recognize different landscape functions and how these functions are interconnected and support human wellbeing
- Explain how landscape resilience can contribute to local people's adaptation to climate change

Time

1.5 hours

Materials

- Flip-charts, markers and masking tape
- A number of large photographs representing different key landscape characteristics: watershed, seascape, intercropped farm, forest restoration, residential area, range land and agroforestry

Steps

1. Explain that the purpose of this session is to discuss the different characteristics within a working landscape and the interaction among these characteristics. Each characteristic serves a different function for human society. This session will help us understand how these different functions contribute to, or influence, each other.
2. As one complete group, ask participants to think of a landscape and identify different characteristics in it. Ask them to share some examples of characteristics and write them on a flip-chart so all can see. Be sure the discussion covers the main characteristics, such as plantations, residential areas, infrastructure, farms, public service areas, cultural sites, sloping areas, and water.
3. Ask the participants to work in four small groups. Distribute to each group a large photograph representing one type of landscape, for example, a watershed, seascape, intercropped farm, forest plantation, residential area, range land, agroforestry site.
4. Ask each group to discuss and identify:
   a. What are the main landscape characteristics in the photograph?
   b. How do these characteristics provide for human wellbeing within the landscape?
   c. What potential losses could these characteristics make to human wellbeing?
5. Each group should prepare to share their results using the table below.

Landscape characteristics	Potential benefits for human wellbeing	Potential losses for human wellbeing

6. After 30 minutes, bring everyone together and ask each group to share their discussion. Follow with Q&A if needed.
7. Highlight some key lessons from the discussion. These could include multiple characteristics within a landscape, multiple functions and interactions across various landscape characteristics, both positive and negative.
8. Conduct a short brainstorm to summarize the different landscape characteristics and functions.

9. Give a short introduction on landscape resilience for climate change: Climate vulnerability = climate exposure – landscape resilience.
10. Ask the groups to take a quick look at their given landscape and share with the other groups any vulnerability in the landscape.
11. Ask each group to share how each landscape characteristic could increase or decrease landscape resilience. Write answers from the participants on flip-chart sheets.
12. End the session by reminding the participants that although most of us work on sustainable natural resource management, we all see how our natural resource management efforts can be influenced by other sectors within a landscape. Therefore, we should understand these characteristics and functions within our working landscape so that we can design a proper integrated landscape management plan to serve society more effectively. Agroforestry should be an approach to support integrated landscape management. In the next module we will have an opportunity to discuss more how agroforestry can increase landscape resilience.

Trainer's note

- If possible, trainers should obtain photographs from case studies that participants will use in later sessions or similar photographs in areas where participants are working.
- Landscape characteristics can serve human wellbeing in terms of water provision, control of soil erosion, food sources, forest products, firewood supply, fertilization of plants and crops, wind breaks, flood protection, pest control, shading, spiritual and cultural activities, and recreation.
- Landscape characteristics can be a threat for human society in terms of water blocked for drainage, soil erosion, vulnerability to strong winds or tides, good habitat for pests, flash floods and forests fires.

Exercise 2.2
Landscape resilience for climate-change adaptation

In your group, take a quick look at the given photograph of one landscape. Discuss the following with your group for the next 30 minutes:

- What are the main landscape characteristics in the photograph?
- How do these characteristics provide for human wellbeing within the landscape?
- What potential losses could these characteristics make to human wellbeing?

Prepare a table for a short presentation.

Summarize your group discussion while showing your landscape.

Landscape characteristics	Potential benefits for society	Potential losses for society

Handout 2.2
Landscape resilience for climate-change adaptation

It is increasingly recognized that well-managed landscape ecosystems can help societies adapt to both current climate hazards and future climate change by providing a wide range of ecosystem services (Turner et al 2009). To support communities adapt to these issues, it is important to understand some of the basic concepts and components of adapting to climate change.

Key adaptation definitions

Vulnerability
The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.

Exposure
The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure or economic, social or cultural assets in places and settings that could be adversely affected.

Sensitivity
The degree to which a system is affected, either adversely or beneficially, by climate-related stimuli.

Adaptive capacity
The ability of a system to adjust to climate change (including climate variability and extremes), to moderate the potential damage from it, to take advantage of its opportunities, or to cope with its consequences. Adaptive capacity may include human, physical, natural, social and financial assets.

Resilience
The ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions.

Landscape resilience can be linked to climate change through the following formula

Climate vulnerability = **Climate exposure** − **Climate resilience**

From the formula, if the landscape resilience is high then society becomes less vulnerable to climate change.

A secure flow of ecosystem services within a landscape can significantly reduce social vulnerability by increasing its resilience. For example, mangroves protect coastal areas against storms and waves, forest products provide safety nets for local communities when agricultural crops fail, and hydrological ecosystem services, such as base-flow conservation, storm-flow regulation and erosion control, are of utmost importance for buffering the impacts of climate change on water users. The conservation

and sustainable management of ecosystems and their services can generate multiple socio-ecological benefits and promote long-term approaches to climate-change adaptation (CBD 2009).

Maintaining nature's capacity to buffer against the impacts of climate change is often less costly than having to replace lost ecosystem functions by heavy infrastructure or technology. According to the Economics of Ecosystems and Biodiversity global initiative (TEEB), cost-benefit analyses indicate that public investment should support ecological infrastructure, such as forests, mangroves and wetlands, because of their contribution to climate change adaptation. In many cases, an ecosystem investment can be justified solely on the basis of one valuable service but it becomes even more attractive when the whole range of services is considered (TEEB 2009). Additionally, ecological infrastructure can often be more adaptive than engineered infrastructure because ecosystem management can be modified more easily in the face of unexpected changes. Ecosystem management can also strive to enhance ecological resilience and facilitate natural adaptation processes so that ecosystems can adapt to unanticipated environmental changes and continue to deliver services.

Numerous examples from around the world show that successful integrated landscape management is not only technically and economically feasible but also socially desirable if prepared and designed with the adequate participation of stakeholders.

Module 3: Roles of agroforestry in the resilient landscape

Session 3.1
What is agroforestry?

Objectives

At the end of this session, participants will be able to:

- Identify key characteristics to explain what is agroforestry
- Classify main agroforestry systems based on their characteristics

Time

1.5 hours

Materials

- Flip-charts
- Colour cards and A0 paper sheets
- Different definitions of agroforestry by different sources, which will be written on flip-charts and placed on a wall to be visible to all participants
- A number of large photographs representing different key landscape characteristics: watershed, seascape, intercropped farm, forest restoration, residential area, range land and agroforestry

Steps

1. Introduce the session by acknowledging that the meaning of agroforestry varies by location and user, reflecting local, national and regional contexts. Discussions of agroforestry often focus on the combination of agriculture and forestry practices, which include production, socio-economic and ecological aspects, both at plot and landscape levels.
2. Present different agroforestry definitions by different sources. Take questions and answer briefly.
3. Ask participants to break into four small groups for a 20-minute discussion. Ask each group to draw a picture representing agroforestry systems starting with a plot and then at landscape level. Let them discuss their definition of agroforestry and its key characteristics. Write down the key characteristics on flip-chart sheets.
    a. What is agroforestry?
    b. What are the key characteristics of agroforestry following your definition?
4. Each group spends 10 minutes to present their results to the whole group. Other groups can comment and ask questions to fully understand the definitions and their associated concepts. Continue until all groups have presented.
5. Lead a brainstorming session, asking all participants to identify the key common characteristics of agroforestry systems by showing photographs of various systems (see trainer's note below).
6. Present the main characteristics of agroforestry systems starting from plot through to landscape level, indicating the four key criteria in agroforestry design: **Intentional, Intensive, Integrated and Interactive.** Ask for examples to support each of the four key I criteria.
7. Take questions for clarification, if necessary. Ask participants to share some examples they may have from their own contexts and link them with the key components.
8. Summarize key lessons and explain that agroforestry also plays a critical role in landscape resilience. Remind participants of the results from the previous session. Explain that the next session will explore agroforestry for climate resilience at landscape level.

Trainer's note

The photographs should show different agroforestry systems, including:

- Shifting cultivation
- Rotational farming
- Agro-aquatic forestry
- Silvopastoral, taungya
- Home garden
- Alley cropping
- Multipurpose trees and shrubs on farmland
- Woody hedgerows
- Crops with plantation tree-crops
- Shelterbelts or windbreak
- Riparian buffer
- Protein bank
- Trees/shrubs on pasture
- Live fences of fodder trees and shrubs
- Plantation with pasture and animals
- Trees with fishery or insects

Handout 3.1
What is agroforestry?

Definitions of agroforestry

Agroforestry is agriculture with trees. It describes practices developed and employed by farmers over many centuries to cultivate trees on farmland in different combinations with crops and livestock. From a purely agricultural perspective, agroforestry is about recognizing and promoting trees on a farm. From a strict forestry perspective, it is about recognition and rights for tree-based systems and livelihoods that farmers have created and can expand with appropriate support from relevant forest management techniques (ICRAF, 2018). Nevertheless, agroforestry is an amalgam of agriculture and forestry, rather than treating these as separate land uses, institutions, policy domains and fields of science. This integration is achieved through a landscape approach. Most importantly, apart from bio-geophysical perspectives, agroforestry can be an entry point for speeding the progress of achieving social, economic, welfare, market, environmental stewardship and political goals.

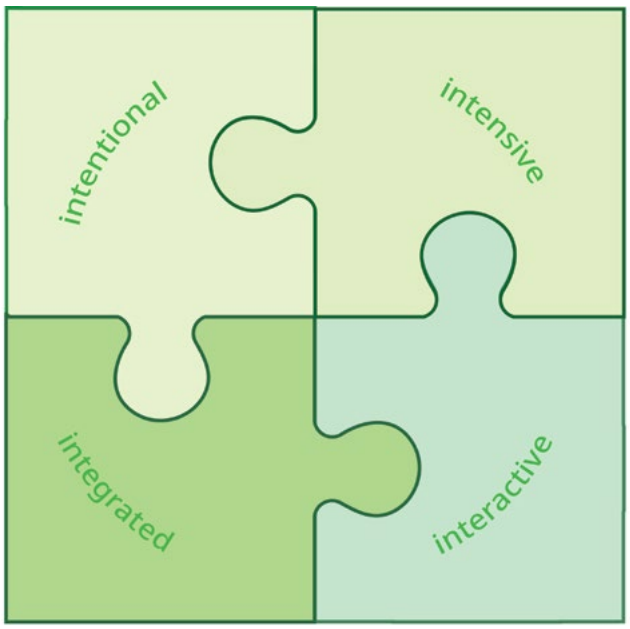
Agroforestry can be defined in many ways, for example:

- A collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms and bamboos) are deliberately used on the same land-management unit as agricultural crops and/or animals, either in the same form of spatial arrangement or temporal sequence. In agroforestry systems, there are both ecological and economic interactions between the different components (Lundgren and Raintree 1982, Young 1997).
- A sustainable-management system for land that increases overall production, combines agricultural crops, tree crops and forest plants and/or animals simultaneously or sequentially and applies management practices that are compatible with cultural patterns of local population (Patra 2013).
- An intensive land-management system that optimizes the benefits from the biological interactions created when trees and/or shrubs are deliberately combined with crops and/or livestock (AFTA 2018).
- The practice and science of the interface and interactions between agriculture and forestry, involving farmers, livestock, trees and forests at multiple scales (ICRAF 2017).

Characteristics of agroforestry systems

Nair (1993) explained the characteristics of agroforestry systems at farm level as follows:

- The deliberate growing of woody perennials on the same unit of land with agricultural crops and/or animals, either in spatial mixture or in temporal sequence
- Involves two or more species of plants and/or animals, at least one of which species is a woody perennial
- Contains complex interactions among species' components that are suited to the needs of environmental and human systems
- Always has two or more outputs



The four criteria determine what is, and what is not, agroforestry practice:

Intentional
Combinations of trees, crops and/or livestock are intentionally designed, established and/or managed to work together and yield multiple products and benefits rather than as individual elements that may occur together but are managed separately. Agroforestry is neither mono-cultural farming nor a mixture of monocultures.

Intensive
Agroforestry practices are created and intensively managed to maintain their productive and protective functions, and often involve cultural operations, such as cultivation, fertilization, irrigation, pruning and thinning.

Integrated
The trees, crops and/or animal components are structurally and functionally combined into a single, integrated management unit tailored to meet the objectives of the landowner. Integration may be horizontal or vertical, above or belowground, simultaneous or sequential. Integration of multiple crops uses more of the productive capacity of the land and helps to balance economic production with resource conservation.

Interactive
Agroforestry actively manipulates and uses the biophysical and physical interactions among the components to yield multiple harvestable products while concurrently providing numerous conservation and ecological benefits, such as control of soil erosion or protection of wildlife habitat.

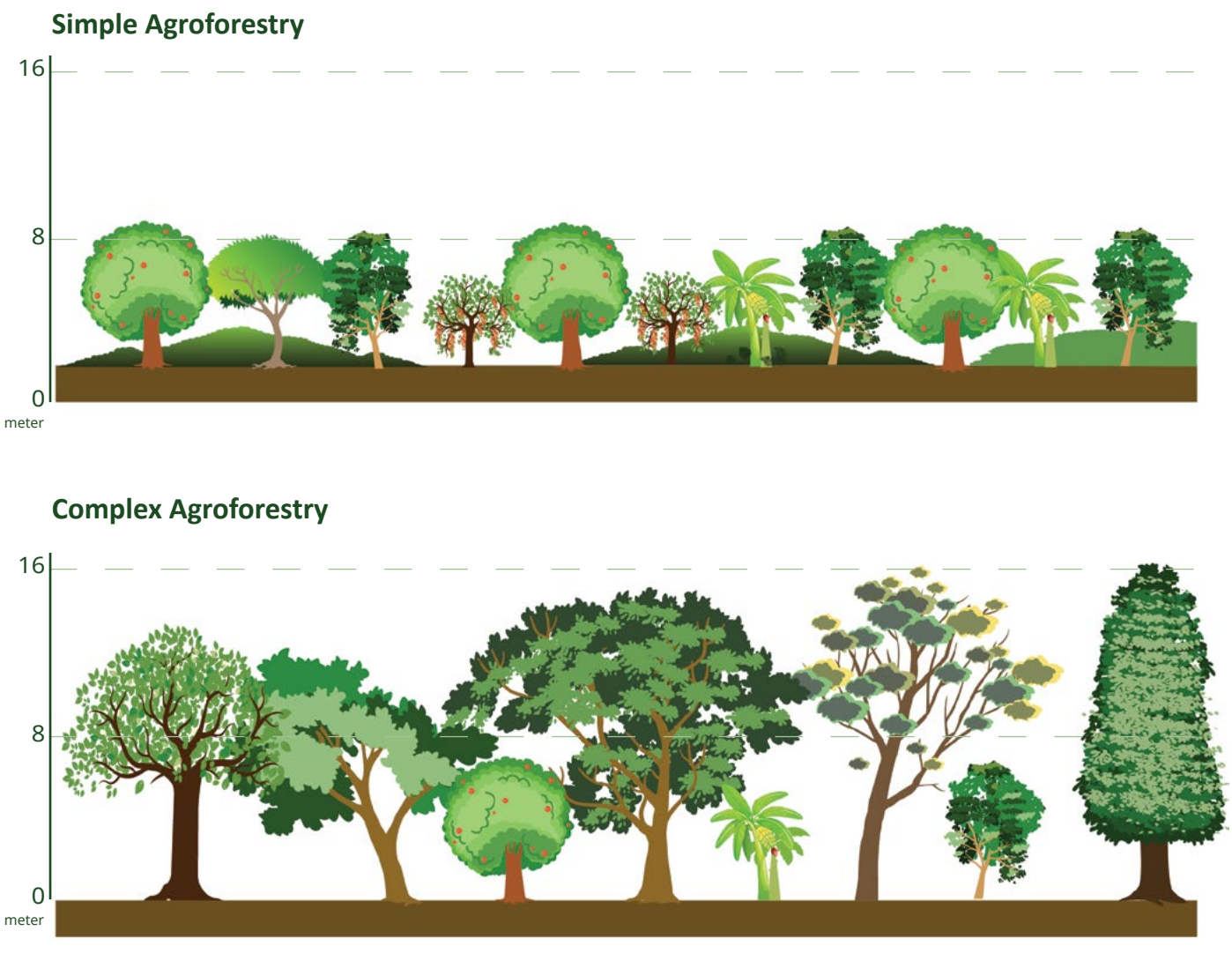
Classification of agroforestry systems

Agroforestry systems are classified into two levels:

- Agroforestry at plot or farm level: activities or practices related to the day-to-day management of an agroforestry system, such as hedgerow planting of leucaena *(Leucaena leucocephala)* or planting of rubber *(Hevea brasiliensis)* seedlings in a multi-strata agroforestry system. At farm level, agroforestry can be managed through regular spacing and irregular spacing depending on the owner's preferences and goals.
- Agroforestry at landscape level: agroforestry is a land-use system that interacts with other land uses to provide livelihoods for local people as well as environmental services in the landscape.

