Gender, Climate Change, Agriculture, and Food Security

A CCAFS Training-of-Trainers Manual

to prepare South Asian rural women

to adapt to climate change

November 2011

CGIAR CIAT

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LIST OF ACRONYMS

CCAFS	Climate Change, Agriculture and Food Security
CEW	Capacity Enhancement Workshop
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
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
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

Contents

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. It has been designed by the Climate Change, Agriculture and Food Security (CCAFS) program, and is appropriate to South Asia.

1.1 Climate Change, Agriculture and Food Security (CCAFS) Program

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic 10-year partnership emerging from a new collaboration between the Consultative Group on International Agricultural Research (CGIAR) and the Earth System Science Partnership (ESSP). Through this collaboration, CCAFS brings together strategic research in agricultural science, development research, climate science, and earth system science, 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 peoples' understanding of climate change issues; and ensuring that decisions on policies and actions are based on the best information and data. In order to meet the overall goal, CCAFS has established four research themes: Adaptation to Progressive Climate Change; Adaptation through Managing Climate Risk; 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: the South Asia (with an initial focus on the Indo-Gangetic Plains), Southeast Asia, West Africa, East Africa, and Latin America. Led by the International Center 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, policy makers, donors and other stakeholders, integrating their knowledge and needs into the tools and approaches we develop.

1.2 Why South Asia, particularly the Indo-Gangetic Plains?

South Asia is considered to be one the most vulnerable regions to climate variability and change due to its high population, high exposure to climatic risks, and widespread poverty. The Indo-Gangetic Plains (IGP) is a densely populated region in South Asia, spanning parts of Pakistan, India, Nepal and Bangladesh. It has historically been characterized 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. But increasing population and incomes are 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 minimizing further environmental degradation is a challenging task for all countries of the region (http://ccafs.cgiar.org/)

1.3 Why a focus on women?

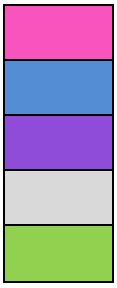
Whilst climate change will likely affect all rural livelihoods, it will have larger and more devastating implications for some. Women comprise about 65% of the agricultural workforce in South Asia, but constitute a majority percentage of the rural hungry. Climate change threatens to exacerbate food security and economic vulnerability, as women generally have fewer livelihood alternatives than

men. Despite these challenges, women are also in important positions that allow them to be critical agents of change. Limited research shows that, in India, during crises like adverse production years, women tend to gain more decision-making power. 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

The manual will provide you with the information and tools required to deliver Capacity Enhancement Workshops (CEWs) to rural women to raise their awareness of the causes and effects of climate change, and empower them to adapt successfully to projected changes. In addition, the manual covers two additional elements: gender awareness, and evaluation.

The manual contains much information on content as well as training skills. In order to simply the material included the following colour key has been used to identify various categories of information:



Definitions and explanations

Training skills

Case studies

Activities for the trainers (ToT)

Activities or tailored explanations for the CEW participants

Since the CEW is targeted at women, there is less need to train participants on gender awareness. However, since both men and women will be acting as the trainers for the course it is necessary to include sensitization on gender differences, and what that means for how men and women experience climate change, and what can be done to promote adaptation. The activities for participants at the CEWs are also designed to be gender sensitive. This forms the first part of the training manual.

With all training initiatives, it is important to evaluate their use. Traditionally, evaluation occurs at the end of the training course. Whilst this is important, it does not allow participants time for the new information and concepts to settle in their minds. Similarly it happens too early to be able to analyse the challenges and opportunities of acting on the new information. As a result, this training programme will be delivered with a longer-term programme of evaluation that includes not only evaluation after the event, but also three months and six months after the training. The last part of the training manual will show you how to do this.

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. However, hints are given for teaching difficult concepts throughout the manual.

1.4.1 What this manual does NOT do

This manual provides you with the information and tools required to deliver the training courses. What is does NOT do is provide 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; hints and ideas for the successful training of concepts and materials to use 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.

1.5 Objectives for this Training of Trainers (ToT) course

At the end of this training of trainers, ***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 behavioural 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.

1.6 Training skills

1.6.1 Training and facilitation skills

(Adapted from ILO, 2002)

The structure and content for the CEWs for rural female legislators and women farmers in South Asia is provided in this manual. However, there may be occasions where you are asked to ***design*** a training course from scratch. The steps provided in Appendix A: How to design a capacity enhancement workshop will help you with this.

There are a number of generic skills for training and facilitation that will stand you in good stead for ***delivering*** this training course. This session briefly reviews some of these.

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!

Table 1: Good Techniques/ Practices for Training

Introductions

- Relax and energise participants;
- Provide the opportunity for participants to learn each other's names and, if appropriate, the organisations they represent. You can use an ice-breaker to do this (see Appendix B: Ideas for "ice-breakers").

The beginning

- If you have not been able to conduct a needs assessment beforehand, try and 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;
- 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: show a wide range of visual aids (simple, easy to read in colour and size, key words not long stories), 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).

Table 2: Attitude/behaviour 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 judgements 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, 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

1.6.2 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 3: 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 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	An outcomes where men and women are equal.
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 behaviours, 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 behaviour (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 behaviour.
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: CONSIDERING GENDER

2. Considering Gender

2.1 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 means that typically women are more disadvantaged. It is for that reason that the training that you will be running is targeted specifically at rural female legislators and women farmers. Although you will not be teaching on gender differences *per se*, it is important that you are familiar with them. 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.

2.2 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. Rural women make up the majority of the world's poor. They 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).

In other words, gender often constrains women to an unequal position in society in comparison to men. The opposite of this, **gender equality**, is an outcome where men and women are deemed equal in society. Achieving gender equality as an outcome, however, does not necessarily mean equal treatment of men and women. Instead, different pathways can be followed, recognising gender differences. This is often referred to as **gender equity**, which means "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

Box 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)

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" (FAO, 2011a).

> ♀ *Gender inequity is extremely applicable to South Asia. Using 2007 data, the UNDP ranked India 114 out of 155 countries in its "Gender-Related Development Index." Sexism is also apparent in the country's unequal sex ratio and, despite laws against it, the practice of female infanticide continues. By some measures, it has actually increased in recent years in parts of northern India.*

2.3 Analysing gender: gender roles and relations

"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).

Box 2: Gender Roles

- Are socially defined
- Determine social and economic activities
- Reflect biological differences
- Vary according to regions and cultures
- Change over time

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

2.3.1 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).

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). 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).

Box 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 is voluntary unpaid work, 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)

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.

While gender roles in agriculture can change depending on circumstances (e.g. the men migrating to cities for seasonal work) or the introduction of technology (so that the other gender can take over), typically these agricultural roles are more or less defined. Table 4 below shows some of the typical ways in which farm tasks are divided:

Table 4: Popular separation of gender roles in South Asian agriculture.

The categorisation provided below may not be universal for all countries in the region. Space in the table is therefore left for you to add further country-specific details.

Women's Sphere	Men's Sphere
• Producing staple crops (wheat, rice) • Sowing/planting • Weeding; applying fertilizers and pesticides • Harvesting, threshing • Milking livestock (cows, goats) • Managing small livestock (e.g., family poultry) • Maintaining the household: raising children; growing and preparing the family's food; collecting fuel wood and drinking water • Generating income via: processing produce for sale; selling vegetables from home gardens or forest products *This income generally goes toward meeting the family's food needs and child education.*	• Handling cash crops and commercial agriculture • Preparing lands for sowing • Irrigating crops • Transporting produce to market • Owning, managing, and trading large livestock like cattle • Cutting, hauling, and selling timber from forests • Capturing fish in coastal and deep-sea waters

2.3.2 Access to resources

The term **resources** refers 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, health
- 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 Table 5, there are many instances in which these types of resources overlap.

Table 5: Gender Gaps in Agriculture (modified from 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. ♀ *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 earn only about 64% of men fry catchers/sorters.*	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. ♀ *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, 54.5% of adult women are literate, compared to 76.9% of adult men.* ♀ *In Madhya Pradesh, by the age of 15-17, only 24% of girls are attending school.* ♀ *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 organizations 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.

2.3.3 Needs

Because the roles of men and women in societies are often different, their needs vary accordingly. With relation to promoting gender equality, women's needs can be distinguished as either *practical gender needs* or *strategic gender needs* (see box 4). 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 4: 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.

Strategic gender needs (SGNs) are the needs women identify *because* of their subordinate position in society. SGNs do challeng 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)

Exercise for trainers: Discussing gender roles and their social construction.

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. 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. Understanding these roles is important for designing appropriate strategies to adapt to climate change.

Women's roles	
Men's roles	
Girl child roles	
Boy child roles	

After 10-15 minutes, these roles will be compared and contrasted in a plenary discussion.

TRAINER'S NOTES

PART THREE: WOMEN'S CAPACITY ENHANCEMENT WORKSHOPS

3. Structure of the Capacity Enhancement workshops for rural female legislators and women farmers in South Asia

3.1 Purpose

This course is targeted at rural women leaders and women farmers in South Asia, 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.

3.2 Needs assessment

In order to design and deliver a training course which is relevant and useful, it is vital that a needs assessment be done prior to the design phase. Ideally the people designing and delivering the training course should assess the needs of the intended participants directly, either through focus group discussions or individual interviews. Observation of intended participants' lives can also be an important tool as people may not be aware of what can improve their lives/ what they need training in.

However, a needs assessment is not just about what is missing or what still needs to be done. It is also useful for ascertaining what already exists – what the intended participants already know or are already doing; what resources are available to them; what community structures are already in place, etc. A successful training course is one which builds on these foundations, rather than attempting to introduce something completely new.

Always bear in mind that a thorough needs assessment will take time and resources – it is therefore critical that these factors are included in all planning and budgetary processes.

3.3 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
- Be able to define climate change and its causes
- Be aware of the likely projected changes in climate in South Asia with regard to temperature and rainfall patterns, and its implications for core livelihood activities
- 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)

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	20 minutes
Materials	Notebook/ paper and pen Smaller pieces of paper or card (white or coloured) Flipchart and flipchart pens
Method	• Facilitate two 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: o What is climate change? o What causes climate change? o Who causes climate change? o Is climate change something which affects you? o Is there something you can do to stop climate change? • Do not be judgemental about participants' answers – this is not the time to start correcting people. All answers are valid as the 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. • 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

Please note!

Depending on where and to whom you are speaking, people in the audience may be non-literate. To avoid losing them, or making them feel lesser for not knowing how to read/write, you may need to rethink some of the flipchart exercise. For example, you could:

- *Take notes for yourself when people speak to be able to continually reference what they say, but don't write it up on a board, expecting others to read it.*
- *Accompany all writing on the flipchart with simple drawings as well. (OR just use drawings.)*

3.4 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 09h00 to 17h00). It then suggests a structure for a shorter day (10h00 to 15h00) for which the content can be extracted from the full day content.

Session	Manual parts
General environmental education	Introduction to environmental systems (part 4)
Impact of humans on the environment	Impacts of humans on the environment (part 5)
Effects of a changed environment on humans	Climate change (part 6); impacts of climate change on agriculture and food security (part 7)
What you can do to adapt to a change environment	Adapting to climate change (part 8)

3.4.1 Full day workshop

The full day workshop is divided into four sessions, covering general environmental education, the impact of humans on the environment, effects of a changed environment on humans, and what women can do to adapt to a changed environment. 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.

