

# **Using Innovations and Climate-Responsive Actions to Build Community Resilience**



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## About this course

This course is one of six related but independent courses that are included in the Strengthening Communities to Attain Resiliency and Food Security (SCARF) project. The SCARF project focuses on transformative learning for climate action through developing and digitising learning resources and fostering social and ecological awareness that helps learners move from practising individual behavioural changes to achieving wider social change by targeting the root causes of climate vulnerability and risk.

Addressing climate change and promoting environmentally sustainable livelihoods is imperative if we are to protect the world's poor and their rights to food and decent livelihoods. The SCARF project aims to:

- change the attitudes and behaviour of communities to mitigate against and adapt to the impact of climate change;
- provide solutions and responses not only to tackle the climate crisis but also to transform societies for a better future;
- provide new insights and opportunities to put into practice the new knowledge and skills gained for mitigating climate change and conserving the environment; and
- enhance the reach to marginalised communities, facilitating lifelong learning among learners and providing them with knowledge, attitudes and skills that will prepare them for the present and future context.

The six courses will enable participants — grassroots-level volunteers, community leaders, field workers and economically disadvantaged women and girls with varying levels of literacy — to:

- use the knowledge they gain in their everyday lives,
- develop a sense of strong personal connection to the issues of climate change,
- understand the value of solutions grounded in human rights,
- critically question the actions and responses of leaders, and
- take appropriate action to respond to climate-related issues.

The six courses and their objectives are:

- **Course 1: Climate Change and Taking Action.** Explains climate change, its impact in the local context, its anticipated impact on human lives and how to mitigate its negative impacts through actions and policy advocacy.
- **Course 2: Small-Scale Traditional Food Production and Food-Processing Techniques for Sustenance and Survival.** Explains how to mitigate the impacts of climate change and achieve sustainable livelihoods. Discusses food and nutrition, local best practices and how to adapt such practices to attain family and community resiliency.



- **Course 3: Gender Equality in the Context of Climate Change and Food Security.** Discusses why women and children suffer most from the impacts of climate change, and the role of women as food growers and providers for better community resiliency and sustainable livelihoods.
- **Course 04: Creating Gender-Sensitive, Climate-Responsive, Sustainable Livelihoods to Build Self-Reliant, Resilient Local Economies.** Explains the importance of climate-responsive and gender-sensitive livelihoods for building a self-reliant, resilient local economy.
- **Course 5: Using Innovations and Climate-Responsive Actions to Build Community Resilience.** Explains the role of innovation in livelihood design and local conservation efforts.
- **Course 6: Respecting Indigenous Rights and Practices: Ways to a Better Planet.** Discusses Indigenous practices and the integration of natural habitat conservation through such practices. Describes Indigenous rights and their importance in mitigating the impacts of climate change.

Each of these six courses can be done independently from [\[https://opentextbooks.colvee.org/climateresponsiveactionscommunityresilience/\]](https://opentextbooks.colvee.org/climateresponsiveactionscommunityresilience/) as a downloadable PDF or online in Moodle.

*Using Innovations and Climate-Responsive Actions to Build Community Resilience* was produced by the Commonwealth of Learning (COL). All modules produced by COL are structured in the same way, as outlined below.

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## How this course is structured

### The course overview

The course overview gives a general introduction to the course. The information it contains will help you determine:

- if the course is suitable for you,
- what you need to know before you begin,
- what you can expect from the course, and
- how much time you will need to complete the course.

The overview also provides guidance on:

- study skills,

- where to get help,
- course assessments,
- icons used in the course, and
- the content of units.

To increase your chances of success, read the overview *carefully* before you begin.

## The course content

The course is broken down into units. Each unit comprises:

- an introduction to the unit content,
- unit outcomes,
- new terminology,
- core content of the unit with a variety of learning activities,
- a unit summary, and
- assessments, as applicable.

## Resources

Resources for further reading — for example, books, articles or websites — are provided throughout this course.

## Your comments

After you complete this course, we would appreciate it if you would take a few moments to email [womenandgirls@col.org](mailto:womenandgirls@col.org) with your feedback on any aspect of it. Your feedback could include comments on:

- content and structure,
- reading materials and resources,
- assessments,
- duration, and
- support (assigned tutors, technical help, etc.).

Your constructive feedback will help us to improve this course for future users.



