Gender, Climate Change, Agriculture and Food Security

A CCAFS Training-of-Trainers (TOT) Manual to prepare South Asian rural women to adapt to climate change

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

Katharine Vincent, Tracy Cull, Aditi Kapoor, Pramod K. Aggarwal, Gopal D. Bhatta, Charlotte Lau, Patti Kristjanson, Pushkin Phartiyal, Gulsan Parvin, Suman Bisht and Sharmind Nilormee

CGIAR
RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security
CCAFS

The writing and research for this training manual was jointly undertaken by:

Katharine Vincent and Tracy Cull (Kulima Integrated Development Solutions); Pramod K. Aggarwal, Charlotte Lau, Patti Kristjanson and Gopal D. Bhatta (CCAFS); Pushkin Phartiyal (Central Himalayan Environment Association); Gulsan Parvin (Pathikrit); and Aditi Kapoor (Alternative Futures) with inputs from Suman Bisht, ICIMOD, Kathmandu, Nepal, and Sharmind Nilofer, Jahangir Nagar University, Bangladesh.

For more information, please contact:
Pramod K. Aggarwal, CCAFS Regional Program Leader for South Asia; Email: p.k.aggarwal@cgiar.org

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CCAFS Coordinating Unit -Department of Agriculture and Ecology, Faculty of Life Sciences, University of Copenhagen, Rolighedsvej 21, DK-1958 Frederiksberg C, Denmark.
Tel: +45 35331046; Email: cafs@life.ku.dk

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A CCAFS Training-of-Trainers Manual

To prepare South Asian rural women to adapt to climate change

December 2012

LIST OF ACRONYMS

CCAFS	Climate Change, Agriculture and Food Security
CEW	Capacity Enhancement Workshop
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
ESSP	Earth System Science Partnership
GCM	Global Climate Model
IFAD	International Fund for Agricultural Development
IGP	Indo-Gangetic Plains
IPCC	Intergovernmental Panel on Climate Change
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
NAPA	National Adaptation Programme of Action
PGNs	Practical Gender Needs
SGNs	Strategic Gender Needs
SRES	Special Report on Emissions Scenarios
ToT	Training of Trainers
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organisation

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PART ONE
INTRODUCTION

1. INTRODUCTION

This training-of-trainers manual is designed to train you to be able to deliver a capacity enhancement workshop (CEW) to rural women on climate change and gender. It has been designed by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and is appropriate to the South Asian context.

1.1 CLIMATE CHANGE, AGRICULTURE AND FOOD SECURITY (CCAFS) PROGRAM OF CGIAR

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic 10-year partnership emerging from collaboration between the Consultative Group on International Agricultural Research (CGIAR) and Future Earth.

Through this collaboration, CCAFS brings together strategic research in agricultural science, development research, climate science, and earth science systems to overcome the threats that a changing climate poses to food security, rural livelihoods and the environment. This entails promoting more adaptable and resilient agriculture and food systems, mainstreaming climate variability and climate change issues into development strategies and institutional agendas, enhancing people's understanding of climate change issues and ensuring that decisions on policies and actions are based on the best available information and data. In order to meet the overall goals, CCAFS has established four research themes: Adaptation to progressive Climate Change; Adaptation through Managing Climate Risks; Pro-poor Climate Change Mitigation; and Integration for Decision Making.

While the themes are global in character, there is a concentration of effort in five focus regions: East Africa, West Africa, South Asia, South East Asia and Latin America.

Led by the Centre for Tropical Agriculture (CIAT), CCAFS taps into the collective expertise of all 15 CGIAR research centres and other thematic CGIAR research programs from around the world.

CCAFS involves farmers, local partners, policymakers, donors and a variety of stakeholders integrating their knowledge and expertise into the tools and approaches we develop.

1.2 WHY SOUTH ASIA, PARTICULARLY THE INDO-GANGETIC PLAINS?

South Asia is considered as one of the most vulnerable regions to climate variability because its climate is strongly connected to the Himalayas and the monsoon rains. The Himalayan glaciers form the largest body of ice outside the polar caps and are the source of water for the innumerable rivers that flow across the Indo-Gangetic plains (IGP). These include perennial rivers such as the Indus, Ganga and Brahmaputra which, in turn, are the lifeline of millions of people in Pakistan, Nepal, Bhutan, India and Bangladesh–the South Asian region. The Gangetic basin is densely populated, home to 500 million people, about 10 percent of South Asia's population and has historically been characterised by fertile soils, favourable climate, abundant surface and groundwater, and its rice-wheat systems based rural livelihoods. It provides food security for millions of people in the region. Himalayan glaciers are receding faster than glaciers in any other part of the world due to global warming and increase in anthropogenic emission of greenhouse gases, threatening to make the perennial rivers into seasonal rivers. The low-lying plains are home to annual floods. Global warming and changes in precipitation are expected to lead to more frequent, unpredictable and intense floods, higher temperatures and variable precipitation. Diminished flow in the rivers and decreased precipitation is expected to lead to water stresses. Increasing population and incomes are also leading to higher food demand, placing pressure on agricultural systems to produce more food on the same or less land and resources, whose availability is dwindling due to competition with other sectors. In the context of widespread rural poverty, depleting resource base, and rapid population growth, climate change threatens to additionally influence the fragile balance between production and consumption in this crucial "breadbasket" of South Asia. Meeting future needs while minimising further environmental degradation is a challenging task for all countries of the region (http://ccafs.cgiar.org/; IPCC AR4, Chapter 10; e-Journal Earth Science India, Vol. I (III), pp. 138-147; http://www.earthscienceindia.info/)

1.3 WHY A FOCUS ON WOMEN?

Whilst climate change will likely affect all rural livelihoods, it will have larger and more devastating implications for some. India's National Action Plan on Climate Change (NAPCC) says: 'The impacts of climate change could prove particularly severe for women. With climate change, there would be increasing scarcity of water, reduction in yields of forest biomass, and increased risks to human health with children, women and the elderly in a household becoming the most vulnerable. With the possibility of decline in availability of food grains, the threat of malnutrition may also increase. All these would add to deprivations that women already encounter. Women comprise about 65 percent of the agricultural workforce in South Asia, but constitute a majority percentage of the rural hungry and the malnourished.

In Bangladesh, for instance, almost one-third of women of reproductive age have a body mass index less than 18.5; this means they are very underweight. Even among the wealthiest quintile of society, 13 per cent of women are underweight. Girls are also slightly more likely to be stunted and underweight for their age, compared to boys of the same age (NIPOPRT, 2009). Climate change threatens to exacerbate food security and economic vulnerability, as women generally have fewer livelihood alternatives than men. In Nepal, women's contribution to agriculture, which is mostly rainfed and therefore climate-sensitive, is 60.5 percent of the total economy, while men contribute 39.5 percent (CBS, 2006). Crop farming, kitchen gardening, livestock rearing, and forest resource management are primarily done by women, although large differences exist in gender roles between caste/ethnic groups, economic class, and development regions in Nepal. Women have tremendous knowledge and skills regarding farming systems, natural resource management and biodiversity management in different agro-ecosystems (Shrestha, 1998). Moreover, as the custodians of water and food in their households, they are also responsible for feeding their families, even in times of economic stress and food shortage. It is crucial that women also be more conscious about the connections between climate change, agriculture, water, food, farm incomes, and their family's food security. Therefore, we focus on women not just because they are populations in need, but also because they are needed to guarantee a more climate resilient future.

1.4 PURPOSE OF THIS MANUAL

This manual will provide you with the information/content, tools and training skills required to deliver Capacity Enhancement Workshops (CEWs) to rural women farmers and rural elected women leaders to

- Raise their awareness of the causes and effects of climate change, especially on agriculture and food security.
- Help empower them to adapt successfully to projected changes by being aware of available government plans and programmes and field-based adaptation models by non-government actors.
- Make them aware of gender-differentiated impacts and the different roles that men and women need to play in adapting to these impacts.
- Equip them to evaluate the result of their training periodically – just after the training and then three and six months later. Traditionally, evaluation occurs only at the end of the training course, which does not allow participants time for the new information and concepts to settle in their minds. It happens too early for them to be able to analyse the challenges and opportunities of acting on the new information.

At the end of this Training of Trainers (ToT) course, trainers will:

- Be aware of the social constructions of gender and how this determines how men and women experience, and can respond to climate change
- Know what the projected climate change is in South Asia in general and the Indo-Gangetic Plains region in particular
- Be able to plan and deliver a training course to rural female legislators and women farmers which enables them to understand climate change and empowers them to understand behavioral changes and low cost technology practices that can help them to adapt
- Have the skills to undertake a longer-term evaluation of the impact of the training.

1.5 TRAINING AND FACILITATION SKILLS

(Adapted from ILO, 2002)

This manual equips trainers with

- Good facilitation techniques (see Box 1 below)
- Positive attitudinal and behavioural frameworks (see Box 2 below)
- Ability to design a training course from scratch (see Appendix A: 'How to design a capacity enhancement workshop.')

EXERCISE FOR TRAINERS

Reflect on training courses that you have attended in the past. For those that went well, why did they go well? What makes them so memorable?

See if you can replicate some of those techniques in your own training!

PLEASE NOTE!

A more detailed background for each training session has been provided for your use, but it will likely not be appropriate to give the same level of detail when you run the training. It is the trainer's role to gauge the level at which the session should be pitched. Each training context will be different and therefore it is not possible, nor desirable, to outline the exact lesson content in this manual.

PLEASE NOTE!

This manual provides you with the information and tools required to deliver the training courses but not a rigid schedule of what should be said, and when. This is impossible to do since the manner in which the training takes place needs to recognize the particular background and needs of the trainees. Instead we provide a session plan which outlines what is to be covered in each session; ideas for the successful use of concepts and materials in the sessions. Further background material is also provided for the trainers. It will be your responsibility to use the visual aids and exercises as appropriate to ensure that the learning objectives are met. This may mean additional emphasis on certain aspects of the session relative to others.

BOX 1.1 GOOD FACILITATION TECHNIQUES

Introductions

- Relax and energise the participants by making eye contact with as many as possible, exchanging smiles and warmly requesting them to settle down so that 'we' can together start the training programme.
- Provide the opportunity for participants to learn each other's names, the work they do and any institution/organisation they may belong to/work with. It is a good idea to use an ice-breaker to do this (see Appendix B: Ideas for "ice-breakers").

The beginning

- It is necessary to first get a sense of the level of knowledge present among participants. You can do this by asking participants to outline their expectations for the workshop; This can be done verbally by going around, or written on small pieces of paper/stick-ons. Volunteers from among the participants can subsequently be asked to group together similar expectations and then share these with the whole group;
- If you have planned and prepared well you should be able to link at least some of these expectations to the overall aims and objectives of the workshop. If you cannot make these links then you need to be flexible and adjust your training so that some of the expectations are met or, if this is not possible, clearly explain why the expectations cannot be met;
- Make sure that all participants understand the key aims and objectives of the workshop;
- Ensure all the activities planned for the workshop are acceptable to the participants;
- Agree to 'rules' of the workshop (e.g. mutual respect, one speaker at a time, no mobile phones, etc.).

During the sessions

- Adapt the programme to address expectations and make modifications to content or structure as requested by the group;
- Start every day with a review of what was covered the previous day. Then introduce the agenda for the day and seek inputs. For every training block explain what they will do, then do it, then summarize what was done including a list of key points (if possible summarized by participants);
- Use a variety of communication methods: key words, short illustrative stories, wide range of visual aids (simple, easy to read in colour and appropriate size), encourage plenary discussion, group work, individual work, role-playing, etc.;
- Also remember to incorporate activities that: invigorate participants (who are sleepy or looking bored), calm participants (who are over-excited) and that refresh participants (who have been working hard) in between training activities;
- Stick to time-frames as far as possible.

Conclusions

- Have a strong closing session where you review aims and expectations, summarize what was learnt, commit to action if appropriate, and close with appreciation and congratulations;
- Always build in an evaluation of the training as improvements can always be made (see Section 9).

BOX 1.2 ATTITUDE/BEHAVIOR AS TRAINER

- Stay relaxed and calm;
- Be open and honest;
- Be a good listener - do not panic when the group is silent; wait patiently for them to think about what they want to say;
- Do not interrupt people;
- Do not make judgments of people's responses (for example, saying that 'this is good, and that is bad') or humiliate anyone;
- Do not let arguments dominate the discussion; encourage participants to re-focus on the main topic;
- Be aware of language barriers; let people talk in the language in which they are most comfortable (and ask someone else to translate if necessary). If necessary, use visual aids and body language to help overcome language barriers;
- Have eye contact, stand up and move around, speak slowly, use your voice (intonation);
- Make your training as interactive as possible - involve and engage participants. Ask questions and invite participants to tell their stories;
- Use humour if natural for you, and smile;
- Choose words, stories, numbers, and cases that capture interest (use real examples to illustrate your points);
- Address concerns, questions, issues as raised by participants, while sticking to the main messages you want to get across.

1.6 DEFINITIONS OF KEY CONCEPTS

In carrying out gender-sensitive training on climate change, you must bridge disciplines, cultures and different fields of practice and it will be helpful to be familiar with the terms used by practitioners. The following list presents key terms used in this guide and others which you may come across in your background reading. Where necessary, definitions from different disciplines are included in order to clarify variations in approaches.

TABLE 1.1 | KEY CONCEPTS (adapted from CCAFS and FAO, 2011)

Adaptation	Adaptation refers to changes or adjustments in natural environments or human systems (e.g. communities; societies) to new or changing conditions. Adaptation to climate change refers specifically to adjustments in natural or human systems in response to new (actual or expected) climatic conditions and their effects, which makes these conditions less harmful or turns them into a beneficial opportunity.
Climate	Climate is usually defined as the "average weather" over a period of time ranging from months to thousands or millions of years although the usual period is 30 years. When determining the climate for a region, the average of temperature, precipitation, and wind, over a long period of time will be used.

Climate Change	Climate change refers to changes in either the average state of the climate (e.g. with regards to temperature, places may, on average, become hotter or colder) or in its variability (e.g. change in rainfall seasons), persisting for an extended period (typically decades or longer). Climate change results from an increase in the Earth's temperature caused by a build-up of carbon dioxide and other greenhouse gases in the atmosphere due to human activity, such as burning coal, oil, and natural gas for energy and transportation; deforestation; and various agricultural and industrial practices. For this reason it used to be called "global warming" but we now know that this is not an accurate description as increases in the Earth's temperature upset the balance of the climate system and may, in some regions, result in cooling (amongst other changes).
Climate system	The climate system is the highly complex system consisting of five major parts: the atmosphere (air), the hydrosphere (water), the cryosphere (ice and snow), the land surface and the biosphere (living organisms), and the interactions between them. The climate system changes over time due to its own internal dynamics and because of external forcing such as volcanic eruptions, solar variations, and human-induced activities.
Climate variability	Climate variability is the way that climatic variables (such as temperature and precipitation) depart from their average state, either above or below the value. Although daily weather differs from the climatic average (e.g. you can have a rainy day in an otherwise dry region), the climate is considered stable if the long-term average does not significantly change. For example, in the context of South Asia, the timing and strength of the monsoon has become increasingly less predictable, or more variable, in these last 3 decades. This is one way in which climate variability has increased. This variability may be due to natural processes within the climate system (internal variability) or due to outside, sometimes human-related, factors (external variability), like greenhouse gas emissions. See also greenhouse gas and climate change.
Coping	Coping is the short-term response that facilitates immediate survival, but does not reduce vulnerability in the long term. An example of coping might be rebuilding a house on the floodplain after a flood.
Development	Planned socio-cultural and economic change for the improvement of quality of living. The goal is to encourage change that is sustainable, equal and efficient.
Extreme weather event	An extreme weather event is an event that does not happen very often and which differs from the average climate for a region or place e.g., a typhoon or flooding.
Food security	Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their culturally-appropriate dietary needs for an active and healthy life. This relates to not only food production (agriculture), but also access (e.g., to markets), allocation (e.g., within the household, between men, women, and children; or within a village); and utilization (e.g., do they have sanitary means to cook/eat the food). A person may also have enough caloric intake (and therefore not be "hungry") but still be food insecure if he/she does not get enough nutritional value (vitamins, proteins, etc) from the food.
Gender	Unlike "sex" which refers to the biological differences between men and women, "gender" refers to socially constructed roles, responsibilities and opportunities associated with being a man or a woman, as well as the hidden power structures that govern the relationships between them. Inequality between the sexes is not due to biological factors, but is determined by the learnt, unequal and inequitable treatment socially accorded to women (UNDP, 2010).
Gender balance	The equal and active participation of women and men in all areas of decision making, and in access to and control over resources and services.
Gender equality	Equal participation of women and men in decision making, equal ability to exercise their human rights, equal access to and control of resources and the benefits of development, and equal opportunities in employment and in all other aspects of their livelihoods.
Gender equity	Fairness and impartiality in the treatment of women and men in terms of rights, benefits, obligations and opportunities. By creating social relations in which neither of the sexes suffers discrimination, gender equity aims at improving gender relations and gender roles, and achieving gender equality. The essence of equity is not identical treatment, treatment may be equal or different, but should always be considered equivalent in terms of rights, benefits, obligations and opportunities.

Gender roles	Those behaviors, tasks and responsibilities that a society considers appropriate for men, women, boys and girls. Gender roles are: socially constructed; learned; dynamic (they change over time); multi-faceted (they differ within and between cultures) and influenced by class, age, caste, ethnicity and religion.
Gender relations	The ways in which a society defines rights, responsibilities and the identities of men and women in relation to one another.
Greenhouse gas	Greenhouse gases are those gases in the atmosphere, both natural and human made, that trap heat close to the Earth's surface. Without these gases average temperatures on Earth would be too low to sustain life. See sections 5.3 and 5.4 for information on the greenhouse effect.
(Climate) Impacts	Consequences of climate change on natural and human systems.
Intergovernmental Panel on Climate Change (IPCC)	The leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.
Mitigation	In connection with climate change, mitigation means the human actions to reduce the amount of greenhouse gases in the atmosphere. In other words, actions to reduce the causes of climate change. Note that outside the debate around climate change, mitigation often has a different, almost opposite, meaning. In the context of disasters, mitigation means: measures taken to limit the harmful impact of natural hazards and related environmental and technological disasters e.g. the installation of flood-control dams. In other words, in the context of climate change, the word mitigation refers to reducing the causes of climate change, while in other contexts, the word mitigation refers to reducing or lessening a negative outcome.
Resilience	Refers to the amount of change a system can undergo without changing completely.
Risk	Risk is a combination of the size of an impact with the likelihood that it will occur. A system is "at risk" if it is very likely that it will be exposed to a large impact. Managing risk can be considered either a coping or adaptive behavior (see "coping" and "adaptation.")
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Uncertainty	An expression of the degree to which a value (e.g., the future state of the climate system) is unknown. Uncertainty can result from lack of information or from disagreement about what is known or even knowable. It may be the result of a number of factors from mistakes in the data to differences in how people define concepts, or uncertain projections of human behavior.
Value	Worth, desirability, or utility based on individual preferences.
Vulnerability (to climate change)	Vulnerability is the degree to which the unit of analysis (e.g. an individual or a community or a natural system) is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

TRAINER'S NOTES

PART TWO

WORKSHOP STRUCTURE

2. WORKSHOP STRUCTURE

Structure of the capacity enhancement workshops for elected rural women leaders and women farmers in South Asia – Bangladesh, India and Nepal

2.1 PURPOSE

This course is targeted at elected rural women leaders and women farmers in South Asia, specifically in the Indo-Gangetic Plains of Bangladesh, India and Nepal, to raise their awareness of the causes and effects of climate change, and to empower them to be able to adapt to the changing conditions to ensure food security.

Women have been chosen as the target audience in recognition of their greater dependence on natural resource- based livelihoods, which leaves them more vulnerable to climate change, compared to men. In patriarchal societies, women also typically have less formal decision-making power. However they have agency to act as the workers in the field, often have in-depth knowledge of agriculture, and act as the primary caretakers of their households.

2.2 LEARNING OBJECTIVES

By the end of the capacity enhancement workshop, *participants* will:

- Be aware of environmental systems, including the atmosphere and hydrological system
- Have knowledge of the mechanisms driving the greenhouse effect
- Be able to recognise the effects of humans on environmental systems, including the gender differences in activities by men and women

- Be able to define climate change and its causes
- Be aware of the likely projected changes in climate in their countries and generally in South Asia with regard to temperature and rainfall patterns, and its implications for agriculture-related livelihood activities, including the gender-differentiated impacts of climate change on agriculture-related tasks of men and women
- Have an overview of global climate negotiations and climate politics, how it affects their countries and their livelihoods and if gender is addressed in the global agreements signed by their countries.
- Have knowledge of a range of locally- appropriate, low-technology or behavioral adaptation strategies and mechanisms that they can employ to reduce adverse impacts from the projected changes in climate (including climate-smart agriculture); and gender barriers in accessing these technologies or mechanisms.
- Have knowledge of locally available government programmes and schemes which can be used for climate-smart agriculture and related livelihood options, and gender barriers in accessing these schemes and options.

2.3 SUGGESTED STRUCTURE

The circumstances around each capacity-building workshop are going to be different. The amount of time available for the course will depend on, amongst other things, the trainees and the time of the year. Furthermore, the level of prior knowledge of the workshop attendees will also vary and this will impact on how much you can cover in each course. As with all other aspects of leading these kinds of events, you will need to be flexible when determining what you can and should cover in each workshop. You should always be prepared to be able to either drop or add sections depending on how the course is going.