	Topic	Subtopics and activities	Time (mins)	Page reference
09h00 – 09h40	Introductions	**Activity: Icebreaker**	10	91
		Needs Assessment **Activity: What do participants already know? What are their expectations of the course?**	20	28
		Overview of Capacity Enhancement Workshop	10	28-31
09h40 – 10h30	Session 1: Introduction to environmental systems	Introduction to Environmental Systems	10	35
		The Hydrological Cycle	40	36
		Activity: Constructing the Hydrological Cycle	*Part of above*	36, 93-101
10h30 – 11h00	Tea			
11h00 – 12h15	Session 2: Impact of humans on the environment	Deforestation	30	40
		Activity: Looking at the effects of change in one part of the system on other parts	*Part of above*	41
		The Atmosphere and the Greenhouse Effect	30	41-42
		The Enhanced Greenhouse Effect **Explanation: The (enhanced) greenhouse gas effect**	15	42
12h15 – 13h00	Lunch			
13h00 – 14h30	Session 3: Effects of a changed environment on humans	What is climate change? How do we know that the climate is changing?	10	42-54
		Activity: Looking for evidence for a changing climate; **Activity: Uncertainty**	30	48, 54-55
		Activity: Defining potential impacts of climate change on people's lives	40	65
14h30 – 15h00	Tea			
15h00 – 16h45	Session 4: What can you do to adapt to a changed environment	Climate change is not new; How will the climate change in the future? **Explanation: Future climate change**	10	46-54, expl: 52
		Activity: Responses to a changing climate – part one	15	70
		Adaptation vs. coping	10	70
		Activity: Responses to a changing climate – part two	10	70
		Activity: Videos of adaptation to climate change in South Asia	20	72-73
		Activity: Mapping out a more resilient future	35	75
16h45 – 17h00	Wrap-up (inc. evaluation)		15	77-80, 101-102

3.4.2 Half-day workshop

	Topic	Subtopics and activities	Time allocated (minutes)	Page reference
10h00 – 10h40	Introductions	**Activity: Icebreaker**	10	91
		Needs Assessment **Activity: What do participants already know? What are their expectations of the course?**	20	27
		Overview of Capacity Enhancement Workshop	10	27-31
10h40 – 11h15	Session 2: Impact of humans on the environment	The Atmosphere and the Greenhouse Effect	20	
		The Enhanced Greenhouse Effect **Explanation: The (enhanced) greenhouse gas effect**	15	Expl: 43
11h15– 11h30				
11h30 – 12h30	Session 3: Effects of a changed environment on humans	What is climate change? **Explanation: Future climate change**	10	40-54 Expl: 53
		Activity: Looking for evidence for a changing climate	20	48
		Activity: Defining potential impacts of climate change on people's lives	30	65
12h30 – 13h15	Lunch			
13h15 – 14h45	Session 4: What can you do to adapt to a changed environment	**Activity: Responses to a changing climate – part one**	15	70
		Adaptation vs. coping	10	70
		Activity: Responses to a changing climate – part two	10	70
		Activity: Videos of adaptation to climate change in South Asia	20	72-73
		Activity: Mapping out a more resilient future	35	75
14h45 – 15h00	Wrap-up (inc. evaluation)		15	77-80, 101-102

TRAINER'S NOTES

PART FOUR: INTRODUCTION TO ENVIRONMENTAL SYSTEMS

4. Introduction to Environmental Systems

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 not possible to go into great depth about the systems approach to understanding the environment so we have chosen to concentrate on the Hydrological Cycle. 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 interlinkages between different aspects of the environment. 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 focus of the next session).

4.1 Session 1 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

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

- be aware of environmental systems, including the atmosphere and hydrological system

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)

4.2 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 need 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).

4.3 The hydrological cycle

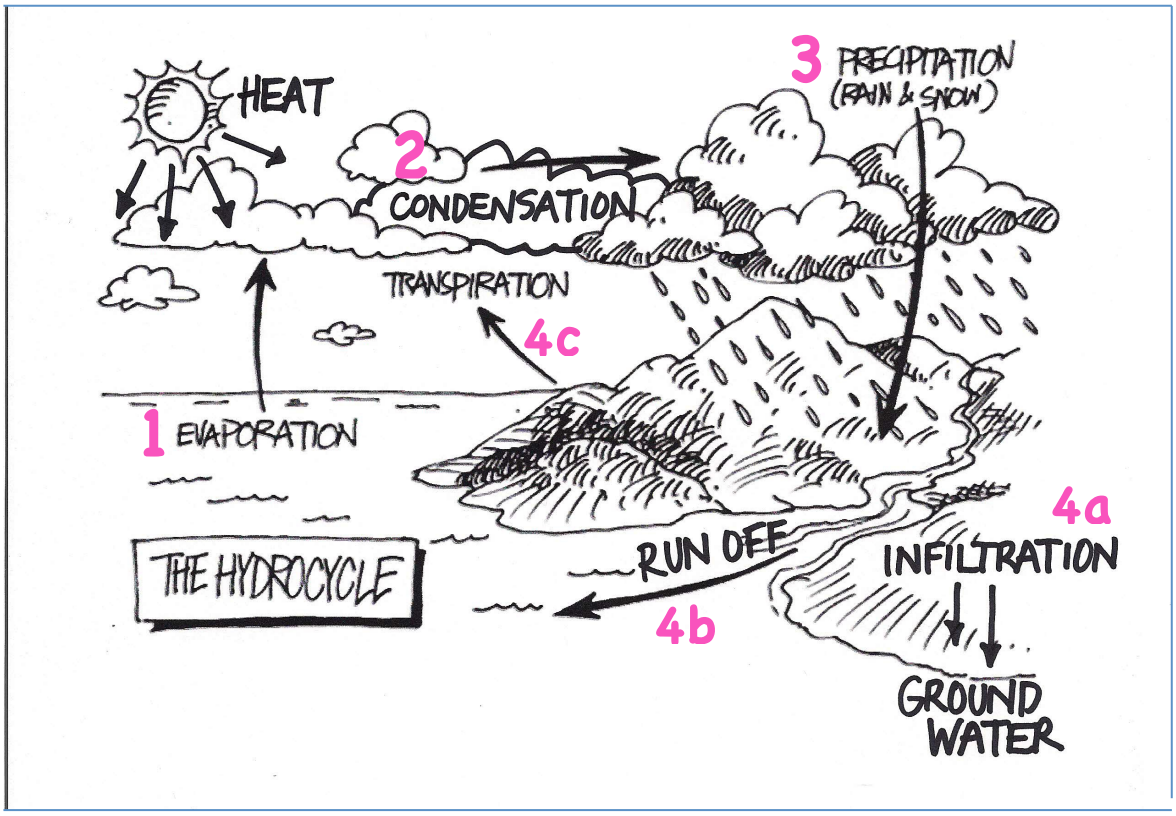


Figure 1: The Hydrological Cycle (adapted from www.fwee.org)

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).

Activity for participants: Constructing the Hydrological Cycle	
Aim	The aim of this activity is twofold: 1. To explain and help participants to visualise each element of the hydrological cycle 2. To demonstrate the interconnectedness of the different elements **Note:** *We suggest using the hydrological cycle but if you are more familiar with another environmental cycle (e.g. the carbon cycle) then use that. The point of the exercise is to show participants the interconnectedness of different aspects of the environment. In the next session we build on this by showing that changes in one part of a cycle will have far-reaching consequences in other parts of the cycle.*
Time	This activity is an integral part of teaching the hydrological cycle – 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 • Run-off • Infiltration / ground water • Transpiration • Arrow to show process (you will need at least 7 of these) 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 no flat surface available, simply place the 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. • As you go through each element make sure you emphasis how it is connected to other parts of the cycle. • Leave the completed cycle up as you will be coming back to this in the next session.

In addition to water, many other substances such as nitrogen, oxygen, and carbon cycle through the earth and 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)

TRAINER'S NOTES

PART FIVE: IMPACTS OF HUMANS ON THE ENVIRONMENT

3. Impact of Humans on the Environment

The first session of the day used the Hydrological Cycle to introduce participants to the concept that all environmental elements are interconnected. We now build on this knowledge to demonstrate that changes in one aspect of a system will cause changes in other aspects of the system. We will be using the phenomenon of deforestation to illustrate the above as this is something which is likely to be familiar to the participants. We aim to show how the removal of trees and vegetation will impact on the Hydrological Cycle.

As this is a training course specifically about climate change the remainder of this session will concentrate on the atmosphere and the weather and climate that takes place 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.

5.1 Session 2 learning objectives

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

- Identify the types of human activity that affect the functioning of environmental cycles, with particular reference to deforestation and the hydrological cycle
- Have knowledge of the greenhouse effect, and the enhanced greenhouse effect
- Identify the causes of climate change

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

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

Additional resources:

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)
http://unfccc.int (United Nations Framework Convention on Climate Change website)

5.2 The impact of deforestation on the hydrological cycle

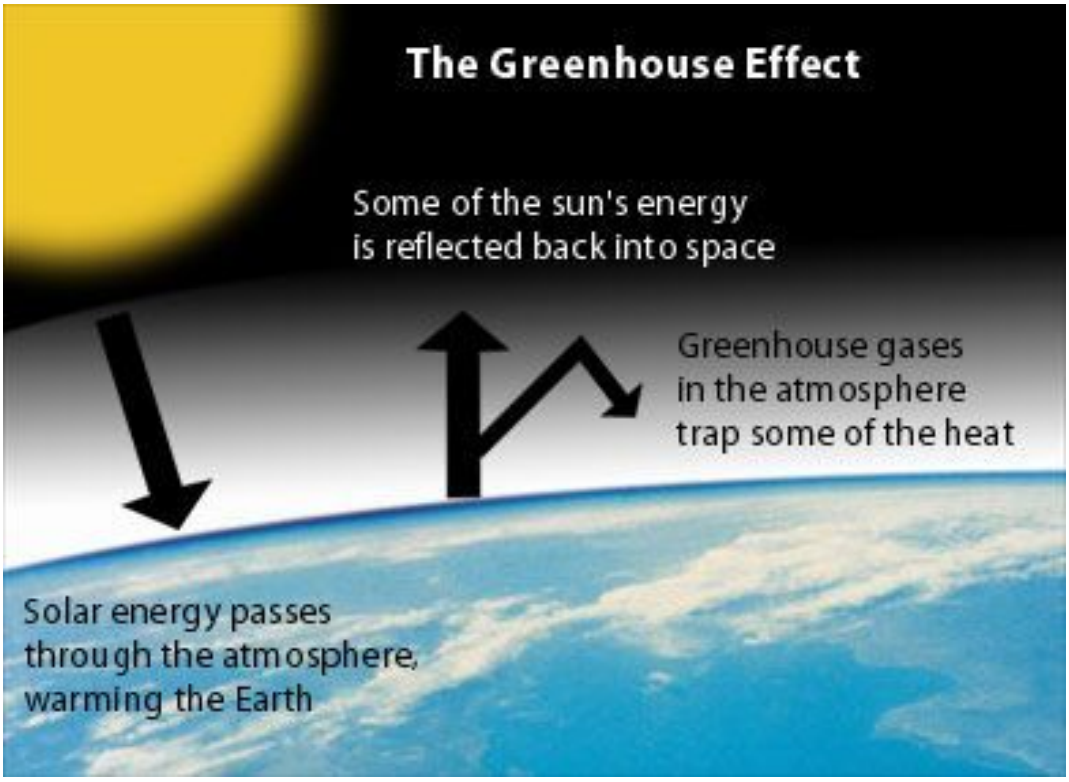
Deforestation affects the hydrological cycle and various other environmental systems. Using the diagrams of the hydrological cycle drawn up in the previous session, take the participants through what will happen to various flows within the cycle if a large number of trees are cut down. The aim is to show that what happens in one part of the system has effects elsewhere. If participants easily grasp this, ask them to identify other human activities that may interfere with the hydrological cycle (e.g. water abstraction, land cover changes, such as urbanisation, and changes in water quality due to agricultural pollution from fertilisers and herbicides).