Generally, at plot or farm level, agroforestry systems can be classified into two types (Figure 3.1):

Figure 3.1: Two types of agroforestry systems at farm level



Simple agroforestry

This agroforestry system usually has no more than five tree species, annual crops (rice, maize, vegetables, forage herbs) and/or vegetatively propagated species (bananas, cacao, coffee). The trees also serve as shade for companion crops, forming a single layer of canopy. Spacing between individual plants is either regular or random. The expected benefits from the system are focused on the economic aspects of the main commodity. The best-documented forms of simple agroforestry are alley cropping, taungya, woody hedgerows, windbreaks (Michon and Foresta 1996, Gold et al 2013).

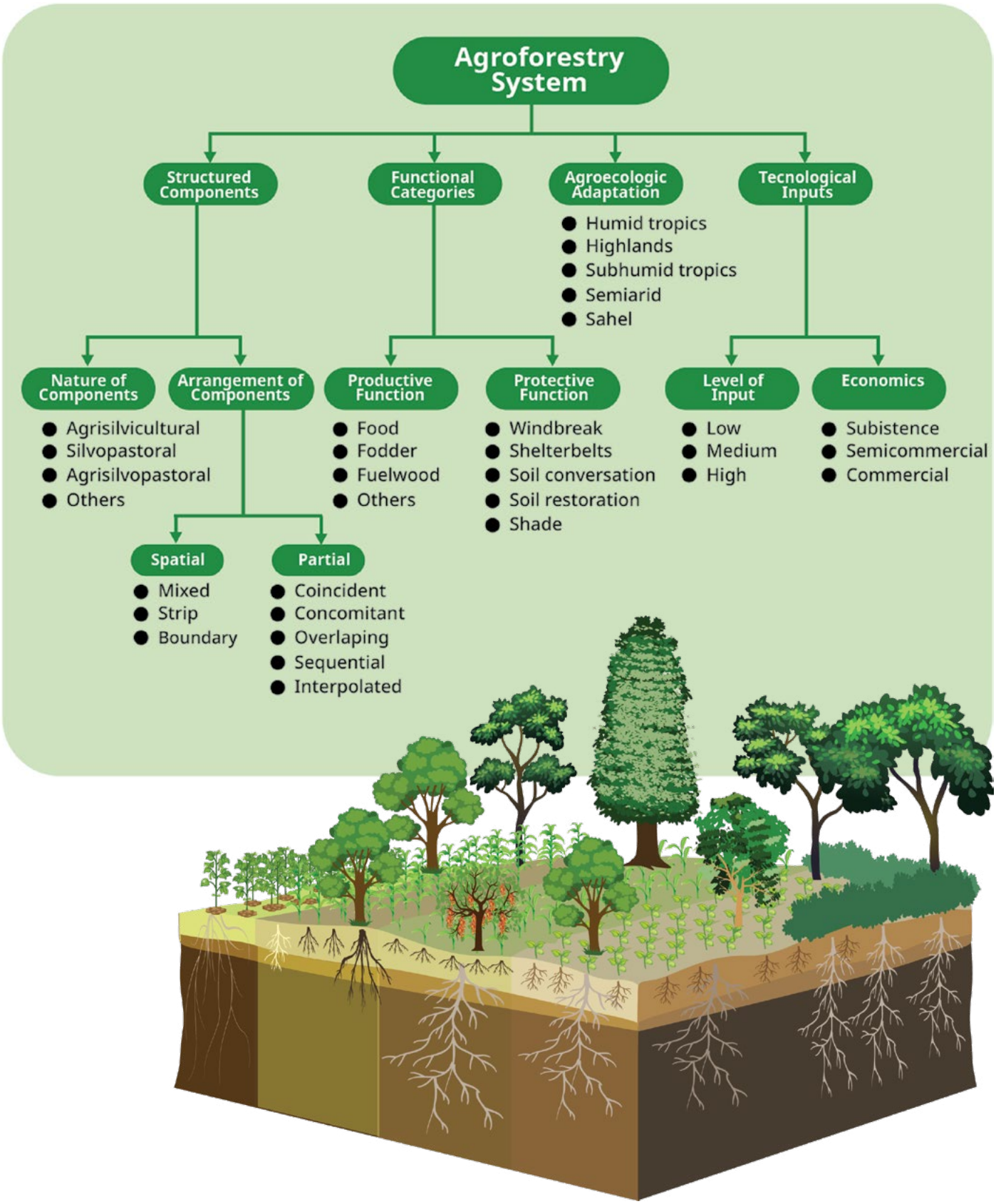
Complex agroforestry

This agroforestry system usually contains more than five tree species besides the main commodity crop or crops. Besides yielding products (fruit, timber, spices), the trees also serve as shade for companion crops and form multiple layers of canopy. Spacing between individual plants is usually irregular and management of the system is usually extensive. The characteristics and functioning of complex agroforestry systems are close to those observed for natural forest ecosystems, either primary or secondary, that is, providing economic (tangible products) benefits and ecosystem services (carbon sequestration, water regulation, prevention of soil erosion and landslides, and habitat for endemic animals and plants) (Michon and Foresta 1996). In some cases, farmers enrich their simple agroforestry systems with other tree or shrub species and other crops and transform them into complex agroforestry systems (Manurung et al 2008).

A further specification by Nair (1993) and Xu et al (2013) classifies agroforestry systems according to the following criteria (Figure 3.2):

- **Structural basis** refers to the composition of the components, including spatial arrangement of the woody component, vertical stratification of all the components, and temporal arrangement of different components.
- **Functional basis** refers to the major function or role of the system, usually furnished by the woody components. These can represent a service or be of a protective nature, for example, windbreak, shelterbelt, soil or water conservation.
- **Socioeconomic basis** refers to the level of inputs (low to high), intensity or scale of management, and commercial goals, for example, subsistence, commercial, or intermediate.
- **Ecological basis** refers to the environmental condition and ecological suitability of a system, based on the assumption that certain types of systems can be more appropriate for certain ecological conditions. There are separate sets of agroforestry systems for arid and semiarid lands, tropical highlands and lowland humid tropics.

Figure 3.2: Classification of agroforestry systems



The structure of an agroforestry system can also be defined in terms of its components and their expected roles. This classification considers the composition of the components, including a spatial mixture of the perennial woody component, vertical stratification of the component mix and a temporal arrangement. Examples of this classification are found in table 3.1.

Table 3.1: Examples of agroforestry systems

System	Components	Examples
Agrosilvicultural	Trees with crops	■ Shifting cultivation ■ Improved fallow ■ Taungya ■ Home-garden ■ Alley cropping ■ Multipurpose trees and shrubs on farmland ■ Crop combinations with plantation crops ■ Shelterbelt ■ Windbreak ■ Soil conservation hedge ■ Rotation woodlot ■ Boundary marking ■ Riparian buffer
Silvopastoral	Trees with pasture and livestock	■ Protein bank ■ Trees and shrubs on rangeland or pasture ■ Live fences of fodder trees and shrubs ■ Plantation crops with pasture and animals
Agrosilvopastoral	Trees with crops and livestock	■ Multi-story system with free grazing ■ Alley cropping with pasture grasses and agricultural crop ■ Woody hedgerows ■ Home-garden
Other systems	Trees with insects Trees with fishery	■ Aqua-forestry ■ Apisilviculture ■ Sericulture ■ Mushrooms with mixed tree species ■ Multipurpose woodlot

Session 3.2
The roles of agroforestry in a climate-resilient landscape

Objectives

At the end of this session, participants will be able to:

- Explain key roles of agroforestry in climate-change adaptation
- Identify potential roles of agroforestry in climate resilience

Time

1.5 hours

Materials

- Hard copies of case studies
- Flip-charts and A0 paper
- Markers

Steps

1. Introduce the objective of the session, which is to look at how agroforestry systems within a landscape can mitigate impacts of extreme climate-change events.
2. Ask participants to work in four small groups. Distribute a case study and exercise sheet to each group (see exercise section).
3. Allow each group 30 minutes to read their respective case study and discuss the following questions:
    a. What agroforestry systems do farmers and local communities practice at the farm level?
    b. What functions, including services and production, are provided by agroforestry systems at the landscape level?
    c. How do these agroforestry functions contribute to climate resilience?
4. Explain to the groups that they need to summarize the findings of their discussions on a flip chart, following the instructions given on the exercise sheet. Once groups complete their tasks, allow 10 minutes for each to share their findings. After all groups complete their presentations, allow time for the other participants to ask questions.
5. Summarize the main findings of each group and keep their flip charts visible for the duration of the session. You may choose to highlight key findings.
6. At this point in the session, facilitate a discussion, based on case studies and discussions, on the functions and benefits of agroforestry at landscape level. Refer to results of discussions from Session 2.2 on landscape resilience.
7. Write down the participants' main responses on a flip-chart sheet. Link the key findings to the climate vulnerability framework (Climate Vulnerability = Climate Exposure – Landscape Resilience).
8. Conclude the exercise by emphasizing the interlinked roles of agroforestry at the landscape and farm levels, particularly in terms of climate resilience.

Trainer's note

- Each case study should indicate issues caused by climate change and how agroforestry has been used to address them.
- Case studies might include people using agroforestry to restore water during dry seasons, protect against storm surges, stabilize temperatures, reduce sun exposure, or slow down water runoff.

Exercise 3.2
Case studies

After reading your assigned case study, you have 30 minutes to discuss within your group the following questions:

- What agroforestry systems do farmers and local communities practice at the farm level?
- What functions, including services and production, are provided by agroforestry systems at the landscape level?
- How do these agroforestry functions contribute to climate resilience?

Write the findings of your group discussion on a flip-chart. You will have 10 minutes to present these findings. The content of your presentation should include:

- A brief introduction of the case study
- A summary of the landscape's issues and hazards caused by climate change
- A summary of agroforestry systems applied at the landscape level
- A summary, in table format, of agroforestry's key roles at the landscape level for climate resilience in the given case study.

Case 1: Multi-strata coffee system in Sumberjaya, Lampung, Indonesia

Sumberjaya is a sub-district located in the upper part of Way Besai watershed in Lampung Province on the island of Sumatra, Indonesia. The area is a major contributor to Indonesia's coffee exports. Since the 1970s, the rapid expansion in smallholder coffee cultivation has led to large-scale deforestation with increased soil erosion and sedimentation during the wet season. From 1991 to 1996, thousands of farmers were ordered to leave the area and evicted from their land. Consequently, violence and social conflict has escalated due to a lack of confidence in the government.

Figure 3.3: Map of the Sumberjaya case-study site

The productivity and quality of coffee largely depends on climatic conditions, especially, precipitation and air temperature. In recent years, the volume of coffee production has decreased owing to climate change, identified through increases in temperatures (0.2–0.3 oC per decade) and changes in precipitation patterns with erratic rainfall. One option to cope with rising temperatures is to shift coffee cultivation to higher and suitably cooler elevations but this could lead to further deforestation and damage to watershed functions. Another option is to plant shade trees around coffee plots to create a multi-strata canopy. Coffee grown with shade trees is far more resilient and productive and less threatened by pests and diseases than coffee grown in monoculture.

In 2000, a Government decree established a community forestry program (Hutan KeMasyarakatan/ HKm). The program allowed groups of farmers to apply for legal permission to use state-owned land. The permission was issued for a five-year trial period with possibility of extension for a further 25 years. In return, a community was required to commit to protect native forest trees and convert coffee monocultures into multi-strata coffee gardens. In this agroforestry system, coffee was grown together with vegetables and medicinal plants under the shade of *Erythrina lithosperma, Leucaena glauca, Paraserianthes falcata* and various fruit-tree species.

The HKm program has resulted in impressive livelihood gains, increased equity, a sense of community responsibility over forest and land care, and contributions to climate resilience in Sumberjaya. The conversion of coffee monocultures to coffee agroforestry helped to increase productivity and thereby secure the incomes and livelihoods of coffee farmers. In a coffee agroforestry system, farmers cultivate more than one plant species so that if one crop fails or the price drops, losses can be covered from the other crops, increasing their ability to cope with climatic shocks. Other benefits are reductions in surface run-off, soil-nutrient leaching, soil erosion and sedimentation, which are aided by filtration processes in tree canopies and roots. Moreover, forest and tree cover in the upper part of Way Besai watershed have been effectively restored and are now better protected, helping to reduce sedimentation in the hydropower dam downstream and maintain watershed functions. As more and more farmers employ agroforestry in coffee cultivation, land use in Sumberjaya has changed. This change will likely contribute to increases in the watershed resilience to climate change.

Table 3.2: Coffee productivities without and under shade

Age of coffee (Year)	Coffee productivity without shade (Kg/ha)	Coffee productivity under shade tree (Kg/ha)	
		Gliricidia	*Erythrina*
3	465.3	463.3	389.9
4	1352.4	1637.4	1595.0
5	1290.5	1431.1	1575.2
15	683.5	805.6	987.5
16	598.8	839.2	935.5

Source: Adapted from Evizal et al (2012)

Case 2: Mangrove shrimp-farming in Ngọc Hiển District of Cà Mau Province in Viet Nam

Cà Mau is home to half of Viet Nam's shrimp production and mangrove forests. Shrimp aquaculture is the main, and in many circumstances only, source of livelihood for the local population living in or near mangrove areas. In response to the rising global demand for shrimp over the last three decades, more than half of Viet Nam's natural mangrove forests, which are vital for coastal resilience, have been cleared to accommodate shrimp aquaculture. However, this shrimp aquaculture has largely been abandoned because of high costs and decreasing returns due to erosion, pollution and shrimp disease. Climate change adds another threat to shrimp cultivation because of the likelihood of increased disease through rising exposure to the sun and higher temperatures.

Since 2013, the Mangroves and Markets (MAM) project has been implemented in Ngọc Hiển District of Cà Mau. The project focuses on the integration of ecologically sound shrimp aquaculture within a mangrove environment by providing incentives for mangrove conservation. It has also supported local producers and authorities in finding ways to access markets.