## Course overview

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### **Welcome to Using innovations and climate-responsive actions to build community resilience**

This course is intended for field workers and practitioners who are working with rural communities that are affected by climate change events and are looking to innovation as the key climate-responsive action to address community resilience. The course will explore alternative sustainable livelihoods to better manage natural resources as a result of innovation in climate resilience. Existing innovations can be tailored to suit local situations. Successful implementation of the innovation depends on institutional support, access to markets, skills and capacity enhancement and the availability of local/traditional knowledge. The concept of total biomass use will help the learner to understand best practices in natural resource management and conservation at a local level. The course will identify types of institutional support, networks and skills required to implement total biomass use and explore a climate-responsive livelihood through the innovation model that is adapted.

### **Using innovations and climate-responsive actions to build community resilience—Is this course for you?**

Each course is available to any member of the community. The learners are people with low literacy levels and include grassroots-level volunteers, community leaders, community health workers and others in positions to support women and girls at the community level. Such individuals could use the course for their own benefit or for working with their community or communities.

The learner should have an understanding of how climate change affects the local area where this learning is to be used and reasonable knowledge about sustainability and its relation to sustainable livelihoods at the village and community level.

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## Course outcomes

On completion of *Using Innovations and Climate-Responsive Actions to Build Community Resilience* you will be able to:



### Outcomes

- *identify* examples of innovations at the household and community level that led to successful climate change mitigation and climate-responsive livelihoods.
- *describe* various innovations and how to identify which innovations are suitable in a specific context — that is, classify innovations based on their contextuality and usability.
- *support or identify* support systems for specific innovation — for example, resources and networks required to turn an idea into an innovation to address local concerns.
- *explain* the link between human habitat, natural resources and optimisation of their use through total or near total biomass use.
- *discuss* the link between human habitat and the available natural resources, as well as their conservation and use to address multiple needs of a traditional community, to develop relevant skills for total biomass use.

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## Timeframe



### Time

You will need approximately 7.5 hours to complete this course.

This course contains five units. Each unit will need approximately 1.5 hours of learning time.

An additional two hours of self-study time may be required.

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## Study skills



As an adult learner you will take a different approach to learning than you did when you were a schoolchild. You will choose what you want to study, you will have a professional or personal motivation for learning and you will most likely be fitting your study activities around other professional or domestic responsibilities.

Essentially you will be taking control of your learning environment. You will therefore need to think about how issues such as time management, goal setting and stress management will affect your performance. You may need to review skills such as essay planning, coping with exams and using the Web as a learning resource.

Your most significant considerations will be time and space — that is, the time you dedicate to your learning and the environment in which you engage in that learning.

We recommend that you take time now — that is, before you begin your self-study — to familiarise yourself with these issues. There are a number of excellent resources on the Web that can help you. For example:

- <http://www.how-to-study.com/>

This website has a list of resources about study skills, including taking notes, strategies for reading textbooks, using reference sources and dealing with test anxiety.

- <http://www.howtostudy.org/resources.php>

This website has useful links to resources on time management; efficient reading; questioning, listening and observing skills; “hands-on” learning; memory building; staying motivated; and developing a learning plan.

These two websites can get you started on your learning journey. At the time of writing, the links to them were active. To find more options, go to [www.google.com](http://www.google.com) and type in phrases such as “self-study basics,” “self-study tips” or “self-study skills.”

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## Need help?



### Help

At the learning centre you will receive the same support as you would from any classroom teacher, or you might find a more experienced tutor to support you during a contact session.

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## Assessments



### Assessments

At the end of each of the five units in this course there is a self-assessment with three questions in multiple choice question (MCQ) format. The MCQ assessment will take 15 minutes to complete. The answers to the multiple choice questions are in the Answer Key, at the end of the course.

There are no teacher-marked assessments.

A formative assessment is also included for each of the five units to enhance your understanding of the unit topic and information.

## Getting around this course

### Margin icons

As you work through this course you will notice the frequent use of margin icons. These icons serve to “signpost” a particular piece of text, a new task or a change in activity. They have been included to help you find your way around this course.

A complete icon set is shown below. We suggest that you familiarise yourself with the icons and their meaning before you start to study.

			
Activity	Assessment	Assignment	Case study
			
Discussion	Group activity	Help	Note it!
			
Outcomes	Reading	Reflection	Study skills
			
Summary	Terminology	Time	Tip



# Unit 1

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## Innovative designs of gender-sensitive, climate-responsive, sustainable livelihoods

### Introduction

Climate change calls for new approaches to sustainable development that take into account complex interactions between climate, social and ecological systems. We must innovate in order to develop and support new sustainable livelihoods that can respond to the challenges of climate change. Alternative sustainable livelihoods at a local level are explored in this unit through appropriate innovation design. Communities and households can identify the innovation that can be adapted at a local level with an understanding of what is required to successfully mitigate the impacts of climate change.

One example of how innovation can play a role in developing sustainable livelihood and community resiliency is the move towards duck farming in Bangladesh.