Activity for participants: Looking at the effects of change in one part of the system on other parts	
Objectives	• To have participants think through how a change in one part of the system affects other parts of the system
Time	30 minutes
Materials	Flipchart pages detailing flows within the hydrological cycle developed during session one.

Steps	• Explain a situation where deforestation has occurred
	• Using the diagrams, ask participants to identify how deforestation is likely to affect:
	  ○ EVAPORATION
	  ○ CONDENSATION
	  ○ PRECIPITATION
	  ○ RUN-OFF
	  ○ INFILTRATION
	  ○ TRANSPIRATION
	• Look at the impacts of that deforestation on people (flooding, soil erosion etc.). It is likely that participants will have experience of this – if so, engage them in discussion.
	• The aim is to highlight how changes observed in one place can be caused by actions elsewhere, and similarly actions in one place can cause changes in the system elsewhere

5.3 The atmosphere and the greenhouse effect

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



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).

Like the greenhouse covering, our atmosphere also serves to keep heat at the surface of the earth. Much of the sun's energy reaches earth as visible light. Of the visible light that enters the atmosphere, about 30% is reflected back out into space by clouds, snow and ice-covered land, sea surfaces, and atmospheric dust. The rest is absorbed by the liquids, solids, and gases that constitute our planet. The energy absorbed is eventually reemitted, but not as visible light (only very hot objects such as the sun can emit visible light). Instead, it is emitted as longer-wavelength light called infrared radiation. This is also called "heat" radiation, because although we cannot see infrared, we can feel its presence as heat. This is what you feel when you put your hand near the surface of a hot pot. Certain gases in our atmosphere (known as "trace" gases because they make up only a tiny fraction of the atmosphere) can absorb this outgoing infrared radiation, in effect trapping the heat energy. This trapped heat energy makes the earth warmer than it would be without these trace gases (www.ucar.edu).

The ability of certain trace gases 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" 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).

Box 6: 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)

5.4 The enhanced greenhouse effect

Over the last 200 years or so, human activities have increased the rate at which greenhouse gases are emitted into the atmosphere. The result of higher concentrations of greenhouse gases in the atmosphere (like carbon dioxide) means more heat energy is trapped. This is the mechanism that is causing **climate change**.

Table 7: 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	Fertilisers
Chlorofluorocarbons	Refrigeration systems

The important thing to note here is that the women attending training are likely to be very low emitters of greenhouse gases. However, the atmosphere is a global system, like the Hydrological Cycle outlined in session one. 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.

Explanation for CEW participants: The (enhanced) greenhouse effect	
Objectives	To teach participants the cause of climate change, i.e. the enhanced greenhouse effect
Time	15 minutes
Materials	Flipchart and markers

Steps	• Draw the figure shown on p. 41 to explain climate change very simply.
	• You can describe the atmospheric layer as:
	  ○ A blanket: The earth needs this blanket for humans to survive. But with more greenhouse gases, the blanket gets thicker/traps more heat, so the world on average gets warmer. (But remember to explain that this is not the only effect of climate change—variability is also important.)
	  ○ A greenhouse/polyhouse: More greenhouse gases is like adding a greenhouse/polyhouse, where everything gets warmer. But sometimes, it gets too warm, etc.
	• You might want to explain some examples of human sources for greenhouse gases, e.g. as in Table 7, but to avoid confusion/unnecessary detail, we would recommend against actually listing out the names/types of greenhouse gases.
	
	**NOTE: We strongly recommend AGAINST using PowerPoint or other such teaching tools. It assumes certain available tools (e.g., projector… and even steady electricity!), but more importantly, it often does not elicit particularly interactive behavior. Go low-tech!

TRAINER'S NOTES

PART SIX: CLIMATE CHANGE

4. Climate Change

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, how it is likely to change into the future (and how we know), and what the impacts of this are.

6.1 Session 3 learning objectives

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

- Be able to provide evidence that the climate is changing
- Be able to explain future projected changes, and how these projections are derived
- Be familiar with projected changes in climate in South Asia and the Indo-Gangetic Plains

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 its implications for core livelihood activities

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 – its 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.

6.2 A changing climate is not new

The climate has always changed. In the past there have been both ice ages and, in some places, warmer periods than today. Natural climate change can occur due to occasional changes in the earth's orbit around the sun, or due to volcanoes which change the composition of the atmosphere. What is different now is that humans are affecting the atmospheric composition as well (resulting in the enhanced greenhouse effect outlined above). We understand the mechanism of the enhanced greenhouse effect, and we know that concentrations of core greenhouse gases (carbon dioxide, methane, NOx) have increased since the 1800s. These days, when people refer to climate change they are typically referring to changes in climate due to human activity. Since we only have one earth, we cannot say what proportion of climate change is due to natural causes relative to human causes.

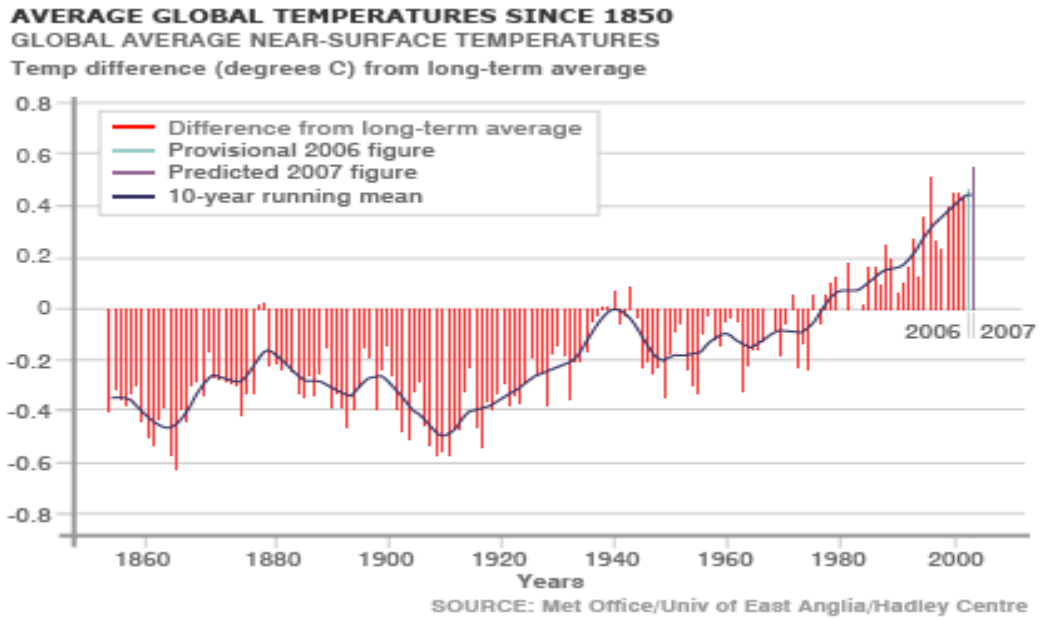
Box 7: What is climate change?

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). 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.

6.2.1 Evidence for climate change to date

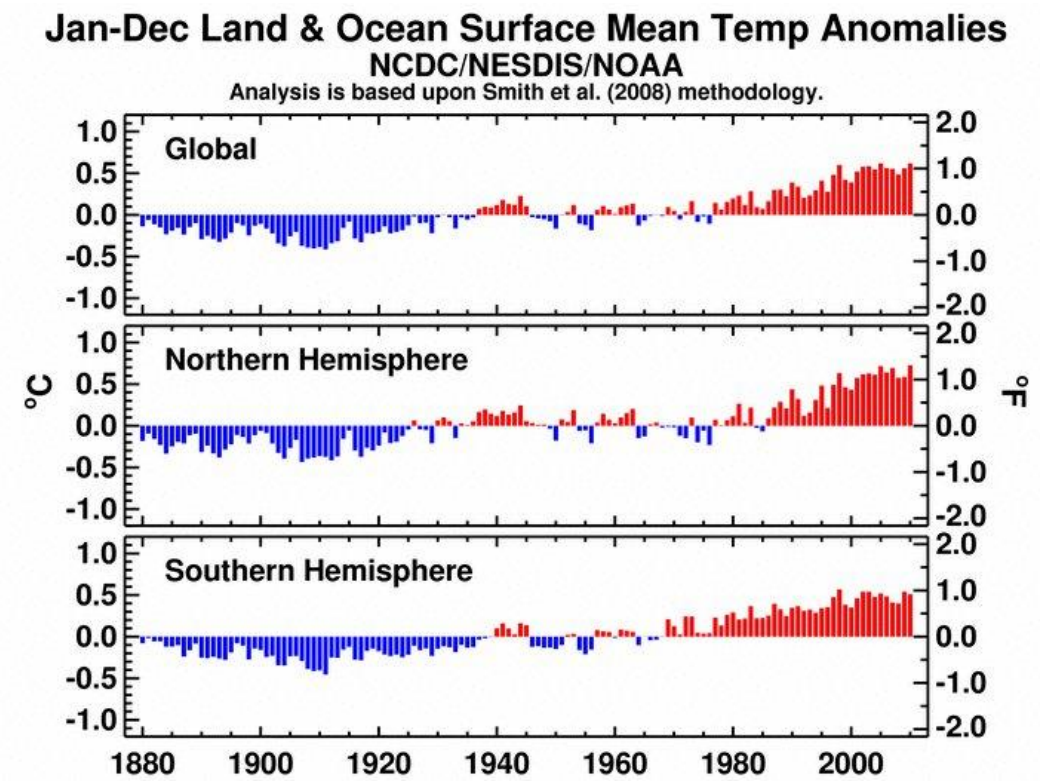
1. Rising temperatures

Average global temperatures rose by 0.8^{0}C over the 20th century.



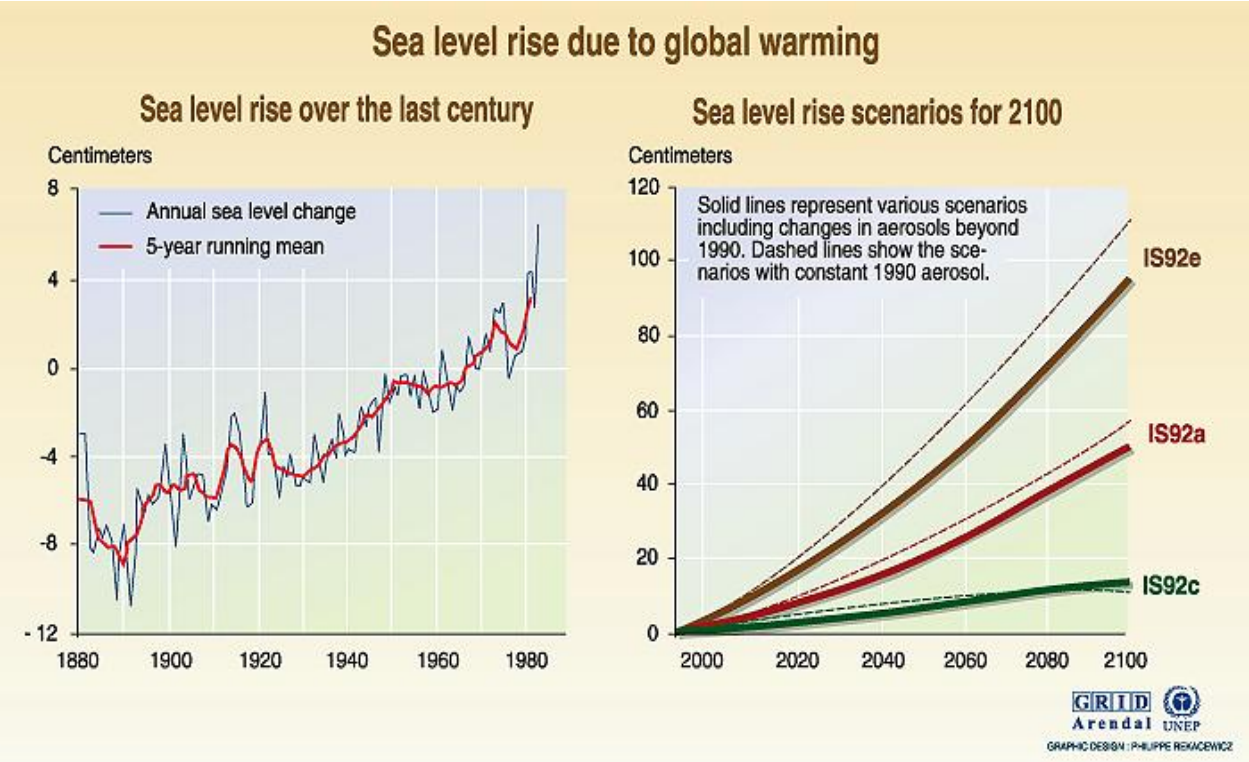
2. Sea surface temperatures

Sea surface temperatures increased by 0.6^{0}C over the 20th century



3. Sea level

Sea level rose between 10 and 25cm over the 20th century.



Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996; Sea level rise over the last century, adapted from Gornitz and Lebedeff, 1987.

Due to increased global average atmospheric and sea surface temperatures, it is true to say that we have experienced global warming, but in general we prefer the term climate change, as this encompasses the fact that increased temperatures are not the only manifestation of climate change – in some places temperatures will decrease, and there will also be changes in humidity, rainfall, wind, and severe weather events (e.g. tropical cyclones).

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
Steps	• In a group discussion format, ask participants to consider any changes they have observed in climate over their lifetime. Prompting questions could include: o Does it rain at the same time of year as in the past? o Does it rain heavier than before? o Has there been any change in temperatures? o Do the seasons change at the same time? o 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. • Then explain the historical records produced by scientists, and show how these match the women's own experiences.

6.3 How will the climate change in the future?

The IPCC Fourth Assessment Report indicated that observed changes are likely to continue and intensify. Global average temperatures are projected to rise by 1.1^0 and 6.4^0C. It is very likely that hot extremes, heat waves, and heavy precipitation events will continue to become more frequent.

6.3.1 How do we know how the 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.

Box 8: Climate models, simply explained

You choose a:

- Global Climate Model (pick one or an ensemble – see Box 9)
- Emissions scenario (SRES)
- Future year for predictions (normally 2030, 2050, 2080, or 2100)

A comprehensive modelling procedure then gives rise to a **climate projection**. This can show data like:

- Annual mean temperature
- Min/max temperature for a month or year
- Total precipitation for a year or month
- Number of rainy days

Then you can use these data to try to predict how crops would respond to these changes (crop modelling). There are a number of ways to do this, all of which are helpful but carry their own types and levels of uncertainty.

Box 9: Modeling global and regional climate change

Global Climate Models

Global Climate Models (GCMs) are the fundamental tool used for projecting future change. They are complex computer models, which represent interactions between the different components of the climate system such as the land surface, the atmosphere and the oceans. Typically, future global climate changes are estimated for a range of different greenhouse gas emission scenarios, because it is not clear how our behavior and policy choices will influence future climate change. So our current estimates include a range of estimates. In 2007, for example, the Intergovernmental Panel on Climate Change Fourth Assessment Report (IPCC, 2007) estimated that global average warming would lie somewhere in a range between 1.1°C and 6.4°C, with a best estimate of 2.4°C by 2100, depending on which of a range of emission scenarios we follow.

Ensembles

Another important technique to overcome the limitation of any one particular estimate of climate change is to use more than one GCM to produce an estimate. By combining multiple estimates into an *ensemble*, it is possible to construct a probability distribution of the range of possible future changes from which to draw conclusions.

Downscaling
GCMs typically work at a spatial scale of 200-300km. For a variety of reasons, this is often too coarse to capture the kinds of detail which are necessary to reliably describe climate and climate change at regional scale. To get around this problem, it is necessary to *downscale* to finer spatial scales. A number of approaches, both using statistical techniques and higher resolution regional climate models, exist to achieve this. It is now generally accepted that it is necessary to downscale climate change projections in order to assess local and regional impacts, adaptation and to develop national climate change policies.

Please note!

This section of the manual contains a lot of background information. You do not have to—and we would in fact recommend against—trying to teach all of this in your Capacity Enhancement Workshop. Simplicity is key!

We have provided extra information, so that you may be able to answer any questions that arise—and so that you feel comfortable enough with the topic to be able to explain it in more basic terms to someone else.

6.4 Current climate description

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, bringing 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 Plain (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 al. 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.

6.5 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 seasons and more frequent and intense storms. Given that the region is home to 600 million of the world's poorest people, most of whom depend on climate-sensitive sectors such as agriculture, forestry and traditional fishing, the combined impacts of climate change and natural disasters have important consequences.

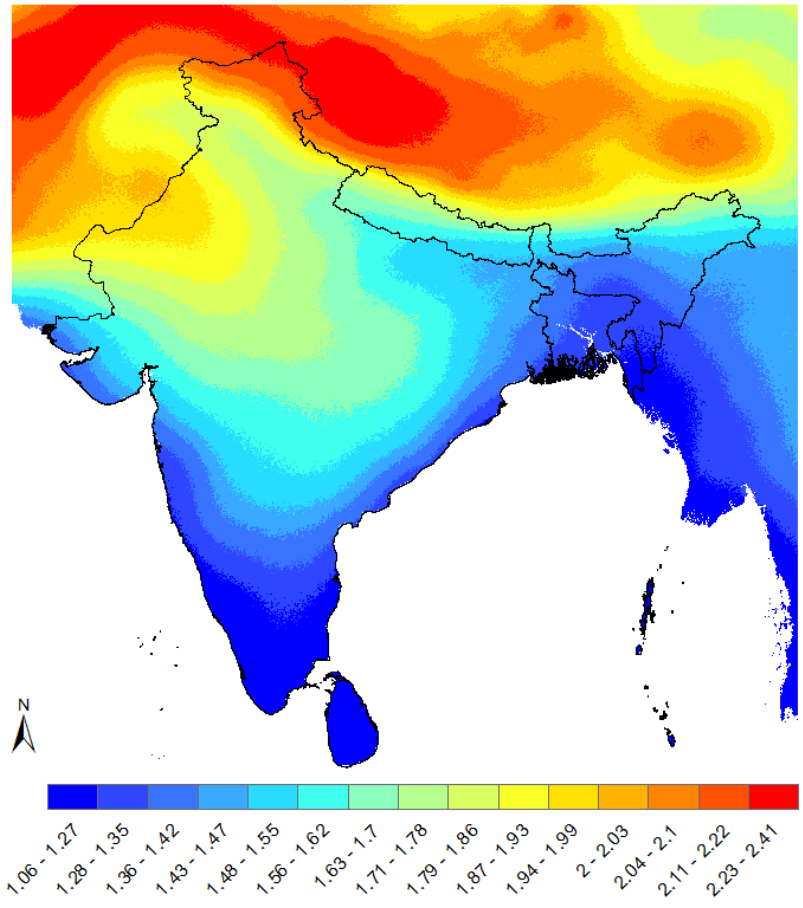


Figure 2: A broad-brush depiction of anticipated *change* in mean annual temperature for South Asia by 2030 (scenario A1B). Note that though warming is anticipated for the whole region, climate change will likely impact different zones differently.
(*Source: CIAT-CCAFS*)

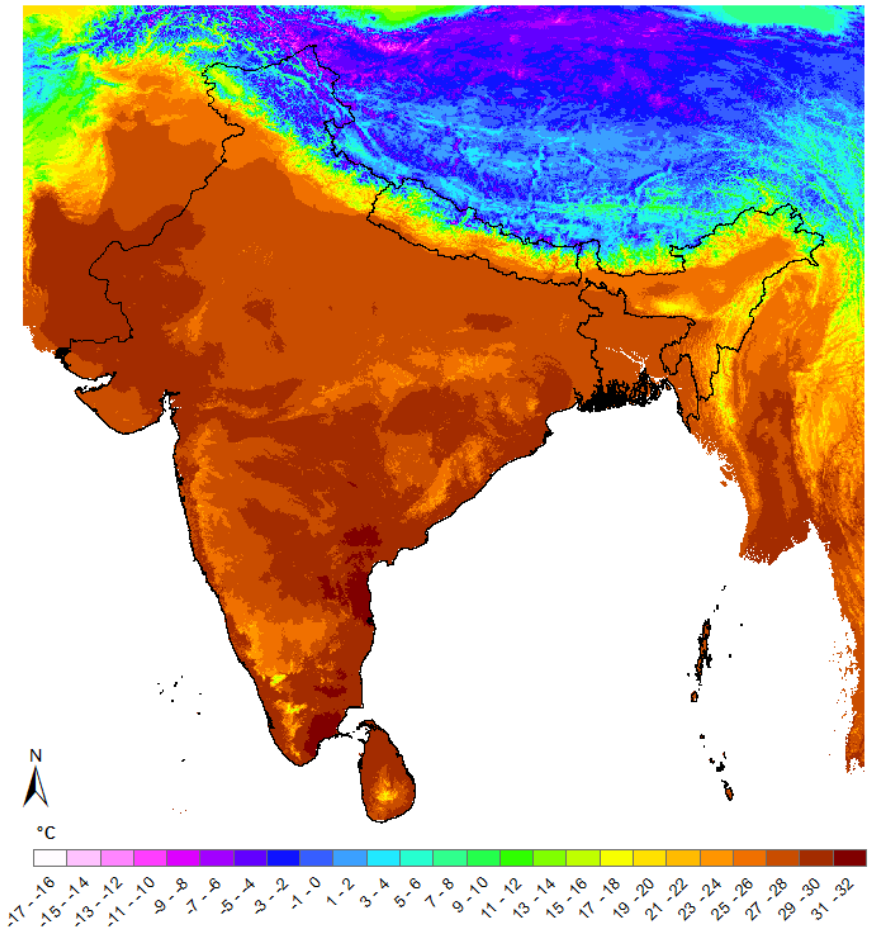


Figure 3: The projected mean annual temperature by 2030 for South Asia (scenario A1B). (*Source: CIAT-CCAFS*)

Table 8: 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).

Explanation for CEW participants: Future climate change	
Objectives	To teach participants about projected future climate change.
Time	15 minutes
Materials	*Optional*: climate change maps (e.g., figure 2 on p. 51, or create your own using one of the resources on p. 54)
Steps	**Unfortunately, this section will be less participatory, as the participants will not have had experience with future climate change. Your explanation should be rather basic.* In particular, you might consider mentioning: • It will, on average, get hotter. If you have a temperature map, you can point to where the village is roughly located and then explain the color coding (e.g., "We are here, which means that by 2030, scientists believe it will get ABOUT X degrees warmer.") • Often these maps just show averages, but climate change often means more variability and more extremes. (Link back to the participants' observed changes.) • Scientists are more sure about temperature rather than precipitation, but they think rainfall will become much more variable (including more extreme monsoon seasons), with possibly more total rain, but fewer number of rainy days. • For coastal areas, the sea level will likely rise, meaning more flooding and more salinization of coastal lands. • For watershed areas, you may experience more water from Himalayan glaciers melting. For simplification's sake, we also suggest NOT mentioning: • How scientists use climate models, and what it does vs. doesn't consider • Complex graphs or tables (like those on p.47-48) • Exact numbers re: precipitation, water availaibility, or crop yields • Relationship of monsoon to El Niño, or other such complex processes

Additional Resources: Creating your own map

The CCAFS Adaptation and Mitigation Knowledge Network (AMKN, http://amkn.org) is a user-friendly online portal where you can play around with climate and crop projections:

- Zoom to CCAFS Region (top bar) → Indo-Gangetic Plains
- Display Data Layers (top bar) → choose a layer. (The last one, "WorldClim GCM" is probably the most applicable.)
- If you click on a CCAFS benchmark site (right-hand panel), it will give you a site profile and more specific data.