This manual outlines the structure and content for a full-day workshop (i.e., from 0900 hours to 1700 hours). It then suggests a structure for a shorter day (1000 hours to 1500 hours) for which the content can be extracted from the full day content.

2.3.1 FULL DAY WORKSHOP

The full day workshop is divided into four sessions: covering

a. Environment, climate change and the human footprint;

b. Agriculture - impact of climate change on agriculture and food security, especially the differentiated impacts on women's and men's work and responsibilities

c. Understanding gender, especially in agriculture and food security

d. What you, as a woman, can do to adapt to a changed environment to secure agriculture-related livelihoods.

Two sessions take place before lunch, and two after lunch. The day is structured so as not to assume prior knowledge, and to give a general outline of environmental systems principles, so that an appreciation of climate change can be integrated with other environmental stressors. As well as informing, the workshop aims to empower participants to be able to make changes in order to adapt to climate change. Throughout the activities, the focus is on where men and women may have differences in what is available to them to make these changes.

TIME DURATION	TOPIC	SUBTOPICS AND ACTIVITIES	TIME ALLOCATED (MINS)	PAGE REFERENCE
0900–0940	Introductions and Expectations	Activity: Icebreaker	10	
		Activity: What do participants already know? What are their expectations from the training course?	20	20
		Overview of capacity enhancement Workshop: Purpose and Expected Outcomes/ Learning Objectives	10	
0940–1030	Session 1: Environment, climate change and the human footprint	The Hydrological or Water Cycle (with visual diagram)	10	37
		The Atmosphere, the Greenhouse Effect, Human Activities and Climate Change (with visual diagrams)	20	38
		Quick overview of global climate negotiations and the place of gender in them	10	
		Group Activity: Looking for evidence for a Changing climate in the Indo-Gangetic Plains (in summer, monsoon rains and winter) over a generation (comparing the times of mothers and daughters). Understanding 'uncertainty' in climate change	20	41
1030–1100	TEA			
1100–1215	Session 2: Agriculture - impact of climate change on agriculture and food security,	Overview of climate change in the region with a focus on the local changes expected.	30	58
		Impacts of climate change on local agricultural cycles, including horticulture/ livestock/ fisheries/ forest land	45 min	62
		Group Activity: Listing the current and potential effects of climate change on agriculture and food security – for men and for women	Part of above	
1215–1300	LUNCH			
1300–1430	Session 3: Understanding Gender, especially in agriculture and food security	What is gender? Biological and social differences between men and women.	20	23
		Gender, agriculture and food security: different tasks, responsibilities and authority to bring about change	30	27
		Activity: Defining gendered agriculture-related tasks and responsibilities.	40	
		Activity: Defining the gender that has greater authority to bring about changes in the above tasks	Part of above	
1430–1500	TEA			

1500–1645	Session 4: What you, as a woman, can do to adapt to a changed environment to secure agriculture-related livelihoods.	What government plans/programmes/ schemes can help adapt to the changing climate?	40	68
		Understanding some field-level interventions by non-government actors that help in adapting to changing climate in agriculture part one	20	71
		Activity: Listing some government adaptive schemes, how it can improve food security part two	15	73
		Activity: Listing gender barriers to accessing government schemes and ways to overcome these barriers	30	76
		Activity: Videos of adaptation to climate change in the local region and the larger Indo-Gangetic Plans in South Asia	Part of all the above	77
1645–1700	Wrap-up Session Feedback and evaluation		15	

2.3.2 HALF-DAY WORKSHOP

	TOPIC	SUBTOPICS AND ACTIVITIES	TIME ALLOCATED (MINUTES)	PAGE REFERENCE
1000–1045	Introductions	Activity: Icebreaker	10	
		Activity: What do participants already know? What are their expectations from the course?	20	20
		Overview of capacity enhancement workshop	10	
1045–1115	Session 2: Climate change and the human footprint	Human Activities, the greenhouse effect and climate change	30	38
1115–1130	SHORT BREAK			
1130–1230	Session 3: Effects of a changed environment on humans	Impact of climate change on agriculture from a gender perspective	10	27
		Activity: Looking for evidence for a changing climate	20	29
		Activity: Defining current and potential impacts of climate change on agriculture on men and women separately	30	
1230–1315	LUNCH			

1315–1445	Session 4: What can you do to adapt to a changed environment	Understanding available government programmes that can help adaptive farming – for men and for women	30	71
		Activity: Responses to a changing climate with the help of government programmes	20	73
		Activity: Mapping out a more resilient future: adaptive measures in agriculture for men and women farmers	30	76
		Activity: Videos of adaptation to climate change in South Asia	10	77
1445–1500	Wrap-up Session Feedback and evaluation			

TABLE 2.1 | ACTIVITY FOR PARTICIPANTS: WHAT DO PARTICIPANTS ALREADY KNOW? WHAT ARE THEIR EXPECTATIONS FOR THE COURSE?

Aim	The aim of this activity is twofold: 1. To briefly determine what participants already know 2. To ascertain their expectations for the course.
Time	30 minutes for 20 participants
Materials	Notebook/ paper and pen/ stick-ons or post-it stickers or smaller pieces of paper Cards (white or coloured), Flipchart and flipchart pens Colored pens for participants Sticking tape or blue tag

Method	■ Facilitate two separate discussions around the above aims (try and keep the discussions separate – use a different sheet of paper for each discussion) To determine what participants already know: ■ A comprehensive pre-assessment would take a couple of hours for which we do not have time. However, it is useful to be able to see what the level of knowledge of the participants is before you start the course. ■ For the first aim, ask a few simple questions, for example: • What is climate change? • What causes climate change? • Who causes climate change? • Is climate change something which affects you? How? • How does it affect you as a woman/man, compared to the other gender? • Is there something you can do to stop climate change? Give example(s). Is there anything that you feel you cannot do here because you are a woman; or, in case the participant is male, you can do something that a woman may not be able to do because of her gender? ■ Do not be judgmental about participants answers – this is not the time to start correcting people. All answers are valid as they show the level of knowledge. ■ Take your own notes as participants respond – it is not necessary to put these down on the flipchart as these are notes for your own evaluation. ■ If possible, try and identify (even by clothing or where they are sitting if you do not know names yet) who says what so you can ask probing questions at the end of the course as to whether individuals have learnt something new/ changes their minds about something ■ Make sure you give everyone in the group a chance to respond. To ascertain what participants expect from this workshop: ■ Ask the question and then give everyone a chance to think about their answer. ■ Give each participant a chance to respond individually and write their answers on the flipchart. If you are able, it is a good idea to write each point down on a separate piece of paper and then stick it up as this gives you the opportunity to group similar expectations. ■ This can also be done by pairing participants and combining this with the ice-breaking exercise where participants get to know their partner and also share their expectation(s). Each pairs either share the expectations verbally and someone writes these on a flip chart or on separate pieces of small paper/post-its which can then be grouped together. ■ When giving the overview of the course you will hopefully be able to refer back to this sheet and show which sections aim to answer/ cover which expectations. If there are expectations that will not be covered, explain why and/ or explain that they will possibly be included in future courses.

TRAINER'S NOTES

PART THREE

UNDERSTANDING GENDER IN THE CONTEXT OF CLIMATE CHANGE AND AGRICULTURE

3. GENDER, CLIMATE CHANGE AND AGRICULTURE

Although this is not a course on gender, you will need to understand gender differences in the area of agriculture and food security and how gender differences matter when dealing with climate change solutions. It is for that reason that we have included this section in the training manual, and will have a session on it during the training of trainers' session.

3.1 DEFINING 'GENDER'

Unlike "sex" which refers to the biological differences between men and women, "gender" refers to socially constructed roles, responsibilities and opportunities associated with being a man or a woman, as well as the hidden power structures that govern the relationships between them. Inequality between the sexes is not due to biological factors, but is determined by the learnt, unequal and inequitable treatment socially accorded to women (UNDP, 2010).

Gender is a central organizing factor in societies, and throughout the world there are gender-specific differences in consumption patterns, lifestyles, access to and control of power and resources and vulnerability to climate change (UNDP, 2010). In fact, the influence of gender on rural people's lives and livelihoods is so substantial that "by any indicator of human development, female power and resources are lowest in rural areas of the developing world" (FAO, 2011a).

In other words, gender often constrains women to an unequal position in society in comparison to men. The opposite of this, gender equality, means equal participation of women and men in decision-making, equal ability to exercise their human rights, equal access to, and control of, resources and the benefits of development, and equal opportunities in employment and in all other aspects of their livelihoods (CCAFS and FAO, 2011).

One way toward reducing gender inequalities is through the pursuit of gender equity, which means "fairness and impartiality in the treatment of women and men in terms of rights, benefits, obligations and opportunities. The essence of equity is not identical treatment - treatment may be equal or different, but should always be considered equivalent in terms of rights, benefits, obligations and opportunities" (FAO, 2011a).

3.2 WHY IT IS IMPORTANT TO CONSIDER GENDER WHEN UNDERTAKING TRAINING AROUND CLIMATE CHANGE?

There are gender differences in the causes and effects of climate change and, critically, gender differences that determine how well men and women are able to respond to climate change. In patriarchal societies, the way in which society determines appropriate behaviour for men and women, distributes wealth, power and authority, means that typically women are more disadvantaged than men in most societies and especially in South Asia.

United Nations' Human Development Report (HDR) 2011 shows that the South Asia region is particularly trailing behind other regions, even economically less developed Africa, in its Gender Inequality Index, the Asia-specific HDR highlights women's economic, legal, and political rights and how they impact human development in the region. The reports says that African countries are comparatively better than Asia with regard to women owning farms and women continue to earn less than men in this region. Asia also ranks second lowest (better only than the Arab states) in women's political voice. Laws that are meant to ensure justice fail to treat men and women equally and fairly. Bangladesh, India and Nepal all rank in the lower spectrum of the range which measures all countries on this index. Women also have the world's lowest levels of schooling and the highest rates of illiteracy. In all developing regions, female-headed rural households are among the poorest of the poor" (FAO, 2011a).

BOX 3.1 EVIDENCE FOR WOMEN'S SUBORDINATION RELATIVE TO MEN ON A GLOBAL LEVEL

- Approximately 70% of the global poor (those who live on less than $1 a day) are women.
- Women work two-thirds of the world's working hours, yet receive only 10% of the world income.
- Women own only 1% of the world's property
- Globally, only 8% of cabinet members are women
- 75% of the world's 876 million illiterate adults are women.

Source: UNDP et al (2009, 14 in UNDP, 2010)

Climate change is adding another layer of inequality. In Bangladesh, for instance, rates of child marriage and adolescent motherhood are among the highest in the world and coping with climate stress for young mothers on the farm is an acute burden. Again, women's employment rates remain low despite progress, and their wages are roughly 60-65 per cent of male wages (BMMS, 2001). Almost one-third of women of reproductive age have a body mass index less than 18.5; this means they are very underweight. Even among the wealthiest quintile of society, 13 per cent of women are underweight. Girls are also slightly more likely to be stunted and underweight for their age, compared to boys of the same age (NIPOPRT, 2009). Studies show that women and girls continue to give more food and the more nutritious food to men and the boys even when agricultural productivity is falling due to climatic changes in temperatures and rainfall patterns.

CASE STUDY FOOD SECURITY FOR JUST A MONTH IN A YEAR IN KHALAPATA, BAJHANG, NEPAL

"I never went to school and now it's like being blind. We're poor because we do not have enough land. We don't get money from anything except wage labour. My husband has been working in Tamil Nadu for 14 years as a security guard. He sends 3,000–4,000 rupees (NPR) (approximately USD 40–55) every 2 to 3 months. It is never enough for me, our two small children, and my husband's second wife. We have taken many loans. Whatever we earn is either spent on food or to pay back some of the loans. We sell some vegetables when we can but it is very infrequent. We mainly do wage labour for about NPR 200–250 (USD 3) a day, in addition to working in our field. Harvests have decreased; insects eat the wheat and rice. Mostly there's no water and when it does come it's too intense and our rice rots. What we get from the land is only enough to feed us for a month." - A *30-year-old female farmer*.

In rural Nepal, it is generally men who migrate to find jobs. For women, the result of men's migration is usually an increased workload and all the added stress that this creates.

It is for this reason that the training that you will be running is targeted specifically at rural elected women leaders and women farmers.

3.3 GENDER, GENDER NEEDS AND GENDER ROLES

"Gender analysis is the study of different *roles* and responsibilities of men and women; their differentiated *access to resources* and their priority *needs* to better understand and address gender inequalities" (FAO, 2011a).

3.3.1 GENDER NEEDS

Women and men have similar needs but gender inequality has given different emphasis to different kinds of needs. Women's needs can be distinguished as either *practical gender needs* or *strategic gender needs* (see Box 3.2). By distinguishing between these needs and the related constraints in meeting them, it is possible to differentiate between needs that relate to women's daily life (practical) and those that transform current gender roles and relations.

BOX 3.2 PRACTICAL GENDER NEEDS AND STRATEGIC GENDER NEEDS

Practical gender needs (PGNs) are what women identify as their needs, *given* accepted gender roles in society. PGNs do not challenge, but rather arise from, gender divisions of labour and women's subordinate position in society. PGNs are a response to immediate perceived necessity, identified within a specific context. They are practical in nature and often arise from inadequacies in living conditions such as water provision, health care and employment. This is because women have a greater role to play in caring for the family and meeting their household needs.

Strategic gender needs (SGNs) are the needs women identify *because* of their subordinate position in society. SGNs do challenge existing roles, and meeting SGNs would require changing these roles to help women achieve greater equality.. They vary according to particular contexts, related to gender divisions of labour, power and control, and may include such issues as legal rights, domestic violence, equal wages, and women's control over their bodies.

(Source: Moser in ILO, 1998)

3.3.2 GENDER ROLES

Gender is shaped by other social factors, including country/region, ethnic group, age, economic class, and religion. Gender defines the roles and relations between men and women, as well as boys and girls. Since men and women play different roles, they often face very different cultural, institutional, physical and economic constraints, many of which are rooted in systematic biases and discrimination (ILO, 1998).

BOX 3.3 MEN AND WOMEN'S MULTIPLE ROLES

Reproductive role: Childbearing/rearing responsibilities, and domestic tasks done by women, required to guarantee the maintenance and reproduction of the labour force. It includes not only biological reproduction but also the care and maintenance of the work force (male partner and working children) and the future work force (infants and school-going children).

Productive role: Work done by both men and women for pay in cash or kind. It includes both market production with an exchange- value, and subsistence/home production with actual use-value, and also potential exchange-value. For women in agricultural production, this includes work as independent farmers, peasant wives and wage workers.

Community managing role: Activities undertaken primarily by women at the community level, as an extension of their reproductive role, to ensure the provision and maintenance of scarce resources of collective consumption, such as water, health care and education. This voluntary unpaid work is undertaken in 'free' time.

Community politics role: Activities undertaken primarily by men at the community level, organising at the formal political level, often within the framework of national politics. This is usually paid work, either directly or indirectly, through status or power.

(Source: Moser, in ILO, 1998)

These roles determine gender relations, that is, the ways in which a society defines rights, responsibilities and the identities of men and women in relation to one another. In addition to the roles ascribed to men and women in relation to each other, men and women each have multiple roles (see Box 3.4). Typically, men are able to focus on one task at a time (e.g. they work as a labourer) while women often have to undertake many tasks all at the same time (e.g. they may need to work in the fields and look after children at the same time).

Gender roles shape men's and women's decision making in all areas of household life, from agricultural decisions such as what crops to grow or when to harvest, to how to earn or spend income, to what foods to eat and how to raise their children. Depending on the context, it may be typical for men and women to have different spheres of decision making or they may share in decision making. Individuals' decision making is shaped by the information and knowledge they possess, their level of participation (this may be dictated by social norms), the options available to them, and the urgency and risk they perceive is posed by the decision.

3.3.3 ACCESS TO RESOURCES

The term *resources* refer to the five types of inputs, or "capital assets," that a person or group possesses. These are:

- Physical: land, livestock, fertilizers, mechanical equipment
- Human: farm labour (and thus, physical health of workers)
- Financial: monetary income or savings
- Social: education
- Institutional: extension services, government social programs

The gender gap in access to these resources between men and women and ways for reducing the gaps have been documented and, as can be seen in the table below (Table 2), there are many instances in which these types of resources overlap.

TABLE 3.1 | GENDER GAPS IN ACCESSING RESOURCES IN AGRICULTURE (MODIFIED ROM FAO, 2011B)

	THE GENDER GAP	HOW TO CLOSE THE GAP
PHYSICAL CAPITAL: Land	Across the world, men hold titles to a disproportionate amount of land. ■ *In South Asia, women constitute two-thirds of the agricultural workforce but own less than 10% of agricultural lands.*	Closing the gap in access to land and other agricultural assets requires, among other things, reforming laws to guarantee equal rights, educating government officials and community leaders and holding them accountable for upholding the law and empowering women to ensure that they are aware of their rights and able to claim them.
HUMAN CAPITAL: Labour Markets	Farms run by female headed households have less labour available for farm work because: 1. these households are typically smaller and have fewer working-age adult members, and 2. women have significant, unpaid household duties that take them away from more lucrative activities. Women's labour is also valued less. (www.wageindictor.org) ■ *In India, women agricultural workers get 50% lower average wage for casual work, and 20% lower wage for the same task, as compared to men.* ■ *In Bangladesh, women fry catchers/ sorters get only about 64% of what men fry catchers/sorters do.*	Women's participation in rural labour markets requires freeing women's time through labour-saving technologies and the provision of public services, raising women's human capital through education, eliminating discriminatory employment practices, and capitalizing on public works programmes. For example, in India, some studies have seen marginal improvements in women's capacity and finances due to the government's Rural Employment Guarantee Act. Freeing up financial capital to women (e.g., via microfinance grants), especially when given in combination with general financial literacy support, has also been shown to raise women's human capital.

Financial Services	Smallholders everywhere face constraints in accessing credit and other financial services, but in most countries the share of female smallholders who can access credit is much lower than for male smallholders.[1] ■ *In India, although 35.8% of women interviewed in one survey knew of a microcredit program, only 4.4% have taken out a loan from one.* ■ *Only 10.7% of rural Indian women have a bank or savings account that they themselves use.* Access to credit and insurance are important for accumulating and retaining other assets, and have also been associated with improvement in women's self-esteem and empowerment.	Closing the gap in financial services requires legal and institutional reforms to meet the needs and constraints of women and efforts to enhance their financial literacy. Innovative delivery channels and social networks can reduce costs and make financial services more readily available to rural women.
Social Capital	Globally, education has seen improvements in gender parity at the national level, with females even exceeding male attainment levels in some countries, but in most regions women and girls still lag behind. The gender gap in education is particularly acute in rural areas, where female household heads sometimes have less than half the years of education of their male counterparts. ■ *In India, 65.5% of adult women are literate, compared to 82.1% of adult men (Census 2011).* ■ *In Nepal, 34.9% of women are literate, to 62.7% of men.*	Women's groups and other forms of collective action can be an effective means of building social capital and addressing gender gaps in other areas as well, through reducing transactions costs, pooling risks, developing skills and building confidence. Women's groups can be a stepping stone to closing the gender gap in participation in other civil society organisations and government bodies.
Technology	Women are much less likely to use purchased inputs such as fertilizers and improved seeds or to make use of mechanical tools and equipment. In many countries women are only half as likely as men to use fertilizers. Within the agricultural realm, women also have much less access to agricultural extension workers. ■ *In South Asia in the 1980s and 1990s, women received only 5% of loans from financial institutions.*	Improving women's access to agricultural technologies can be facilitated through participatory gender-inclusive research (e.g., field trials with women) and technology development programmes, the provision of gender sensitive extension services and the scaling up of Farmer Field Schools.

FAO (2011b) concludes that "while the size of the gender gap differs by resource and location, the underlying causes for the gender asset gap are repeated across regions: social norms systematically limit the options available to women". In addition, the gains from closing this gap include higher productivity, reduced hunger, and other social and economic benefits.

1 www.oecd.org/dev/perspectivesonglobaldevelopment/46838043.pdf

EXERCISE FOR TRAINERS

Discussing gender roles and their social construct.

It is clear from the preceding discussion that the roles that society ascribes to men and women differ from country to country, and within countries between different contexts. Understanding these roles is important for designing appropriate strategies to adapt to climate change. Spend 10-15 minutes thinking about female, male, girl child and boy child roles within your culture, and note them down in the following table. You can also look at roles in a specific area like agriculture. After 10-15 minutes, these roles will be compared and contrasted in a plenary discussion.

WOMEN'S ROLE	
MAN'S ROLE	

3.4 GENDER AND CLIMATE CHANGE

Climate change is already having a noticeable, and indeed worsening, effect on communities (IPCC, 2007). The developing world will bear the heaviest burdens of climate change, despite having contributed the least to the causes of anthropogenic (human-made) climate change, women will likely be especially affected (UNDP, 2010)(Table 6).