Figure 3.4: Map of the Ngọc Hiển District case-study site

One key project approach has been working with shrimp importers, traders and farmers to introduce ecologically sound shrimp production practices in areas of high deforestation and degradation. Smallholding shrimp farmers in the project area received training and technical assistance to adopt mangrove shrimp-farming practices that enhanced the sustainability of their production and met Naturland Organic Certification (NOC) standards (Naturland 2019), which requires 50% mangrove coverage per farm. The project also collaborated with processing companies and government authorities to develop stable market links and create an enabling policy environment. By February 2016, some of the key project achievements were:

- Nearly 800 shrimp-farming households obtained NOC and received price premiums.
- Payments for Forest Ecosystem Services of about USD 44,000 were made to more than 550 certified households.
- 2000 households were trained in mangrove ecosystem management, international organic shrimp certification standards, and mangrove shrimp-farming practices.
- 80 hectares of mangroves were planted within the shrimp farms of 402 households to meet Naturland's 50% mangrove coverage.
- 12,600 hectares of mangrove forest was effectively protected from clearance.

Through facilitating ecologically sound mangrove shrimp-farming practices, MAM produced meaningful outcomes for local incomes and livelihoods, forest restoration and protection, and climate resilience. Under the mangrove shrimp-farming system, shrimp, fish and other species were better protected from hotter temperatures, reduced to zero deaths from heat intolerance compared to those farmed in open areas. Household incomes from shrimp increased 1.5–2 times in comparison to aquacultural models in open areas or those with less mangrove cover. Each household was able to obtain a stable income of VND 175–233 million per year (approximately USD 7500–10,000) from shrimp farming. The mangrove forest in the project area has been effectively restored, protected and its cover increased from 39% in 2013 to 44% in 2015. The increase in forest cover and household incomes has helped to increase the resilience of both the mangrove landscape and local livelihoods, contributing to climate change mitigation and adaptation.

Mangrove shrimp-farming

Case 3: Landscape restoration farmer-managed natural regeneration, Niger

The Sahel is the belt of land across Africa on the southern edge of the Sahara Desert. It is a site for one of the poorest regions in the world, long plagued by droughts. Throughout the Sahel, farmers have maintained a traditional land-use system within parklands, also known as agroforestry parklands. This is characterized by the deliberate retention of trees on cultivated land (Garrity, 2010). Farmers maintain 10–50 trees per farm hectare by identifying seedlings of useful species and allowing them to regenerate naturally in their fields. This practice is known as farmer-managed natural regeneration (FMNR). Trees are an integral part of their agricultural system. They provide food, fuel, fodder, medicines, wood for buildings and cash commodities, and contribute to soil fertility, water conservation and environmental protection.

Figure 3.5: Map of the Sahel case-study site

Demographic, economic, environmental and social developments during the past 40 years have put pressure on traditional land-use systems. Modern Sahelian forest laws, and the ways that they are locally enforced, have discouraged farmers from optimum parkland management and led to the degradation of the parklands to a varying extent across the region. This was particularly so in the case of Niger.

During the 1970s and 1980s, the parklands experienced a massive loss of trees owing to drought and human population pressures, resulting in widespread desertification of the agricultural landscape. Considerable efforts were made to re-establish the tree cover through conventional reforestation projects. However, these overwhelmingly failed owing to the harsh environment and a lack of attention given to the species that farmers preferred to nurture on their farms.

The regreening process began through the success of an NGO pilot project, which provided food aid to farmers willing to protect natural regeneration. The project brought into focus the use of FMNR, and the planting of Faidherbia trees, practices that were incorporated into other projects and further stimulated when the government relaxed restrictive forestry regulations. Farmers now gained incentives to farm more intensively with Faidherbia and other trees, which they could cut and sell. This dramatically increased their efforts to regenerate and expand tree populations on their farms. In 2004, a formal revision of the national forestry laws by the Government of Niger eliminated restrictions on the freedom of farmers to manage trees on their own land and helped to further accelerate the process.

Over time, tree cover in Niger has increased. About 4.8 million hectares of Faidherbia-dominated farmlands were generated through FMNR. These landscapes now harbor up to 160 Faidherbia trees per hectare. Vast expanses of savanna devoid of vegetation in the early 1980s are now densely studded with trees, shrubs and crops. The transformation has contributed to the production of, on average, 500,000 additional tonnes of food per year. Despite a near doubling of the population since 1980, Niger has been able to maintain its per capita protduction of millet and sorghum. In addition, FMNR has indirectly impacted food security through tree products — for example, fuel wood and timber — that farmers harvest and sell. The changed landscape has also been critical in managing crises. When much of Niger was experiencing food shortages caused principally by drought, villages with protected and managed natural regeneration were much less affected by the shortages than others.

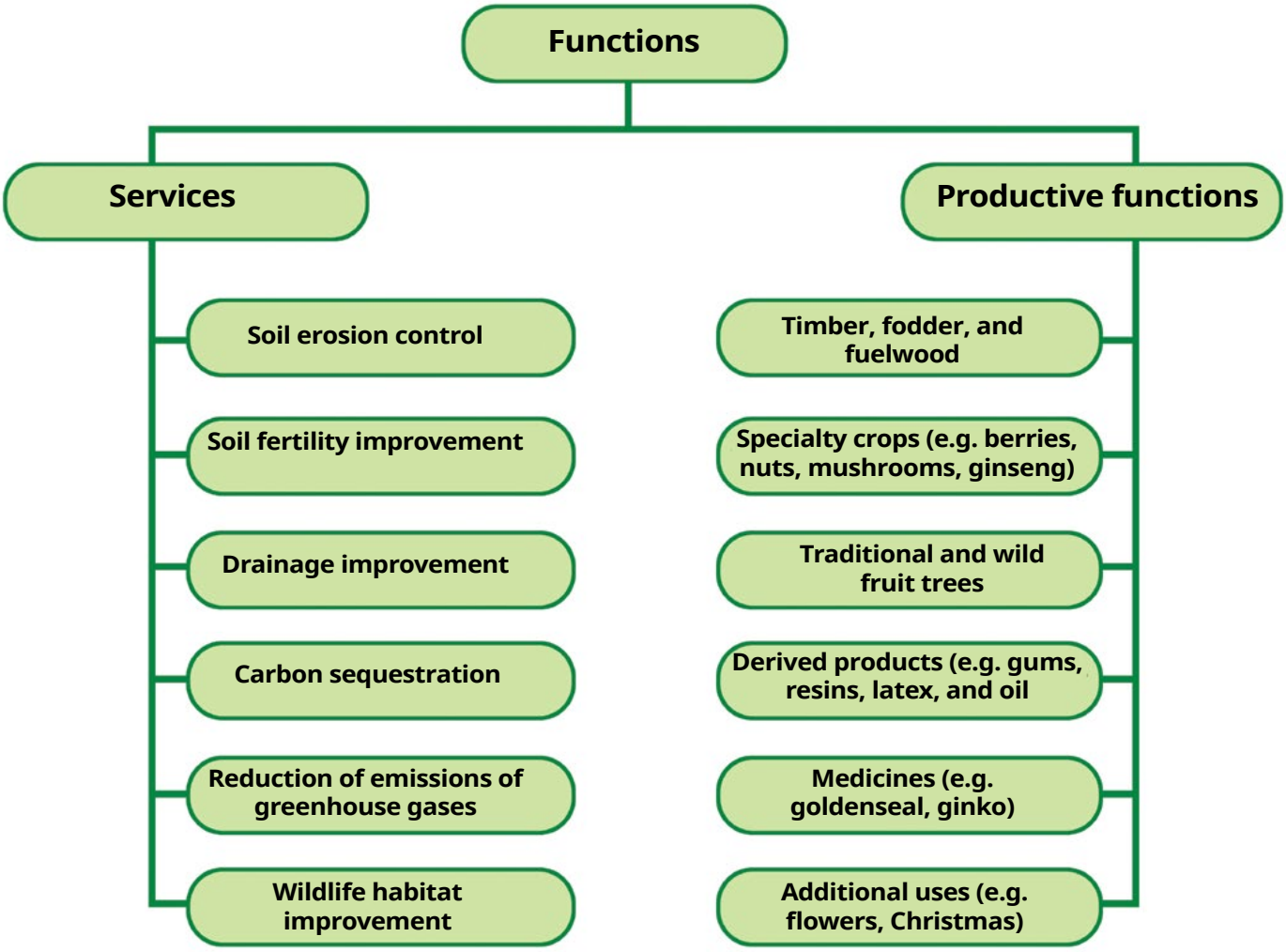
Faidherbia trees intercropped with millet in southern Zinder, Niger

Handout 3.2
The roles of agroforestry in a climate-resilient landscape

Functions of agroforestry in a landscape

The role of agroforestry, through the integration of trees on farms and in landscapes, is to provide both products and services to achieve an improvement in livelihoods, the sustainable management of land and forests, and climate-change mitigation and adaptation. The providing of products and services are linked to the interests of all stakeholders, including smallholders, government agencies, the private sector, researchers and NGOs. The functions help landscape stakeholders increase their resilience to climate change.

Figure 3.6 Productive and service functions of agroforestry



Source: Blanco and Lal (2008: 262)

Productive functions

Agroforestry provides a range of commodities from a variety of trees and crops. Tree products include fuelwood, timber, fodder, fruit, gums, resins, thatching and medicines. Other products include:

- Tree products: Fuelwood, timber, fodder, fruit, gums, resins, thatching and medicines
- Food: Fruits, nuts, edible leaves and roots, honey
- Tree commodities: Confectionery, beverages, oils, industrial products
- Energy: Liquid biofuels, fuelwood, charcoal
- Timber: Sawn wood, veneer, plywood, poles
- Medicines: Herbal and other medicinal products
- Fodder: Animal nutrition supplements, dry-season feed

Service functions

Agroforestry provides multiple environmental services at farm and landscape levels.

Control of runoff and soil erosion

Agroforestry practices reduce transport of non-point source pollutants, such as sediments or chemicals, to waterways. Trees help to improve water infiltration, reduce runoff volume, and clean polluted runoff and sediment.

Improved soil fertility

Incorporation of trees and crops that biologically fix nitrogen is common in tropical agroforestry systems. Non-N-fixing trees in agroforestry systems can also enhance the physical, chemical and biological properties of soil by adding above- and belowground organic matter, and releasing and recycling nutrients.

Rehabilitated degraded land and mitigated land depletion

Degraded land can be regenerated and brought into production through regenerative agroforestry practices, with similar practices preventing further degradation and erosion.

Improved microclimates

Agroforestry microclimates provide protection for crops and livestock from direct sunlight, reduce wind speed and associated erosion, reduce temperature, and increase humidity.

Improved water infiltration

An appropriate selection of tree species and planting locations provides better management of water, with improved infiltration and flow regulation.

Conserved biodiversity

Agroforestry landscapes provide shade, migration corridors and habitats for mammals, birds, insects and other life forms. Agroforestry conserves biodiversity by reducing rates of conversion for natural habitats, providing corridors between habitats, and supporting other ecosystem services.

Sequestrated and stored carbon

Trees and shrubs in agroforestry systems sequester more carbon compared to monoculture crops or pasture. Agroforestry systems also store more carbon belowground.

Conserved spiritual and ritual values

Trees have symbolic, spiritual and ritual values in most cultures. Indigenous tree species are often part of identity and value systems, including religious and judicial traditions.

Contribution of agroforestry to climate-change mitigation

Through carbon sequestration, conservation and substitution, which is the converting of biomass into durable wood products, agroforestry helps to reduce atmospheric CO2 levels and mitigate climate change. Agro-ecosystems contain approximately 12% of the world's terrestrial carbon. Of all land uses, agroforestry has the greatest potential for carbon sequestration. Carbon stored in agroforestry systems ranges from 0.29 to 15.21 Mg C per hectare per year aboveground and 30–300 Mg C per hectare up to a depth of 1 metre in soils. About 630 million hectares of land globally are suitable for agroforestry. The inclusion of trees in agricultural landscapes provides considerable opportunities to create carbon sinks. Potential carbon sequestration by 2040 in agroforestry is estimated to be more than 550 Mt C per year, the highest potential amongst different options for land use and management. In Southeast Asia, the carbon sequestration potential of agro-silvicultural systems in humid tropical eco-regions ranges from 12 to 228 Mg C per hectare. Almost all agroforestry practices, except alley cropping, can sequester and accumulate a significant amount of carbon stock (Table 3.3).

Table 3.3: Example of carbon-storage potential in agroforestry systems

Country	Agroforestry system	Carbon stock (Mg C/ha)	Remark
Indonesia	Sumatran home-gardens	55.8–162.7	Aboveground: 12–17 year
	Complex systems (many species of trees, shrubs and crops)	209.39	Total
The Philippines	Taungya agroforestry systems	174	Total stock
	Mixed multi-strata systems	162	Total stock
	Falcata and coffee multi-strata systems	92	Total stock
Viet Nam	Home-gardens	69.63	Total stock
	Litsea glutinosa and cassava	24.7–84.2	Stock of Litsea trees: 5–10 years

Source: Adapted from Catacutan et al (2017)

Session 3.3
Agroforestry and food security

Objectives

At the end of this session, participants will be able to:

- Explain key roles of agroforestry and different ways in which agroforestry contributes to food security
- Link agroforestry with landscape resilience

Time

1 hour

Material

- Copies of case studies
- Session handout
- Flip-charts, A0 paper and markers

Steps

1. Introduce the objective of the session, explaining that food security is an important aspect of climate-resilient landscapes and that this session will help to deepen an understanding of agroforestry's contribution to food security.
2. Ask participants to individually write at least three key ways in which agroforestry could contribute to food security. They may refer to case studies used in the training program and their own experiences.
3. Provide the session handout to the participants, with 5–10 minutes given for reading.
4. Ask participants to form three groups to discuss and then present on the potential ways, as mentioned in the handout, in which agroforestry contributes to food security.
5. Facilitate the presentations by asking participants from other groups to ask questions as well as provide comments. Do they agree or not agree with the key ways that agroforestry contributes to food security? What are other possible ways?
6. Summarize the session by stressing agroforestry's contribution to food security and, therefore, landscape resilience.

Handout 3.3
The contribution of agroforestry to food security

Food security exists 'when all people at all times have access to sufficient, safe and nutritious food to maintain a healthy and active life' (ADB 2013). There are several ways in which agroforestry can contribute to food security. These include, but are not limited to, direct and indirect food production, income generation and fuelwood supply.

Agroforestry and food production

Food production, direct or indirect, is a basic function of agroforestry. Agroforestry systems, such as alley cropping, allow sloping land to be used for food production without the negative consequences of soil erosion and land degradation that would otherwise cause unsustainability. Other agroforestry systems, like home-gardens, are specifically relevant for dietary diversity. These agroforestry systems, which cover more than 5 million hectares in Indonesia and are maintained by over 70% of households in The Philippines, provide a wide range of tree and agricultural products — for example, fruits, nuts, grains, vegetables, tubers, and leaves — for daily consumption in rural households (Kumar 2006a, b). Studies have found that in Cagayan Valley, the Philippines, 65% of interviewed households maintained their home-gardens to have a year-round supply of fruit, vegetables and spices (Snelder 2008). In West Sumatra and West Java, Indonesia, households consume forest fruits and vegetables, and annual crops like chili, tubers, beans and eggplant (Jensen 1993). Dietary supplies from home-gardens can account for 3–44% of total calorie intake and 4–32% of protein intake in Java, Indonesia (Torquebiau 1992). In Viet Nam, the level of satisfaction for interviewed households in three provinces in the north and north-central regions regarding home-gardens as sources of food was 55–70% (cited in Catacutan et al 2017). Home-gardens seldom meet the entire basic staple-food needs and are, at best, complementary to rice or maize. However, diverse products available year-round in home-gardens contribute especially to food security during lean seasons and are a significant source of minerals, nutrients and vitamins.