The World Bank Climate Change Knowledge Portal (http://sdwebx.worldbank.org/climateportal/):

- Click on Asia in the map → your country
- Top bar: choose historical or future climate.
- You can also choose your variable, scenario, model, etc.

6.6 Understanding and managing uncertainty

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.

One widely-used technique to manage uncertainty is to construct a probability distribution of the likely range of future climate changes, using an ensemble approach (see box 8). Sometimes, models or scenarios disagree on the direction of change (whether there will be more or less rainfall, for instance), but more commonly, they disagree on the magnitude (how many millimeters more or less) or the timing (by when it will get this wet). See Figure 4 below.

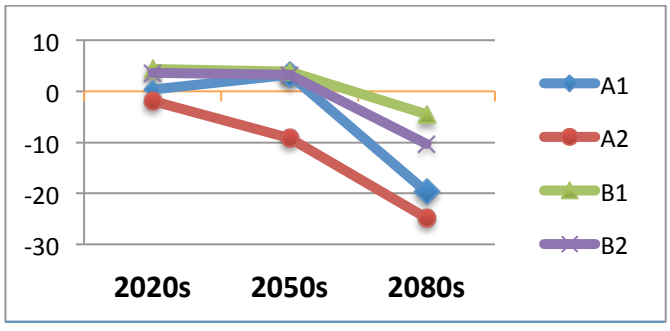


Figure 4: Projected winter precipitation change (%), India subcontinent

Ultimately, uncertainty is part and parcel of the process of estimating future climate change and must be managed. However, as the exercise below demonstrates, we are already accustomed to managing uncertainty in other spheres of our life.

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 weather will be like tomorrow? Are you more or less certain about tomorrow's weather than you are of next week's (month's / year's) weather?
- Is the weather the only 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?

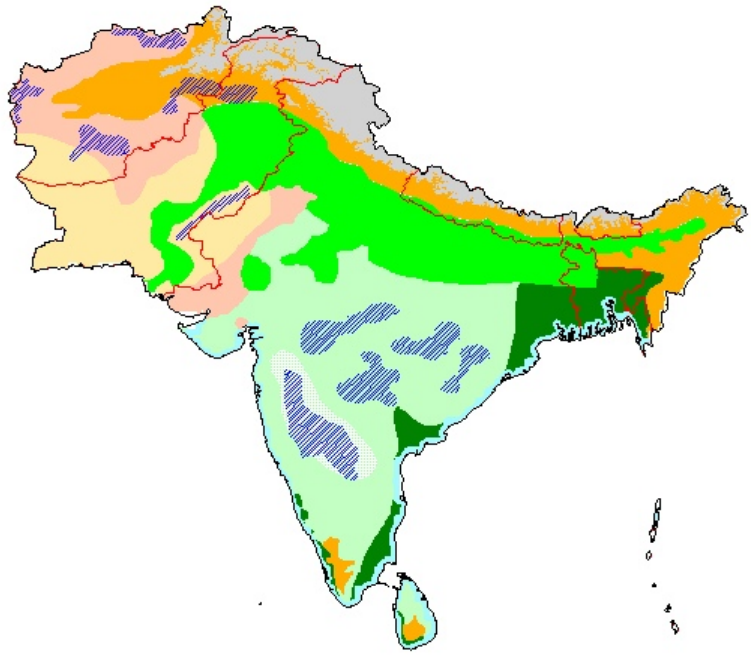
TRAINER'S NOTES

PART SEVEN: CLIMATE CHANGE IMPACTS ON AGRICULTURE & FOOD SECURITY

7. Climate Change Impacts on Agriculture and Food Security

7.1 Agriculture in South Asia

Agriculture is an important part of the economy in all the countries of South Asia. As Figure 5 shows, the predominant farming systems are rice-wheat and rice. The Green Revolution 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 each country still comprises small-scale farmers in rural areas. Rural women, in particular, are very dependent on agriculture for their livelihoods.



Farming systems

1. Rice
2. Coastal artisanal fishing
3. Rice- wheat
4. Highland mixed
5. Rainfed mixed
6. Dry rainfed
7. Pastoral
8. Sparse (arid)
9. Sparse (mountain)

Irrigated area in rainfed farming system

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

Figure 5: Major farming systems in South Asia

7.2 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 the household cannot *utilize* the food, so 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 is 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 eating 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. That said, despite strong economic growth and increasing incomes, malnutrition and food insecurity still seem to be a trend in the region.

- ♀ *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.*

7.3 Current climate 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 several 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 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.

7.4 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 at the same time as increasing numbers of people mean growth in competition for freshwater 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 10). At the same time as this, food demand will rise in the region due to population increase.

Box 10: 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 the reductions in production level. The growth in people 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 the 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 for wheat 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 1°C rise in night time temperatures. Given that South Asia is projected to experience a median temperature increase of 3.3°C by the 2080s, these yield loss estimates are well within the range of likely temperature rise over the next several decades.

Furthermore, higher temperatures and evapo-transpiration, and increase seasonal rainfall variability, and eventual loss of seasonal glacial meltwater 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 9 outlines some projected impacts by country in the Indo-Gangetic Plains.

Table 9: Likely impacts of climate change by sector

Sector	Likely 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 estimated to decrease by 10% for every 1°C temperature increase (Peng et al, 2004) • Higher temperatures and evapotranspiration will increase seasonal rainfall variability; increased droughts, floods, and heat events will increase production variability • Productivity of most crops to remain unaffected/ marginally decrease by 2020 but decrease by 10-40% by 2100 (Aggarwal, 2009) • Climate change will also impact on livestock- less milk, greater stress on animals (Aggarwal, 2009) Increasing sea and river water temperatures are likely to affect fish breeding, migration, and harvests (Aggarwal, 2009)
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
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

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).
Water resources	• Initial increase in water (to 2040) due to glacial melt, followed by less water (to 2100) due to retreat of glaciars. • 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
Marine and coastal ecosystems	• Projected sea level rise (SLR) will severely impact coastal ecosystems, infrastructure and human settlements o More than 35 million people in Bangladesh will be at risk of flooding by 2050 (Government of Bangladesh, 2007). o SLR in major Indian cities (Mumbai, Kolkata, Kochi) will be at risk o SLR of 1m by 2050 in Sri Lanka could submerge significant proportions of land and severely impact the rail transport network o 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
Settlements	• Flooding will several impact parts of Bangladesh, India, Nepal and Sri Lanka – regional 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 centres

7.5 Gendered impacts of 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, and women will likely be especially affected (UNDP, 2010).

7.5.1 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 patterns 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 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 a 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 then men to run; often have not learnt to swim, and have behavioural restrictions which limit their mobility in the face of risk (UNDP, 2010) (Box 5).

Box 5. CASE STUDY. Women as leaders, decision-makers and full participants: Action Aid's tsunami response programme in Nicobar and the Andaman Islands.

The 2004 Southeast/South Asian tsunami killed more women than men. The reason for this is underlying gender norms. Due to their traditional child-rearing roles, women typically spend their lives at home. When the tsunami hit, they put the safety of their children before themselves. Many reported having their clothes ripped off by the debris, and chose to stay within the house rather than run outside naked. Women also traditionally couldn't swim, unlike the men. During the relief effort, their reduced role in decision-making relative to men meant that they were often excluded from the distribution process, and thus unable to access aid.

In a subsequent project from 2005-07, Action Aid undertook a participatory vulnerability analysis with women in Nicobar and the Andaman Islands. Through this exercise of identifying vulnerability, women were able to share experiences and form participatory groups. These groups were then supported by Action Aid in skills needed to reduce vulnerability, such as learning to swim and fish. Collective action has also raised their stakes in decision-making processes, putting them on a more equal footing with men.

Source: UNISDR (2008)

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

Activity for participants: Defining potential impacts of a changing climate on people's lives	
Objectives	To have participants consider what the projected changes in climate will mean for them and their lives.
Time	40 minutes
Materials	Flipchart or notebook to record answers
Steps	• In a group discussion format, ask participants to consider what the projected changes in climate will mean to their lives. You can divide the discussion into the impact of climate change on the various **sectors** (outlined in Table 9, above) that are relevant to the participants. • If you have both men and women participants then it is important to divide them into two single-sex groups as the points arising from the discussion will differ according to their gender. • If you only have women in your audience then you can ask them to consider how the impacts will differ depending on whether you are a man or a woman (divide the sheet into three columns—women, men, or both). ***Table 6 below may give you some ideas.***

Table 6: Potential climate changes and their effects on women
(Source: based 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 weather-related 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 mobilising 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, but 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.

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!) (see Box 11).

Box 11. CASE STUDY Apples 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.

TRAINER'S NOTES

PART EIGHT: ADAPTING TO CLIMATE CHANGE

8. Adapting to climate change

As we have seen above, the people who cause climate change are rarely the ones who experience its most damaging effects. The key point in this session is that knowledge is power – and understanding how climate change might alter the environment is sufficient information to enable changes in behaviour and practices that reduce the negative impacts. These changes 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.

8.1 Session 4 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

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)

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

8.2 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, migration). These can be non-agricultural as well (e.g., taking out loans, selling assets, reducing consumption, etc.) • 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 northwestern 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' inability 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. 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

8.3 Women farmers: What more can be done to respond to climate change?

Identifying potential actions will be dependent on the livelihood context of the audience. 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, health, human settlements/houses, energy, and disasters. 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.

8.3.1 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 organise 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 complementarity 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).

8.3.2 Mitigation of emissions

Although emissions from rural women in developing countries are negligible on a global scale, there are still behavioural changes that can be adopted to reduce emissions. These include improvements in soil, water and land management and conservation. In many cases these have additional benefits of saving time and money. Linking back to environmental systems and the hydrological cycle, ask participants to identify any changes they could make to reduce emissions and thereby mitigate climate change (Table 9).

8.3.3 (Agricultural) adaptation

Adaptation is of ultimate importance to the participants in this training. Their livelihoods are likely to be dependent on natural resources which, in combination with their gender, renders them very vulnerable to climate change. It is likely that, since the majority of women are already engaged in farming, they have existing knowledge of how to conserve natural resources. 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. Watch the videos first to prompt ideas. Table 10 contains some ideas to discuss.

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 include: (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_campaign=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) (e) General environmental education ○ Warming globe, dwindling water (Hindi) http://www.youtube.com/watch?v=VuIN4DQwarU ○ Global warming (Hindi) http://www.youtube.com/watch?v=WxZvTMz5byQ ○ Ek Khwahish (English) http://www.youtube.com/watch?v=Kbrm4F_uFGk ○ Ek Khwahish (Hindi) http://www.youtube.com/watch?v=LcG1ofAb06E ○ Manyata (Hindi with English sub-titles) http://www.youtube.com/watch?v=hFIf4vm9BC

	• Discuss each one briefly after showing, and then refer back to them in a subsequent discussion on potential adaptations for participants. This should lead into the next activity.

☑ For trainers: Discussion and Sharing of Ideas

Are there other mitigation and/ or adaptation options which you think should be added to Table 10?