TABLE 3.2 | POTENTIAL CLIMATE CHANGES AND THEIR EFFECTS ON WOMEN (SOURCE: BASE ON UNDP ET AL, 2009, 82-83, IN UNDP, 2010)

CLIMATE CHANGE EFFECTS	EXAMPLES / TRANSLATES LOCALLY TO…	POTENTIAL EFFECT ON WOMAN	
Direct	Increased land temperature	Hot days become hotter (maximum temperature increases) and more frequent (number of hot days increases)	Women work longer days because they cannot do labour during the scorching afternoons, so they start earlier and finish later. Crops and livestock may face heat stress, affecting the subsistence crops that the families rely on to eat. Women are principally in charge of feeding their households.
	Flooding	Cumulative salinization in wide swaths of coastal Bangladesh	Can affect staple crops, of which women are the primary producers.
		The 2010 floods in Pakistan destroyed livelihoods and caused displacement.	Displaced women often ended up in camps. Some camps had no bathing facilities, and where men could bathe outside this was not an option for women. Similarly it is culturally taboo for women to receive medical treatment from men, and too few women doctors were provided.
	Increased drought and water shortage	2008-2009 winter drought in Nepal – one of the winters with the lowest rainfall on record, and reached a significant part of the country	Women and girls in developing countries are often the primary collectors, users and managers of water. Water shortage may have health effects, and also increase women's labour—requiring them to go farther from their homes to fetch drinking water for their families. Droughts may also result in widespread crop failure, jeopardizing families' livelihoods. They may even have secondary effects such as lower school enrolment figures for girls or less opportunity for women to engage in income- generating activities.
	Increased extreme weather events	Greater intensity and quantity of cyclones, hurricanes, floods and heat waves. e.g. Catastrophic rainfall events in Mumbai (2005) and Rajasthan (2006).	A sample of 141 countries over the period 1981–2002 found that natural disasters (and their subsequent impact) kill more women than men on average or kill women at an earlier age than men.

Indirect	Increased epidemics	Climate variability accounted for an estimated 70% of variation in recent cholera series in Bangladesh.	Women have less access to medical services than men, and their workloads increase when they have to spend more time caring for the sick. Poorer households affected by HIV/ AIDS have fewer resources to adapt to the effects of climate change. Adopting new strategies for crop production or mobilizing livestock is harder for female-headed and infected households.
	Loss of species	By 2050, climate change could result in a species extinction rate of between 18 and 35%.	Women often rely on crop diversity to accommodate climate variability, permanent temperature change will reduce agro-diversity and traditional medicine options, potentially affecting food security and health.
	Decreased crop production	In India wheat yields may drop by 2%, and in Pakistan cereal crops are already at the margins of tolerance, and may drop by 6-9% in sub-humid, semi-arid and arid areas.	Rural women in particular are responsible for much small-holder production, and a decrease in production may exacerbate their nutrition levels, which already lag behind those of men.

3.4.1 WOMEN'S VULNERABILITY TO CLIMATE CHANGE

Women are vulnerable to climate change not because of natural weakness (i.e. because of their sex) but rather because of socially and culturally constructed roles ascribed to them as women (i.e. because of their gender). Given the severity of gender inequality, especially in the developing world, climate change is likely to magnify the existing of gender disadvantage. There are several factors which will exacerbate this (UNDP, 2010):

- Limited access to resources:
  In many poor communities, women have limited access to important resources such as land, livestock, tools and credit. Lack of access to land and security of tenure is often regarded as an important source of women's vulnerability. Even when women do have access to resources, they often have limited control over it. For example, where women do not own land, they may not be able to make decisions regarding its use.

- Dependence of natural resources and the gender-based division of labour
  As the main users and managers of natural resources (e.g. fetching water and wood for use in the house), women depend on the resources most at risk from climate change. When these become scarce, women often have to work harder, or go farther, to obtain these resources for their families. Climate change is likely to affect the availability of natural resources and potentially affect the growth of staple crops.

- Lack of education and access to information
  In the developing world especially, the education of boys is regarded as more important than the education of girls. Girls are therefore much more likely to be pulled out of school when resources are scarce or when more help is needed at home. Without education women are at a disadvantage, as they have less access to crucial information and fewer means to turn the information into usable knowledge about, for example, climate risks and adaptation. Limited education also means that women are less likely to be able to diversify their livelihoods by entering into formal, paid, employment which further reinforces their subordinate position relative to men.

- Limited mobility

  Migration is often used as a coping mechanism in times of crisis. However, social and cultural norms, along with limited education often prevent women from leaving their homes where climate change has hit the hardest. As a result, they miss out on the economic opportunities and enrichment of personal experience that migration affords. Moreover, when men migrate seasonally, women are often left to manage all the tasks that two people used to tend to, thereby increasing their workload substantially.

  A 2010 CCAFS study of 980 households in Bihar identified migration as the number one coping strategy to adverse weather events. In every indicated case of migration, it was a male member of the family (the father, in all but one instance) who migrated.

- Limited roles in decision-making

  Women's opinions are often not accorded the same status in family and community decision-making processes. This is especially unfortunate given women's close relationship with natural resource management and awareness of conservation and possible adaptation measures.

- Lower capacity to cope with natural disasters

  As well as bringing about incremental change in temperature and precipitation, climate change is also projected to change the frequency and magnitude of hazards such as cyclones. When disasters occur, more women die than men, which reflects women's social exclusion: they are less able than men to run; often have not learnt to swim, and have behavioral restrictions which limit their mobility in the face of risk (UNDP, 2010).

BOX 3.5 FIELD VIEW

Bangladesh

Research shows that the water logged areas in South-west belt in Bangladesh, where no land production has been possible since last 7-8 years, male members in these areas often migrate leaving the families behind. Women take most of the burdens to maintain and raise these families. Fulfillment of women's traditional gender-based roles on the customary "sexual division of labor" becomes increasingly difficult under flooding condition elsewhere. Preparing dry food for emergency, collecting banana stems and preparing a raft, collecting and safeguarding biomass for cooking, safeguarding poultry and livestock, improving storage condition of seeds for the post-flood season, making an extra portable earthen cooking stove – all these are additional to daily household activities. During flood people confront acute shortages of potable water and edible food stuff. In deeply flooded areas young girls often scrounge for edible reeds and roots while women of all ages travel long distances by boat or raft to fetch drinking water.

India

Climate change has led to increased labour for farm women. "Scarcity of rainfall in the monsoons is leading to decreasing soil moisture and an increase in insects and weeds," says Manju of village Shadeykhurd in district Sant Kabir Nagar, Uttar Pradesh. Manju now spends much more time weeding than she did before: "I have to be ready all the time with my *khurpi* (traditional weeding tool)," she says.

Nepal

In a study done by ICIMOD, Nearly two-thirds of respondents (61%) thought that an increase in male migration rates was leading to increased feminisation of agriculture, which was increasing women's workloads. Around 80% believed that they have to travel longer distances to fetch fodder – the burden of fetching fuel and fodder falls solely on women. Similarly, drinking water has to be carried from the nearest springs (some of which are drying up) or someone has to wait in a queue of 2–3 (or more) hours at the tap, another responsibility adding to the workload. Measures to counter the impacts of climate change – for example, repeat sowing in the event of crop failures; spreading traditional and chemical fertilizers and pesticides; walking longer distances to fetch water and fodder – are all activities implemented by women and adding to their regular workload. The limited number of oxen available for ploughing in the villages (and the inability to afford to rent these animals) is compelling women to use shovels to plough their fields.

3.4.2 GENDER AND ADAPTATION TO CLIMATE CHANGE

Women are not just victims of adverse climate effects due to their vulnerability; they are also key active agents of adaptation. This is due to their often deep understanding of their immediate environment, their experience in managing natural resources (water, forests, biodiversity and soil) and their involvement in climate-sensitive work such as farming, forestry and fisheries. Furthermore, women typically form strong social networks within their communities which places them in the ideal position to organize collectively around the risks posed by climate change. Despite this, women are usually excluded from decision-making processes and thus prevented from contributing their unique knowledge and experience to the struggle to adapt to a changing climate (UNDP, 2010).

A gendered approach towards adaptation is important – if the differences between men and women are overlooked, then gender inequality and women's disproportionate vulnerability to climate change may be reinforced. If gender is overlooked in the planning of adaptation measures then these measures may not be appropriate or sustainable. For example, women are often in charge of collecting water for the household, but if they are not consulted with regards to the placing of new wells then the wells may be built too far from the village, thereby actually increasing women's burdens (UNDP, 2010).

It is important to bear in mind that a gender-sensitive approach does not mean only considering the needs of women. The complementarily of men's and women's knowledge and skills is key to designing and implementing effective and sustainable adaptation initiatives, answering to their specific needs and ensuring that both benefit equally from the development process (UNDP, 2010).

ADDITIONAL RESOURCES:

UNDP guidebook on Gender, Climate Change and Community-Based Adaptation http://www.beta.undp.org/undp/en/home/librarypage/environment-energy/climate_change/gender/gender-climate-change-and-community-based-adaptation-guidebook-.html

Global Gender and Climate Alliance/IUCN/UNDP Training Manual on Gender and Climate Change
http://cmsdata.iucn.org/downloads/eng_version_web_final_1.pdf

UNDP Resource Guide on Gender and Climate Change
http://content.undp.org/go/cms-service/download/publication/?version=live&id=2087989

World Bank/FAO/IFAD Gender in Agriculture sourcebook
http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook.pdf

TRAINER'S NOTES

PART FOUR

ENVIRONMENT, CLIMATE CHANGE AND THE HUMAN FOOTPRINT

4. INTRODUCTION

4.1 INTRODUCTION TO ENVIRONMENTAL SYSTEMS AND CLIMATE CHANGE

The main aim of this initial session is to introduce participants to the concept that all aspects of the environment are interconnected and that changes in one aspect will inevitably lead to changes (positive and negative) in other aspects. In the short time we have available, it is important to understand the systems approach adopted by several natural cycles. Though it is not possible to go into great depths about this understanding, we have chosen to concentrate on the hydrological or the 'water cycle' to demonstrate this approach in a little more detail. Not only is this a very important natural cycle but it is one which most people will be familiar with (at least aspects of it) and it effectively demonstrates the inter-linkages between different aspects of the environmental systems and is core to the ocean-atmosphere system which influences climate change, the area under study in this session. Once participants understand how a cycle works, it is possible to demonstrate how changes in one aspect will lead to further, sometimes unanticipated, changes. The earth-atmosphere system will then be explained in this session because the phenomena of weather and climate take place in the atmosphere. Participants will first be presented with an overview of the importance of the atmosphere in maintaining life on Earth before the focus turns to the emission of greenhouse gases and their impact on the atmosphere – the Enhanced Greenhouse Effect. The role of human activities in this earth-atmosphere system will be explained to show how it influences the natural system – even when impacts may be felt only on one part of the entire system. The carbon cycle is given more briefly to help participants understand climate change by combining the water cycle and the carbon cycle.

4.2 LEARNING OBJECTIVES

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

- Identify and explain the different elements of the hydrological cycle
- Explain how these different elements fit together to form a continuous cycle
- Explain the earth-atmosphere system and how the hydrological cycle influences this
- Have knowledge of the greenhouse effect, and the enhanced greenhouse effect
- Identify the types of human activity that affect the functioning of environmental cycles, with particular reference to greenhouse gas emissions
- Explain the connections between the earth-atmosphere and the ocean-atmosphere systems and explain the causes of climate change

At the end of the session, *participants* will:

- Be aware of environmental systems, including the atmosphere and hydrological system
- Have knowledge of the mechanisms driving the greenhouse effect
- Be able to recognise the effects of humans on environmental systems
- Be able to define climate change and its causes

4.3 WHAT IS CLIMATE CHANGE?

Climate change refers to changes in either the average state of the climate (e.g. with regards to temperature, places may, on average, become hotter or colder) or in its variability (e.g. change in rainfall seasons), persisting for an extended period (typically decades or longer).

BOX 4.1 WEATHER AND CLIMATE.

Heat in the atmosphere powers the Earth's weather and climate.

Weather is the mix of events that happen each day in our atmosphere including temperature, rainfall and humidity.

Climate is the average weather pattern in a place over many years. According to research, climates are changing because our Earth is warming. This does not mean that it is getting hotter everywhere; global climate change is actually much more complicated than that because a change in the temperature can cause changes in other weather elements such as clouds or precipitation.

(www.ucar.edu)

Climate change results from an increase in the Earth's temperature caused by a build- up of carbon dioxide and other greenhouse gases in the atmosphere due to human activity.

The important thing to note here is that the women attending training are likely to be very low emitters of greenhouse gases but one of the highest among those impacted by climate change. Both the emitters and those impacted have a role to play in dealing with climate change. This is because the atmosphere is a global system, like the hydrological cycle and the carbon cycle outlined below. There is only one atmosphere and it is shared by all countries and all people on earth – so wherever the emissions come

from, we all feel the changes that result in the atmosphere and we all have a role to play in setting it right, or adapting to the changes.

Figure 4.1 | HUMAN CARBON FOOTPRINT (WWW.HOMAHKU.COM)

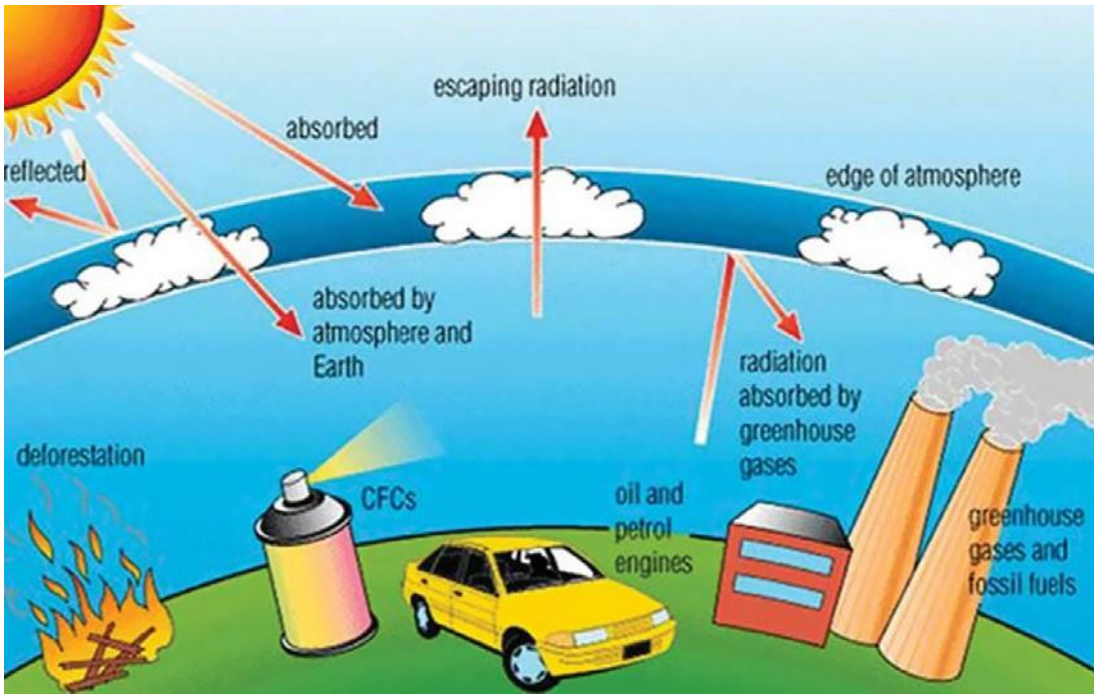


TABLE 4.1 | GREENHOUSE GASES AND HUMAN SOURCES

GREENHOUSE GAS	HUMAN SOURCES
Carbon dioxide	Burning fossil fuels (industry, transport, domestic use) and deforestation
Methane	Cows
Ozone	Industry
Nitrous oxide	Fertilizers
Chlorofluorocarbons	Refrigeration systems

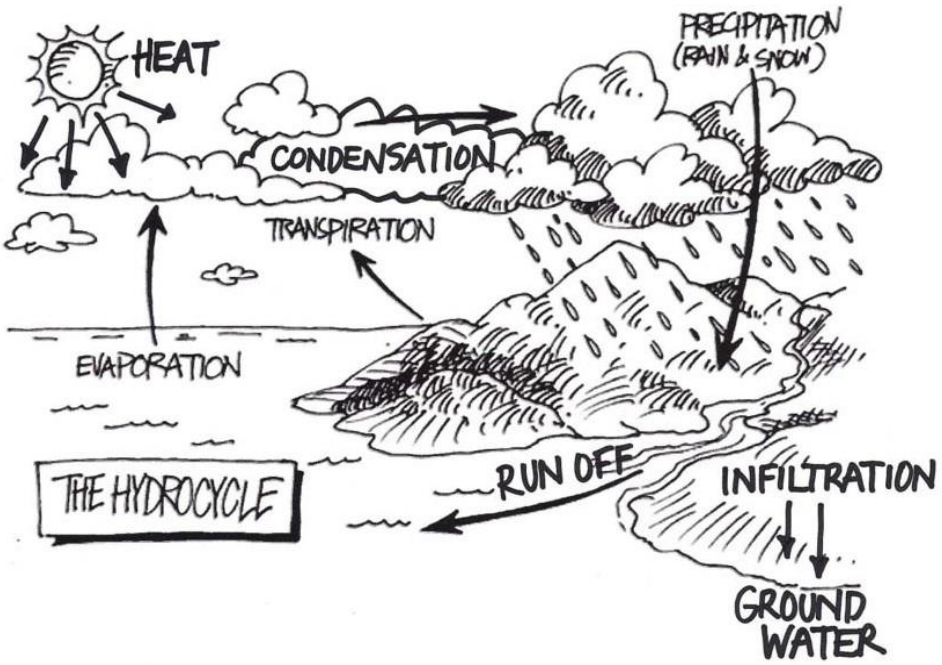
4.4 ENVIRONMENTAL CYCLES

The biosphere is the portion of earth in which all known life forms exist. It occupies a thin layer of air (atmosphere), water (hydrosphere), and land (lithosphere).

Just as humans require a source of energy, water and the chemical components of our bodies, so too does the entire global biosphere. These are provided to the biosphere by global energy and chemical cycles. The basic concept of a cycle is that certain substances move endlessly throughout the earth's biosphere, hydrosphere, atmosphere, and lithosphere, existing in different forms and being used by different organisms at different times, but always moving, always circulating. One of the most important cycles is the hydrological, or water cycle. Water, in its different forms, cycles continuously through the lithosphere,

hydrosphere, atmosphere, and biosphere. At one time or another, all of the water molecules on earth have been in an ocean, a river, a plant, an animal, a cloud, a raindrop, a snowflake, or a glacier. (www.ucar.edu).

FIGURE 4.2 | THE HYDROLOGICAL CYCLE (ADAPTED FROM WWW.FWEE.ORG)



4.4.1 THE HYDROLOGICAL CYCLE OR WATER CYCLE

Heat from the sun causes water to EVAPORATE from oceans, rivers, lakes and even puddles. "Evaporate" means it turns the water from a liquid to a gas, or "vapour". Warm air currents rising from the earth's surface lift this water vapour up into the atmosphere.

When the air currents reach the cooler layers of the atmosphere, the water vapour condenses around and clings onto fine particles in the air. This step is called CONDENSATION. When enough vapour attaches itself to tiny pieces of dust, pollen or pollutants, it forms a cloud.

As the air gets more and more moist, the droplets that form the clouds grow larger and larger. Eventually they will get so big that the swirling atmospheric winds can no longer hold them up. The droplets then fall from the sky as PRECIPITATION. Precipitation can be in the form of rain, snow, sleet or hail depending on other atmospheric conditions such as temperature.

Once the precipitation reaches the ground, several things can happen to it. First, it might be RE-EVAPORATED. For instance, we've all seen the mist rising off hot surfaces after a summer shower. If it is not re-evaporated, much of the water will become RUN–OFF that goes into streams and rivers as it flows back to the ocean.

Some of the precipitation will be absorbed into the ground. This is called INFILTRATION. Once in the ground, the water can join the earth's GROUND WATER supply. This is one of the world's largest storehouses of water. The water could also be absorbed from the ground by the roots of plants.

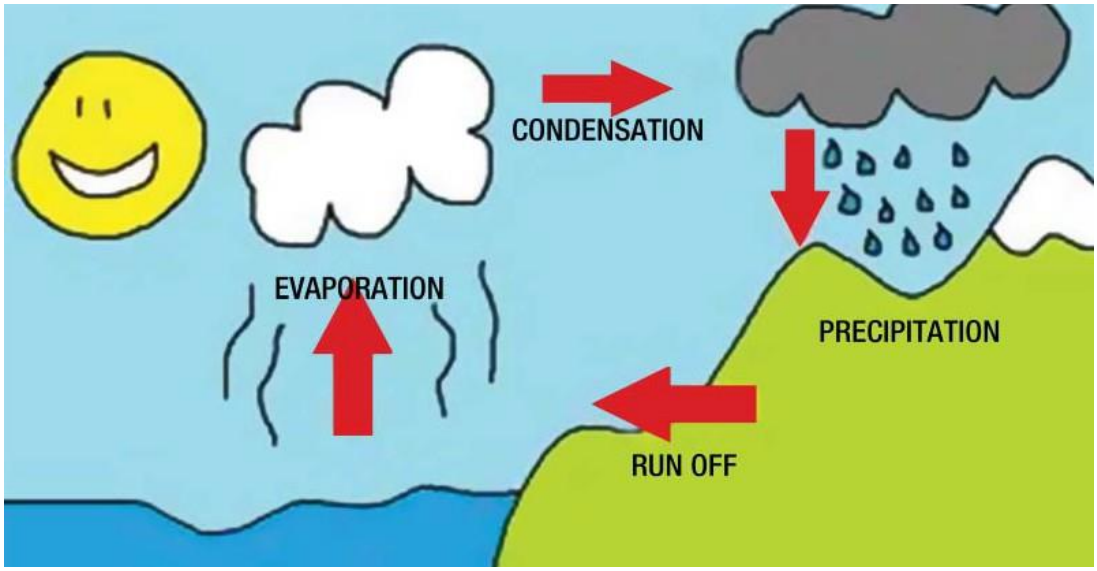
Another form of evaporation that contributes to the water cycle is TRANSPIRATION. Here, water given off through the pores of plants and animals joins the atmosphere as a vapour.