Agroforestry also indirectly enhances and maintains food production through a range of mechanisms, including nitrogen fixation, control of soil erosion, improvement of soil fertility, and modification of microclimates. One of the key benefits of alley cropping or hedgerow intercropping systems in which perennials (for example, leguminous trees or shrubs) are grown together with arable crops between the tree rows, is improved crop performance owing to the addition of nutrients and organic matter to the soil and plant system. When practised on sloping land, such systems result in a significant reduction of soil erosion. Farmers in Claveria, the Philippines, have adopted contour hedgerow farming practices to conserve soil and sustain yields on steeply sloping cropland, resulting in gradually increasing yields of about 0.5 tonnes per hectare per crop (Garrity 1999). Studies found that when Ipil-ipil *(Leucaena leucocephala)* foliage was mulched into soil beneath a maize crop, maize production improved by up to 300% after the first three harvests. The adoption of Sloping Agricultural Land Technology (SALT) helped to increase yields of maize by 400%, from 0.5 to 2.0 tonnes per hectare per crop. Boundary planting or windbreak systems can enhance food production on degraded land. Planting *Casuarina equisettifolia* along rice-field boundaries in coastal sandy areas of Viet Nam resulted in rice yield increases from 800 kg per hectare per crop to 2500–3000 kg per hectare per crop and expansion of the rice cultivation area in the region (Nguyen Ngoc Binh 1985).

Agroforestry and income generation

Agroforestry provides important sources of income for rural households, helping to raise their food-purchasing power. In Indonesia, the net income generated from home-gardens ranged 7–56% of total household income (Kumar and Nair 2004). In West Sumatra, Indonesia, agroforestry products accounted for 26–80% of total income from agricultural produce (rice fields and gardens). A hectare of home-garden produced about IDR 365,000–5,000,000 per year, which is approximately USD 36.5-500 (Michon et al 1986). Households with both rice and home-gardens have higher incomes than those with rice only. Kalimantan and Sumatra were home to 2–2.6 million hectares of jungle rubber agroforests. About 5 million people obtained their incomes from rubber, which was the only profitable product for most smallholders in nutrient-poor lowlands (Ihalainen 2007).

In the Philippines, about 60% households from a study in northern Luzon sold produce cultivated from home-gardens (Snelder 2008). In the same study, 28% households sold only livestock, which were raised in home-gardens. Finally, 16% of households sold only fruit and vegetables, and another 16% sold a combination of fruit, vegetables and livestock. The annual gross income generated from home-gardens varied, with an average of PHP 3,739 (approximately USD 74) per household and up to 18% of total household income. Research in the Eastern Visayas revealed that investments in agroforestry to improve soil capital can increase annual agricultural profit by USD 53 for a typical household, which was 6% of total income (Pattanayak and Mercer 1998). Likewise, another study found that adopting SALT provided farmers in Mindanao almost year-round harvests. A family could obtain an income from a hectare of SALT of about PHP 1000 per month (Watson and Laquihon 1987).

In Thailand, studies found that agroforestry can provide greater income for farmers. Agroforests in rubber–cassava, rubber–banana, rubber–rice, rubber–corn, rubber–pineapple, and rubber–custard apple systems have yielded significant net income increases in comparison to monoculture rubber plantations. For instance, growing rubber and pineapple brought farmers THB 500,000 per year, almost six times the average income from rubber alone (THB 83,428) (Somboonsuke et al 2011).

In Viet Nam, when comparing economic benefits for different agroforestry systems, such as *Melia azedarach*–cassava, *Acacia hybrid*–cassava, *Acacia mangium*–maize and star anise *(Illicium verum)*–tea, researchers found that the latter had the highest annual net profit (USD 6,527 per hectare per year), much higher than either monoculture tea or star anise (Thang et al 2015).

Agroforestry and fuelwood

Fuelwood supply also represents a way in which agroforestry can contribute to food security as well as to climate-change adaptation and mitigation. Fuelwood is the primary source of household energy for cooking and heating in almost all areas of the developing world. Supplies of fuelwood are essential not only for nutrition but also the prevention of disease (Byron and Arnold 1999). Fuelwood for cooking and heating may cost almost as much as food in some developing countries (Pimentel et al 1997).

Table 3.4: Estimated annual fuelwood demand in rural Southeast Asia

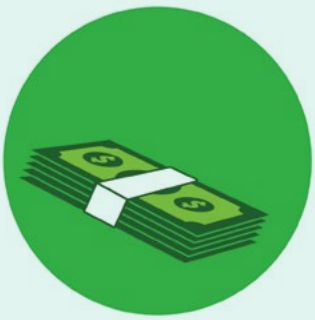
Country	Annual household demand (kg)	Country consumption (million tonnes per year)	Average household size (persons)
Indonesia	2288–2470	93.2	4.9
Lao PDR	3538	2.4	6.1
Myanmar	3276	630	5.2
Philippines	2262	29.1	5.6
Thailand	2865	23.9	5.2
Viet Nam	2650	33.0	5.3
Average	28135.4		

Source: Adapted from Jensen (1995:7)

On average, a rural household in Southeast Asian needs about 2,800 kg of fuelwood annually (Table 3.4). Although available information is somewhat scattered, there are strong indications that agroforestry systems are an important source of fuelwood for rural households and have the potential to meet fuelwood demands in most countries of the region. Traditional home-gardens, for instance, constitute a principal source of biofuels for rural households. In Java, Indonesia, 51–90% of the fuelwood collected is from home-gardens (Torquebiau 1992). The Food and Agriculture Organization of the United Nations (1991) estimated that as little as 50–100 trees would be enough to supply, on a continuous basis, the necessary fuelwood for one household. There is an argument that about 140 trees in humid areas and 400 in sub-humid areas are needed to supply enough fuelwood for a household, which could be achievable if farmers devoted 20–30% of their land in humid areas and 25–50% in drier areas to agroforestry (Jensen 1995).

Recognition of agroforestry by policymakers

Specific and adequate agroforestry policies



Return on investment

Markets for agroforestry products

Land and tree trenure

Extension services

Farmer's knowledge

Availability of planting stock

Coordination between sectors

Module 4: Enabling conditions for the adoption of agroforestry

Session 4.1
Key opportunities and challenges for agroforestry practices

Objectives

At the end of this session, participants will be able to:

- Assess key opportunities and challenges at landscape level that influence agroforestry practices in the context of climate change
- Identify measures to manage these opportunities and challenges

Time

1.5 hours

Material

- Different agroforestry systems written on cards
- Handout 4.1
- Flip-chart, A0 paper and marker pens
- Colour cards

Steps

1. Refer to some of the key lessons we have learned in previous sessions, particularly on the roles of agroforestry for resilient landscapes. Introduce the objectives of this session.
2. Remind participants that this session will look at the landscape level and we will learn more about the enabling environments that support or hinder agroforestry practices.
3. Hold a short discussion on what are enabling environments? The enabling environments for agroforestry can refer to government policies, land and tree tenure, market trends, access to markets and finance, human capacity and technology, and extension programs.
4. Divide participants into small groups according to sector (agriculture, forestry, water or rural development), country or working context.
5. Ask each group to identify opportunities and challenges that support or hinder agroforestry practices in their working context in accordance with the enabling environments defined earlier. Distribute two or three agroforestry systems to each group.
6. Allow 30 minutes for group discussions and encourage each group to list specific answers if possible.

Agroforestry system	Enabling environment	Opportunities for agroforestry	Challenges for agroforestry
Name of agroforestry system 1	Policy		
	Tenure		
	Access to market		
Name of agroforestry system 2			
Name of agroforestry system 3			

7. Ask each group to share their results with the other groups. Ask participants to comment on the results, for example by providing additional information. From the discussion, highlight the enabling environments for agroforestry practices.
8. Lead a short brainstorming session on what we should do to act on these opportunities and challenges. Note the answers on a flip-chart. We will use them for the next session on agroforestry design.

9. Share key examples of enabling environments for agroforestry practices in Southeast Asia, linking to the results of the group discussion.
10. Close the session by introducing the next session.

Trainer's note

- You can encourage participants to share the enabling environments that they have in their own particular contexts. Pick some key opportunities and challenges that they are facing and identify potential measures to address them.
- Another option when facilitating the small group work is to ask each group to select which enabling environment (government policies, land and tree tenure, market trends, access to markets and finance, human capacity and technology, extension program) they want to focus on.

Handout 4.1
Key opportunities and challenges for agroforestry practices

Opportunities for agroforestry in the context of climate change

Global and regional levels

The United Nations Framework Convention on Climate Change and the Intergovernmental Panel on Climate Change are increasingly acknowledging agroforestry as a component of climate-smart agriculture. In 2011, the 17th Conference of Parties to the Framework Convention identified agroforestry as having strong potential for climate-change adaptation and mitigation.

The United Nations Convention to Combat Desertification also acknowledges the potential of agroforestry to reverse desertification through restoration. Agroforestry is also seen as an important practice in the ecosystem approach promoted by the Convention on Biological Diversity and contributes to its Global Strategy for Plant Conservation.

Recently, agroforestry has been viewed as a vital element in realizing a number of the UN Sustainable Development Goals. There are four ways agroforestry can contribute:

1. As a land-use system in-between forest and open-field agriculture, through combinations of trees, crops and livestock, providing simultaneously a range of goods, benefits and services, for example, food, energy and clean water while conserving biodiversity.
2. By allowing efficient, multifunctional land use (in technical terms with a Land Equivalent Ratio > 1) agroforestry supports sustainable intensification.
3. As an institutional response to contested access to resources, allowing gender and social equity enhancement and acting as a source of empowerment.
4. As an integrative mindset and culture, helping to create synergies in multifunctional landscapes between the various Sustainable Development Goals, allowing release from institutional silos.

In Southeast Asia, the *Vision and Strategic Plan for ASEAN Cooperation in Food, Agriculture and Forestry 2016–2025* was endorsed at the 37th Meeting of the ASEAN Ministers on Agriculture and Forestry in 2015. One of the Plan's important Strategic Thrusts is 'to increase resilience to climate change, natural disasters and other shocks'. The expansion of resilient agroforestry systems, where ecologically and economically appropriate, has been defined as a key action program to achieve this goal.

National level

Policy reforms in many countries have directly targeted agroforestry development.

- In **Cambodia**, the Community Forestry Directorate has developed a roadmap for agroforestry development to speed the handover of community-based forest management rights and improve farmers' livelihoods.
- In **France**, the role of trees on farms was recognized in the agricultural policy of 2010. Agroforestry plots with 30–300 trees per hectare are eligible for subsidies under the Common Agricultural Policy of the European Union.
- In **India**, the State of Chhattisgarh adopted an agroforestry policy in 2009, establishing a price floor and guaranteed market for agroforestry products. The most attractive market-linked agroforestry sees farmers facilitated with bank loans, supplied with good quality seedlings and technical guidance in the field, and guaranteed to be paid at market-prevailing prices when trees are harvested after 7–8 years. On 10 February 2014, at the opening day of the Fourth World Congress on Agroforestry in New Delhi, the President of India announced the world's first national agroforestry policy. The policy has established a national agroforestry body to coordinate stakeholders, allocated a budget for increased research and capacity building under the Indian Council of Agricultural Research, simplified regulatory mechanisms; promoted institutional credit and insurance coverage, improved farmer access to quality planting material and strengthened market access.
- In **Indonesia**, the Ministry of Environment and Forestry produced two regulations, P.12/Menlhk-II/2015 and P.17/Menlhk/Setjen/Kum.1/2/2017 referring to the use of agroforestry in the Tanaman Kehidupan (Plants for Livelihoods) Zone within forest-estate concession areas. The establishment

of a Tanaman Kehidupan Zone in 20% of concession areas is compulsory, to be used by nearby communities for agricultural activities.

- In **Kenya**, the Government, particularly the Ministry of Agriculture, passed new Farm Forestry rules in 2009, requiring 10% of all farms to be covered with trees in response to deforestation, helping to increase the agricultural area and farmers' motivations to plant trees. Funds were also allocated to assist farmers to meet this requirement.
- In **Myanmar**, both Forestry and Agriculture departments are working together to create a roadmap for agroforestry development to synergize across government, NGOs, the private sector and communities to optimize benefits for farmers and the environment.
- In **Niger**, restrictive regulations in the Forestry Code were eased. Tree tenure was awarded to farmers, providing incentives to farm intensively with *Faidherbia* and other trees, and helping to expand the practice of farmer-managed natural regeneration to over 5 million hectares.
- **In Viet Nam**, the Ministry of Agriculture and Rural Development created a national Agroforestry Technical Working Group in 2016 with the task of reviewing the policy environment for agroforestry development in the country.

Enabling conditions for agroforestry practice

In Southeast Asia, there are several common enabling conditions that support or restrict agroforestry practices.

Recognition of agroforestry by policy makers

An overdependence on conventional agricultural methods and inadequate knowledge of sustainable approaches restricts the interest of policy-makers in agroforestry development. In The Philippines, for instance, 'territorial or turf issues' deter the institutionalization of agroforestry. There is no dedicated recognition and support for agroforestry at national and local levels. A separate, cross-sectoral body for agroforestry in the national government does not exist.

Specific and adequate agroforestry policies

Policy is a major concern restricting agroforestry development in the region. Again in the Philippines, policy-related issues are regarded as the most critical in comparison to other issues for the promotion of agroforestry. In Viet Nam, a lack of agroforestry policies ranks highest among key challenges. Although tree farming requires high initial investment and returns are delayed, policy that directs financial support to farmers is absent. Policy to support agroforestry in terms of environmental services is not yet in place.

Return on investment

Investing in agroforestry can present various disadvantages. Although trees do become profitable, the break-even point for agroforestry systems occurs only after several years, for example after 2 to 5 years as indicated by ICRAF studies on different agroforestry systems in the northwest of Viet Nam. Unlike conventional agriculture, farmers often have to absorb initial net losses before benefitting from their investment, which reduces their enthusiasm for investing in agroforestry.

Markets for tree/agroforestry products

Markets are less efficient and developed than those for crop and livestock commodities. Value chains for agroforestry products receive little support. Mapping agroforestry across Viet Nam by ICRAF reveals a number of constraints, for example, lack of consumer demand, no markets (farmers don't know where to sell), unstable and low prices, lack of market information and access. The lack of well-developed markets for agroforestry products, combined with the difficulties faced investing in activities that have a delayed financial return, forces many farmers to rule out agroforestry as a viable option.

Land and tree tenure

Insecure or ambiguous land tenure results in confusion about land delineation and rights. Rights to trees may be separate from rights to land, and both land and tree tenure insecurity may discourage people from introducing or continuing agroforestry practices. The lack of long-term rights to land inhibits long-term investments such as agroforestry. When the rights to land are not clearly stated by law, other measures are ineffective. This can manifest itself as a conflict of interest between the state and land users. If people do not possess land titles, there is a perception that there is no point to investing in trees, where benefits take longer to be realized. Competing claims of tenure rights, for example, seasonal rights to communal grazing, can jeopardize the protection of trees. Moreover, recent

attempts by some governments to attract large-scale foreign investors have heightened the insecurity of rural communities.

Extension services

Limited experience of and low capacity among national extension services, in both traditional and new agroforestry systems, means that farmers are often reluctant to adopt them. Many field extension officers do not understand the concept of agroforestry, as observed in Myanmar, Lao PDR, Cambodia, Thailand, Viet Nam and Indonesia. In Viet Nam, a structure of extension services exists from central to communal levels. However, expertise in agroforestry is lacking, with a focus on forestry or agriculture prevailing.

Farmer knowledge, capital and land resources

In most ASEAN countries, the land available for agricultural production is limited. Farmers often feel that planting trees will reduce their available land area for annual crops and thereby threaten their food security. They are ill-informed of the tree species suitable to plant together with annual crops and do not know how to manage trees. They also lack money to buy germplasm and to invest in agroforestry. These are common issues as found through studies in Viet Nam, the Philippines, Indonesia and other ASEAN countries.