Table 10: Potential response options by theme
(Agricultural examples here often contribute to both adaptation and mitigation – the energy and human settlements themes are more mitigation-focused)

ADAPTATION	
Water management	• Water storage, e.g. water pans • Dams, pits, retaining ridges • Cover irrigation channels to reduce evaporation loss • Rainwater harvesting
Agriculture (crops)	• Crop diversification • Planting different crops (as appropriate to the climate) • Planting early maturing crops • Changing planting dates • Cultivating terraces/baira • Watering late in the day (to reduce evapo-transpiration) • Livelihood diversification
Agriculture (livestock)	• Introduce mixed-livestock farming systems • Grow fodder crops to ensure feed availability • Improving rangeland management
Agroforestry	• Hedges, windbreaks, shelterbelts, live fences • Nitrogen-fixing trees, bushes, fodder trees
Soils management	• Minimum/no tillage • Rotating with legumes • Intercropping with legumes • Efficient application of manure • Mulching
Fisheries and aquaculture	• Saline-resistant species • Increased feeding efficiency • Low-energy, fuel-efficient fishing
Human settlements/houses	• Building on stilts • More secure structures (cross beams for high winds)

Disasters	• Secure harvest storage facilities
	  ○ Conserving seed by mixing with ash
	  ○ High ground facilities for animals

MITIGATION	
Energy	• Keep the lid on the pot when boiling water • Replant seedlings when cutting down fuel wood
Human settlements/houses	• Insulating the dwelling to reduce wastage from heating

8.3.4 Encouraging collective action

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 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.

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 adaptation options in terms of possible impacts (both positive and negative) **on women**, and solutions to overcome them. A few measures are included to get you started but remember that not all measures are appropriate in all situations – as we have stressed before, adaptation is very context-specific!

Some examples might include: Build breakwaters against rising tides; Introduce varieties of crops and plants tolerant of higher temperatures; Implement reforestation or afforestation; Introduce irrigation for crops; or migration (e.g. to towns)

Adaptation measure	Possible positive impacts on women	Possible negative impacts on women	Solutions/ what needs to be done to implement

8.4 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. 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.

The key here is to empower the women and given them agency. They should leave having identified a couple simple actions that they can take now, even in the absence of outside help/money. We want to *steer clear* of unhelpful conversations that disempower the women by stressing obstacles (like paltry resources, or bad federal government policies, etc.), unless immediately available adaptation funds are possible to support larger projects.

Activity for participants: Mapping out a more resilient future	
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. This should build upon the three previous exercises (p.66 and p.71): You should tape these flipchart sheets to the wall to keep referring to them. Then ask the participants how they would adapt to each identified climate change impact/threat (p.66), taking into account the adaptive actions that the participants are already undertaking (p.71), as well as the videos showcasing other methods (p.73).

Additional Resource

UNDP, 2010: *Gender, Climate Change and Community-Based Adaptation. A guidebook for designing and implementing gender-sensitive community-based adaptation programmes and projects,* New York. http://www.beta.undp.org/undp/en/home/librarypage/environment-energy/climate_change/gender/gender-climate-change-and-community-based-adaptation-guidebook-.html

TRAINER'S NOTES

PART NINE: MONITORING AND EVALUATION

9. Monitoring and 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.

9.1 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 fulfil. 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.

9.2 Monitoring

Learning is a gradual process and a single 4-to-8 hour training workshop crammed with new information may not be enough to change people's behaviors or significantly improve their adaptive capacity. Therefore, if time is sufficient, we recommend a tiered training approach that goes through all the exercises and builds knowledge slowly. Often information may need to be rehashed and explained more than once, as people can be forgetful. In this case, the kind of structured evaluations presented in the next sessions may complement a more informal monitoring process, in which you or your organization monitors any adaptive change or visible improvement in knowledge that occurs as a result of continued education on the environment and climate change.

9.3 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 or what they would have liked to have learnt more about. 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.

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. If appropriate, the trainer can modify or shorten this evaluation template.

- 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 you can add to the questionnaire sheets later).
- However, in many circumstances some or all of your participants may be non-literate 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 the you need air 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 non-literate 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 not to 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?

9.4 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 see 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 non-literate, 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.

9.5 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 TEN: REFERENCES & FURTHER INFORMATION

10. References and Further Information

10.1 References

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.

Asian Development Bank, undated: Climate Change in South Asia. Strong Responses for Building a Sustainable Future, Manila, Philippines (available at http://www.adb.org/documents/reports/climate-change-sa/climate-change-sa.pdf

Baettig, M. B., M. Wild, and D. M. Imboden. 2007. A climate change index: Where climate change may be most prominent in the 21st century. *Geophysical Research Letters* 34(1): L01705.

CGIAR Program on Climate Change, Agriculture and Food Security (CCAFS) and the Food and Agriculture Organization of the United Nations (FAO), 2011: *Gender and Climate Change Issues in Agriculture and Food Security Research and Rural Development Training Manual,* DRAFT

CGIAR Program on Climate Change, Agriculture and Food Security (CCAFS), (http://ccafs.cgiar.org/where-we-work/indo-gangetic-plains)

Christensen, J. H., B. Hewitson, A. Busuioc, A. Chen, X. Gao, I. Held, R. Jones, et al. 2007. Regional climate projections, Climate Change 2007: The physical science basis. Contribution of Working Group I to the *Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* ed. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Avery, M. Tignor, and H. L. Miller. Cambridge: Cambridge University Press.

Cruz, R. V., H. Harasawa, M. Lal, S. Wu, Y. Anokhin, B. Punsalmaa, Y. Honda, M. Jafari, C. Li, and N. Huu Ninh. 2007. Asia. Climate Change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the *Fourth Assessment Report of the Intergovernmental Panel on Climate Change,* ed. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson, 469–506. Cambridge: Cambridge University Press.

FAO, 2011: *Why gender?* (http://www.fao.org/gender/gender-home/gender-why/why-gender/en/)

FAO, 2011b: *The State of Food and Agriculture 2010-2011. Women in Agriculture: Closing the gender gap for development*, Rome.

Foundation for Water and Energy Education (FWEE), 2000, (www.fwee.org)

GGCA, 2009: *Training Manual on Gender and Climate Change*. IUCN, Costa Rica.

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

Government of Bangladesh, Department of Environment. 2007. Climate Change Cell. Dhaka.

ILO, 1998: *ILO/SEAPAT's OnLine Gender Learning & Information Module. Unit 1: A conceptual framework for gender analysis and planning,* (http://www.ilo.org/public/english/region/asro/mdtmanila/training/unit1/groles.htm)

ILO, 2002: *Guidelines for Training of Trainers*, Technical Intervention Area Summary Notes

IPCC, 2007: Summary for Policymakers. In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Chang,* M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

Kapoor, Aditi. 2011. Engendering the climate for change: Policies and practices for gender-just adaptation. Alternative Futures, New Delhi, India, 83 pp. http://www.alternativefutures.org.in/userfiles/Engendering%20the%20Cilmate%20for%20Change.pdf

Knox, J.W., Hess, T.M., Daccache, A., and Perez Ortola, M. (2011). What are the projected impacts of climate change on food crop productivity in Africa and S Asia? DFID Systematic Review. Technical Report. Cranfield University.

Ladha, J. K., D. Dawe, H. Pathak, A. T. Padre, R. L. Yadav, B. Singh, Y. Singh, et al. 2003. How extensive are yield declines in long-term rice-wheat experiments in Asia? *Field Crops Research* 81:159–80.

Lambrou, Y., and S, Nelson. 2010. Farmers in a changing climate: Does gender matter? Food security in Andhra Pradesh, India. FAO. Rome, Italy, 82 pp.

Mall, R. K., A. Gupta, R. Singh, R. S. Singh, and L. S. Rathore. 2006. Water resources and climate change: An Indian perspective. *Current Science* 90 (12): 1610–26.

Padgham, J., 2009: Agricultural Development Under a Changing Climate: Opportunities and Challenges for Adaptation, Joint Discussion Paper 1, Agriculture and Rural Development & Environment Departments, World Bank, Washington, 198pp.

Pathak, H., J. K. Ladha, P. K. Aggarwal, S. Peng, S. Das, Y. Singh, B. Singh, et al. 2003. Trends of climatic potential and on-farm yields of rice and wheat in the Indo-Gangetic Plains. *Field Crops Research* 80:223–34.

Peng, S., J. Huang, J. E. Sheehy, R. C. Laza, R. M. Visperas, X. Zhong, G. S. Centeno, G. S. Khush, and K. G. Cassman. 2004. Rice yields decline with higher night temperature from global warming. Proceedings National Academy of Sciences 101(27): 9971–75.

Sivakumar, M. V. K., H. P. Das, and O. Brunini. 2005. Impacts of present and future climate variability and change on agriculture and forestry in the arid and semiarid tropics. *Climatic Change* 70:31–72.

Schmidhuber, J. & Tubiello, F.N. 2007: Global food security under climate change. *Proceedings of the National Academy of Sciences* 104:19703-19708.

UNDP, 2010: *Gender, Climate Change and Community-Based Adaptation. A guidebook for designing and implementing gender-sensitive community-based adaptation programmes and projects,* New York. http://www.beta.undp.org/undp/en/home/librarypage/environment-energy/climate_change/gender/gender-climate-change-and-community-based-adaptation-guidebook-.html

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

UNISDR, 2008: *Gender Perspectives: Integrating Disaster Risk Reduction into Climate Change Adaptation Good Practices and Lessons Learned*, Geneva

World Bank, Food and Agriculture Organization, and International Fund for Agricultural Development. *Gender in agriculture sourcebook*. Washington, DC, 791 pp. http://siteresources.worldbank.org/INTGENAGRLIVSOUBOOK/Resources/CompleteBook.pdf

World Bank. 2009. Why is South Asia Vulnerable to Climate Change? http://go.worldbank.org/OJ4FWPUB10

10.2 Sources of further information available online

10.2.1 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

10.2.2 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

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
Has existing education resources

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/wp-content/uploads/nepalcasestudy.pdf

PART ELEVEN: APPENDICES

11. Appendices

11. 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 (maybe 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

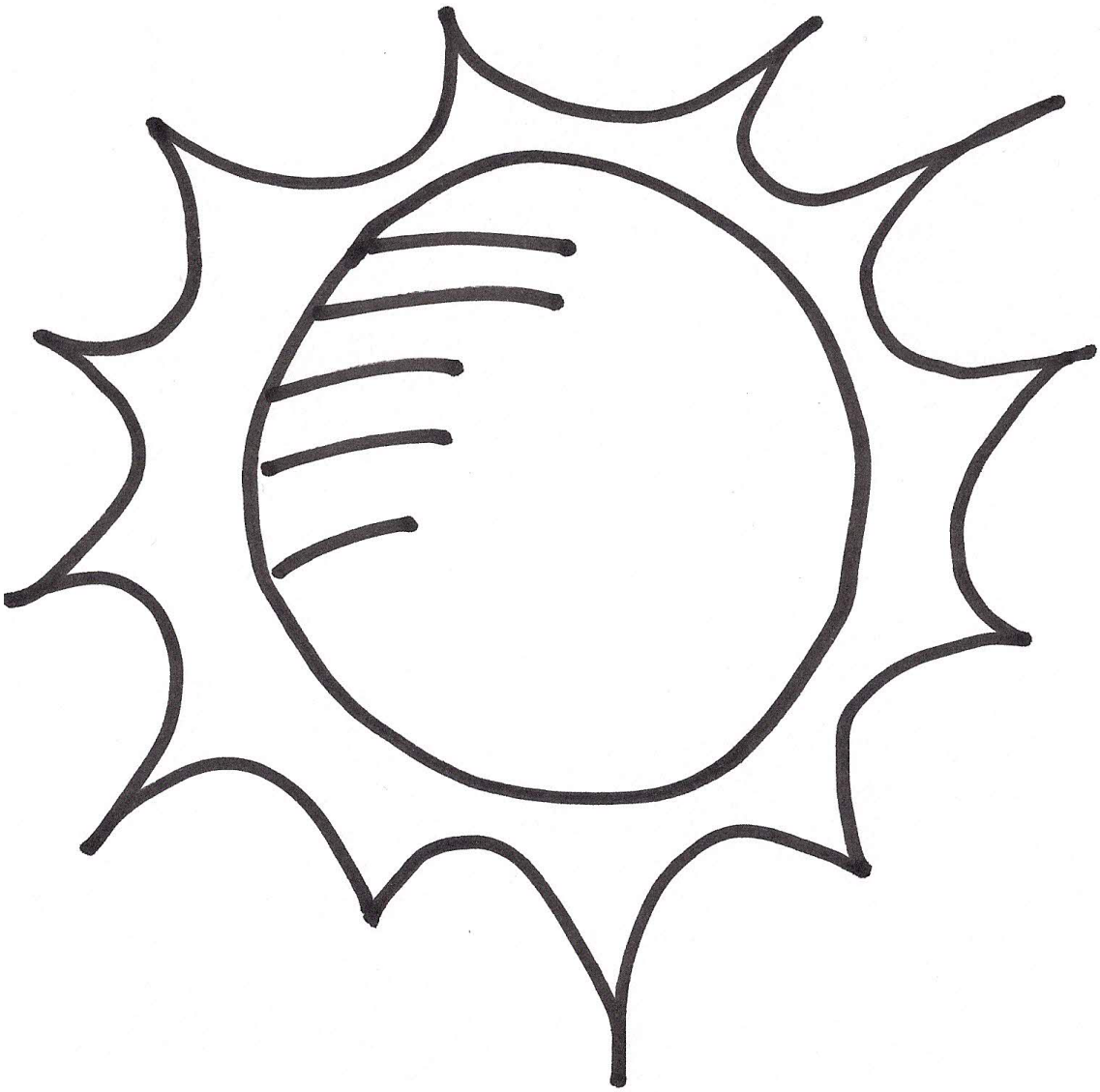
- If it is appropriate, draw up a handout for the participants. This handout should include, at least, the aim and objectives of the course; an agenda of the learning sessions; any assessments of the course as well as contact details of the instructors/ organisation holding the workshop.
- Draw up a 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!