With transpiration and evaporation, the cycle begins again: EVAPORATION, CONDENSATION, PRECIPITATION, RUN-OFF, INFILTRATION, and TRANSPIRATION (www.fwee.org).

4.4.2 THE LAND AND SEA BREEZE CYCLE

Linked to this water or hydrological cycle is 'air cycle' which causes 'land breezes' and the 'sea breezes' and which determine how climate will change in a geographical region. Nature has a simple rule. The lighter hot air rises and the heavier cold air sinks. When the earth absorbs the sun's heat, land becomes hotter quicker than its seas and oceans. Hot air from land rises and sea air, which is still cool, rushes in as 'sea breezes.' At night, land is cooler than the sea. Land loses its heat faster than water. So hot air rises from the sea and cooler air from land blows out into the sea as 'land breeze.'

FIGURE 4.3 | THE LAND AND SEE BREEZE CYCLE (HTTP://THELIBERALZOMBIE.WORDPRESS.COM)



4.4.3 THE CARBON CYCLE
(www.ucar.edu)

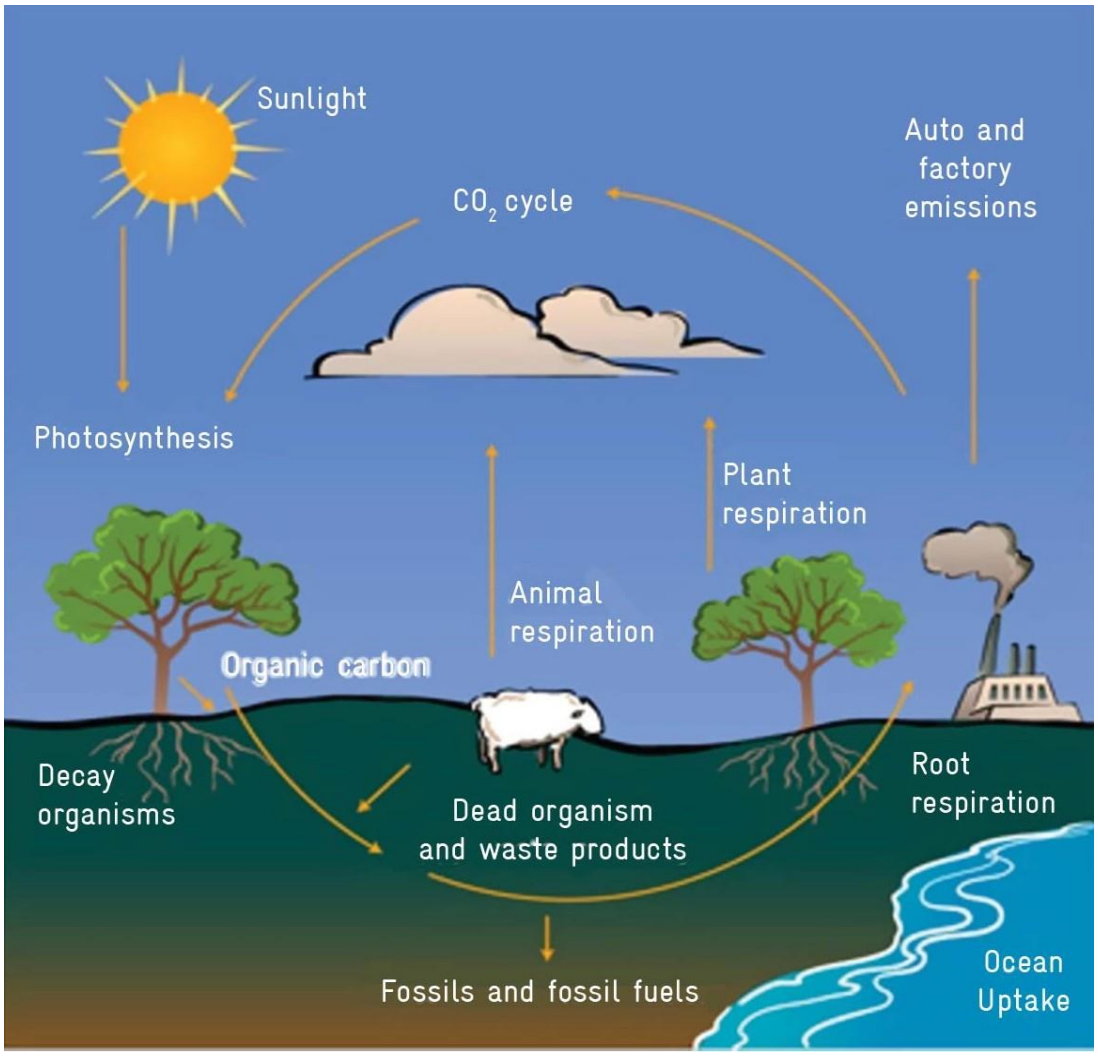
All living things are made of carbon. Carbon is also a part of the ocean, air, and even rocks. Because the Earth is a dynamic place, carbon does not stay still. It is on the move!

In the atmosphere, carbon is attached to some oxygen in a gas called carbon dioxide. Plants use carbon dioxide and sunlight to make their own food and grow. The carbon becomes part of the plant. Plants that die and are buried may turn into fossil fuels made of carbon, like coal and oil, over millions of years. When humans burn fossil fuels, most of the carbon quickly enters the atmosphere as carbon dioxide.

Carbon dioxide is a greenhouse gas and traps heat in the atmosphere. Without it and other greenhouse gases (like methane, Earth would be a frozen world. But humans have burned so much fuel that there is

about 30 percent more carbon dioxide in the air today than there was about 150 years ago, and Earth is becoming a warmer place. In fact, ice cores show us that there is now more carbon dioxide in the atmosphere than there has been in the last 420,000 years.

FIGURE 4.4 | THE CARBON CYCLE (WWW.UCAR.EDU)

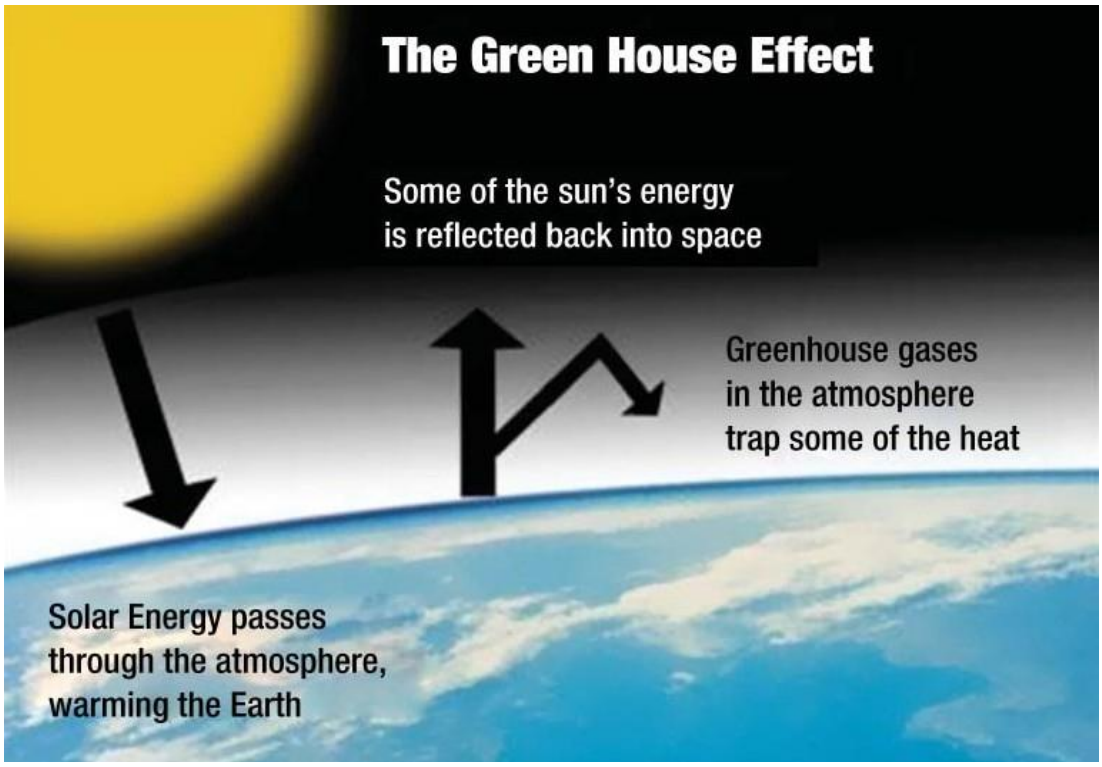


In addition to water, many other substances such as nitrogen, oxygen and carbon cycle through the earth atmosphere. These cycles are important to individual animals and plants and even to entire ecosystems. Furthermore, these cycles fundamentally influence the planet as a whole, dramatically and unmistakably altering the earth's atmosphere (www.ucar.edu)

4.5 THE ATMOSPHERE AND THE GREENHOUSE EFFECT

Most of the Earth's atmosphere is within 10 miles (16 km) of the Earth's surface.

FIGURE 4.5 | THE EARTH-ATMOSPHERE GREENHOUSE EFFECT



Greenhouses are used extensively by botanists, commercial plant growers, and dedicated gardeners. Particularly in cool climates, greenhouses are useful for growing plants because they both allow sunlight to enter and stop heat from escaping. The transparent covering of the greenhouse allows visible light to enter unhindered, where it warms the interior as it is absorbed by the material within. The transparent covering also prevents the heat from leaving by reflecting the energy back into the interior and preventing outside winds from carrying it away (www.ucar.edu).

The ability of certain trace gases to allow incoming visible light from the sun to pass through and heat the Earth's surface and then trap the heat energy radiated from earth is called the "greenhouse effect." This is because the trace gases trap heat similar to the way that a greenhouse's transparent covering traps heat. Without our atmospheric greenhouse effect, earth's surface temperature would be far below freezing (www.ucar.edu).

4.6 THE ENHANCED GREENHOUSE EFFECT AND CLIMATE CHANGE

When rich, western countries of United States of America, Canada, Europe, Australia, Japan and Russia developed rapidly, they expanded industrialization, transport and electricity in their countries. All these primarily used fossil fuel - coal, petroleum products, natural gas. These were extracted from under the ground and burnt. They emitted large amounts of GHGs. High chemical-based agriculture, mainly practiced in these countries, also emitted GHGs. This 'industrial revolution' started about 150 years ago and since

then lots of fossil fuel has been burnt to emit huge amounts of GHGs. The emission of greenhouse gasses due to human activity is known as the human's 'carbon footprint' and there are ways to measure this. These rapidly growing GHGs, trapping the sun's heat rays on earth, now form a one-way blanket that does not allow the earth's heat to escape. This is called 'global warming.' Over the last 100 years, between 1906 and 2005, the earth's average temperature increased by about 0.74 degree Centigrade, affecting the ocean-atmosphere cycle and the earth-atmosphere cycle differently in different places on earth. This has led to uncertainty over predicting long term climate change in a location.

ADDITIONAL RESOURCES:

http://ga.water.usgs.gov/edu/watercycle.html (includes water cycle diagram in 30 languages)

http://www.youtube.com/watch?v=0_c0ZzZfC8c&feature=related (hydrological cycle animation)

Other cycles:

http://earthobservatory.nasa.gov/Features/CarbonCycle/ (carbon cycle)

http://www.enviroliteracy.org/article.php/479.html (nitrogen cycle)

Greenhouse gases:

http://environment.nationalgeographic.com/environment/global-warming/gw-overview- interactive/ (animation of the greenhouse effect)

http://www.science.org.au/nova/016/016key.htm (enhanced greenhouse effect)

http://www.ipcc-nggip.iges.or.jp/ (IPCC national greenhouse gas inventories)

ACTIVITY FOR PARTICIPANTS | CONSTRUCTING THE CLIMATE CHANGE CYCLE USING THE HYDROLOGICAL AND THE CARBON CYCLES

Aim	The aim of this activity is twofold: 1. To explain and help participants to visualise the key elements of the hydrological cycle and the carbon cycle 2. To demonstrate the interconnectedness of the different elements and how this leads to climate change
Time	This activity is an integral part of teaching the climate change causes and how it is influenced by the hydrological and carbon cycles – it is not done separately

Materials	Pictures (hand drawn, photographs or downloaded) of each element of the hydrological cycle: ■ Heat from the sun ■ Evaporation ■ Condensation ■ Precipitation ■ Infiltration/ground water Pictures to show the parts of the carbon cycle and the earth's absorption of the heat ■ Greenhouse emitting items – cars, airplanes, plants, factory chimneys, etc ■ Earth's surface ■ Arrows to show processes for both of the above Simple pictures of the above are provided in Appendix C: The hydrological cycle. Photocopy each of these, cut off the description in English, glue on cardboard and add the title in the appropriate language. You will also need something to stick the pictures up on a flat surface or, if there is not flat surface available, simply place pictures on the ground.
Method	■ As you teach each section of the hydrological cycle, stick the corresponding picture up (or down). This will help to breakdown the complex cycle into parts that the participants can more easily understand. ■ Do a similar exercise with the carbon cycle, showing how the sun rays enter the earth's surface; the greenhouse emissions happen and how the heat rays get trapped on earth. ■ Get the participants to see the connection between higher temperatures and how in different temperatures the land and sea breezes will differ and so the the hydrological cycle will get affected. ■ Use everyday examples to illustrate. For example, if you leave a trough of water outside in the sun, the ground heats up faster than the water and so it is more difficult to walk on the ground than to step in that water. This will explain the land the sea breeze to them. ■ As you go through each element make sure you emphasis how it is connected to other parts of the same cycle and the different cycles. ■ Leave the completed cycles up as you will keep coming back to this to explain different things in subsequent sessions.

TRAINER'S NOTES

PART FIVE

CLIMATE CHANGE AND GOVERNMENT INITIATIVES

5. CLIMATE CHANGE AND GOVERNMENT INITIATIVES

The previous session outlined the concept of environmental systems, using the example of the hydrological cycle. The climate system is another example of a system and, as outlined previously, climate is changing as a result of the enhanced greenhouse effect. This session looks at how the climate is changing, especially in the Indo-Gangetic Plains, what some of the government initiatives are in trying to deal with this and what all this means from a gender perspective.

5.1 LEARNING OBJECTIVES

By the end of this session, *trainers* will:

- Be able to provide evidence that the climate is changing in the region and in the relevant country – Bangladesh, India and Nepal and how this holds different implications for men and women
- Be able to share information on some of the future projected changes and information on some of the ongoing studies and methods of these projections in South Asia and specifically in the Indo-Gangetic Plains with a strong gender perspective
- Be aware of the status of international climate negotiations and their country's stand in it and within the South Asia region
- Know the key government institutions engaged in tackling climate change.

By the end of this session, *participants* will:

- Be aware of the likely projected changes in climate in South Asia with regard to temperature and rainfall patterns and what this means for men and women

- Be aware of the implications of climate changes on core agriculture-related livelihood activities of women and men
- Be aware of the process of international climate negotiations.
- Understand which kind of government programmes can be used to tackle climate change impacts that affect their livelihoods.

5.2 EVIDENCE OF CLIMATE CHANGE IN THE INDO-GANGETIC PLAINS

The IPCC Fourth Assessment Report indicated that observed changes are likely to continue and intensify. Global average temperatures are predicted to rise by 1.10 and 6.40C. It is very likely that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent.

SOUTH ASIA

Regional climate changes

South Asia as a region is experiencing very rapid growth. It is also highly vulnerable to climate change (Cruz et al, 2007). This vulnerability is driven by the region's geographic diversity, high population and density and extreme poverty (World Bank, 2009). For these reasons, it is very important to understand the regional impacts of climate change

The South Asia region is geographically highly diverse, including the Himalayas for northern India, Bhutan and Nepal, the fertile delta of Bangladesh in eastern India and the Indian Ocean islands of the Maldives and Sri Lanka. This diversity leads to wide variety of expected climate impacts, including glacial melting, forest fires, rising sea levels, mountain and coastal erosion and salt water intrusion.

Weather and climate patterns are also expected to change. The region is already experiencing disruptions to the monsoon season and more frequent and intense storms. Given that the region is home to 600 million of the world's poorest people, most of who depend on climate-sensitive sectors such as agriculture, forestry and traditional fishing, the combined impacts of climate change and natural disasters has important consequences for the region.

TABLE 5.1 | PROJECTED CHANGES IN CLIMATE IN SOUTH ASIA

VARIABLE/FACTOR	EXPECTED CHANGE
Temperature	■ Mean annual temperature increase of 3.3°C for South Asia (Christensen et al, 2007) • Range of warming estimates under different emission scenarios extends from 2.7°C to 4.7°C • High-lying regions of the Himalayas can expect greater warming (mean increase of 3.8°C with a range of 2.6°C to 6.1°C projected for Tibet)

Rainfall	■ Greater uncertainty exists for estimates of rainfall changes as a result of climate change ■ Some evidence for a slight increase in precipitation for the Indian subcontinent by the end of this century (Christensen et al, 2007) ■ Some indications that rainfall will become more variable • Increase in inter-annual rainfall variability means an increase in the number of very dry and very wet years (Baettig et al, 2007) • Changes in the distribution of rainfall within a year will be characterised by an increase in the number of *heavy* rainfall days, but a decrease in overall number of days receiving rain ■ Some evidence for a change in seasonality ■ Projected increases in extreme rainfall will be characterised by increases in the frequency and intensity of heavy rainfall events
Monsoons	■ The Indian monsoon is expected to intensify with climate change ■ The timing of the monsoons may become more variable under climate change
Extreme Events	■ Increase in hot extremes, as well as heat waves expected ■ More extreme rainfall events - increase in both frequency and intensity
Sea-level Rise (SLR)	■ Increase in mean sea-level of 0.18 to 0.59 m projected by 2100, relative to 2000 (Christensen et al, 2007).

INDIA

India's climate is dominated by monsoons, which together account for more than 80% of the total annual rainfall. The main monsoon season - the summer "southwest" monsoon - extends over a four month period between June and September, brining warm moist air over India from the southwest. The "retreating" or "northeast" monsoon (between October and December), is generally associated with drier conditions as air descends off the Tibetan highlands, but picks up moisture as it passes over the Bay of Bengal, and is associated with rainfall predominantly over the eastern portions of the Indo-Gangetic (Padgham, 2009).

Given their predominance and massive amount of rainfall involved, Indian agriculture is highly dependent on the timing and strength of the monsoons. However, the distribution and timing of monsoon precipitation can be highly variable. For example, under extreme cases, up to 60% of annual rainfall can occur within a period of several days, resulting in severe flooding, high crop and livestock loss, and reduced groundwater recharge (Mall et all., 2006)

In terms of variability from year to year, severe breakdowns of the Indian monsoon season are associated with El Niño events. Droughts tend to have a more severe impact than floods, and are common over the western portions of the Indo-Gangetic Plain. The eastern part of the region is highly flood-prone as seasonal flooding associated with glacial melting and the monsoon flood the Ganges River system. Some of the climate change impacts forecasted by the IPCC and already seen in India include more extreme rainfall events in India, Bangladesh and Nepal, more floods in the flood plains and droughts associated with El Niño in north India becoming more common.

FIELD VIEW ERRATIC CLIMATIC BEHAVIOUR IN THE FLOOD-PLAINS OF UTTAR PRADESH, INDIA

"When there is sudden rain or drought, we can move to a shelter but what happens to the crops we grow? They cannot move. They are completely devastated and so are our lives. They are our means of survival. Without them we are nothing. July was when we used to expect the floods and we farmers would plant our Kharif crop in June so that when the rains came around 15 June our seeds would get adequate moisture to germinate. Now we are getting late rains – in September and October – when the crop is ripe for harvesting. Untimely heavy and frequent floods in the region have left around 300 acres of agricultural land in 7 villages waterlogged. With waterlogging, the soil nutrients are pushed deep down into the ground and the land became unfit for cultivation." Sushil Kumar, a farmer in district Gorakhpur, Uttar Pradesh

CLIMATE CHANGE IN THE GANGETIC PLAINS IN NORTH BIHAR

To understand the past, present and future trends of rainfall and temperature in Bihar, climate scientists are using very complex 'Climate Models.' To provide future projection of climatic variable on a regional scale, the Regional Climate model, PRECIS is being used by the Central University of Bihar, Patna. Based on the observed data for the period of 1871-1990, the mean (or average) annual surface temperature shows increasing trend in northwest and southwest regions of Bihar. The future projected mean annual surface temperature under high emission scenario during 2071-2100 shows change of 4°-5°C. Similarly the mean temperature in May shows change of 1°-2°C.