#### Reading

Savage, S. (2019, 13 July). To survive in a wetter world, raise ducks, not chickens. *Atlantic*.

<https://www.theatlantic.com/international/archive/2019/07/bangladesh-climate-change-floods-ducks/593581/>

Licence: Open access

On completion of this unit you will be able to:

- *identify* innovations at the household and community levels that can lead to successful climate change mitigation and climate-responsive livelihoods.



#### Outcomes



## Terminology

<b>Ecological systems:</b>	Also known as an ecosystem, an ecological system is a biological community consisting of all the living organisms (including humans) in a particular area and the non-living components — for example, air, water and soil — with which the organisms interact.
<b>Climate change mitigation:</b>	Actions to reduce the flow of heat-trapping greenhouse gases into the atmosphere.
<b>Post-harvest:</b>	The stage of crop production that immediately follows the harvest. It includes cooling, cleaning, sorting and packing crops.
<b>Climate-smart:</b>	An approach that helps guide actions to integrate green and climate-resilient practices into agri-food systems.
<b>Drought-prone area:</b>	An area in which the probability of experiencing drought in a given year is greater than 20%.
<b>Watershed:</b>	An area of high ground from which water flows down to a river.
<b>Grassroots-level:</b>	The most basic level of an action, social movement or social organisation. Ordinary people are involved at this level.
<b>Resilient:</b>	Able to withstand or recover quickly from difficult conditions or situations.
<b>Biodiversity:</b>	The variety of living organisms in an area, from microscopic ones to large trees and animals.

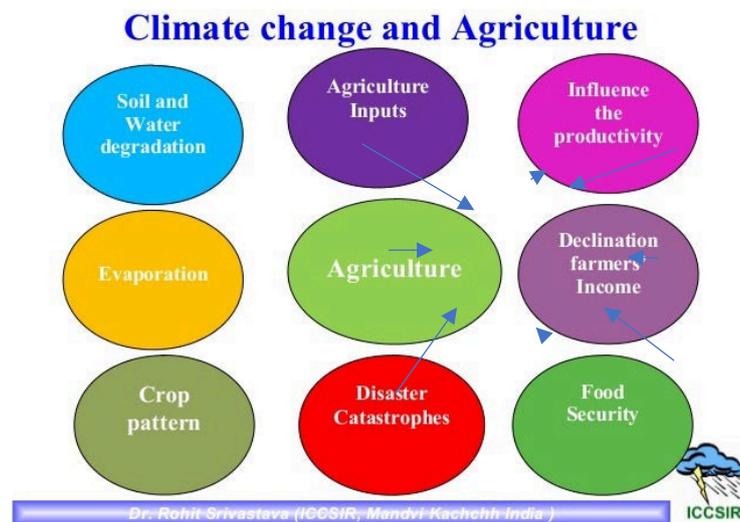
## Innovation in response to climate change

### How climate change affects us

Climate change affects each and every one of us, whether we live in an urban or rural setting. Communities adapt in the wake of climate change and traditional agricultural practices persist, but as the impacts and severity of climate change increase, we need innovative methods to build resilience and mitigate those impacts.

Rising sea levels and erratic rainfall patterns, flooding and drought brought on by rising temperatures are all examples of the effects of climate change. In turn, these lead to loss of land mass, reduced yields of agricultural crops and disrupted crop cycles. Fishing activities can be affected by changes in sea temperatures, which can limit the availability of local fish species.

Groundwater is overdrawn for agriculture and potable water for households. In the event of natural disasters, this can lead to saline water intrusion.



Source: Srivastava, R., & Kachchh, M. (2016, 19 November). *Weather forecasting and sustainable agriculture* [PowerPoint presentation]. SlideShare. <https://www.slideshare.net/KiritShelat/entalkweatherforecastingagriculture>  
Licence: Open access

The diagram above shows how agriculture is affected by climate change:

- Soil and water degradation refers to soil and water sources being polluted and soil fertility reduced.
- Agriculture inputs refers to seeds, fertilisers, pesticides, veterinary drugs, equipment, animal feed and energy (electricity/other power to run farm machinery).
- Influence on productivity refers to agricultural yields being reduced.
- Declination of farmers' income refers to drops in farmers' incomes.
- Food security refers to reliable access to a sufficient quantity of affordable and nutritious food.
- Disaster/catastrophe refers to typhoons, earthquakes, flooding, tsunami, extreme drought and other extreme natural events.
- Crop pattern refers to the proportion of an area in which various crops are being grown at a given point of time.



- Evaporation refers to water from soil surfaces and water bodies turning to water vapour, which results in water loss.