11.2 Appendix B: Ideas for "ice-breakers"

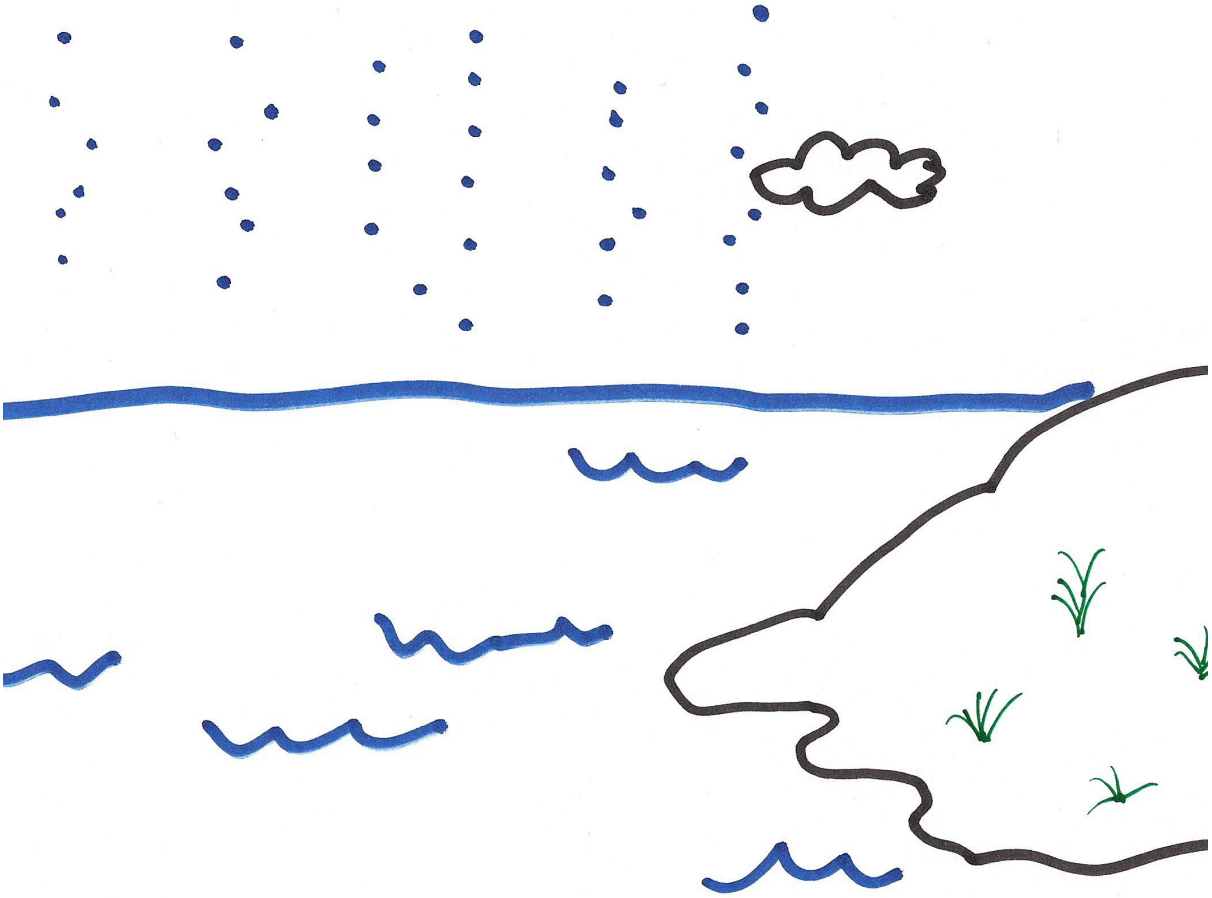
Participants interview each other (adapted from CCAFS and FAO, 2011)	
Objectives	• To have participants meet one another and help them relax • To share participants' challenges and expectations of the workshop
Time	30 minutes
Materials	• Coloured A4 paper/ cards • Markers • Pens
Steps	• Introduce the 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: o Name or nickname that participant wants to be called in the workshop (Partners should make a name card with this name) o Institution o Type of work o Any other interesting thing about the person, i.e. one good thing that happened in the last year, their favourite food, etc. Be creative. o 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.

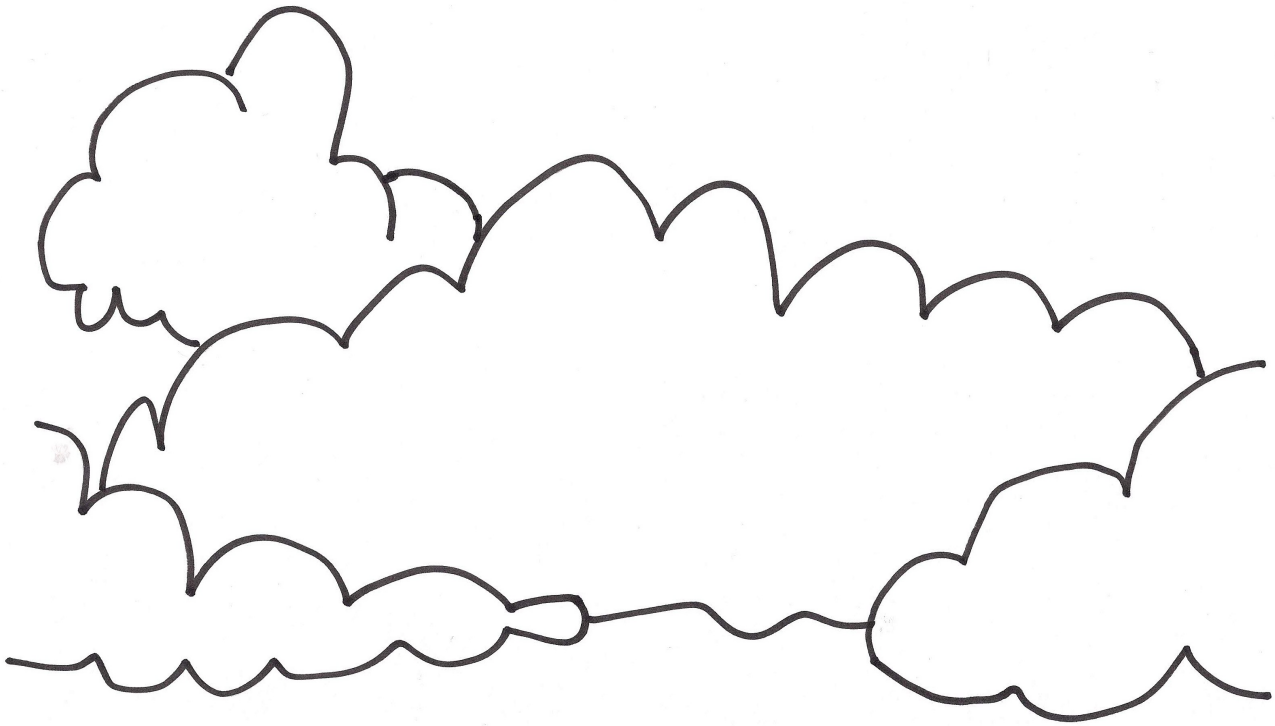
11.3 Appendix C: The hydrological cycle



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



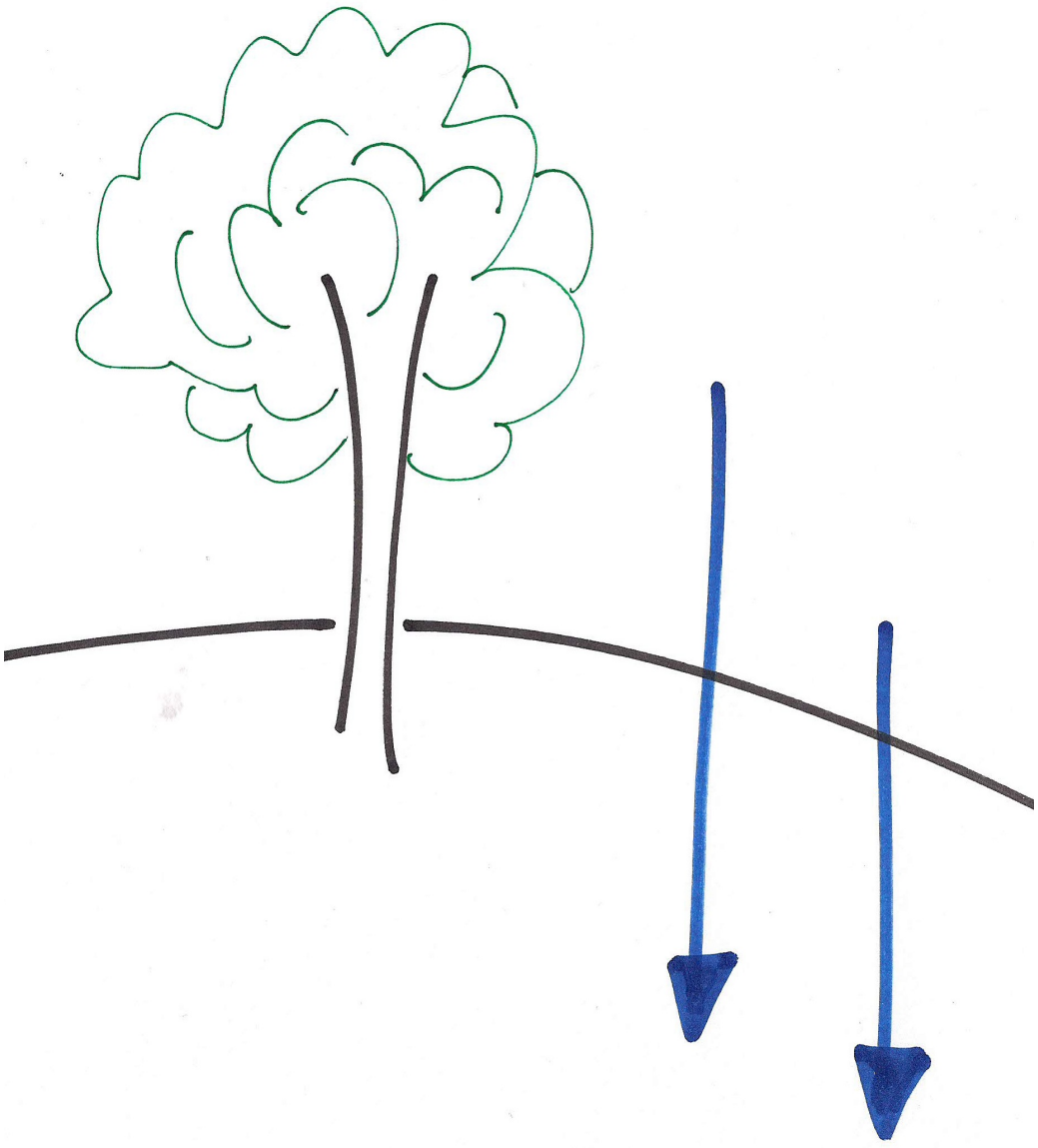
(Evaporation: due to the heat from the sun, water changes from a liquid to a gas)