In Bihar, the region of north of the Ganga receives good amount of monsoon rainfall in comparison to the region south of the Ganga. The average rainfall received in the eastern part of the State is 100-120cm of rainfall during Indian Summer Monsoon Rainfall (ISMR) whereas the western part of the State receives 80-100cm of rainfall. Districts that lie south of the Ganga, show significant decreasing trend in ISMR. The future projected ISMR, based on PRECIS model, shows overall change of 5cm during June-July-August over Bihar. During 2011-2040, the future projected change in ISMR, based on climate models, is showing both surplus and deficit ISMR in different parts of Bihar. Central Bihar, especially, is showing surplus ISMR.

Based on observed long data series of Indian Meteorological Department (IMD), it is found that Bihar as a whole has experienced 5-6 monsoon drought years in the last decade (2001-2010); only 2 monsoon flood years have been identified in the same decades. All districts of Bihar are showing negative trend of ISMR since 1991. It is very clear that in recent years Bihar has been experienced a deficit in ISMR. In fact, the water table is continuously going down and creating a very difficult situation (lack of drinking water, lack of water for irrigation and animals) during the summer (April-May) season, especially in rural areas. *(Written by Dr. P. Parth Sarthi, Central University of Bihar, for CCAFS/AF Training of Trainers Summary Manual, India.)*

NEPAL

Peer-reviewed studies analyzing regional changes due to global climate change in South Asia - and even more so in Nepal are limited, especially in relation to water resources, because of the difficulty in scaling down the general circulation models (GCMs), and a lack of long-term climate records,(Cruz et al. 2007; HMG, 2005; Eriksson et al. 2009). There are, however, general trends that have been corroborated by ground level observations of various communities in Nepal that do at least give a basic framework of the identified and projected changes.

TEMPERATURE:

- Some studies cite an increase in temperature in recent years (Cruz et al. 2007; Agrawala et al. 2003), with more pronounced warming at higher altitudes (Liu and Chen 2000; Bhutiyani et al. 2010).
- There has been a small but significant increase in the frequency of hot nights and a significant decline in the annual frequency of cold days and nights. Hot nights have increased by 2.5% (McSweeney et al. 2008).
- GCMs predict that the country is expected to become warmer with more frequent heat waves and less frost.

GLOF

A significant threat in the Himalayas and directly correlated to rising temperatures are glacial lake outburst floods (GLOFs) that result from rapidly accumulating water into glacial lakes that then burst, sending flash floods of debris and water from high elevations, wreaking havoc on downstream communities. There are approximately 9,000 such lakes in the Himalayas, of which 200 are said to be in danger of bursting (Bajracharya et al. 2007). High rates of glacial melt due to increases in temperature are adding to this threat.

PRECIPITATION:

- There is no clear trend in Nepal with reference to precipitation but there is general agreement that the monsoon will at the very least become more variable in the coming decades. Summer monsoon (June to August) will become more 'intense', but also more variable, meaning more frequent heavy rainfall events even as the number of rainy days decreases (IPCC 2007).
- There will be abrupt transitions between two stable states of the monsoon in a "roller coaster scenario". The monsoon would most likely be weakened initially, leading to a drier state in the short term due to the effects of land use changes and greater aerosol production from increasing industrialization on the Indian subcontinent, followed by a more wet monsoon in the long term as the effects of increased CO_2 levels become increasingly significant.

BANGLADESH

It is reported that the surface average temperature has been rising in Bangladesh; through there is no agreement among studies on the rate of change (Quadir et al. 2001, Chowdhury, Quadir, Neelormi and Ahmed 2003). Available literature suggests that a general warning is expected in future, where the rate of warning will be higher for the winter months (i.e. DJF-December, January, February) than the monsoon months (i.e. June/July/August) (Ahmed and Alam 1998, Agrawal et al. 2003)

There is a great deal of local-level perception-based evidence that the rainfall pattern has become erratic in recent years, if not in recent decades (RVCC, 2004; Ahmed, 2008). However, the official agency has ruled out any possibility of drastic change in rainfall patterns beyond climate variability. Intriguingly, a bi-modal shift in rainfall behaviour has already been reported (Chowdhury, 2007), which may further be attributed to recent shifts in hydrological peaks in various rivers inside Bangladesh. Local level experience and anecdotal evidence clearly show that in both Gaibandha and Jamalpur, people now observe two or three flood peaks instead of one, as the latter had been regularly observed decades ago.

The literature on future rainfall projections, based on climate modelling exercises, clearly shows two distinct features: (a) the monsoon will be wetter (which is consistent with IPCC projections), and (b) the winter (already insignificant) rainfall will further diminish (Ahmed and Alam, 1998, Agrawala et al. 2003). Islam's (2009) results may also be interpreted in a similar manner.

The above findings lead to a few inferences:

1. Wetter monsoon would lead to increased flood vulnerability, which will be compounded if the observed shift in second rainfall peak in September persists (Alam, Nishat and Siddique, 1998);
2. Drier winter months would give rise to higher evapo-transpiration in combination with higher temperature and diminishing rainfall, leading to further intensification of degree of aridity (phonological drought) (Huq, Ahmed and Koudstadl, 1996, Asaduzzaman, Reazuddin and Ahmed, 1997); and
3. Decline in winter rainfall would reduce flow in the rivers, which would aggravate saline ingress along the coastal region (BCAS-RA-Approtech, 1994; Ahmed, 2005)

Increased susceptibility to Natural Disasters

All the above phenomena clearly highlight the increased hazard susceptibility in terms of flood, drought and salinity ingress in Bangladesh. As it has been reported in many articles, floods will be more intense, will inundate more areas and occasionally will perhaps prolong to devastate people's livelihoods, national economy and infrastructure (BCAS-RA-Approtech, 1994, Huq, Ahmed and Koudstadl, 1996, Alam, Nishat and Siddique, 1998). Similarly, literature suggest that the central western region will be hit hard due to exacerbated drought and marginal farmers would not be able to maintain livelihood thrusts by switching technologies to offset moisture stress (Ahmed, 2005). Simultaneously, increased salinity would tend to reduce crop suitability throughout the south-western region and perhaps appear to be a deterring factor for industrial activities in the affected areas (Ahmed, 2005).

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ACTIVITY FOR PARTICIPANTS | LOOKING FOR EVIDENCE FOR A CHANGING CLIMATE

Objectives	■ To have participants assess their own experiences of changes in climate ■ To empower women by showing them that their own experiences validate the scientific knowledge
Time	30 minutes
Materials	Flipchart and pen

Method	■ In a group discussion format, ask participants to consider any changes they have observed in climate over their lifetime and their mother's lifetime. Prompting questions could include: • Does it rain at the same time of year as in the past? • Does it rain heavier than before? • Has there been any change in temperatures? • Do the seasons change at the same time? • Has there been any change in the occurrence of extreme events, such as floods, droughts, cyclones, storms? ■ Write down the changes that the women have identified ■ Explain how their experiences match the projections of scientists.

5.3 HOW DO WE KNOW HOW CLIMATE WILL CHANGE?

We can investigate how climate has changed in the distant past using a variety of methods based on evidence from a variety of sources, including rocks, sediments, ice sheets and tree rings. More recent climate changes can be estimated using observational records, as well as satellite-based observations. But to investigate how climate may change in the future, we rely on our understanding of the entire climate system functions, and we need to make assumptions about how the factors which drive that system will evolve in future. This is why we refer to *projections* of future climate change, and not predictions: *predictions* are based on events which have already occurred, while *projections* are based on assumptions about events which may occur in future. While the past can be understood because we have already observed it, the future is always uncertain, because, by definition it has not happened yet. We need to understand the sources of this uncertainty and manage its impact carefully, when planning and making future decisions for a world in which climate is changing. Approaches for modelling global and regional climate and climate change are discussed in boxes 8 and 9.

5.4 GLOBAL NEGOTIATIONS ON CLIMATE CHANGE
(source: http://unfccc.in)

In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC), to cooperatively consider what they could do to limit average global temperature increases and the resulting climate change, and to cope with whatever impacts were, by then, inevitable. By 1995, countries realized that emission reduction provisions in the Convention were inadequate. They launched negotiations to strengthen the global response to climate change, and, in 1997, adopted the Kyoto Protocol (KP). The Kyoto Protocol legally binds developed countries to emission reduction targets. The first commitment period for richer countries to lower emissions started in 2008 and ends in 2012. The KP has several market-based instruments to lower emission. Its main drawbacks are the low level of commitment from the countries and the exclusion of the United States of America, the largest emitter country from the KP agreement. In fact, the KP targets have been hardly achieved even by countries which signed up. Many countries have actually overshot the 1990 level emissions.

At COP17 in Durban, governments of the Parties to the Kyoto Protocol decided that a second commitment period, from 2013 onwards, would seamlessly follow the end of the first commitment period. The length of the second commitment period is to be determined: it will be either five or eight years long.

A total of 195 country governments, or 'Parties' to the Convention, meet every year to arrive at some solution to reduce the emissions. These are called 'COP meetings' and COP 18 was last held in Doha in December 2012. In 2010, at COP 17 in Cancun, Mexico, all the 195 governments agreed that emissions need to be reduced so that global temperature increases are limited to below 2 degrees Celsius. However, so far there is no firm commitment from countries to reduce emissions to make this possible. And there is hardly any discussion on adaptation in the agriculture sector though the economically 'Least Developed Countries' (LDCs), have made their 'National Action Plans on Adaptation' (NAPAs) which the richer countries are mandated to fund and support.

Both Bangladesh and Nepal are member countries of this LCDs grouping and have made NAPAs. India is economically poor, being home to a third of the world's poor people and the world's largest number of malnourished people, but its carbon emissions are much higher than neighbouring Nepal or Bangladesh. India's emissions are also expected to grow far more and much faster in the future with economic growth. Thus, the two LDC countries and India sit on different sides of the negotiating table at the UNFCCC and there are tensions here. India and two LDC countries are not in agreement on what India should commit to on mitigation, or reducing its emissions.

5.5 GOVERNMENT CLIMATE CHANGE PLANS IN INDO-GANGETIC COUNTRIES

BANGLADESH

The COP 13 in Bali, Indonesia the negotiations resulted in the Bali Action Plan (BAP) which placed the need for mitigation (i.e. emission reduction) within the overall framework of sustainable development. Bangladesh, in subsequent submission to the UNFCCC has operationalized the Bali Action Plan (BAP) in terms of ensuring four types of security - food security, water security, energy security and livelihood security (including health). These four securities have been incorporated in the Bangladesh Climate Change Strategy and Action Plan (BCCASAP). The BCCASAP focuses on suitable crop varieties and development of technology suitable for agriculture production under various adverse climate conditions under the food and livelihoods security section. This is part of the country's adaptation plan. The other two adaptation programmes relate to construction and maintenance of necessary infrastructure, particularly related to water management. And disaster-risk reduction and post-disaster rehabilitation is the third focus of adaptation under the BCCASAP.

Box 5.2 CCSAP 2009 THEMES AND PROGRAMME AREAS

Theme	T1: Food security, Social Protection and Health
Programme	P1. Institutional capacity for research towards climate resilient cultivars and their dissemination P2. Development of climate resilient cropping system P3. Adaptation against drought P4. Adaptation in fisheries sector P5. Adaptation in livestock sector P6. Adaptation in health sector P7. Water and sanitation programme in climate vulnerable areas P8. Livelihood protection in ecologically fragile areas P9. Livelihood protection of vulnerable socio-economic groups (including women) Theme T2: Comprehensive disaster Management
Programme	P1. Improvement of flood forecasting and early warning P2. Improvement of Cyclone and storm surge warning P3. Awareness raising and public education towards climate resilience P4. Risk management against loss on income and property

Theme	T3: Infrastructure
Programme	P1. Repair and maintenance of existing flood embankments P2. Repair and maintenance of existing costal polders P3. Repair and maintenance of existing coastal polders P4. Improvement of urban drainage P5. Adaptation against floods P6. Adaptation against tropical cyclones and storm surges P7. Planning and design of river training works P8. Planning, design and implementation of resuscitation of river and *khals* through dredging and de-siltation work
Theme	T4: Research and Knowledge management
Programme	P1. Establishment of a center for knowledge management and training on climate change P2. Climate change modeling at national and sub-national levels P3. Preparatory studies for adaptation against sea level rise P4. Monitoring of ecosystem and biodiversity changes and their impacts P5. Macroeconomic and sectorial economic impacts of climate change P6. Monitoring of internal and external migration of adversely impacted population and providing Support to them though capacity building for their rehabilitation in new environment P7. Monitoring of impact on various issues related to management of tourism in Bangladesh and implementation in priority action plan
Theme	T5: Mitigation and Low Carbon Development
Programme	P1. Improved energy efficiency in production and consumption of energy P2. Gas exploration and reservoir management P3. Development of coal mines and coal fired power stations P4. Renewable energy development P5. Lower emission form agricultural land P6. Management of urban waste P7. Afforestation and reforestation programme P8. Rapid expansion of energy consumption pattern in transport sector and options for mitigation P9. Energy and Water Efficiency in Built Environment P10. Improvement in energy consumption pattern in transport sector and options for mitigation
Theme	T6: Capacity Building and Institutional Strengthening
Programme	P1. Revision of sectoral policies for climate resilience P2. Mainstreaming climate change in national, sectoral and spatial development P3. Strengthening human resource capacity P4. Strengthening gender consideration in climate change management P5. Strengthening institutional capacity for climate change management P6. Main-streaming climate change in the Media

NEPAL

The Government of Nepal established the Climate Change Management Division in the Ministry of Environment (MoE) in the first quarter of 2010. The MoE prepared the National Adaptation Programme of Action (NAPA), which was endorsed by the Government on 28 September 2010. Local Adaptation Plans of Action (LAPAs) have been prepared to implement adaptation programmes. To coordinate climate change activities and implement collaborative programmes, a multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC) was formed in 2011 with representation from relevant ministries and institutions, international and national nongovernment organizations, academia, private sectors, and donors.

There are specific thematic areas under NAPA. These include:

- Agriculture and food security
- Climate-induced disaster
- Urban settlement and infrastructure
- Public health
- Forest and biodiversity
- Water resources and energy
- Livelihoods and governance (cross-cutting)
- Gender and social inclusion (cross-cutting)

Nepal has also come up with the Climate Change Policy in 2011. The policy has focused on an inter-disciplinary approach with 80% funds allocated to the local level. Some of the main components of Nepal's climate change policy are:

Climate adaptation and disaster risk reduction: Implementing priority actions identified in the National Adaptation Programme of Action (NAPA), and identifying and implementing medium-and long-term adaptation actions in the climate impacted and climate-induced disaster-prone areas, communities, and people.

Low carbon development and climate resilience: Adopting a low carbon emissions and climate-resilient development path for sustainable socio-economic growth;

Access to financial resources and utilization: Establishing a Climate Change Fund for mobilizing the financial resources from public and private, internal and external sources to address the issues of climate change.

Capacity building, peoples' participation and empowerment: Updating information and building capacity from local to policy level on climate adaptation, impact mitigation, low carbon growth, technology development and transfer, and carbon trade.

Study and research: Conducting climate change-related research to expand the implementation of measures for adapting to adverse impacts and benefiting from positive impacts;

Technology development, transfer and utilization: Identifying and developing appropriate technologies for mitigating the adverse impacts of climate change.

Climate-friendly natural resources management: Developing and implementing a scientific land use system. Proper utilization, promotion, conservation of forest resources as a means of alternative livelihoods; Prioritizing and implementing programmes on the sustainable management of forests, agro-forestry, pasture, rangeland, and soil conservation that can address the impacts of climate change.

INSTITUTIONAL STRUCTURE

The Ministry of Environment is the national nodal ministry for Nepal's climate plans and is the overall coordinator for adaptation policy and planning and on-the-ground implementation; the MoE also coordinates with external actors and across ministries for programmes and activities that come under climate change

purview. At the district level, the district office is the nodal office for all climate change-related policies and programmes and disaster management plans to be planned or implemented at the district level. This includes NAPA and LAPA plans and programmes. At the village level, the Village Development Committees, and in urban areas the municipalities are the nodal institutions to implement climate change adaptation and mitigation plans and programmes.

INDIA

In India, the Prime Minister's Council on Climate Change released the National Action Plan on Climate Change (NAPCC) in 2008. The NAPCC has a set of eight Missions, four of which focus on adaptation, three on mitigation and one on strategic knowledge and learning. Each Mission is under a specific government Ministry or Department (see Table 5.2)

TABLE 5.2 | CLIMATE CHANGE MISSIONS AND THE NODAL MINISTRIES

FOCUS	MISSION	MINISTRY
Mitigation	National Solar Mission	Ministry of New and Renewable Energy
	National Mission on Enhanced Energy Efficiency	Bureau of Energy Efficiency, Ministry of Power
	National Mission on Sustainable Habitat	Ministry of Urban Development
Research & Development	National Mission on Strategic Knowledge for Climate Change	Ministry of Science and Technology
Adaptation	National Water Mission	Ministry of Water Resources
	National Mission for Sustaining the Himalayan Eco-system	Ministry of Science and Technology
	National Mission for a Green India (focusing on forests)	Ministry of Environment and Forests
	National Mission for Sustainable Agriculture	Ministry of Agriculture

THE NAPCC'S PRINCIPLES INCLUDE:

- Protecting the poor and vulnerable sections of society through an inclusive and sustainable development strategy, sensitive to climate change.
- Achieving national growth objectives through a qualitative change in direction that enhances ecological sustainability, leading to further mitigation of greenhouse gas emissions.
- Devising efficient and cost-effective strategies for end-use demand-side Management.
- Deploying appropriate technologies for both adaptation and mitigation of greenhouse gases emissions extensively as well as at an accelerated pace.
- Engineering new and innovative forms of market, regulatory and voluntary mechanisms to promote sustainable development.
- Effecting implementation of programmes through unique linkages, including with civil society and local government institutions and through public-private-partnership.
- Welcoming international cooperation for research, development, sharing and transfer of technologies enabled by additional funding and a global Intellectual Property Rights (IPR) regime that facilitates technology transfer to developing countries under the UNFCCC.

Since India is a federal country, the adaptation Missions will primarily be implemented through the various States. Each of the States has come up with a State-level Action Plan on Climate Change (SAPCC) which are at various levels o f preparation. These are cross-sectoral plans covering agriculture and related areas like livestock, fisheries, horticulture and forest, besides the main Mission areas. Many of the State-level programmes under these areas are now being understood from a climate perspective and some States like Uttarakhand and Madhya Pradesh have also added the gender dimension. In all, the NAPCC and the SAPCCs are silent on the gender dimension and this gap needs to be filled. This training manual and the trainees will be hopefully address this gap.

5.6 SPECIFIC GOVERNMENT AGRICULTURE PROGRAMMES DEALING WITH CLIMATE CHANGE ADAPTATION

By its very nature, the future is uncertain. Indeed, the process of developing projections of future climate change involves making assumptions about how society and economies will evolve, as well as how physical climate processes actually work and can be represented in complex models. We still have very limited understanding of some of these processes, like the monsoon. All of these issues introduce additional uncertainty into the process of projecting climate change. While each of the countries have begun initiating work on adaptation, also by making some of their development schemes climate-resilient, there is no specific focus on implementing climate change-resilient agriculture programmes yet; the focus is still on research and grappling with the future uncertainties and coming up with prototypes on what can work in the given circumstances. The next section will discuss this in more detail.

ACTIVITY FOR PARTICIPANTS UNCERTAINTY

- You will more than likely find that the women themselves are familiar with the concept of uncertainty even if they are not familiar with the term. If you have time draw out their knowledge by facilitating a discussion around questions such as:
- How certain are you what the climate will be like in the next 5 years? Have you been more or less certain about the climate/weather over the past 5 years/1 year?
- Is the weather the only important factor for ensuring you and your family have enough to eat? What other factors are there? Can you be certain whether these will happen or not?
- What aspects of your life are you certain will happen?
- What do you think you can do to deal with this uncertainty?

ADDITIONAL RESOURCES:

www.ipcc.ch Intergovernmental Panel on Climate Change (IPCC): The Intergovernmental Panel on Climate Change is a body comprising national governments that periodically asks leading scientists to come together to assess the state of our knowledge on climate change - it's causes, consequences, and what we can do about it. The Fourth Assessment Report was released in 2007, and the Fifth Assessment Report is currently in preparation.

http://unfccc.int/ : The official website of the United Nations Framework Convention on Climate Change.