Availability of planting stock

Tree growth and productivity may be relatively low and variable due to the poor quality of germplasm. Farmer knowledge on seed collection, propagation and multiplication methods, and vegetative propagation is poor. They often have no option but to protect or transplant trees that have germinated spontaneously. Few nurseries exist to provide a range of native multipurpose trees. A lack of high-yielding varieties and reliable seedling sources and the low quality of seeds and seedlings, for example, are key constraints for agroforestry development in Viet Nam.

Coordination between sectors

In principle, agroforestry is regarded as belonging to all sectors, but in practice it belongs to none and is rarely given a specialist position in a governmental body or its own policy space. It falls between agriculture, forestry and environment departments, with no institution taking a lead role in the advancement of agroforestry or in its integration. Agriculture departments emphasize crop production on agricultural land. Thus, agricultural policies directly contribute to excluding trees from farms and the landscape. Some forestry departments do not believe that it is possible to grow good quality, widely-spaced timber on farms and have little interest in non-timber trees or growing trees with crops and/or livestock on the same plot of land.

Example 1: Policy for mangrove shrimp-aquaculture in Kien Giang, Southwest Viet Nam

In 2011, the Provincial People's Committee of Kien Giang, a province in Southwest Viet Nam, issued a regulation on coastal protection forest plantation, protection and use, through Decision No. 25/2011/QD-UB. The objectives were to develop and protect coastal protection forests while creating livelihoods for local households. As regulated, forest land could be leased to individual farm households for 50 years; allowing use of 30% of their leased forest land area for aquaculture. The rest of this land (70%) must be used for forest plantation and protection (articles 2, 8). Households are also entitled to receive support, including seedlings and payment for labour, to plant trees, and to keep all benefits from aquaculture and a certain percentage of harvested forest products. The regulation created an enabling legal environment for the adoption and implementation of agroforestry practices, for example, mangrove shrimp-farming by farmers on their leased land in mangrove areas. This helped to restore and protect mangrove forests while creating and securing income for farmers from aquaculture.

Example 2: (New) Forestry Law and Decree with provisions on combined forestry, agriculture and fishery production in protection forest and production forest in Viet Nam

The Government of Viet Nam recently approved the Forestry Law and the decree guiding the implementation of the law. Recognizing the important role of agroforestry in achieving sustainable forest management, the high-level legal regulations stipulated specific articles on combined forestry,

agriculture and fishery production in forests (articles 57, 60 in the Law; articles 25, 30 in the Decree). These provide the legal framework for the implementation of agroforestry practices in two categories of forests — protection and production — across the country. For instance, forest owners, whether individuals, households or organizations, are allowed to intercrop both farm crops and non-timber-forest-product plants, raise livestock and practice aquaculture under forest canopies, as long as they do not cause any harm to the protection function of the forest. They can use 20% of any allocated non-forested land plot for combined agriculture and/or fishery production in watershed protection areas (Article 25 in the Decree). For more information, see the Forestry Law No. 16/2017/QH14 and Decree No. 156/2018/ND-CP.

Example 3: Community forestry program (KeMasyarakatan/HKm), land tenure, coffee-agroforestry practices in Sumberjaya, Lampung Province, Indonesia

This example illustrates how a government decree, a community forestry program and land tenure create an enabling environment for the adoption of agroforestry. Since the 1970s, a rapid expansion in smallholding coffee cultivation occurred in Sumberjaya. In 1990, when a hydropower plant was planned in the upper watershed of the Way Besai River, 40% of the land in Sumberjaya was declared for 'restricted use' and 'forest protection'. Between 1991 and 1996, thousands of farmers were evicted from their land and social conflict escalated. In 2000, with the eviction of farmers proven ineffective and unenforceable, a legal decree established a community forestry program, Hutan KeMasyarakatan (HKm). The program allowed groups of farmers to jointly apply as a community to obtain the legal permission to use state-owned forestland. Permission was issued for a trial period of 5 years with extension possible for a further 25 years. In return, as well as forest protection, the communities committed to converting coffee monocultures into multi-strata coffee gardens in which coffee was grown together with vegetables and medicinal plants under the shade of *Erythrina lithosperma, Leucaena glauca, Albizzia falcata* and various types of fruit trees. Over time, more and more farmers adopted this type of agroforestry, leading to positive land-use changes in Sumberjaya (Agus and Suyanto 2009, Pasha and Beria 2011).

Session 4.2
Measures to support agroforestry practices

Objectives

At the end of this session, participants will be able to:

- Analyse key measures for agroforestry development in the landscape context
- Make a design where the five livelihood capitals are mobilized for agroforestry practices

Time

1.5 hours

Material

- Handout 4.2
- Flip-chart, A0 paper and marker pens
- Colour cards and tape

Steps

1. Conduct a short review on enabling environments for agroforestry practices that were identified in Session 4.1.
2. Explain that this session will focus more on plot- or farm-level assessment.
3. Divide participants into four small groups. You may use the same groupings from Session 3.2.
4. In each group, based on the results from Session 4.1, ask the participants to identify potential measures for agroforestry practices in their working contexts.

Opportunities and challenges for agroforestry practices (see session 4.1)	Potential measures to mobilize the opportunities and overcome the challenges

5. After all groups finish their discussions, explain that there are five key livelihood capitals that influence the decisions about whether or not people adopt agroforestry practices.
6. Discuss with participants all five livelihoods capitals, one by one:
   a. Human
   b. Social
   c. Natural
   d. Physical
   e. Financial
7. Ask each group to link their potential measures to the five livelihood capitals and discuss how these could increase the adaptive capacity of farmers.
8. Answer questions or share examples from participants to clarify the meaning of the five livelihood capitals so that everyone understands.
9. Show a short video about adoption of agroforestry (see Trainer's notes). Ask the participants to pay attention to landscape features, agroforestry systems and their benefits and functions, the measures and the stakeholders involved. After it finishes, discuss the video with the participants.
10. At the end of the session, together with the participants, review examples of potential measures for agroforestry practices, using with of their own examples.

Trainer's notes

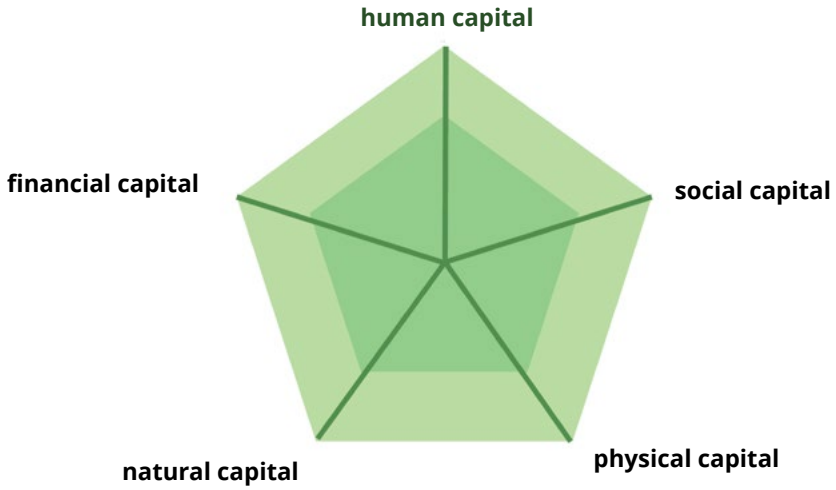
- Understand the five livelihood capitals, agroforestry systems, and types of measures to promote agroforestry practices.
- View Mangroves and Markets produced by SNV Netherlands Development Organization (SNV, 2015) in advance to know the key climate issues in the landscape, the causes and effects of these issues, as well as the measures that were applied. For example: capacity development through training; provision of incentives by allowing farmers to obtain harvested forest products or payments for forest protection; facilitation of market access through linking farmers with buyers of products.

Handout 4.2
Measures to support agroforestry practice

Livelihood capitals

The concept of livelihood capitals was developed by the UK Department for International Development in their Framework for Sustainable Livelihoods Approach. The capitals represent the range of key elements that people require to achieve positive livelihood outcomes. There are five capitals upon which livelihoods are built: human, social, natural, physical and financial.

Figure 4.1: The five livelihood capitals



Based on FAO (2003), the following definitions apply for each capital.

Human capital

People's health and ability to work, and the knowledge and skills they have acquired over generations of experience and observation, constitute their human capital. Education can help to improve people's capacity to use existing assets better and create new assets and opportunities.

Social capital

The way in which people work together, both within a household and in the wider community, is of key importance for household livelihoods. In many communities, different households will be linked together by social obligation, reciprocal exchange, trust and mutual support, all of which can play critical roles, particularly in times of crisis. These can be thought of as social capital, which forms part of a household's or community's capabilities.

Natural capital

For people living in rural areas, natural capital, including assets such as land, water, forest resources and livestock, are obviously of key importance for the production of food and income. The ways in which people have access to these resources, including ownership, rental and common ownership need to be considered as well as the condition of the resources themselves, their productivity and how they may be changing over time.

Physical capital

Physical capital may include tools and equipment, as well as infrastructure such as roads and railways, seaports and airports, and market facilities. Access to these, as well as water supply or healthcare facilities, will influence people's ability to earn an adequate livelihood.

Financial capital

The financial capital available to rural households may come from the conversion of their production into cash in order to cover periods when production is less or to invest in other activities. They may make use of formal or informal credit to supplement their own financial resources.

Measures to support agroforestry practices

There is no single way in which agroforestry is promoted. Agroforestry policies and programs are shaped by a variety of factors, including: the social-ecological contexts in which they are implemented; the specific objectives, knowledge, and interests of the external organization and farmers involved; and the financial, technical and material, including tree and shrub germplasm, resources available. There are at least six different types of measures through which agroforestry can be designed.

Building farmer capacity

through the provision of training, extension, other advisory services, technical information, demonstration sites, participatory trials, and other modes of action learning.

Enhancing access to tree germplasm

through the direct provision of tree seedlings or other germplasm, by linking farmers to tree germplasm suppliers, and building farmer capacity to propagate their own seedlings.

Community-level campaigning and advocacy

by encouraging community members to plant trees on their farms and/or pursue specific agroforestry practices.

Providing incentives

through direct payments or rewards to farmers for planting and caring for trees on their farms and the receipt of premiums for particular agricultural commodities, for example, for shade-grown coffee.

Facilitating market links

by a greater and/or more favourable integration of smallholders into tree-product value chains.

Policy and institutional change

by developing an enabling environment that promotes and strengthens the adoption of agroforestry and/or streamlines the regulatory environment to improve or strengthen benefits from agroforestry.

It is especially useful to know what kinds of measures can effectively promote agroforestry practices to yield desired social-ecological outcomes. The measure types are elaborated in the table below.

Table 4.1: Description for each Measure Type

Measure types	Description and examples
Building farmer capacity	Enhancing the knowledge and skills of farmers for agroforestry practices. For example, establishing and managing tree nurseries; tree planting and management techniques; and seed collection and seedling propagation. Such interventions involve training, extension and other advisory services, specific technical information, establishing demonstration sites and participatory trials.
Enhancing access to tree germplasm	Facilitating farmer access to quality germplasm of the priority species required to establish an agroforestry system, often by directly providing seeds and seedlings to farmers. Access can also be improved by linking farmers to suppliers and/or improving the ability of existing suppliers to provide farmers with quality germplasm for the types of trees they want to grow. Developing the capacity of farmers to manage their own nurseries also enhances access to tree germplasm.
Community-level campaigning and advocacy	The main objective is to motivate community members to plant trees on their farms and/or pursue specific agroforestry practices. Campaigning and advocacy may be done through radio, newspapers, social media, focus groups, farmer group meetings, community meetings, and theatrical performances. Sometimes the targeted action is mass tree planting, such as on a specific day of the year.
Providing incentives	Incentives motivate farmers to plant trees and practice agroforestry by providing payments or rewards. Examples include paying farmers for planting and caring for trees on their farms; paying communities to protect ecosystem services (for example, carbon stocks, watershed functions); and offering premium prices to farmers for commodities produced under certain conditions (for example, certification schemes for organic cocoa or coffee).
Facilitating market links	Facilitating better links to markets encourages the adoption of agroforestry by enhancing returns for agroforestry products or services. This could be done through directly linking producers to buyers, improving contractual arrangements with buyers, and collective marketing of agroforestry products.
Policy and institutional change	Reforming or creating new polices, laws, regulations and institutions can facilitate the greater adoption of agroforestry. They should address existing policy and institutional constraints such as prevailing forestry or agricultural regulations that restrict tree planting, harvesting or sale.

Source: adapted from Miller et al (2017)

Module 5: Stakeholder engagement in agroforestry interventions

Session 5.1
Stakeholder mapping

Objectives

At the end of this session, participants will be able to:

- Use a tool for analysing the different stakeholders in agroforestry interventions in the context of climate change
- Explain basic relationships among stakeholders in supporting agroforestry practices within a specific landscape

Time

1.5 hours

Material

- Flip-charts, easels, and whiteboards
- Index cards or sticky notes of various colours
- Markers and pens of various colours,
- Masking tape and double-sided tape
- Case studies from Session 3.2

Steps

1. Ask participants why we need to engage landscape stakeholders in agroforestry design. Summarize the key reasons.
2. Ask participants to work in small groups (you can suggest the same groupings as in Session 3.2).
3. In each group, based on the case studies from Session 3.2, ask participants to set objectives for potential agroforestry practices in the context of climate change. They can refer to the issues linked to climate change and the roles of agroforestry in Session 3.2.
4. Ask each group to list all specific stakeholders, including government agencies, NGOs, private sector, researchers, farmers and others, who could support agroforestry practices for climate-change adaptation. Ask the groups to answer the questions below and tabulate the answers in the table below:
   a. Who are the stakeholders with an interest in adapting to climate change?
   b. Who are the stakeholders with an interest in agriculture?
   c. Who are the stakeholders with an interest in forestry?
   d. Who are the stakeholders with an interest in agroforestry?
   e. Who are the stakeholders with an interest in 'green' development?

   The trainer should remind the participants that stakeholders with an interest in most subjects (climate change, agriculture, forestry, agroforestry and green development) are the ones to engage in designing agroforestry practices for resilient landscapes.

Specific issue linked to climate change	Climate change	Agriculture	Forestry	Agroforestry	Green development
Long drought	Stakeholder A	Stakeholder B	Stakeholder C		
High temperature					
Extreme thunderstorm					

5. Identify the level of interest and influence of each of the listed stakeholders by mapping them into a table following the model below.