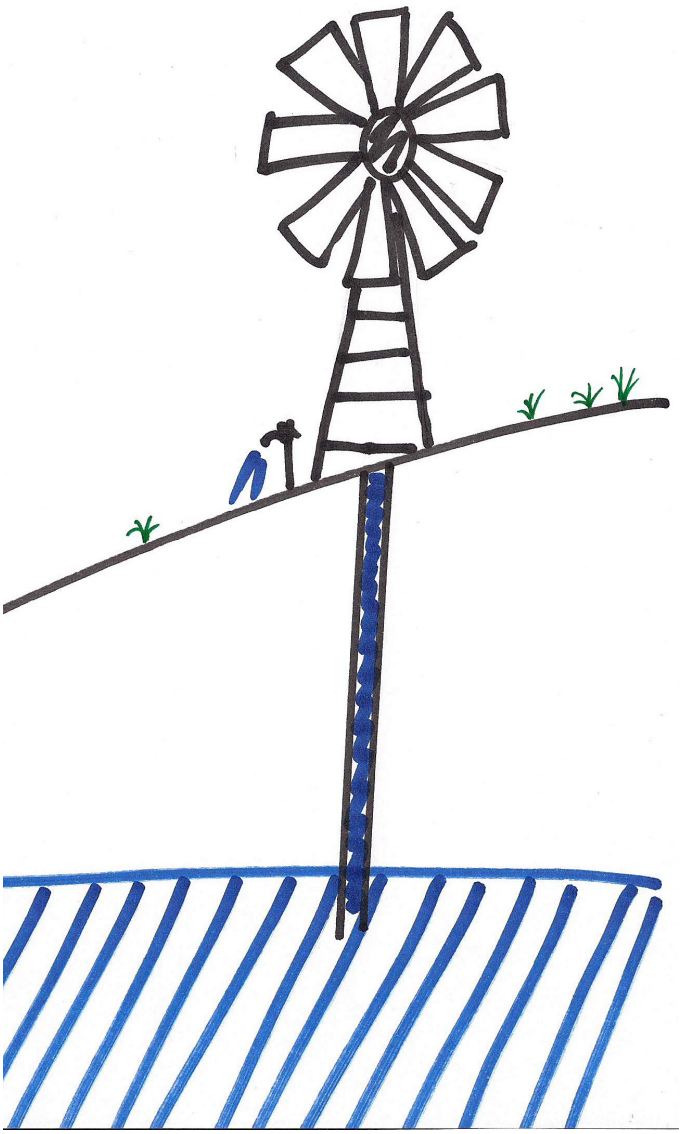
(Condensation: clouds form)

(Precipitation: for example, rain or snow)

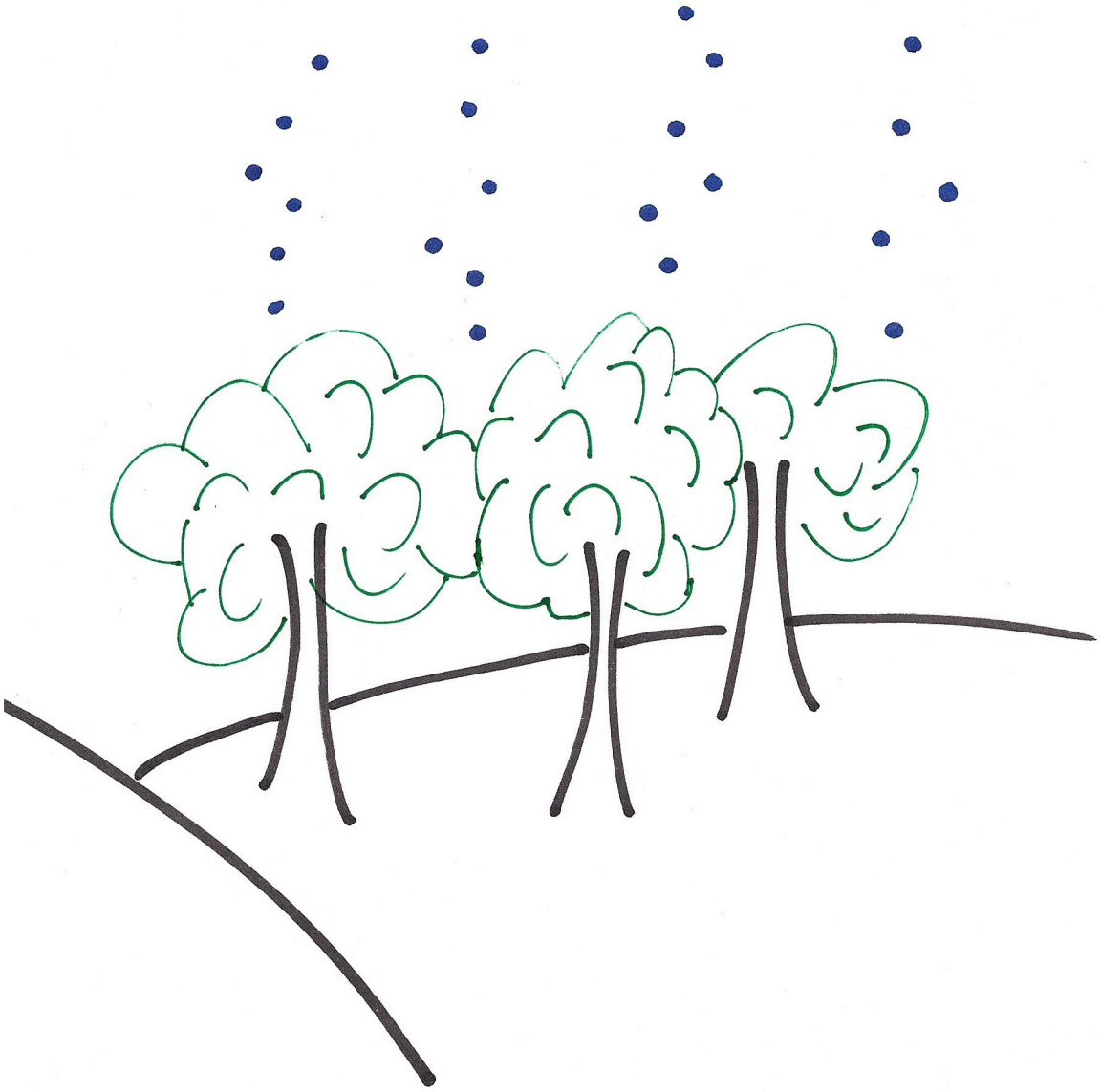
(Run off: water flows on the surface – first over the ground and then in river channels)



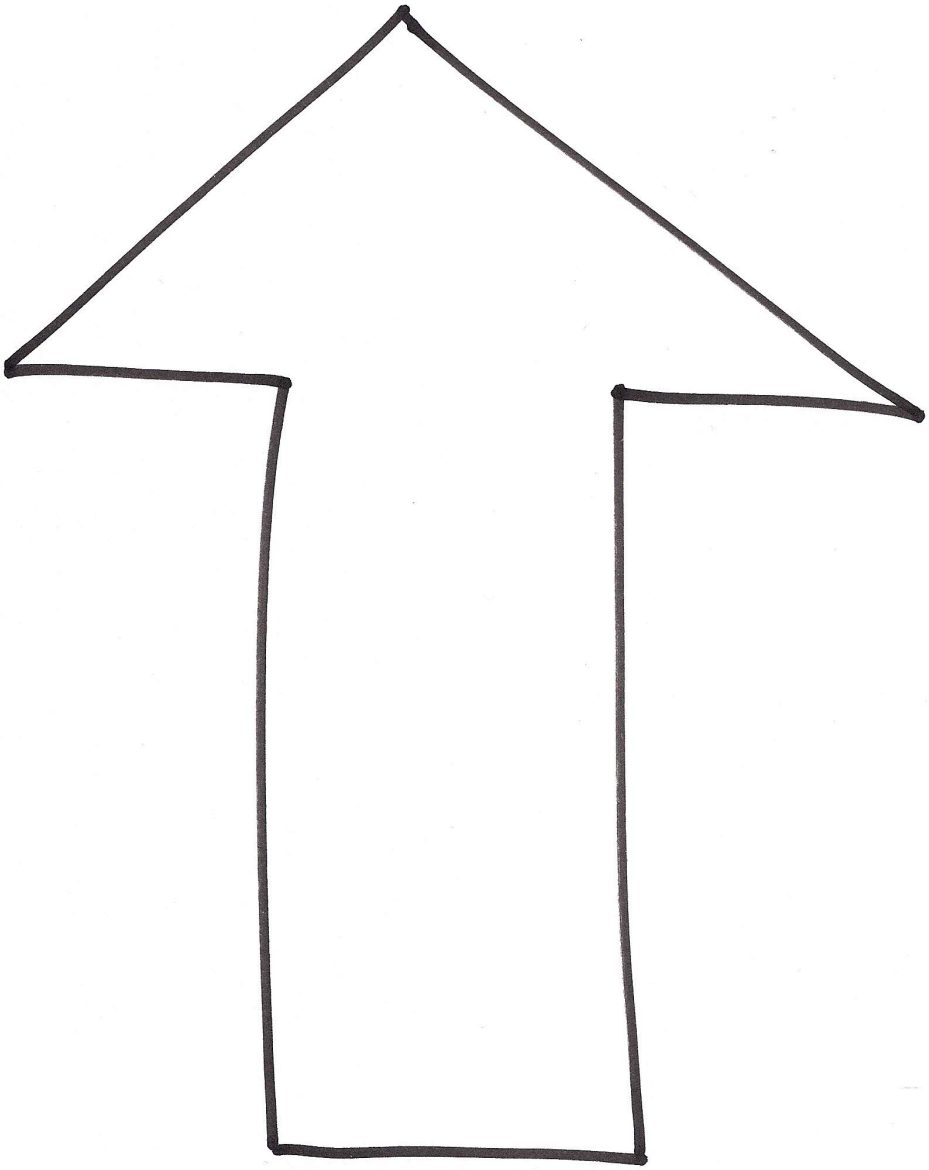
(Infiltration: water soaks into the ground)



(Groundwater: water collects and is stored underground)



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



(Process arrow)

11.4 Appendix D: Evaluation template

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

Participant name	
Training course (date and location)	
1. Evaluation after the workshop	
1.1 What did you learn today?	
1.2 What is 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 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?	
1.6 Additional comments/observations	
2. Evaluation three months after the workshop	
2.2 What is climate change, and how might it affect you?	
2.3 How have you been able to use information that you learnt at the training?	

2.4 Have you shared the information with anyone else? If so, how?	
2.5 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?	
2.6 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 3 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 comment]. Have you been able to do this? If not, why not?	
3.4 Additional comments/observations	