Bangladesh: http://www.thegef.org/gef/sites/thegef.org/files/documents/document/ban01%20(1).pdf
Nepal: http://moenv.gov.np/moenvnew/ ; http://www.napanepal.gov.np/
India: http://pmindia.gov.in/climate_change_english.pdf

TRAINER'S NOTES

PART SIX

CLIMATE CHANGE IMPACTS ON AGRICULTURE & FOOD SECURITY

6. CLIMATE CHANGE IMPACTS ON AGRICULTURE AND FOOD SECURITY

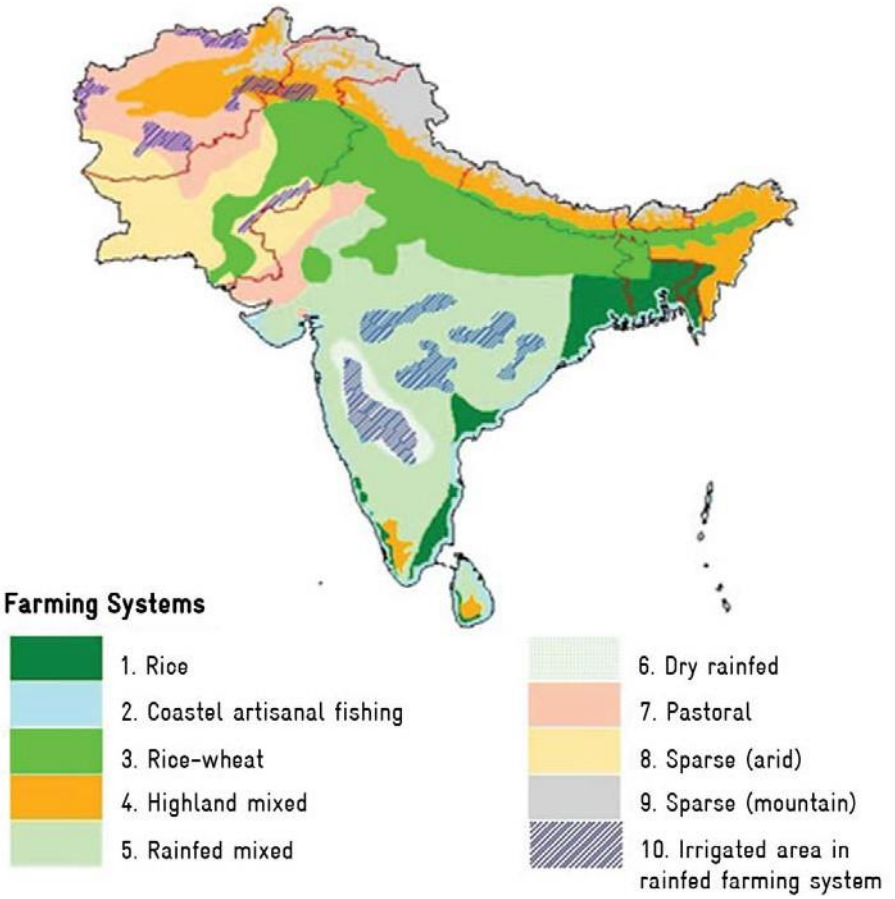
6.1 AGRICULTURE IN SOUTH ASIA

Agriculture in South Asia employs a majority – 60% - of the region's workforce. About 70% of the region's population is rural and most of the region's farmers are poor. About 75% of the region's poor live in rural areas. Most of the farmers depend on rainfed agriculture, livestock, fragile forests, and/or casual, often migratory, employment. In India, 60%, in Bangladesh about 70% and in Nepal almost 80% of the agriculture is rainfed. Agriculture employs a majority of people but contributes just 22% to the regional economy and the sector is growing at less than 3 per cent per annum. With a majority of its people poor and dependent on monsoons for agriculture, agricultural and rural non-farm growth will be critical to reach the Millennium Development Goals of halving the number of poor people by 2015.

As figure 6.1 shows, the predominant farming systems are rice-wheat and rice. The Green Revolution in the late 60s in India, was a major factor in agriculture in South Asia, leading to increased production levels and a resulting decrease in the poverty rate. That said, the vast majority of the agriculture sector in Bangladesh, India and Nepal still comprises small-scale farmers. About 80% of the farmers in India (Planning Commission, XI Plan) and 87% of the farmers in Nepal are still small and marginal farmers. Rural women, in particular, are very dependent on agriculture for their livelihoods. Agriculture is the main source of livelihood for around 78% of women in Nepal and for about 70% of women in India. India's Planning Commission notes (XI Plan) the increasing feminisation of this sector and the dominance of women workers in livestock and forestry. In fact, in rural India up to 90% of the women workers earn their livelihoods from

agriculture and allied sectors. Two-thirds of the people in Bangladesh work in agriculture and about 46% of them are women. *Among them roughly half are women but they do 90% of the work says Rahela Rabbani, a project coordinator at the non-governmental organization Karmojibi Nari in Dhaka. "As they are women their work doesn't count," she says. "Often they are not paid in money but in food."*

FIGURE 6.1 | MAJOR FARMING SYSTEMS IN SOUTH ASIA



(Source: http://www.fao.org/farmingsystems/maps_SAS_en.htm)

6.2 FOOD SECURITY IN SOUTH ASIA

Food security has four key dimensions: availability (agricultural production), stability, access and utilization. Agricultural adaptation to climate change therefore must guarantee *stable* production, which in turn feeds rural incomes and gives people adequate resources to *access* and purchase food. Infrastructure and connection to markets is also crucial here. Whether there is or is not enough food for a household, *allocation* patterns mean that certain members of the family (e.g., men) are prioritized over others (e.g., women). And even if food is produced, accessed, and allocated evenly, if the food does not have nutritional value, or if a family lacks clean water to cook/clean it, or if certain members are too sick to properly digest it, then food security does not really exist. This is where nutrition, sanitation (including access to clean water), and food safety come in as well.

In other words, food security is not just about having enough food; it's also about having enough safe and nutritious food. This means that, often, to be food secure, a family does not only need strong agricultural production but also the (economic or physical) ability and desire to purchase complementary foods to create

a healthy diet with calories and micronutrients. Diets dominated by cereals, for instance, lack an adequate array of micronutrients. This highlights the importance of fruits and vegetables (and animal products, for non-vegetarians) as well.

Women play a key role here. They are often crucial in transforming agricultural products into food/nutritional security for their families. When they have income, research shows that they generally spend it on food or on their children's needs. Despite strong economic growth and increasing incomes, malnutrition and food insecurity still seem to be a trend in the region.

India is home to the world's maximum number of malnourished children. Bangladesh, India, and Nepal all rank among the top 5 in globally underweight children. Bangladesh and India rank among the top for low birth weight babies, a good indicator of maternal malnutrition. In a CCAFS study of nearly one thousand households in the Indian Indo-Gangetic Plains, the top concern voiced by women family members relating to women/children in adverse climate years was lack of sufficient nutritious foods for their families.

6.3 CLIMATE AND AGRICULTURE IN SOUTH ASIA

South Asia's climate is dominated by monsoons, which together account for more than 80% of the total annual rainfall. The main monsoon season - the summer "southwest" monsoon, extends over a four month period between June and September, bringing warm moist air over the region from the southwest. The "retreating" or "northeast" monsoon (between October and December), is generally associated with drier conditions as air descends off the Tibetan highlands, but picks up moisture as it passes over the Bay of Bengal, and is associated with rainfall predominantly over the eastern portions of the Indo-Gangetic Plain (Padgham, 2009).

Given their predominance, and massive amount of rainfall involved, South Asian agriculture is highly dependent on the timing and strength of the monsoons. However, the distribution and timing of monsoon precipitation can be highly variable. For example, under extreme cases, up to 60% of annual rainfall can occur within a period of a few days, resulting in severe flooding, high crop and livestock loss, and reduced groundwater recharge (Mall *et al.* 2006).

A periodic global weather phenomenon known as El Niño can interfere with the functioning of the monsoon. Droughts tend to have a more severe impact than floods, and are common over the western parts of the Indo-Gangetic Plain. The eastern part of the region is highly flood - prone as seasonal flooding associated with glacial melting and the monsoon flood the Ganges River system.

6.4 ANTICIPATED EFFECTS OF CLIMATE CHANGE

These projected changes will have a variety of impacts, across a variety of sectors, including endangering agriculture, food security and rural livelihoods in the region.

A reduction in the levels of water flowing in the Ganges (due to changing rainfall patterns and increasing evapo-transpiration; plus glacial melting that is reducing the size of the original water source will have implications for all activities that rely on water from the river (e.g. for irrigation). This will happen whlie increasing number of people will mean growth in competition for fresh water resources.

There will also be impacts on agriculture. A combination of the increased temperatures (and increasing evapo-transpiration) and increasing intensity of extreme events have impacts on crop yields in central and western regions. The places where the climate is suitable for cultivating wheat and rice will also likely decrease (see Box 6.1). At the same time, food demand will rise in the region due to population increase.

Box 6.1 CASE STUDIES

Upward shifting apple belt in Himachal Pradesh

Agriculture in Himachal Pradesh, India has traditionally consisted of vegetable production in the (warmer) lower hill areas, and apples in the (cooler) mid-mountain areas. In order to grow to maturity, apples require a certain amount of cold ("chilling units"). So increasing temperatures and decreased snowfall have been disastrous for the region's apple yields. But former apple growers are adapting to climate change by switching to off-season vegetables (peas, cabbage, cauliflower, garlic, tomatoes, etc.). These fetch high prices, resulting in net increases in farmers' incomes. The extra production also helps India meet its growing food demand. Meanwhile, further uphill, poor farmers who previously struggled with agriculture are now replacing their coniferous forests with profitable fruit trees. These are examples of adaptation to climate change.

In the future, as the apple belt continues to move upwards, farmers may need to shift once again, but this case study of Himachal Pradesh farmers shows that such adaptation is possible.

Changing flow of river Ganges impacts inland fisheries

In one of the other studies it was found out that the recent hydrological changes in the flow pattern of river Ganga due to changes in climatic patterns has resulted in erratic breeding and decline in fish spawn availability. The average fish landing in the river Ganga has declined from 85.2 tonnes during 1959 to 62.5 tonnes during 2004. There is also a clear shift in geographic distribution of the fishes of river Ganga. Due to increase in river water temperatures in recent periods, the warm water fish species earlier available only in the middle stretch of river Ganga are now available in the colder stretch of the river around the city of Haridwar in the foothills of the Himalayas. In the middle and lower Ganga, the number of phytoplankton and zooplankton organisms, the agents that create organic compounds from carbon dioxide dissolved in water to sustain aquatic food supply, have declined between 1959 and 1996 (India's 2nd National Communication to UNFCCC.)

6.4.1 CLIMATE VARIABILITY AND CHANGE IN THE INDO-GANGETIC PLAINS (PADGHAM, 2009)

The Indo-Gangetic Plains (IGP) contain some of the most productive agricultural land in South Asia, providing staple grain for 400 million people, primarily through a rice-wheat rotation system practiced on 13.5 million hectares.

Levels of production of rice and wheat in this highly intensive system have stagnated and, in some cases, declined over the past few decades. This is problematic given population growth and the fact that production levels will need to increase in the future. The UN Food and Agricultural Organisation (FAO) estimates that South Asia will need to increase its cereal output by almost 50% over the next three decades to meet increasing demand.

Various factors are contributing to reductions in production level. The growth in population is placing pressure on the natural resource base (soil and water), causing loss of soil fertility and soil nutrient imbalances. In order to increase production there has been increasing reliance on irrigation. Demand for irrigation water has led to unsustainable extraction of groundwater, with several areas experiencing declining water tables. The introduction of canal irrigation in semi-arid parts of India and

Pakistan has resulted in widespread salinity and water logging affecting nearly 7 million hectares of cultivated land.

Future climate change is expected to magnify the adverse effects of these existing pressures. Wheat is currently near its maximum temperature range, with high temperatures during reproductive growth and grain filling, representing a critical yield-limiting factor in much of the IGP. Incremental increases in temperature could thus have a large impact. It is estimated that by 2050 approximately half of the highly productive wheat areas of the IGP could be reclassified as a heat-stressed, short-season production mega-environment.

Rice yields are also expected to be affected, with an estimated decrease of 10% for every 1ºC rise in night time temperatures. Given that South Asia is projected to experience a median temperature increase of 3.3ºC by the 2080s, these yield loss estimates are well within the range of the likely temperature rise over the next several decades.

Furthermore, higher temperatures and evapo-transpiration, and increased seasonal rainfall variability, and eventual loss of seasonal glacial melt-water will create greater pressure on existing irrigation water supplies, thereby further exacerbating soil salinisation risk. Climate change may already be contributing to productivity decline in the IGP due to decreased solar radiation and increased minimum temperatures. These factors suppress crop yields by decreasing photosynthesis and increasing respiration losses.

Of course the impacts will vary from place to place. Table 8 outlines some projected impacts in the Indo-Gangetic Plains.

TABLE 6.1 | LIKELY IMPACTS OF CLIMATE CHANGE BY SECTOR

SECTOR	LIKELY IMPACTS	GENDER IMPACTS
Agriculture and Food Security	■ Climate change may already be contributing to decreasing productivity in the IGP (Ladha et al., 2003; Pathak et al., 2003) ■ Projected increase in carbon dioxide in the atmosphere is beneficial to crops: Increase to 550 ppm increases yields of crops such as wheat and rice by 10-20% (Aggarwal, 2009). Despite this, crop yields may decline due to increasing temperatures and extreme events. A 1°C increase in temperature may reduce yields of some crops by 0-7%. Much higher losses at higher temperatures (Aggarwal, 2009); Maize (16%); sorghum (11%): Knox et al (2011) ■ Rice yields are estimated to decrease by 10% for every 1°C temperature increase (Peng et al, 2004)	More women than men will get affected in the agriculture and allied sectors because these sectors employ as much as 89.5% of the total female labour in India (FAO Fact Sheet) First priority to food, more food and more nutritious food goes to men and boys. Girls are next in priority. Women are the last. In areas affected by decreasing productivity, women are already saying they have learnt to go to bed hungry (Kapoor, 2011) Higher temperatures are already leading to more weeds and weeding is a woman's job. So this has led to more labour and time spent on this task.

	■ Higher temperatures and evapo-transpiration will increase seasonal rainfall variability; increased droughts, floods, and heat events will increase production variability ■ Productivity of most crops to remain unaffected or marginally decrease by 2020 but to decrease by 10-40% by 2100 (Aggarwal, 2009) ■ Climate change will also impact on livestock - less milk, greater stress on animals (Aggarwal, 2009)	Higher temperatures will lead to more pests and making bio-pesticides or mixing readying chemical pesticides is a woman's job. The climatic changes will also result in new pests and women do not have the priority to access new knowledge or new resources in South Asia. Lower livestock productivity affects women more because small animals are a source of income for women and also give food security, especially when farm crops fail due to climate change.
Human Health	■ Adverse impacts for human health ■ Increase of water-borne diseases such as diarrhoea and cholera, as well as vector-borne diseases such as malaria	Heat stress and water stress will lead to women travelling further for water, fodder and firewood, carrying heavier loads in the heat or doing with less resources, both of which have health impacts. Women are the last to seek medical advice and generally malnourished/ anaemic so climate change will deepen health impacts.
Forests and Biodiversity	■ Forest expansion, land use/land cover changes leading to fragmentation of forests and population pressure will further threaten biodiversity and lead to extinctions of fauna and flora ■ The tree line is shifting upward and so the biodiversity of sub-regions is threatened and is changing.	Majority of collectors of minor forest produce are women and it is a means of livelihoods for them. A lot of women's traditional knowledge is linked to forest biodiversity and this loss of local knowledge is a threat as tree lines shift upwards. Women depend a lot on forests for food – wild berries, leafy vegetables, mushrooms, fruits, medicinal herbs and food-flavouring herbs. Food from the forest ensures food security in times of crop failure. Women also depend on forests for collecting fodder and firewood and loss of these trees threatens food security for their households. Forests play a critical role in ensuring regeneration of groundwater for farms around the forests and especially those that are located downhill.
Natural Disasters	■ The probability of climate-related disasters will rise with changes in precipitation patterns and temperature increase. ■ Droughts are projected to be more intense and prolonged in the arid and semiarid areas of India and Bangladesh, while landslides and glacial lake outburst floods will be more frequent in the mountain regions of Bhutan and Nepal. (Asian Development Bank, undated; World Bank, 2009).	Women are impacted far more than men during disasters (several studies cited elsewhere). Women have fewer resources and hardly any authority so find it far more difficult than men to overcome disasters with respect to their livelihoods; loss of women's livelihoods is seldom recorded or addressed by the authorities. Distress male-migration puts additional burden on resource-poor and disadvantaged women where they have to don the dual role of feeding the family – children/elders – and caring for them.

Water resources	■ Initial increase in water (to 2040) due to glacial melt, followed by less water (to 2100) due to retreat of glaciers. ■ Reduced availability of freshwater, combined with rapidly-growing populations in close proximity to water means a reduction in freshwater resources, growing water stress and reduced water quality ■ Glacial melting will increase the number and severity of floods, and related impacts such as slope destabilisation and a decrease in river flows as glaciers recede	Women are primarily responsible for collecting water for the household and the livestock, especially small animals so this would mean carrying water for longer distances with time, labour and health implications. Reduction of available water has special hygiene implications for women. Reduction in water will impact farm crops but more so the kitchen gardens which get 2nd priority for irrigation. Water quality will be a new issue for women to deal with.
Marine and coastal ecosystems	■ Projected sea-level rise (SLR) will severely impact coastal ecosystems, infrastructure and human settlements • More than 35 million people in Bangladesh will be at risk of flooding by 2050 (Government of Bangladesh, 2007). • SLR in major Indian cities (Mumbai, Kolkata, Kochi) will be at risk • SLR of 1m by 2050 in Sri Lanka could submerge significant proportions of land and severely impact the rail transport network • SLR is a threat to the very existence of low-lying small island states, such as the Maldives ■ Salt-water intrusion and declining river runoff will increase the habitat for brackish water fisheries ■ Coastal inundation, especially in the heavily populated mega deltas will have severe impacts on economies and people, as well as ecosystems such as mangroves, wetlands and coral reefs ■ Increasing sea and river water temperatures are likely to affect fish breeding, migration, and harvests (Aggarwal, 2009)	Sea-level rise means there is less space on the beaches for fish processing which is a woman's task. Less fish productivity means women fisher folk will have to find alternative work which is more difficult given their lack of mobility, negotiating skills and limited ability to do heavy manual work. Migration of men fisher folk will lead to more women-headed households; seasonal migration brings with it threats of increased HIV/AIDS infections and trafficking of men and women (see Box 6.2 case study below)
Settlements	■ Flooding will several impact parts of Bangladesh, India, Nepal and Sri Lanka - regions already flood-prone due to heavy monsoon rains and low elevation ■ Melting glaciers and SLR put parts of Bangladesh, in particular, at significant risk ■ Combined impacts on rural poor of multiple stresses, including climate change will lead to increasing climate-related migration and growing pressure on already overburdened urban centers	Floods lead to increased male distress migration leaving behind women-headed households. Flooding brings with it hygiene-related problems for women. Migration leads to breaking down of community structures which especially support women in care activities. Women also find it more difficult to find new livelihood options post-migration and are given fewer opportunities compared to men.

Box 6.2 CASE STUDY

Climate Change impact on farms in the Ganga floodplains in Uttar Pradesh (UP)

"This change in climate is really affecting our agriculture. Last year (2008), because of early rains, sowing of paddy, ground nut, Arhar (pulse variety) got affected because seeds could not germinate well in such wet soil. And this year, monsoon came in so late - in the end of Sawan (July) - that about one-third of my paddy saplings dried up. Last year was, in fact, so different. There were two floods. Once in June end and then again in Sept end. There was so much water in the field that the crop would not ripen and become dry. There was so much damage. Again, last year due to frequent changes in temperature and rain, my three hen and three goats died due to heat and humidity-related diseases. I have one buffalo and the change in temperature also affected the milk production. Earlier, the buffalo was giving 8 litres of milk but now, with longer and hotter summers, it is only 3-4 litres which means a loss of Rs 60-70 every day. Vegetable production is also affected. Last year, sudden rains damaged bitter gourd and sponge gourd completely, meaning a loss of Rs. 1500 for me." Meera Devi, village Janakpur, district Gorakhpur, UP

GROUP ACTIVITY FOR PARTICIPANTS | DEFINING POTENTIAL IMPACTS OF A CHANGING CLIMATE ON PEOPLE'S LIVELIHOODS

Objectives	To have participants consider what the projected changes in climate will mean for agriculture and food security
Time	40 minutes
Materials	Flipchart or notebook to record answers
Steps	In groups, discussion format, ask participants to list some of the projected climate changes , what these will mean for agriculture in a gender disaggregated fashion. Include impacts on farm crops, homestead farming, livestock, fisheries, horticulture to get a range of agriculture-related activities done my men and women A similar exercise can be done for the availability, stability, access and utilisation of food for men and for women within a family following climate change impacts.

If there is time, it is worth also talking about potential opportunities. Whilst climate change may mean an adjustment, there are opportunities there for people who are well prepared (and that is part of the point of this course!).

ADDITIONAL RESOURCES

FAO Factsheet: ftp://ftp.fao.org/sd/sdw/sdww/Ind.pdf

World Bank: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/EXTSAREGTOPAGRI/0,,contentMDK:20750711~menuPK:452772~pagePK:34004173~piPK:34003707~theSitePK:452766,00.html

Impacts of climate change communicated to UNFCCC by the country governments:

India: http://envfor.nic.in/downloads/public-information/2ndNational_Communication_2_UNFCCC.pdf

Bangladesh: http://unfccc.int/resource/docs/natc/bgdnc1.pdf

Nepal: http://unfccc.int/resource/docs/natc/nepnc1.pdf

TRAINER'S NOTES

PART SEVEN

GENDER AND ADAPTATION TO CLIMATE CHANGE

7. ADAPTING TO CLIMATE CHANGE

As we have seen above, people who cause climate change are rarely the ones who experience its most damaging effects. Women are often the first and worst sufferers but play a far less role than men in causing climate change. There is also a difference in class, caste, religion, ethnic background and geographical locations within gender. Thus, for instance, a richer woman will travel by car and use electricity more than a poor woman. Women in the plains may be travelling more by public transport than women in the more remote locations where they may be travelling by cycle-pulled vehicles or an animal-pulled vehicle or simply walk longer distances to get to bus-stands. Thus, emissions vary within these intra-gender divisions. The same is true for adapting to the impacts of climate change. Better-off women will have more wherewithal than poor men to adapt to the changes. However, overall, women will have fewer wherewithal to adapt than men.