## What is innovation in response to climate change?

Households and communities can change:

- the way their local products are made or grown,
- the processes involved in producing goods, and
- the services they provide to generate income.

These changes — or new practices or new methods — are innovations.

In light of the impacts of climate change, communities can make changes to the ways they produce, package, transport and supply food produce such as grains, vegetables, fruits, meat and fodder for domestic animals.

Innovation is a way to help communities and households to improve their livelihoods when their income-generating activities are affected by the impacts of climate change.

Here are some examples of innovation or new ideas:

- new crops (e.g., plant lotus in waterlogged areas as a new source of food and fibre)
- new methods (e.g., post-harvest techniques using local nipah or edible palm leaves to wrap raw food to keep it fresh for longer)
- new products (e.g., handicrafts made from widely available raw materials such as reeds/wetland plants or screw pine trees in waterlogged soil)

## Case studies on innovation

This section contains two case studies on innovation for sustainable livelihoods in response to climate change.



### Case study

#### How a farmer in Maharashtra is adapting to drought

Read the article [How Five Indian Communities Are Adapting to Climate Change](#) before you read the case study.

A farmer in Ahmednagar, Maharashtra, a state in northern India and one of the country's most drought-prone areas, has a small landholding. The farmer has been working in agriculture in a region with low-fertility soil, which requires large amounts of fertilisers and water to produce crops.

The farmer also has to cope with erratic rains and longer, harsher dry seasons, both of which are the result of climate change. Maharashtra faced significant droughts in 2005, 2007, 2013 and 2016. The villagers had no drinking water, and farmers abandoned their fields and migrated to nearby towns for work.

The farmers and villagers then adopted innovations to deal with their situation.

With help from local grassroots-level organisations, the villagers became involved in watershed management and efficient innovative farming techniques. The new farming techniques include using drip irrigation systems and shifting to new, drought-resistant crop varieties. The villagers benefited greatly from watershed programmes and outreach sessions that taught them how to prevent run-off from the hills. Gradually, the groundwater recharged, replenishing the water in wells and lakes.

The availability of water helped the farmer to introduce other crops, such as onions, soybeans, pomegranates and papayas, which sold for higher prices at market. Planting new varieties of fruits, vegetables and edible plants is an innovation.

The farmer also started to bury water diffusers — made of local material such as clay — connected to existing drip lines in the pomegranate garden to mitigate the effects of droughts. The diffusers helped to optimise water use during dry spells by moistening only the soil around the roots of the pomegranate trees. The use of clay pots as diffusers to trap water for the pomegranate trees is an innovative method.

Discuss the case study with community members using the notes provided in the discussion section.



### Discussion

Why were the innovations in the case study above successful?

- Assistance from grassroots-level organisations that are knowledgeable about local climate conditions, watershed management and climate-responsive agricultural practices.
- Use of simple clay pots as diffusers — clay and mud are both naturally available at a local level and girls and women can use them to make clay pots.
- The women can make a sustainable living from selling clay pots to the farmers.
- Farmers tend to have more trust in local grassroots organisations than in outside groups that want to intervene and assist.
- The use of a diffuser where water drip lines exist was an innovative approach.
- Switching to cash crops that are easier to manage during drier periods was an innovative approach.
- The new crops that were planted fetch a higher price than traditional crops.



### Reading

Chhabria, P., & Jacob, M. (2023, 7 March). *How five Indian communities are adapting to climate change*. World Economic Forum. <https://www.preventionweb.net/news/reviving-traditional-crops-climate-proofing-infrastructure-how-5-indian-communities-are>

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### Reflection

Write in your personal journal what natural resources are found in abundance in your household or village and could be innovated in terms of planting, harvesting, processing and packaging.



### Case study

#### **Challenges during the implementation of innovations that damaged their effectiveness: Climate change and climate-smart agriculture adaptation among the farming community in the coastal region of Sundarban Biosphere Reserve in India**

The Indian Sundarban Biosphere Reserve, a large coastal zone, is very vulnerable to frequent catastrophic climatic events. Severe storms affect the area every year, displacing village households and destroying crops. People in the area face daily social and economic struggles to survive: they live in remote locations, they experience extreme impacts of climate change and farmland is inundated by seawater because it is in a low-lying delta region traversed by many tributaries of major rivers.

Researchers looked at 12 farming villages in the Sundarban Biosphere Reserve to assess the effectiveness of climate-smart innovation techniques that had been implemented in them.

The climate-smart innovations were the use of local pesticides, rather than factory-produced ones, weather forecasts and early warning weather information; planting saline-tolerant varieties of crops; diversifying crops; and changing the planting times in the fields.