	High interest	Low interest
High influence		
Low influence		

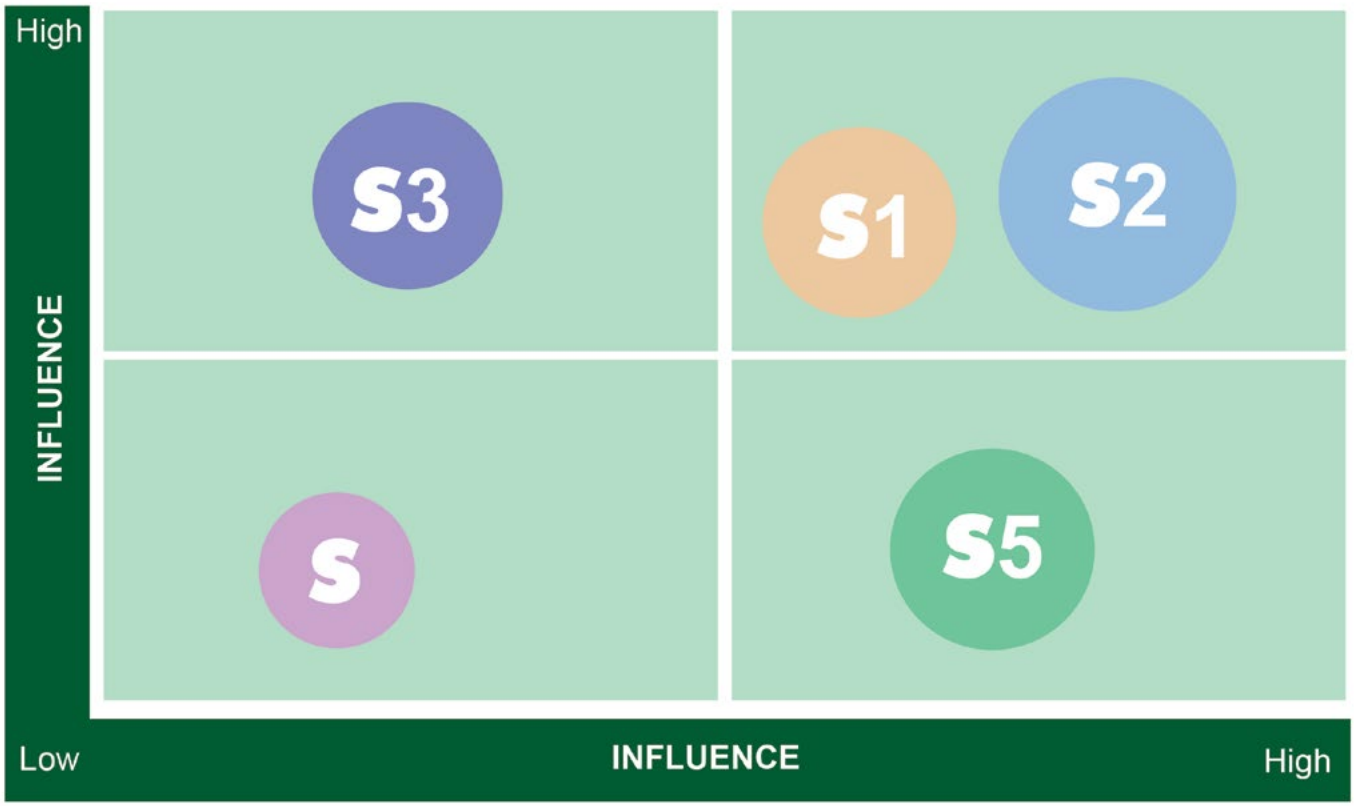
6. For stakeholders who have high interest and high influence, identify their potential roles and level of willingness to support agroforestry.
7. Allow each group to present their results and encourage discussion with the other participants.
8. Discuss what we should do about stakeholders who have a) high interest and high influence; b) high interest and low influence; c) low interest and high influence; and d) low interest and low influence?
9. Conclude the session by highlighting key points in stakeholder mapping.

Exercise 5.1

From the case studies in Session 3.2, list all stakeholders in the landscape who could support agroforestry practices in the context of climate-change mitigation and adaptation. Classify all stakeholders by assessing their influence and interests. The table below acts as a model to compile information.

Stakeholder	Influence	Interest	Willingness to engage	Expected role
Stakeholder 1				
Stakeholder 2				
Stakeholder 3				
Stakeholder 4				
Stakeholder 5				
Stakeholder 6				
Stakeholder 7				
Stakeholder 8				

Map the stakeholders into four quadrants, as below.



Handout 5.1
Stakeholder mapping

Stakeholder mtapping is a collaborative process of research, debate and discussion that draws on multiple perspectives to make a list of stakeholders (Morris and Baddache 2012). It can be classified into four phases:

- Identifying: Listing groups, organizations and people.
- Analysing: Understanding how perspectives vary between stakeholders.
- Mapping: Visualizing relationships between stakeholders with interests.
- Prioritizing: Ranking stakeholders by relevance and identifying issues.

The process of stakeholder mapping is as important as the result. The quality of the process depends heavily on the knowledge of the people participating in it. When designing agroforestry practices, stakeholder mapping is an important component when evaluating the competing demands of stakeholders. The results of the mapping help develop cooperation, compromise and a common vision for agroforestry. The mapping process acknowledges that the interests of some stakeholders might be prioritized over those of others. Stakeholder mapping is frequently used during the preparatory phase of designing agroforestry practices, to understand stakeholder attitudes toward the potential changes. Stakeholder mapping can be done once or regularly to track changes in stakeholder interests and influence over time.

Who are stakeholders?

A stakeholder is any individual, group or organization that can affect, be affected by, or perceive itself to be affected by an issue or an action. Stakeholders can be categorized as below:

- Primary stakeholders: Those who are ultimately affected, either positively or negatively, by the action.
- Secondary stakeholders: Intermediaries, namely those who are indirectly affected by the action.
- Key stakeholders: Those who have significant influence over the designing, planning and implementation of agroforestry practices or exert influence upon an organization carrying out the design. They might also belong to the first two categories.

What are the interests, influence and roles of different stakeholders?

Analysing stakeholders is the process of assessing the role, interest and influence of individual stakeholders involved with an action. The first step is to make a list of stakeholders in the targeted landscape. Once the list is almost complete, you can begin to categorize the possible roles of the proposed stakeholders, assessing their level of interest and influence. Composing the list of stakeholders can often take longer than the time available for analysis and mapping, so it is best to focus on the stakeholders who are most relevant.

A simple, common and effective mapping tool is a matrix representing stakeholder interests and influence. ‘Interest’ is the priority each stakeholder gives to agroforestry practices. ‘Influence’ is the power a stakeholder has to persuade others to encourage or stop the adoption of agroforestry. When creating stakeholder-engagement strategies, adding ‘willingness to engage’ will help define the type of strategy.

Session 5.2
Stakeholder engagement in agroforestry design

Objectives

At the end of this session, participants will be able to:

- Identify ideas for effectively engaging stakeholders in designing, planning and implementing agroforestry
- Identify challenges and opportunities for each form of engagement

Time

1.5 hours

Material

- Flip-charts, easels and whiteboards
- Index cards or sticky notes of various colours
- Markers and pens of various colours
- Glue sticks, masking tape and double-sided tape
- Prepared flip-charts with titles for different purposes for engagement, such as technical support, risk management, conflict management, resource saving or meaningful impact. One flip-chart is used for one purpose, each placed in different corners of the room.

Steps

1. Explain the objectives of this session and its link to agroforestry design and implementation.
2. Review briefly the results from the stakeholder analysis exercise, with a focus on why we need to engage all stakeholders in agroforestry, and the purpose of the stakeholder engagements.
3. Discuss the different purposes (for technical support, risk management, conflict management, resource saving or meaningful impact) and key approaches for engaging stakeholders. Ask participants to add more purposes and approaches for engaging stakeholders, particularly, ones they might have used before.
4. Divide the participants into four or five small groups. Each group will select one or two key stakeholders with a willingness to engage in an agroforestry program.
5. Use the World Café game[1] to facilitate small group work. Ask each group to focus on one specific purpose for engagement, and discuss the approach they want to use to engage that particular stakeholder. Write the name of the stakeholder and the approach on a prepared flip-chart sheet. See the table below.

Purpose 1
Stakeholder 1
Approach:

Purpose 2
Stakeholder 1
Approach:

Purpose 3
Stakeholder 1
Approach:

Purpose 1
Stakeholder 2
Approach:

Purpose 2
Stakeholder 2
Approach:

Purpose 3
Stakeholder 2
Approach:

1 The World Café is a discussion method that imitates concepts from informal "café" conversations that we used to have in round tables, with 24-30 participants are divided in 4-5 round tables. More information can be found at: http://www.theworldcafe.com/

6. After 10 minutes, ask each group to move to another purpose and repeat the same discussion. Participants should do this exercise with additional stakeholders as well.
7. After 3 to 4 rounds, ask each group to present the results from the flipchart.
8. Discuss the potential challenges and opportunities for each approach, such as areas of potential conflict between stakeholders, methods of achieving engagement, and who is organizing the engagement.
9. Summarize the key lessons where the trainer encourages the participants to discuss the purposes and approaches for stakeholder engagement in relation to their own particular contexts.

Trainer's notes

- Before the training, you should conduct stakeholder mapping.
- This session can be effectively implemented with a maximum of 30 participants so that you can capture all the different perspectives.

Handout 5.2
Engaging stakeholders in agroforestry

Why is it important to engage all stakeholders?

The purpose of stakeholder engagement is to involve individuals, groups and institutions (the stakeholders) who are affected by, and can have an effect on, an agroforestry project, policy, program or activity. Engaging stakeholders involves facilitating interactions among all stakeholders, and giving them opportunities to express support and raise concerns around an issue or action. This process is intended to ensure that all perspectives are taken into consideration during planning and subsequent implementation, so that no one is left behind.

The effective engagement of stakeholders depends on mutual trust, respect and transparent communication between all parties. It can achieve the following:

Technical support

Agroforestry design may need different technical inputs from different agencies responsible for the landscape. Engaging with experts will likely support a successful design.

Savings in time and cost

Engaging with all stakeholders at the outset can save costs by identifying their priorities, concerns and potential conflicts. This helps avoid false starts, wasted expense and loss of reputation.

Risk management

Engagement helps both the leader of the agroforestry design and all the other stakeholders to identify, prevent and mitigate environmental and social impacts that might threaten the agroforestry plan for a resilient landscape.

Reputation enhancement

When you acknowledge stakeholder priorities and concerns (particularly those of local communities) and respond positively, it will boost your credibility and minimize the risks.

Conflict avoidance

Understanding existing and emerging issues of sensitivity provides an opportunity where they can be managed before conflict occurs.

Impact identification, monitoring and reporting

The early identification of stakeholder priorities and concerns leads to better mechanisms for monitoring and reporting.

Expectation management

Early consultation with all stakeholders helps to plan for agroforestry, allowing you to manage against unrealistically high expectations.

Participation and commitment

Engaging all stakeholders in planning and implementation from the beginning builds a sense of ownership, participation and commitment, which is essential for success.

Fatigue prevention

Active, inclusive planning and implementation avoids the repetitive and redundant meetings planned on short notice or with previously overlooked groups of stakeholders.

How to effectively engage stakeholders?

Stakeholder engagement should be conducted in a timely, relevant, clear, informed and culturally appropriate manner. Guidelines for effective stakeholder engagement include the following:

Understand the stakeholders

It is essential to understand and respect the working and living conditions, cultures, priorities and concerns of stakeholders.

Use existing mechanisms

As far as possible, avoid developing new or re-organizing structures that already exist. It is better to collaboratively examine with all stakeholders the strengths, weaknesses, opportunities and threats of the existing mechanisms and together develop an improvement plan.

Commitment

The project leader and all stakeholders should demonstrate willingness to identify, understand and act upon the priorities and concerns of all other stakeholders, particularly those from the community.

Respect

The engagement process should recognize the rights, beliefs, values, priorities, and concerns of all stakeholders, particularly, when they differ from those commonly held by the majority of stakeholders or wider society.

Transparency

Plans, decisions and constraints should be shared with all stakeholders in a timely fashion. Unforeseen modifications to plans and activities are common, so these should be communicated to everyone as soon as possible, with clear explanation of the causes.

Inclusiveness

Engagement should include the broad participation of all stakeholders, encouraging them to participate in planning and implementation according to their proposed function (see Handout 5.1 Stakeholder mapping).

Trust

The engagement process should be open, free, informed and meaningful, respecting and upholding all stakeholder rights, beliefs, values, priorities and concerns. Stakeholder engagement should be free of manipulation, interference, coercion and intimidation.

Level of stakeholder engagement

The range of stakeholder engagement, as shown in the table below, shows different levels that we should consider when designing and implementing agroforestry.

Passive	Reactive	Participative	Empowered	Contributing
When a stakeholder has low interest and low influence	When a stakeholder has something to offer but has low interest	When a stakeholder has moderate interest and moderate influence	When a stakeholder has high influence but low interest	When a stakeholder has both high interest and high influence

What types of approaches can be used in the stakeholder engagement processes?

In all cases, the first contact with potential stakeholders should be conducted in a positive, constructive manner that provides a clear indication of the purpose of the engagement, namely agroforestry planning and design. Complete background information should be provided about the proposed idea for agroforestry, the recommended commitment of the stakeholder, and how you plan to engage with them. After the first contact, stakeholders need to be engaged again to design and plan the agroforestry. Generally, only stakeholders who have both a high level of influence and high interest (see Handout 5.1) will be involved in the actual design and planning. The other types of stakeholders are usually engaged to seek their input or to be informed of progress in design and planning. Your

approach will vary by stakeholder and the intention of each activity. A summary of useful approaches is provided in Table 5.1.

Table 5.1: Approaches to stakeholder engagement

Form of engagement	Description
Advisory committee	The committee is comprised of key stakeholders who meet regularly to receive progress reports and provide guidance. Stakeholders who have high influence but low interest, and low influence but high interest are appropriate to be members of the committee. The agroforestry project leader facilitates the committee but is not a member of it.
Forum	A forum is a structured activity to provide an overview of progress. It can also be used to seek input on a specific issue. A forum allows for open discussion with many stakeholders and the general public.
Workshop	A workshop is a structured activity designed to address specific issues and identify ways to proceed. People involved include the leader of the agroforestry project, stakeholders with high influence and high interest, other selected stakeholders who have knowledge or experience of the specific issue, and possibly external specialists.
Consultation or interview	Direct consultation, interview, or discussion with experts in agroforestry design and implementation will help reduce risks and increase the chance of success.
Regular communication	Used when stakeholders need to be informed on particular issues, concerns or any progress in agroforestry so that they can take action, such as providing institutional or policy support, or conflict prevention.
Networking	Networking takes place when there are several stakeholders who have similar interests and influences in agroforestry, so that they can share ideas and make links to help the agroforestry progress.
Capacity development	Capacity development can be undertaken when a stakeholder has high influence but low interest in supporting agroforestry practices.

Module 6: Designing agroforestry interventions for a climate-resilient landscape

Session 6.1
Agroforestry interventions for a climate-resilient landscape

Objectives

At the end of this session, participants will be able to:

- Identify the main objectives of agroforestry interventions for climate resilience
- Determine detailed plans for agroforestry interventions

Time

1.5 hours

Material

- Flip-charts, easels and whiteboards
- Index cards or sticky notes of various colours
- Markers and pens of various colours
- Glue sticks, masking tape and double-sided tape
- Photos representing landslides, drought, flood, thunderstorm or other impacts of climate change

Steps

1. Begin by asking participants to share any evidence of climate-change impacts at landscape level that they have experienced. Write the examples on a flip-chart. Ask how agroforestry could play a role in responding to these impacts.
2. Explain that in this session we will identify key agroforestry interventions to mitigate the negative impacts of climate change. Give a short explanation about what an agroforestry intervention is with examples of such interventions.
3. Divide participants into small groups and ask each group to select one impact of climate change and identify at least five potential agroforestry interventions to respond to the selected impact. If available and needed to stimulate ideas, distribute photos of climate-change impacts to each group.
4. Explain that we need to review existing enabling environments that could support agroforestry interventions in a landscape.
5. Assuming that we have supportive policies and regulations, each group selects the most promising intervention and develops objectives for agroforestry towards a climate-resilient landscape that will reduce or eradicate the negative effects of the selected impact. The objectives should be Specific, Measurable, Achievable, Realistic and Timely (SMART).
6. After each group has completed their discussions, ask each group to share the objectives of their agroforestry intervention. Conduct a discussion for everyone that addresses the following questions:
    a. What are your general observations after hearing all the agroforestry interventions?
    b. How well could agroforestry increase landscape resilience in each case? For example, does it:
        - Increase interactions between the various functions of the landscape so that they are more integrated and therefore resilient?
        - Increase the number of opportunities for people to talk about how to use the landscape sustainably?
        - Increase the responsive of the many different stakeholders so that everyone works together and strengthens the resilience of the whole community?
    c. What can we do to strengthen the role of agroforestry for a climate-resilient landscape?