In this session, the key point is that knowledge is power. Understanding how climate change might alter the environment is sufficient information to enable changes in behaviour and practices that reduce the negative impacts. Add to this information on what government and non-government resources are available will make adaptation that much easier. This training focuses on gender because women are often disadvantaged with regard to accessing information and knowledge on adaptation and their traditional/local understanding and knowledge to adapt is too often unrecognised and unvalued.

7.1 ADAPTATION MEASURES REDUCE AGRICULTURAL EMISSIONS

Emissions from agriculture in rural South Asia are negligible on a global scale. According to the World Bank, methane and nitrous oxide, primarily from livestock and rice cultivation, emitted from agriculture account for just 20-30% of the global average in India. For South Asia this figure is far lesser. This is largely due to poor soils which lower productivity, low levels of chemical application and continued use of low-yielding rice cultivators and traditional planting regimes. Interestingly, adaptation measures encourage farming practices that also reduce emissions. Thus, for instance, bio inputs replace chemical fertilisers and pesticides and so greenhouse gasses produced from chemical input farming in the western countries give rise to far higher agricultural emissions, including the GHGs from manufacturing these chemical inputs. In Australia, per capita emissions arising from agriculture are more than six times the world's average.

Again, eco-friendly or climate-friendly 'cyclic' agricultural practices of South Asia's small farmers entail outputs of one process being used as inputs for anther process. This too limits emissions. For instance, in organic agriculture, dung (which emits methane) is used as bio-fertilizer on the farms and thus emissions are controlled. Dung manure enriches soil fertility and retains soil moisture thus making the soil more productive during droughts or flood-induced waterlogging; crops are able to stand for a longer time in these soils and provide higher levels of food security to small farmers.

Adaptation is necessary but there are limitations to adaptation. Ultimately, reducing emissions is key to stopping human-induced climate change. People can adapt but only to a cetain extent. Beyond that, it becomes almost impossible to adapt to uncertainties.

Within agriculture, these changes to adapt need not be costly. In fact, the aim in this session is not to come up with a wish list that a donor needs to support and an NGO needs to implement. Instead the idea is to identify small individual actions which the participants can take immediately upon returning home after the course. And to understand that government programmes and schemes can be used to help adapt to climate change impacts on agriculture. This is particularly important as this training is for rural women leaders, also elected women leaders, whose mandate is to help vulnerable people with the support of government programmes and schemes.

7.2 LEARNING OBJECTIVES

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

- Identify responses they have already made to respond to a changing climate
- Determine whether those responses help cope or adapt
- Be aware of a wider range of potential adaptation strategies they can employ to respond to a changing climate
- Be aware of the need to understand the government's stand on agriculture and climate change and the government's main initiatives towards adaptation.

By the end of this session, *participants* will:

- Have knowledge of a range of locally-appropriate, low-technology or behavioural adaptation strategies and mechanisms that they can employ to reduce adverse impacts from the projected changes in climate (including climate-smart agriculture)
- Have knowledge of a few ways in which government programmes can help in adaptation.

ADDITIONAL RESOURCES:

Adaptation Learning Mechanism

http://www.adaptationlearning.net/

CBA-X (Community-Based Adaptation Exchange)

http://community.eldis.org/.59b70e3d/

CARE's Climate Change Resource Page

http://www.careclimatechange.org/

Community-Based Adaptation to Climate Change Conference 2011

http://www.iied.org/climate-change/key-issues/community-based-adaptation/cba-conference-2011

7.3 RESPONSES TO PAST CLIMATE

Since the climate has already been changing, people are likely to have already introduced responses. In particular, it is known that women have many indigenous responses that are often not formally documented. However, there is a difference between coping and adaptation. Begin the session by asking participants to brainstorm what they have done in response to a changing climate.

ACTIVITY FOR PARTICIPANTS | RESPONSE TO A CHANGING CLIMATE – PART ONE

Objectives	To get participants to identify what they have done to respond to observed changes in climate
Time	15 minutes
Materials	Flipchart paper and marker (someone to record, either in words or pictures)
Steps	Ask participants what they have done in response to observed changes in climate, with regard to their livelihoods (e.g. planting different crops, cultivating new ground, irrigation), and their living circumstances (rebuilding homes with different materials, constructing drainage channels) Divide a flipchart page into two, and write these responses on the left-hand side

Coping is a short-term response that facilitates immediate survival, but does not reduce vulnerability. An example of coping might be rebuilding a house on the floodplain after a flood. It is important to note that immediate coping strategies can also have longer-term negative, or maladaptive, impacts. In CCAFS household surveys of 699 households in Nepal and north-western India, for example, the top 2 coping mechanisms involved taking out loans from money lenders or from family. Money lenders are known for charging very high interest rates, and farmers' inabilition to pay back loans have led to farmer suicides in India.

Adaptation is a longer-term response that also reduces vulnerability to repeat exposure to the same hazard. In response to a house being damaged by a flood, for example, an adaptation might be to build it back out of stronger materials (e.g. brick instead of mud brick), or to build it on stilts or raised platforms as is being done in some places in the flood-plains of Bangladesh and India (Bihar). Handpumps too have been built on raise platforms in Assam and Bihar to save water sources during floods (see pictures at the end of this section). Flood shelters in India and Bangladesh not only give a higher ground for people to stay during floods but are also used to keep small animals which enhances food security during this emergency period.

EXAMPLES OF ADAPTING TO CLIMATE CHANGE IMPACTS

Raised homesteads in Bangladesh floodplains

(source: Oxfam)

Raised water handpump in Bangladesh floodplains

(source: Oxfam)

Raised homestead in Bihar floodplains

(source: Aditi Kapoor/Oxfam)

'Integrated farming' with poultry (in thatched hut behind) and fishing promoted by Gorakhpur Environmental Action Group (GEAG) on a small farm in the flood plains of Uttar Pradesh. This ensures food security as the source of food is diversified and this can withstand flood waters.

(source: Aditi Kapoor/Alternative Futures)

Go back to the list of responses, and discuss whether these responses are examples of coping, or of adaptation. Write the decision on the right hand side of the paper next to the appropriate response.

ACTIVITY FOR PARTICIPANTS | CHANGES IN RESPONSE TO A CHANGING CLIMATE – PART TWO

Objectives	To get participants to determine whether their responses are coping or adaptation
Time	10 minutes
Materials	The flipchart paper used in part one of this exercise, and a marker (someone to record, either in words or pictures)

Steps	■ Get participants to discuss whether these responses are coping, or adaptation ■ Write the decision on the right hand side of the paper, next to the appropriate response ■ Make a third column and write there the gender division of work for the new responses. Are women or men putting in more labour/time? ■ In a fourth column ask the participants to write any government programmes/schemes that are supporting their responses, or can support adaptation initiatives. Eg. watershed development, integrated farming, organic farming, etc (see Table 7.1 below) ■ Have a discussion on whether the government schemes benefit men, women or both to adapt to climate change. *For instance, farmers in India can legally form irrigation committees to regulate water for irrigation. In practice, only land-owners are made members of the committee. This effectively leaves out women farmers because less than 10% of women in South Asia own agricultural land. The local self-government – the village Panchayat, can, if it so desires, allow women farmers as the de facto tillers to be members. Thus, elected rural women can make this possible and tackle water stress in their area.* *In Bangladesh, women agricultural workers are paid less than men agricultural workers for the same work and women have no legal recourse to correct this.* *According to a 2010 survey by the FAO, about 3% of women-headed households used mechanical equipment on farms compared to 8% of men-headed households.*

7.4 WOMEN FARMERS: WHAT CAN BE DONE TO ADAPT TO CLIMATE CHANGE?

Identifying potential actions will depend on the livelihood mix of the audience. For instance, there will be women who will be landless labourers on fields, those who depend for their living more on livestock rearing than on farms, etc. It will be up to the facilitator to steer the discussion to push participants to come up with ideas. Remember to go back to the impacts identified in the previous session to ask people what actions need to be taken to adapt to these. There are a number of themes which can be explored – water, agriculture, livestock, forestry, fisheries, disasters, etc. In a large group, one option would be to split participants into groups and give them one theme to brainstorm, before sharing ideas in a plenary discussion. Building on adaptations already identified, lead a discussion around potential other adaptations that they could consider in order to make their activities resilient in the face of a changing climate. Ask them to also list some of the resources they can use – like government programmes and schemes from the Panchayat or the district administrative office at the block level; reviving some of the traditional varieties of their staple crop (paddy/ coarse cereal/red bean or other nutritive lentils); or reviving their water sources. Watch the videos listed at the end of this section to prompt ideas. Table 7.1 gives some examples of adaptation measures. Put these on a flip chart or on a powerpoint and add to these from the discussion.

TABLE 7.1 | SOME ADAPTATION MEASURES FOR DISCUSSION AND ADOPTION

Add to this list where possible, especially recording what women have to share

SECTOR	ADAPTATION MEASURES SOME EXAMPLES	SUPPORT – VALUING WOMEN'S KNOWLEDGE AND ENSURING BENEFITS TO WOMEN'S WORK AND LIVELIHOODS SOME EXAMPLES
Water management	■ Water storage, e.g. water pans ■ Dams, pits, retaining ridges ■ Irrigation channels to reduce evaporation loss ■ Rainwater harvesting	Watershed programmes – with a focus on farms and kitchen gardens MGNREGA (Mahatma Gandhi National Rural Employment Guarantee Scheme) in India
Agriculture (crops)	■ Crop diversification ■ Planting different crops (as appropriate to the climate), especially coarse cereals/millets ■ Planting early maturing crops (paddy varieties are available) ■ Changing planting dates ■ Cultivating terraces/baira ■ Watering late in the day (to reduce evapo-transpiration) ■ Use of mulching to reduce evaporation and to improve soil fertility ■ Livelihood diversification ■ Multi-level farming in flood-prone areas to secure at least some plants survive floods and do not get washed away.	Several agricultural programmes including flood management scheme in Bangladesh to raise productivity in low-lying areas and floating agriculture in flooded areas Agricultural extension services Connecting with national agricultural research institutions which do field-based work; eg Bangladesh and India's work on drought, flood and saline resilient varieties. Exposure visits to best practices undertaken by NGOs in similar agro-climatic zones Revival of traditional knowledge, especially with women farmers
Agriculture (livestock)	■ Introduce mixed-livestock farming systems ■ Integrated farming can include poultry and fishing ponds ■ Grow fodder crops to ensure feed availability ■ Improving management of the commons, including forests	Cross-departmental support needed – India's programme ATMA (Agriculture Technology Management Agency) Specific livestock management programmes Joint Forest Management Programme (India/ Bangladesh) /Community Forest Management Programme (Nepal) Revival of local species
Agroforestry	■ Hedges, windbreaks, shelterbelts, live fences ■ Nitrogen-fixing trees, bushes, fodder trees	MNREGA programme in India Joint Forest Management Programme (India/ Bangladesh) /Community Forest Management Programme (Nepal); Green Belt Project in Bangladesh for coastal areas

Soils management	■ Minimum/no tillage ■ Rotating with legumes ■ Intercropping with legumes ■ Efficient application of manure ■ Mulching	Several agriculture programmes Exposure trips to adaptation experiments by NGOs Revival of traditional practices
Fisheries and aquaculture	■ Saline-resistant species ■ Increased feeding efficiency ■ Low-energy, fuel-efficient fishing	Linking with ongoing research Revival of traditional species
Human settlements/ houses	■ Building on stilts/raised soil platforms ■ More secure structures (cross beams for high winds)	■ India's Indira Awas Yojana to factor in additional cost of raised platform (already done in few States like Bihar) ■ Local Government Engineering Department Housing Programme in Bangladesh
Disasters	■ Secure harvest storage facilities ■ Conserving seed by mixing with ash ■ High ground facilities for animals	■ Disaster Management Plans in each country with disaster preparedness committees at the local and district level

7.5 ENCOURAGING COLLECTIVE ACTION THROUGH GROUPS OF WOMEN FARMERS

As we saw in the section on gender, gender relations means that women rarely have a voice in decision-making. Acting collectively with other women can help to overcome this problem. If there appears to be sufficient energy and motivation, and if participants live close to each other, probing how they may be able to work together in the future is important – for example through setting up support groups, or lobbying with local government. Since many groups may already exist, discussion could also take place around how trainees can disseminate information learned so that groups engage in adaptation actions.

The above is particularly true because women often do not own land which is the prerequisite to access most government programmes and schemes on agriculture. However, most programmes and schemes have a provision for groups of women to benefit from them as these women stand as witness to each other's status as the *de facto* tiller. Landless women can especially benefit through collective action.

7.6 WOMEN RURAL LEADERS AND LEGISLATORS: WHAT MORE CAN BE DONE TO RESPOND TO CLIMATE CHANGE?

Women rural leaders and legislators have additional and unique power as esteemed members of their communities and in a position to influence decisions for their constituencies. In addition to ensuring that their own livelihoods are resilient in the face of climate change, they should spread the message on climate change and potential adaptations to their constituents. At the same time, as politicians, they may be able to allocate more local funds to support adaptation or lobby for more adaptive local institutions or structures. These again may come in the form of policies or financial assistance. Local-level planning exists in all the countries and adding climate change resilient to development programmes will help their constituency to adapt to climate change.

Objectives	To get the women to concretely think about what the next steps are towards a more adaptive future.
Time	35 minutes
Materials	Flipchart paper and marker (someone to record, either in words or pictures)
Steps	Facilitate a discussion in which women discuss what concrete steps they plan to take to better adapt to climate change, either as individuals or as a collective group.

EXERCISE FOR TRAINERS: GENDER DIFFERENCES IN SELECTED ADAPTATION OPTIONS

(adapted from GGCA, 2009)

Given gender differences outlined above, adaptation options are often not gender neutral. An example is that mechanising farming may benefit men, since technology is typically seen as the male domain. The result is that men benefit relatively more than women, thereby reinforcing the situation of gender inequality.

Brainstorm the following options in terms of possible negative impacts, and solutions to overcome them.

ADAPTATION MEASURE	GENDER ROLES AND ANY ADVERSE IMPACTS ON WOMEN	SOLUTIONS (ALSO FOR IMPLEMENTING GOVERNMENT SCHEMES DIFFERENTLY TO BENEFIT WOMEN/GIVE THEM DECISION-MAKING POWERS
Introduce poultry to diversify livelihoods and promote food security		
Introduce organic farming		
Implement reforestation or afforestation		
Introduce coarse cereals		
Migration (e.g. to towns)		
Add rows for more measures		

ACTIVITY FOR PARTICIPANTS | VIDEOS OF ADAPTATION TO CLIMATE CHANGE IN SOUTH ASIA

Objectives	■ To allow participants to observe other examples of adaptation in South Asia and prompt discussion on what they can do to adapt
Time	35 minutes
Materials	Laptop with DVD, or DVD player, and projector

Steps	■ Show videos -- Some suggestions: (a) Examples of adaptation strategies • Sisters on the planet – Sahena (Bangladesh) http://www.youtube.com/watch?v=WqYgDGy8Z4M • IRIN changing crops (in Nepalese) http://www.youtube.com/watch?v=f14OdHvGQI0 • CLACC Bangladesh Baira – the floating gardens http://www.youtube.com/watch?v=bWGRX_cH3oM • HEDGE ROW Community Based Adaptation Technology for Sloping Agriculture Land http://www.youtube.com/watch?v=A6WIOEdQ7dw&feature=relmfu • Adapting to climate change in the Himalayas http://www.youtube.com/watch?v=jXM3eMqQrwY • Nepal hedgerow (in Nepalese) http://www.youtube.com/watch?v=PDueeyQL2d0 • Ardaman Singh, Punjabi farmer http://www.youtube.com/watch?v=e9dAHa-Sjgc (b) A longer video from a training course with similar aims • India women, food and climate change training http://vimeo.com/26985653?utm_source=WEAvings+The+Newsletter&utm_camp aign=August+2011+Newsletter&utm_medium=email (c) Experts/political figures speaking on adaptation • Prof. A.K. Gosain speaking on adaptation (in Hindi) http://www.youtube.com/watch?v=Wu5MnQII8TE • Dr R. P. Singh, agriculture expert, Punjab http://www.youtube.com/watch?v=L_NLT7atwG0&feature=related • Sheikh Hasina speaking on community-based adaptation (in Bengali) • http://www.youtube.com/watch?v=vz0OT00Kvsk (d) Women organising to express opinions on climate change (useful for a group with lots of legislators) • Dhaka women workers in climate change rally http://www.youtube.com/carooxfam#p/u/22/MambPN9tvd0 (for additional resources, see www.amkn.org) Discuss each one briefly after showing, and then refer back to them in a subsequent discussion on potential adaptations for participants.

TRAINER'S NOTES

PART EIGHT
EVALUATION

8. EVALUATION

Monitoring and evaluation is an important component of any training process.

There are two main reasons why you would want to evaluate your training course:

1. To get feedback on the training course content, the arrangements and structure of the course and to find out whether participants found the course useful or not. This feedback allows the trainers to make any adjustments necessary for future courses to ensure that the training better meets its objectives.
2. To determine whether participants have learnt something from the course, as well as whether or not they have been able to turn the information they learnt at the course into knowledge (i.e. they have been able to apply the concepts taught).

Both of the above are important reasons for doing an evaluation of your training course. The first category of questions can be answered quite simply at the end of the course through, for example, a group discussion or structured feedback form. The second category of questions requires more work, including follow-up visits and assessments, in order to be fully answered. In particular, it requires qualitative research.

8.1 PRINCIPLES OF QUALITATIVE RESEARCH

Qualitative research seeks to address why people behave in the way they do – it asks the "how" and why" questions. It therefore allows a greater depth of analysis, but it can make recording and analysing

more difficult. This is because qualitative research does not generate number answers that can easily be subject to statistical analysis. Instead qualitative research requires an intensive period of analysis through coding in order to determine emerging insights. The outcomes of qualitative research do, however, provide much more in-depth insights, and are thus often very useful in evaluations in determining future directions for training.

Conducting research in an ethical manner is important in any research. It is standard practice to keep research responses confidential. This is arguably even more critical with qualitative research, since the nature of the findings may give in-depth opinions and analysis. In some cases, findings are kept anonymous – meaning that the findings are never attributable to the person who said them. Anonymity is difficult to maintain with a longitudinal evaluation that takes place with the same participant at several times. This is because in order to show change over time, you need to attribute findings to the correct participant. However, at the stage of writing up findings it is possible to maintain anonymity, for example by giving each participant a letter or number (e.g. participant A, or participant 1).

When undertaking any training it is vital to remember that participants are using their valuable time to attend. This is particularly true of rural women who, as we have learnt, have multiple roles to fulfill. As time is valuable and there is much to be taught and learnt, we suggest the following evaluation process which addresses both of the reasons for evaluation in the most efficient way.

QUESTIONNAIRE TEMPLATE

The questionnaire template is attached as Appendix D: Evaluation template. The trainer should make copies of this template – at least one per participant but a few extras is always a good idea – before the start of the training course.

8.2 EVALUATION OF THE TRAINING AT THE END OF THE COURSE

At the end of the training course it is important to get feedback from participants on how they found the training. We suggest first asking people what they learnt today, and then what they felt was missing today. This provides you with useful feedback for when you run your next training course. Since you will also be conducting follow-up evaluation, we also suggest you ask people for one thing that they plan to change after the training course. These results need to be linked with the relevant person (unlike many course evaluations, which are anonymous) so make sure you make a note of names.

- If all your participants can read and write then it is quicker and easier to ask them to fill in the evaluation forms themselves (make sure you have enough pens or pencils for everyone!). Once everyone has had a chance to fill in the forms, and if you have time, then it is a good idea to have a group discussion – other points may come out (make a note of these yourself, as well as the person who said them, so that you can add to the questionnaire sheets later).
- However, in many circumstances some or all of your participants may be illiterate and therefore unable to fill in the evaluation forms themselves. In an ideal situation (when you have enough time!) the trainers would “interview” each participant individually, asking them each of the questions and then recording their answers in the space provided. This method has the added benefit of allowing further explanation of questions and “probing” questions to get richer answers.
- Unfortunately you will not always be training under ideal circumstances. Whilst you should always plan for enough time to do a thorough evaluation, sometimes this just is not possible. And if some, or all,

of your participants are illiterate then the evaluation process is even more difficult and requires some creativity and thinking on your feet. Under these circumstances the evaluation can take place in a group setting, with the answers recorded on a flipchart or notebook (try and get someone else to do the recording and ensure that they record names next to comments). Some of your participants may be shy and not used to speaking up in a group situation so you will make this as non-threatening a situation as possible. Explain that everyone's answer is important and that you need a response from each person. Read out the question and give people time to think about their answer. Of course, not all their answers have to be unique but, by giving people time to formulate their own responses, you lessen the chances of "copying".

DISCUSSION AND SHARING OF IDEAS:

Any other ideas of how to do an evaluation in less than ideal circumstances?

8.3 LONGER TERM EVALUATION OF WHAT WAS TAUGHT IN THE COURSE

Whilst participants can give you their experiences of the training at the end of the course, it is only after they have returned home that we can truly evaluate whether the training has had an impact on their thinking and actions. As a result, we suggest return visits to trainees, three months and six months after the end of the training. Visiting them in their home environment means that it is on "their territory" and will likely prompt them to consider how the training has affected their thinking and doing. You may also have the opportunity to changes they have made (they are likely to be enthusiastic that you see them if changes have been made!). Given that some trainees will be illiterate, an oral discussion is preferable, with you asking the questions and taking notes.

EXERCISE FOR TRAINERS

Role play for longer-term evaluation

Divide into pairs. One person will play the role of a workshop participant who has undergone training. The other will play the role of the person performing the evaluation, having the opportunity to ask the questions and record answers accordingly.

8.4 RECORDING, ANALYSING AND REPORTING ON RESULTS OF THE EVALUATIONS

Since there will be three stages of evaluation (on the day of the training course; 3 months later and then 6 months later), it is important to keep good records, to link each stage. We recommend completing a template for each participant, and keeping it safe to add with each further stage.

Once data has been gathered at each stage, analysis needs to occur. Since the data that you will have will be in the form of words recorded from the trainees, as opposed to numbers, the process of analysis will involve coding. Coding is a way of ordering your data so that emerging themes can emerge. Although there are software packages available to undertake coding, with the small number of questionnaires the most useful tool is your mind and a set of highlights/coloured pens.

Sometimes questionnaires are pre-coded. In this case, however, we do not want to presuppose the responses and limit the data range. Because we want to instead respond to what emerges, we will be post-coding (namely after data collection).

Coding involves interrogating the data for emerging themes. When they appear, you can highlight/underline them – that will become your code. When the same theme occurs elsewhere, either in the same questionnaire or another questionnaire, you colour it in the same way. You undertake this process repeatedly until you are happy that all the major points have been recorded.

Coding should take place after each stage, with no presumptions from one stage carrying over to the next. You may find, however, similarities in themes arising, particularly between the 3 month and 6 month evaluation.

Once all three evaluations have been completed, a qualitative report can be written. In particular, highlight positive examples of where learning has been translated into concrete action, and where information has been further disseminated. It is also important to identify obstacles to changed behaviour and activities.

EXERCISE FOR TRAINERS

Coding

Using the examples of data recorded in the previous exercise, we will demonstrate and discuss coding as a group. In keeping with the nature of qualitative research, it often creates much discussion as there is more subjectivity involved in devising codes than for quantitative data.

TRAINER'S NOTES

PART NINE

REFERENCES & FURTHER INFORMATION

9. REFERENCES AND FURTHER INFORMATION

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9.2 SOURCES OF FURTHER INFORMATION

9.2.1 TRAINING RESOURCES

Adaptation and Mitigation Knowledge Network: http://amkn.org

Map-based tool that allows you to see profiles, videos, and blog entries about our CCAFS benchmark sites. It also allows you to layer on climate or crop models (at low resolution) for the whole globe.

Climate change 101

- "Understanding and responding to global climate change." Available for download from http://www.pewclimate.org/docUploads/Climate101-Complete-Jan09.pdf
- "Science and impacts" Available for download from: http://www.pewclimate.org/docUploads/Climate101-Science-Jan09.pdf

Climate Change Capacity Development C3+
www.3cd-unitar.org

The Climate Change Capacity Development (C3D) project addresses capacity needs for climate change in developing countries through an innovative training and capacity building partnership, as stated in the UNFCCC Decision 2 CP/7. It contains a variety of more advanced training materials.

The UNITAR Climate Change Programme
http://www.unitar.org/ccp/

The mission of the UNITAR Climate Change Programme (CCP) is to enhance the capacity of government and civil society representatives in the developing world to assist developing countries improve their participation in the United Nations Framework Convention on Climate Change (UNFCCC) and their adaptation process

9.2.2 COUNTRY-SPECIFIC RESOURCES

Bangladesh

Climate Change Strategy and Action Plan 2009
www.moef.gov.bd/climate_change_strategy2009.pdf

National Adaptation Programme of Action (NAPA) under the UNFCCC
http://www.moef.gov.bd/bangladesh%20napa%20unfccc%20version.pdf

Bangladesh Centre for Advanced Studies (BCAS)
http://www.bcas.net/

An independent, non-profit, non-government policy, research and implementation institute that works across a broad range of sustainable development themes.

India

National Action Plan on Climate Change
(http://www.adaptationlearning.net/sites/default/files/India%20-%20National%20Action%20Plan%20on%20Climate%20Change.pdf)

National Communication to the UNFCCC
http://www.natcomindia.org/flashmain.htm

This website contains information on the process of India's First and Second National Communications

Aggarwal, P.K. (Editor). 2009. Global Climate Change and Indian Agriculture. Case Studies from the ICAR Network Project. Indian Council of Agricultural Research, New Delhi-110012, India.

Paryavaran Mitra (http://www.paryavaranmitra.in/)

A sustainability and climate change education project aimed at creating 20 million "friends of the environment" in Indian schools. Website has resource material and publications in a variety of Indian languages.

Divecha Centre For Climate Change, Indian Institute Of Science, Bangalore, India
(http://www.dccc.iisc.ernet.in/home.html)

Interdisciplinary research centre to understand the impacts of climate change on the natural environment. Partners with the Grantham Institute in the UK

Various women's organisations:
http://www.jagriti-international.org/organizations.asp?Country=India

Indian Network on Ethics and Climate Change
http://inecc-net.ced.org.in/index.php?option=com_content&view=category&layout=blog&id=95&Itemid=130

Have existing education resources

Alternative Futures
http://alternativefutures.org.in/userfiles/Engendering%20the%20Cilmate%20for%20Change.pdf

Nepal

Climate Change Policy 2011
http://www.moenv.gov.np/newwebsite/

National Adaptation Programme of Action (NAPA) under the UNFCCC
http://www.napanepal.gov.np/

Nepal Climate Change and Development Portal
http://www.climatenepal.org.np/main/

A portal run by the Ministry of Environment and the climate change community of practice in Nepal that provides practitioners with a platform to conduct research, network, discuss and share climate change knowledge.

Himalayan Alliance on Climate Change
http://www.himcca.org/

This alliance of researchers concerned with climate change works in different themes.

Case study: Gender and climate change in the Hindu Kush Himalayas of Nepal
http://www.wedo.org/wpcontent/uploads/nepalcasestudy.pdf

PART TEN
APPENDICES

10. APPENDICES

10.1 APPENDIX A: HOW TO DESIGN A CAPACITY ENHANCEMENT WORKSHOP

STEP 1	■ Decide on a topic for your workshop and write a one-two sentence description. What will the course be about? What will learners get from the course?
STEP 2	■ Write a 1-2 sentence purpose for the workshop. Who is this course aimed at? Why is it important for them to take this course? What can they do once they complete the course?
STEP 3	■ Review the description and the purpose and decide on one to three objectives (also referred to as "outcomes"). ■ When deciding on the objectives, it is important to bear in mind how much time you have - obviously the longer the training period, the more objectives can be covered. ■ To help write the objectives, think of an action verb and connect it to something that the participant will be able to do once the course is completed. The verb must be demonstrable (for this reason "understand" is not a good objective) ■ Example: Upon completion, the learner will be able to design (action verb) a complete course.

STEP 4	■ Look at each of the objectives you have stated and write a statement that will tell the learner how the stated objective will be measured or assessed. It is also possible to measure if all objectives have been attained through just one assessment. ■ For example, for the objective above, a measure could be: Design a course, complete with description, purpose, objectives, measures, deliverables, and assessments. ■ This is what the instructor will use to evaluate the participant's comprehension of the workshop. It is very important that the assessment is aligned with the objectives.
STEP 5	■ Divide the workshop into learning sessions - you can do this by looking at the objectives and creating a session for each objective or pair of related objectives. Try not to include more than two objectives for each session as this can become confusing. ■ Determine how long each session will last. You decide how much time you need to teach the objective and measure the outcome in each session. Remember that participants can easily become tired and bored and lose concentration - it is therefore better to keep each learning session as short as possible (but not so short that the objective is not covered adequately!!)
STEP 6	■ Try and make each session as varied as possible - two hours of being lectured to is not pleasant for anyone! ■ Divide each session into varied sections e.g. start off with buzz groups to see what participants know already; a short lecture/ power point presentation/ video to transmit the content; time for the participants to interact e.g. discussion and questions/ debate/ role play. You may even want to take participants out into the field to show them what you want them to know about. ■ Varying your activities makes each learning session much more interesting and will hold the attention of your audience for much longer but for this to work, time management is extremely important! ■ Look carefully at how much time you have for each learning session, allocate time within each section for each activity and then stick to it!! ■ Remember to allow time (may be at the end of each learning session and/ or a whole session at the end of the course) to recap/ assess what has been covered in the session(s).
STEP 7	■ Decide who in your trainers group is going to do what. It is not necessary that everyone in the group presents in the workshop - play to the strengths of the members of your group - but it is more interesting for the participants to be instructed by a several different people.
STEP 8	■ If it is appropriate, draw up a handout for the participants. This handout should include, at least, the aim and objectives of the course; an agenda of the learning sessions; any assessments of the course as well as contact details of the instructors/ organisation holding the workshop. ■ Draw up a training outline for the instructors/ organisers of the workshop. It is a good idea to have as detailed an outline of your workshop on paper as possible so that if a member of the team is not able to attend or falls ill, etc., all the information and instructions are available for someone else to take their place. And if you have to do the same course again, it'll help to remind you what you did!

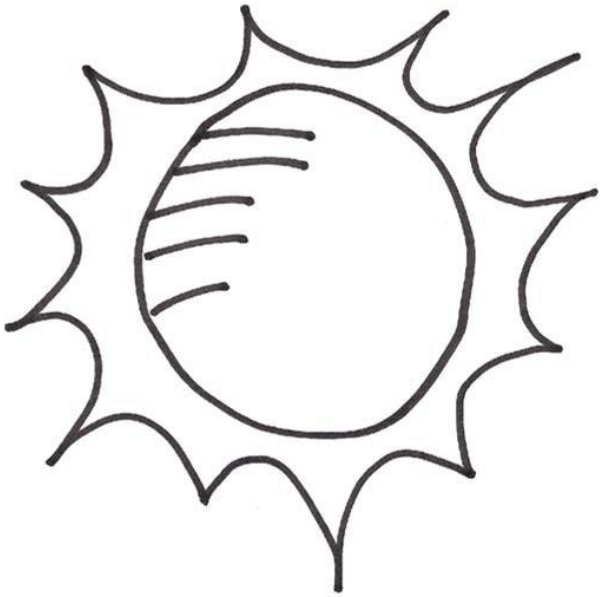
10.2 APPENDIX B: IDEAS FOR "ICE-BREAKERS"

PARTICIPANTS INTERVIEW EACH OTHER (ADAPTED FROM CCAFS AND FAO, 2011)

Objectives	■ To have participants meet one another and help them relax ■ To share participants' challenges and expectations of the workshop
Time	30 minutes
Materials	■ Coloured A4 paper/cards ■ Markers ■ Pens
Steps	■ Introduce the exercise and ask participants to find someone they don't yet know (it might be the person next to them, but doesn't have to be). ■ Explain that each pair will have ten minutes to conduct pair interviews. Participants should find out the following about their partner: • Name or nickname that participant wants to be called in the workshop (Partners should make a name card with this name) • Institution • Type of work • Any other interesting thing about the person, i.e. one good thing that happened in the last year, their favourite food, etc. Be creative. • One expectation of the workshop, written on a piece of paper ■ After the pair interviews, have each pair introduce each other to the larger group. Post the pieces of paper with their expectations of the workshop onto the wall.

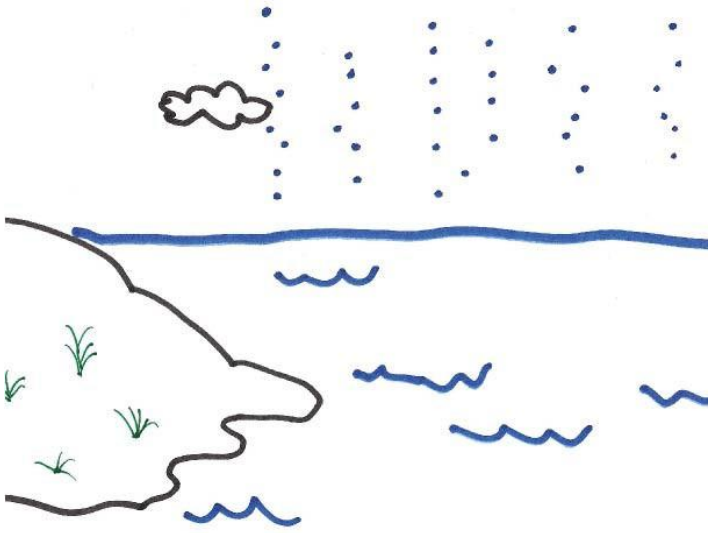
LEARNING NAMES

Objectives	■ To have participants meet one another, learn each other's names and help them relax
Time	15 minutes (approximately 30 seconds per participant)
Materials	None
Steps	■ Ask each participant to explain what their name (or nickname) means. They may be names after someone or an event that occurred at the same time as their birth. Their name (or nickname) may have a specific meaning. Nicknames especially are usually because of some trait or experience. ■ The trainer or facilitator should start the introductions with an explanation of his or her own name.

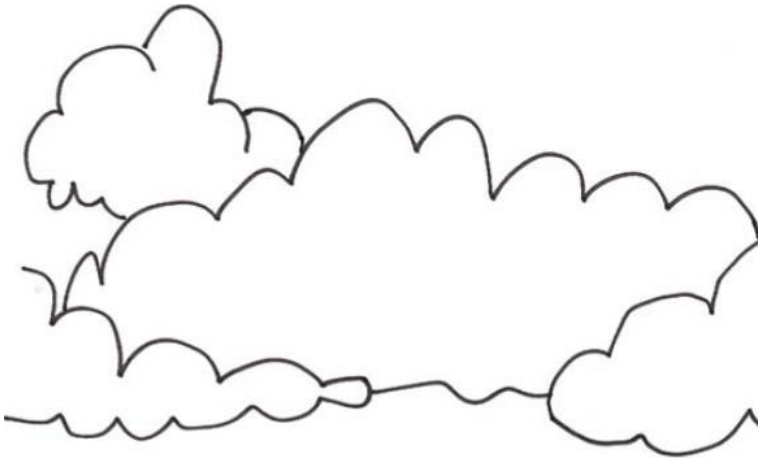


10.3 APPENDIX C: THE HYDROLOGICAL CYCLE

(Heat from the sun drives the hydrological cycle - causes water to evaporate)

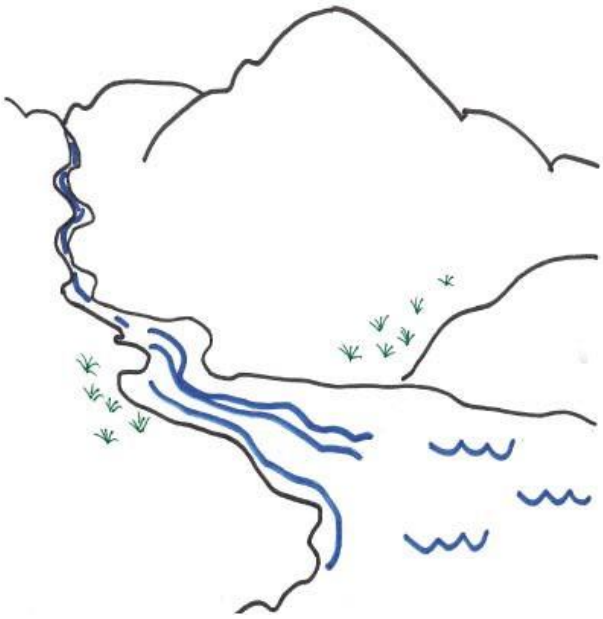


(Evaporation: due to the heat from the sun, water changes from a liquid to a gas)

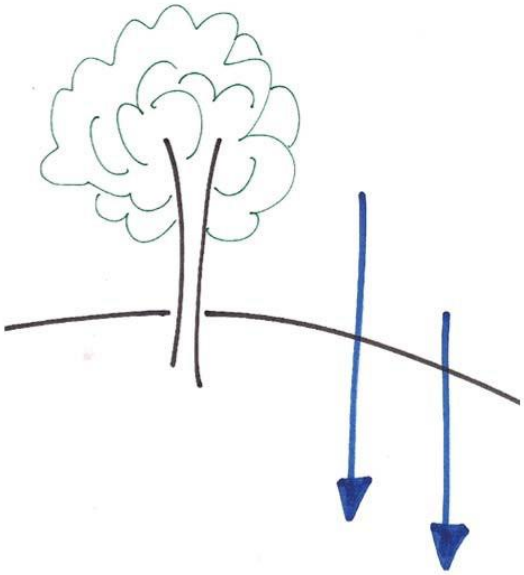


(Condensation: clouds form)

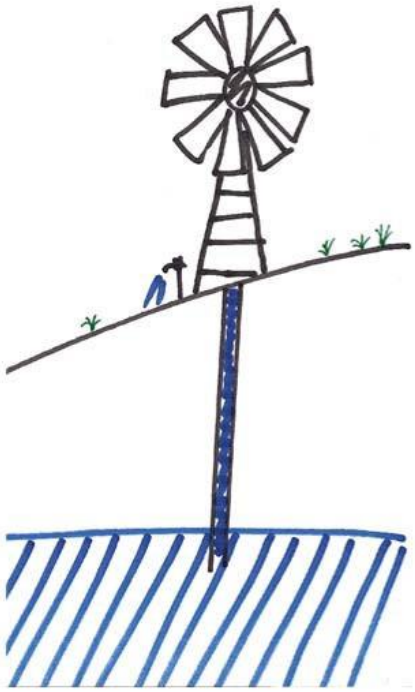
(Precipitation: for example, rain or snow)



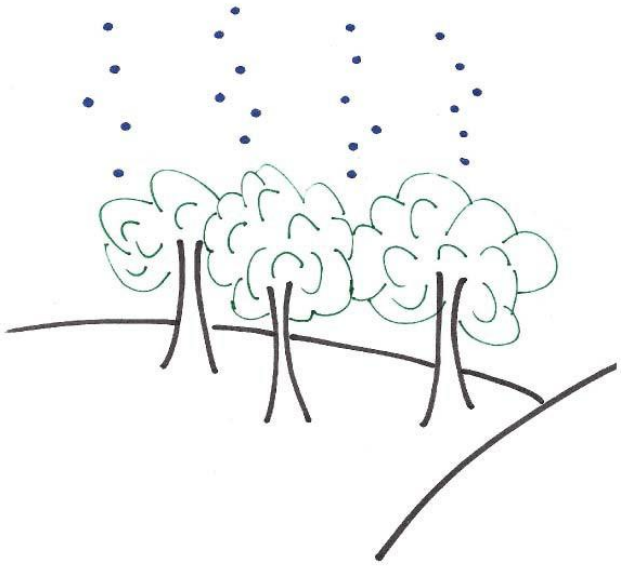
(Run off: water flows on the surface, first over the ground and then into river channels)



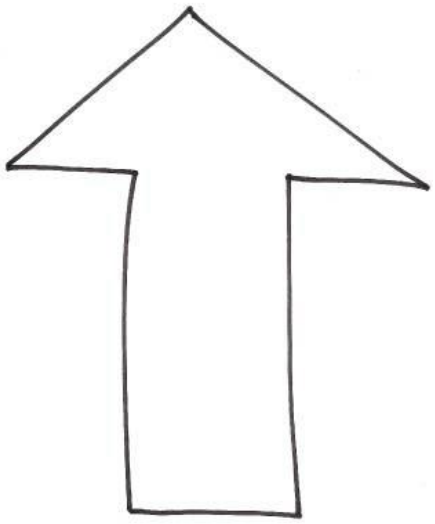
(Infiltration: water soaks into the ground)



(Groundwater: water collects and is stored underground)



(Transpiration: water vapour is released from trees and other vegetation)



(Process arrow)

10.4 APPENDIX D: EVALUATION TEMPLATE

(Critical questions are marked in grey, in case of limited time)

Participant name (optional)	
Training course (date and location)	
1. EVALUATION AFTER THE WORKSHOP	
1.1 What was the main thing that you learnt today?	
1.2 What is one thing you found interesting about climate change, and how might it affect you?	
1.3 What did you feel was missing?	
1.4 What was the most interesting part of the course?	
1.5 What was the least interesting or boring part of the course?	
1.6 What one thing do you hope to change when you go home?	
1.7 Additional comments/observations	
2. EVALUATION THREE MONTHS AFTER THE WORKSHOP	
2.1 What is climate change, and how might it affect you?	
2.2 How have you been able to use information that you learnt at the training?	
2.3 Have you shared the information with anyone else? If so, how?	
2.4 At the end of the training, you said the one thing you wanted to change when you got home was [*insert participant's comment*]. Have you been able to do this? If not, why not?	
2.5 Additional comments/observations	
3. EVALUATION SIX MONTHS AFTER THE WORKSHOP	
3.1 What is climate change, and how might it affect you?	

3.2 How have you been able to use information that you learnt at the training? Has anything changed since three months ago?
3.3 Have you shared the information with anyone else? If so, how?
3.4 At the end of the training, you said the one thing you wanted to change when you got home was *[insert participant's comments.]* Have you been able to do this? If not, why not?
3.5 Additional Comments and observations

TRAINER'S NOTES