7. Summarize the key lessons learned from this session and remind everyone that this process requires input from all other stakeholders in a landscape. Refer to the 'stakeholder engagement' discussion. Conducting a participatory area assessment will help reach a comprehensive understanding about the landscape contexts, and help us identify key objectives for agroforestry.

Trainer's notes

This session is linked with the results discussed in Session 2.2 and 3.2.

Figure 6.1: Impacts of climate change

From top left clockwise: Landslide after heavy rain, unexpected flooding in the dry season damages crops, temperatures over 40oC cause an outbreak of white-shrimp disease, coffee plants suffer from drought

Handout 6.1
Understanding the scope of agroforestry interventions

What is an agroforestry intervention?

An agroforestry intervention is a set of actions to implement concepts of agroforestry. The types of agroforestry interventions vary depending on the objectives (Table 6.1).

Table 6.1: Examples of agroforestry interventions for different objectives

Agroforestry intervention	Specific objectives	Example of activities
Agroforestry for moderating microclimates of agricultural systems	■ Appropriate shade trees moderate the effects of heat stress, particularly for heat-sensitive crops such as coffee, cacao, ginger ■ Appropriate shade trees provide windbreaks and shelter belts	■ Select appropriate shade trees based on your objectives ■ Provide information on techniques for planting shade trees in agricultural landscapes ■ Promote the growing of shade trees
Agroforestry for soil and water conservation through provision of permanent cover	■ Increased organic matter accumulation in the soil ■ Increased infiltration of rain water by growing more trees ■ Decreased runoff and erosion from growing cover crops and adopting contour hedgerows	■ Select appropriate cover crops ■ Provide contour hedgerows ■ Introduce practices for managing land-use systems with permanent cover ■ Monitor soil and water quality regularly
Agroforestry for sustainable diversification of agricultural systems and incomes	■ Increased farm income from agroforestry systems ■ Reduced risks of income instability ■ Identified new market opportunities and ways to expand existing markets ■ Diversified agroforestry products (not only production but also on-farm processing and other farm-based, income generating activities)	■ Provide more information at all levels on markets for agroforestry products ■ Increase the adoption of multiple production activities that are complementary in economic and or ecological dimensions
Agroforestry for limiting carbon emissions and sequestering carbon	■ Trees in agroforestry systems are significant sinks for carbon in agricultural land ■ Empirical evidence is collected to explain how agroforestry systems can reduce CO2 ■ Actions for mitigating CO2 emissions are promoted (including biofuel and bioenergy)	■ Conservation of existing carbon pools through practices such as avoided deforestation and alternatives to slash and burn ■ Promote carbon sequestration through improved fallows and integration with trees ■ Substitution of biofuel and bioenergy plantations to replace fossil fuels

Source: Rao et al (2007)

To ensure that the intervention has a positive impact, there are three major principles that need to be considered at the design stage:

1. Involve multiple stakeholders
2. Intervene at multiple scales
3. Remember that the landscape has multiple functions

How to identify the objectives and priorities of agroforestry interventions?

The objectives of an agroforestry intervention can be divided into three types:

Productivity
Production of expected products that contribute to the livelihoods of the community in the area.

Environmental
Environmental services provided by the landscape that contribute to the sustainability of that landscape.

Social
Improvements in social interaction, policies and human relationships that support community-based sustainable management of their landscape.

Socio-ecological characteristics and biophysical conditions of the landscape, as well as the severity of impact of climate change, will determine the details of the objectives. It is important to assess the landscape through an in-depth analysis of climate change and its impacts. The assessment should include analysis of the socio-ecological and biophysical conditions of the landscape. Consultation with multiple stakeholders is required to determine the appropriate objectives for, and the types of, agroforestry interventions.

Remember that in one landscape, several agroforestry interventions can be implemented. The availability of resources, such as budget, time, human resources and technologies, will determine the prioritization of agroforestry interventions. There are three criteria for prioritizing agroforestry interventions.

1. Urgency of environmental and social issues in the area.
2. Magnitude of potential impacts from agroforestry interventions.
3. Perception and levels of interests of all the stakeholders about their involvement in the agroforestry intervention.

Module 7: Planning agroforestry interventions for a climate-resilient landscape

Session 7.1
Planning agroforestry interventions for a climate-resilient landscape

Objectives

At the end of this session, participants will be able to:

- Review the main objectives of, and key factors in, agroforestry design
- Use a simple matrix to prepare a plan for an agroforestry intervention

Time

1.5 hours

Material

- Flip-charts and whiteboards
- Index cards or sticky notes of various colours
- Markers and pens of various colours
- Glue sticks, masking tape and double-sided tape

Steps

1. Explain that after the selection of agroforestry interventions for the landscape, detailed activities need to be planned.
2. Ask the participants to return to the same groups as in Session 6.1 and use the same case studies.
3. Introduce the matrix for planning an agroforestry intervention, as shown below.

Name of agroforestry intervention:

Activities	Expected results	Timeline	Required resources: social, human, natural, financial, infrastructure	Potential sources of resources	Who will do what	Potential risks and mitigation strategies

4. Ask each group to remind themselves of the main objectives for agroforestry intervention and the key factors involved in its design. Then consider the existing livelihood capitals within the landscape, using the matrix to prepare a plan for one agroforestry intervention.
5. After all groups finish their plans, ask each group to present and discuss with all other groups.
6. Remind the participants that, ideally, we work closely with farmers and other key stakeholders in the landscape to develop the plan so that they all know which role they can play and what they can contribute.
7. End by discussing the key steps in the planning process and the importance of including the perspectives of many stakeholders when planning an agroforestry intervention.

Trainer's notes

- Activities in agroforestry interventions are divided into those at landscape, farm and plot levels.
- This session works well if it's combined with field exercises.
- In the planning process at landscape level there are two common approaches:
  - Through government programs, including multi-sectoral ones
  - Through projects that synergize with government objectives

  For each of these two planning processes, identify who needs to be involved and bear which responsibilities.
- Remind participants of the four livelihood capitals that are required for successful agroforestry.

Handout 7.1
Planning agroforestry interventions

How to plan for agroforestry interventions?

Planning is the process of prioritizing and organizing activities to achieve a stated goal, in this case an agroforestry intervention. In the planning process, there are elements that need to be developed, that is, a logical framework, the intervention logic, the assumptions, targets and indicators, stakeholder roles and responsibilities, budgets and financial frameworks, and various other documents. There are four key planning principles we should always take into account.

- Strategic: Strategic planning is balancing long-term goals and intermediate objectives with available resources. Prioritization, and possibly compromise, will be necessary. All planning processes are most effective when balancing objectives and resources.
- Values-based: Good planning incorporates local community values and objectives in addition to the objectives of government plans and strategies.
- Participatory: Engaging a variety of landscape stakeholders rather than just only, say, the local leaders of government and villages, in the planning process helps to ensure a more coordinated and effective intervention. Participatory planning helps to ensure the support of the government, communities and other stakeholders. It is responsive to local community interests and values, yet also targets a broader range of development objectives.
- Integrated: The realization of agroforestry interventions is usually most effective if they are implemented or 'mainstreamed' through existing government policies, programs, plans, strategies and processes.

Participatory planning can be defined as joint actions of local people, governments and project staff with the objective of creating plans that have a common vision and contain the best alternatives for implementation. Participatory planning should be a two-way learning process of dialogue, negotiation and decision-making between all stakeholders.

Planning agroforestry interventions in different ecozones will likely require different approaches. For instance, in coastal areas, plans need to take into account not only the coastal zone but also adjacent land that may affect the coastal area. Such plans should be based on watershed units whenever possible.

Activities need to be included in plans that help expand the scale of the impact of agroforestry programs. These activities could include the identification of ways to increase usage of agroforestry technology, such as through extension services, and the development of monitoring and evaluation protocols.

What type of information is needed for planning agroforestry interventions?

To support planning of agroforestry interventions, the following information is needed.

- Landscape description
  - Delineation of the area within the targeted landscape
  - Description of the biophysical and socio-economic characteristics of the targeted area
  - Supportive policies related to agroforestry programs in the targeted landscapes
  - List of stakeholders who are interested in participating in agroforestry intervention
  - Issues or priorities of the agroforestry intervention
- Priorities of the agroforestry intervention at the landscape level
- Priorities of the agroforestry intervention at the farm level
- Existing resources that support agroforestry
  - Existing and potential designs of agroforestry systems in the landscape
  - Relevant agroforestry technologies and research results

- Existing extension programs and strategies
  - Sources of funding or investments

How to plan agroforestry interventions?

Planning for agroforestry interventions is best done through a series of consultations and workshops with different stakeholders to:

- Share responsibilities between stakeholders for implementing the agroforestry interventions
- Identify activities and outputs in each agroforestry intervention
- Identify sources of resources needed for implementing the interventions
- Identify criteria and indicators to monitor and evaluate implementation of the intervention

The workshops should be attended by all key stakeholders in the targeted landscape. The output of the planning process should be a logical framework on how to implement the prioritized agroforestry interventions. Information that needs to be included in the logical framework are:

- The objectives of the agroforestry interventions
- Expected outputs
- Types of activities
- Timeframe
- Potential risks
- Resources needed
- Potential sources of resources
- Stakeholders to be involved

Module 8: Monitoring and evaluation of agroforestry interventions

Session 8.1
Criteria for the monitoring and evaluation of agroforestry interventions

Objectives

By the end of this session, participants will be able to:

- Explain the importance of and be familiar with criteria and indicators for the monitoring and evaluation of agroforestry for climate-resilient landscapes
- Explain linkages between monitoring and evaluation and agroforestry design

Time

1.5 hours

Material

- Handout 8.1
- Flip-chart and A0 paper
- Index cards of various colours
- Markers

Steps

1. Refer to the key roles of agroforestry in resilient landscapes and the plan for agroforestry interventions from the previous sessions and introduce the objectives for this session.
2. Ask participants to discuss what are (agroforestry) 'monitoring' and 'evaluation' and their importance. Write their answers on colour cards then stick them on a wall.
3. Briefly discuss the collection of answers.
4. Divide the participants into four small groups and ask each group to discuss the purpose of monitoring and evaluation (M&E) in agroforestry for landscape resilience. What key indicators do they think are most important for M&E? If needed, ask the participants to revisit the expected results of agroforestry interventions discussed in Session 6.1.
5. Remind everyone that key indicators should be easily measurable.
6. Allow 30 minutes for group work and then ask each group to share their results.
7. You can give some examples of different sets of indicators for M&E of agroforestry in the region.
8. Summarize the key lessons and link them to the designing of agroforestry interventions.

Trainer's note

For step 7, you might remind the participants about Session 3.2 on the benefits of agroforestry systems.

Handout 8.1
Criteria and indicators of monitoring and evaluation in agroforestry

The importance of agroforestry monitoring and evaluation (M&E)

Monitoring can be defined as a continuing function that provides managers and key stakeholders with early indications of progress, or lack thereof, toward achieving results. It helps to track achievements through the regular collection of information. This helps make timely decisions, ensures accountability and provides the basis for evaluation and learning.

Evaluation is the systematic and objective assessment of an active or completed project or program, looking at its design, implementation and results. The aim is to determine whether the intervention is achieving its objectives, whether it is efficient and effective in development, how much impact it is making, and whether the impact is sustainable. An evaluation should give information that is credible and useful, helping to include lessons learned into decision-making processes. Evaluation helps improve transparency, learning and accountability. It helps us draw lessons for the future about what works, in which circumstances and why.

In the case of agroforestry, the basic goals of all agroforestry systems are productivity, sustainability and adaptability. M&E must examine those goals. M&E is conducted at farm, plot and landscape levels.

- At farm or plot level, the focus of the M&E is on aspects such as the tree and crop species, their arrangement, interaction, growth characteristics and management, yield, farmer reference and response, benefit/income, soil erosion, and soil fertility.
- At landscape level, the focus of M&E is on agroforestry as a land-use system that contributes to various social, economic and environmental goals and therefore, to resilience of the landscape.

M&E can help in several ways:

- By helping us to understand whether the agroforestry intervention is supporting resilience, in which way, and by how much.
- By helping us recognize the shortcomings of existing practices and intervention strategies that could lead to corrective actions.
- By communicating lessons learned from the most resilient agroforestry practices to help us expand their adoption.
- By providing reference material for planning of subsequent agroforestry interventions.
- By enhancing accountability of, and coordination among, stakeholders when undertaking agroforestry.

M&E criteria

In general, when conducting monitoring and evaluation, the following criteria need to be addressed.

Relevance
What is the value of the agroforestry intervention in relation to other stakeholder needs, national priorities, national and international partner policies?

Efficiency
Does the agroforestry intervention use resources in the most economical manner to achieve the objectives?

Effectiveness
Is the agroforestry achieving satisfactory results?

Impact
What are the results of the agroforestry intervention: intended or unintended, positive or negative? These include social, economic, and environmental effects on individuals, communities and institutions.

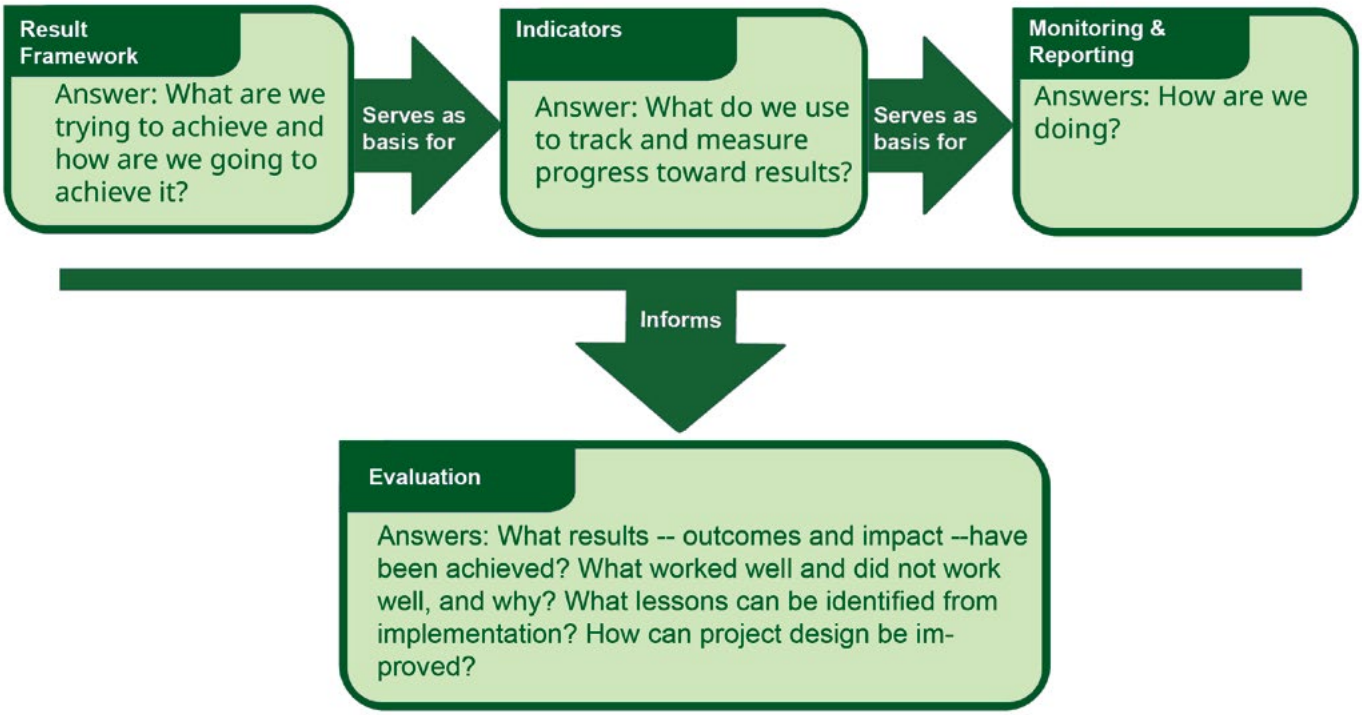
Sustainability

Are the agroforestry practices and their impact likely to continue when external support is withdrawn. Will other stakeholders operating either in the targeted landscape or neighbouring ones also develop agroforestry?

Indicators for agroforestry M&E

Indicators are an essential component of any M&E system (Figure 8.1). They are measures used to demonstrate the status of an activity. They set the standard for measuring progress and assessing achievement. Over time, indicators provide information on whether a certain condition exists or certain results have been achieved.

Figure 8.1: Primary components of an M&E system



Source: William (2016)

Given a defined purpose of agroforestry M&E is to measure landscape resilience, a specific set of key indicators must be selected (Table 8.1). These indicators need to be discussed, tested and agreed upon with the main stakeholders. The following are some criteria to be considered:

- Relevant: Representative of the intended outcomes and impacts.
- Clear: Unambiguous and clearly defined.
- Specific: Measures specific changes and are set to a precise timeframe, location and target.
- Measurable: Must be practical and easy to measure, quantitatively or qualitatively.
- Consistent: Values of indicators should be reliable and comparable over time, collected using the same methods.

Table 8.1: Examples of indicators for evaluation of climate-resilient agroforestry

Shock due to extreme climate event	Indicator	Adopted agroforestry practice
Drought	■ Improvement in the fertility of degraded soils ■ Increase in water retention in soils ■ Increases in yields for maize, sorghum, millet, cotton and groundnut ■ Reduction of vulnerability to seasonal drought	Improved fallow system (Verchot et al 2007) Multipurpose tree, for example Faidherbia albida, on farmland (ICRAF 2009) Shade-tree planting in agricultural systems (Jost and Pretzsch 2012)
Increased temperatures	■ Microclimate modification that is beneficial for livestock and crops ■ Reduction of stream temperatures to protect salmon and other cold-water species ■ Maintenance (and improvement) of water quality ■ Maintenance (and improvement) of stream-bank stability	Silvopasture, windbreaks and alley cropping Riparian forest buffer (Schoeneberger et al 2017)
Increased temperatures (in mangrove areas)	■ Increase in mangrove cover per household farm and in the project area as a whole ■ Reduction in shrimp death due to disease ■ Increase in number of households practicing mangrove shrimp farming ■ Increase in shrimp production and resulting household income ■ Existence of linkages among stakeholders	Mangrove shrimp-farming (MAM project in Ca Mau, Viet Nam)
Flooding, soil erosion, sediment	■ Reduction of soil erosion & sediment ■ Forest/tree cover increase ■ Increase in coffee yield ■ Change in land use (in the watershed) ■ Existence of linkages/collaboration among stakeholders	Multi-strata coffee agroforestry system in in Sumberjaya, Indonesia (Agus & Suyanto 2009, Evizal et al 2012)

Session 8.2
Methods and tools for the monitoring and evaluation of agroforestry interventions

Objectives

At the end of this session, participants will be able to:

- Explain common methods used to monitor and evaluate agroforestry for climate-resilient landscapes
- Decide which methods are suitable for each form of agroforestry

Time

1.5 hours

Materials

- Handout 8.2
- Flip-chart and A0 paper and whiteboards
- Index cards of various colours
- Markers

Steps

1. Refer to Session 8.1 and explain that in this session we will learn about several methods commonly used to monitor and evaluate agroforestry.
2. As discussed in Session 8.1, there are different purposes and indicators of agroforestry M&E related to climate-resilient landscapes, community livelihoods, and food security. Divide participants into four small groups. Ask each group to select one or two purposes and indicators. Ask the groups to identify certain methods that they think are most suitable to use for data collection, keeping in mind the two purposes and indicators that they have selected.
3. Allow 20 minutes for group work and then ask each group to explain the methods they identified and whether they require qualitative or quantitative data.
4. Summarize the methods and stress the importance of combining both qualitative and quantitative data collection in agroforestry M&E.
5. Ask participants to share their ideas about participatory monitoring and evaluation. To do so, first write the following questions on coloured cards and stick the cards on a wall:
   a. On a red card: “What is participatory monitoring and evaluation?”
   b. On a yellow card: “ What are the principles we should follow?”
   c. On a blue card: “Why is it important?”
6. Read the cards out loud and ask some of the participants to explain what they wrote.
7. Introduce the key steps of participatory monitoring and evaluation and give examples of its use in agroforestry for climate-resilient landscapes (Handout 8.2).
8. Ask questions to clarify understanding.
9. Summarize the session.

Handout 8.2
Methods for monitoring and evaluation in agroforestry

Start by listing methods that can be used for monitoring and evaluation in agroforestry using the matrix below.

Methods	Strengths	Weaknesses	Notes

Participatory Monitoring and Evaluation (PM&E) is a process through which stakeholders at various levels:

- Engage in monitoring or evaluating a particular project, program, policy, activity or initiative
- Share control over the content, process and results of the monitoring and evaluation
- Engage in identifying corrective actions (Sirker and Ezemenari 2002)

The focus is on the active engagement of primary stakeholders. Key principles include the following:

- Primary stakeholders should be active participants and not just sources of information.
- PM&E must help build the capacity of stakeholders to analyse, reflect and take action.
- Stakeholders should have opportunities to engage in joint learning.
- PM&E must catalyse stakeholder commitments to taking corrective action.

PM&E helps in several ways:

- Increases ownership, autonomy and self-organization, leading to institutionalization of participation and empowerment
- Provides better information
- Increases accountability and transparency
- Facilitates joint learning to improve performance and outcomes and strengthen commitments to implement corrective actions
- Improves capacity, increases efficiency and effectiveness, fosters decentralization, encourages coordination of data collection and supervision
- Creates new partnerships
- Promotes sustainability

General steps for design of PM&E consist of the following (Sera and Beaudry, 2007):

1. Identify who will be involved in the design, implementation, and reporting. Engaging stakeholders helps ensure their perspectives are understood and feedback is incorporated.
2. Clarify scope, purpose, intended use, audience, and budget for evaluation.
3. Develop the questions to answer what you want to learn as a result of your work.
4. Select indicators. Indicators are meant to provide a clear means of measuring achievement, to help assess the performance, or to reflect changes. They can be either quantitative and/or qualitative. A process indicator is information that focuses on how a program is implemented.
5. Determine the data collection methods. Examples of methods are: document reviews, questionnaires, surveys, and interviews.
6. Analyse and synthesize the information you obtain. Review the information obtained to see if there are patterns or trends that emerge from the process.
7. Interpret these findings, provide feedback and make recommendations. The process of analysing data and understanding findings should provide recommendations about how to strengthen the work, as well as any mid-term adjustments you may need to make.
8. Communicate findings and insights to stakeholders and decide how to use the results to strengthen your organization's efforts.

Quantitative and qualitative data collection when monitoring and evaluating agroforestry

PM&E is best carried out with a mix of qualitative and quantitative data so that information can be triangulated or cross-checked. Quantitative information provides the status or change of a specific variable – for example, changes in crop yields, number of households adopting agroforestry or area of farms with agroforestry practices — to provide direct numerical results. It can be seen as formal data collection, for example by using a structured questionnaire. Qualitative data collection gathers information by asking people to explain what they observe, do, believe or feel. The output is written descriptions, and the researchers have an open-ended approach to gathering data.

Rather than relying on one or the other type of data collection, a combination of both increases our ability to better understand and interpret complex situations.

There are several methods for quantitative data collection:

- **Formal surveys** are commonly used at the start and end of an activity to gather baseline information and compare outcomes to targets. A standardized form may be used for recording physical measurements. For socio-economic data, a structured questionnaire is usually used to record data from interviews with individual respondents.
- **Bio-physical measurements** are measurements of physical change over time, for example, crop yields, soil erosion, water-table depths and availability. Measurement may require recording instruments installed on-site, for example a soil-trap installed on the lower part of a slope to measure soil erosion.
- **Geographic Information System** uses satellite imagery for data collection and computers for interpretation. Data are gathered about spatial changes, rehabilitation mapping, and for mapping change in cropping patterns over time, and are often collected at baseline prior to the intervention and later after completion.

There are several methods for qualitative data collection:

- **Semi-structured interviews** involve a relatively small and non-random sample of stakeholders to gain information from individuals in small groups, using broad questions to guide conversations but allowing for new questions to arise as a result of the discussion. This helps to provide an understanding of perspectives, attitudes and behaviour patterns of the target population.
- **Key informant interviews** are usually semi-structured and open-ended but can make use of structured, closed-ended questionnaires. Key informants are usually few in number and purposively selected because of their particular knowledge and position, such as village chiefs, teachers, local officials and higher-level officials.
- **Focus-group discussions** with selected groups that are familiar with pertinent issues can be used to explore issues and processes, clarify details and gather opinions. Focus groups are particularly useful for assessing opinions about change, the causes of change, and for identifying areas that need improvement.
- **Direct observation** involves structured observation of an activity, relationship, phenomenon, network or process in the field. It can be used to understand the context and to explain the results of monitoring and evaluation and should always be used in conjunction with other methods.
- **Analysis of documents and review of records** involves examining administrative databases, training material, correspondence and routine progress reports. This can be very useful for identifying issues to investigate further and provide evidence of action, change and impact.
- **Case studies** document the sequence of events over time related to a person, household, location, or organization and facilitate in-depth understanding of the processes behind observed changes.

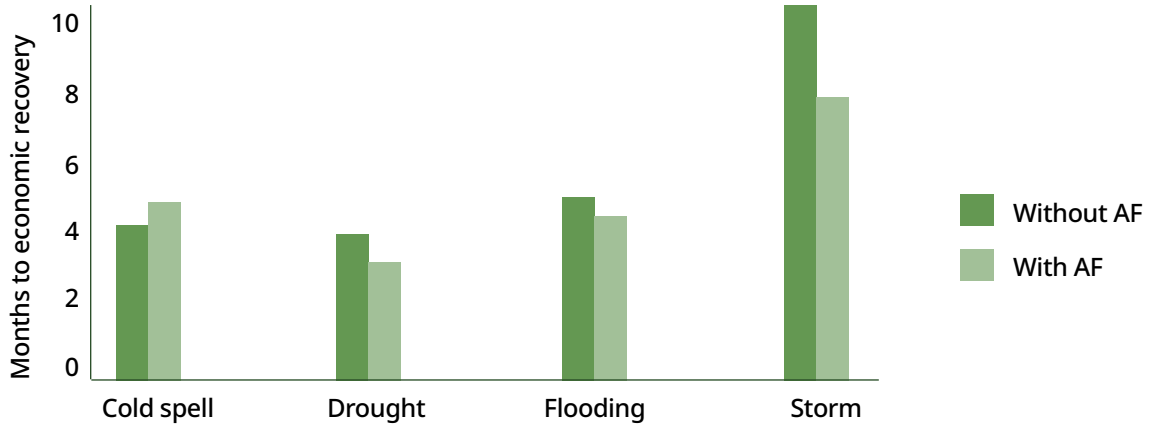
Example 1: Trees and agroforestry for coping with extreme weather events in Viet Nam

Tree-based farming systems are often assumed to be resilient or climate-smart. Simelton et al (2015) reported on initial results of an evaluation of farmer experiences with trees and crops, when responding to major climatic exposure in 21 villages in northern and north-central Viet Nam. Their study assessed the suitability and roles of trees by analysing data gathered through focus-group discussions, workshops and a survey of 661 households.

Results showed that a majority of households were exposed annually to what they perceived as natural hazards, for example cold spells, droughts, hot spells, dry winds, dry hot winds, flooding and storms. Experience with using trees for coping and adaptation depended on household income status, local awareness and supporting agroforestry policies.

Farms with trees had shorter recovery times after most types of natural disasters, except for cold spells, demonstrating that the trees provided economic and environmental buffers.

Figure 8.2: Comparison of the recovery periods after extreme events of farms with and without agroforestry.



Source: Simelton et al (2015)

Example 2: Multipurpose agroforestry as a climate resilience option for farmers: local adaptation in Viet Nam

The increasing frequency, intensity and duration of severe weather events is posing major challenges to global food security and the livelihoods of rural people. Local experience in responding to severe weather conditions, accumulated over generations and centuries, is valuable for developing adaptation options to current climate change. A study by Nguyen et al (2013) in Cam My Commune, Ha Tinh Province in Viet Nam identified tree species that reduced the vulnerability of cropping systems under climate variability. The study developed a method for rapidly assessing vulnerability and exploring strategies for farmers exposed to climate variability.

Participatory Rural Appraisal methods, including semi-structured interviews at landscape level and questionnaire interviews at farm level, in combination with participatory Geographical Information Systems mapping and statistical analysis of meteorological data were used to evaluate local vulnerability to climate change and to investigate adaptation measures. This took place in two selected villages that represent some of the most vulnerable areas to climate change in Viet Nam. The low predictability of severe weather events makes food crops, especially grain production, insecure. The study shows that while rice and rain-fed crops suffered more than 40% loss of yields in years of extreme drought or flooding, tree-based systems were less affected. Thirteen tree species performed well under the harsh local climatic conditions in home- and forest-gardens, continuing to provide income, food, animal feed and other environmental benefits. The research suggests that maintenance and enhancement of locally evolved agroforestry systems, with high resilience and multiple benefits, can contribute to climate-change adaptation.

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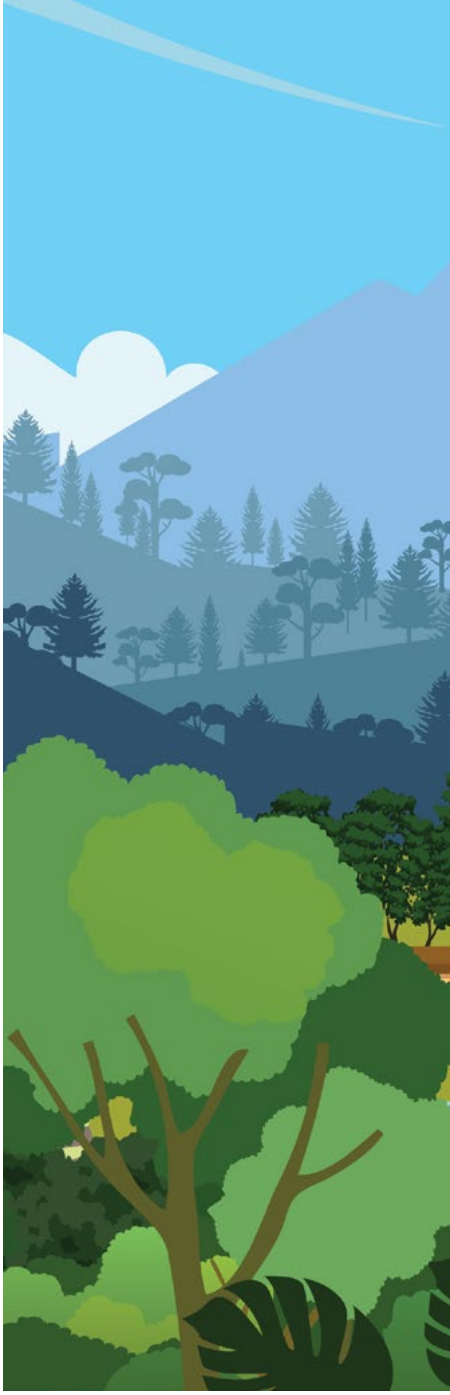

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