The communities faced many challenges — for example, lack of education and knowledge about climate-responsive interventions, insufficient organic materials for composting, low literacy rates among farmers and a shortage of labour to implement the climate-smart agriculture practices — which were noted and analysed.

Source: Das, S., & Sharma, K. K. (2023). *Climate change and climate smart agriculture adaptation among the farming community in the coastal region of Sundarban Biosphere Reserve in India*. Social Science Research Network. <https://ssrn.com/abstract=4544318>  
Licence: Open access



### Discussion

The coastal communities in this case study faced the following challenges:

- Inadequate knowledge about and awareness of the impacts of climate change, including weather conditions at a local level.
- Innovative design was NOT intimately linked to total farm productivity and revenue.
- Inadequate or lack of financial assistance to procure better crop varieties.
- Insufficient use of traditional techniques and biodiversity-friendly agriculture to combat the effects of pests and diseases.
- Inadequate training and capacity building of farmers.
- No holistic cooperation or partnerships among inter-governmental agencies.

Discuss these challenges with a small group of other learners.



### Assessment

#### Formative assessment 1

Write a step-by-step approach on how to adapt innovation to mitigate climate change to suit your local context and situation. You can use simple illustrations with text. Invite relevant community leaders to discuss your ideas with you.



### Group activity

#### Identify an innovation model to suit your local context

Create a step-by-step guide to design an innovation model that is applicable to your context:

- List all the important local livelihoods that are affected by climate change. Identify the people in your village or community who are affected.
- List all the local natural resources — for example, wetland plants for food and fodder, new seeds adapted for growing in a nursery, new crop varieties, tree species that could promote soil stabilisation — that are available.
- Identify new ideas or methods — for example, crop rotation, planting shallow-rooted and deep-rooted plants in alternate years, planting nitrogen-fixing plant species to improve soil fertility, using watershed management techniques, adopting new post-harvest techniques to keep produce fresh for longer — to counter the effects of climate change.
- Identify new products or services — for example, new activities relating to nature-based tourism.

With the help of the facilitator, discuss and outline how the new natural resources, methods or products that you listed can be explored further to create new sustainable livelihoods with relevant stakeholders at the local level. Use the information in this unit to guide you.



### Reading

Defe, R., & Matsa, M. (2021). The contribution of climate smart interventions to enhance sustainable livelihoods in Chiredzi District. *Climate Risk Management*, 33: 100338.  
<https://doi.org/10.1016/j.crm.2021.100338>

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## Unit summary



### Summary

In this unit you learned:

- what innovation is in the context of climate-responsive livelihoods, and
- how to identify one or two innovations at your local level that will lead to successful climate-change mitigation.

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## Assessment



### Assessment

#### Multiple choice questions: 1

1. Which one of the following is not a result of climate change?
  - A. Waterlogged soils
  - B. High yield of agricultural crops
  - C. Erosion of river banks
  - D. Degradation of coastal vegetation
  
2. Which one of the following statements **does not** describe sustainable livelihoods?
  - A. Displaces community knowledge and skills
  - B. The local habitats or regional ecosystems are restored
  - C. Nurtures a sense of place and connection to the local community
  - D. Provides an equal opportunity for both women and men in the community to have income generating activities
  
3. Which of the following are not positive outcomes of innovation?
  - A. Improved agricultural yields
  - B. Creation of alternative livelihoods for local communities who are facing the impacts of climate change
  - C. Increased income for villagers in remote areas
  - D. Reduction in naturally occurring local tree and plant species

## Unit 2

# Types of innovations and the issues or concerns they could address

## Introduction

Broadly speaking, there are three main types (categories) of innovation: process, product and institutional. They can be applied at the organisational (business), village or household levels. Sometimes a fourth category — service innovation — is identified, but generally service innovation is part of product innovation as it involves the enhancement of the product and its use. In this unit, service innovation refers to improvements in the manufacture and delivery of a product or improvements in the quality of the product itself.

On completion of this unit you will be able to:



### Outcomes

- *describe* various innovations and how to identify what innovations are suitable for your context.
- *explain* classifications of innovation based on their context and applicability.



### Terminology

<b>Optimal:</b>	Best; most likely to bring success or advantage.
<b>Legislation:</b>	The laws made by state or national governments; the preparation and enacting of those laws.
<b>Shelf life:</b>	The length of time for which an item is usable.
<b>Subsidies:</b>	Money granted by the state or a public body to help an industry or business keep the price of a commodity or service low.
<b>Early warning system:</b>	Warns people that something bad — for example, an earthquake or tsunami — is likely to happen.



**Drought-tolerant:** Plant species that grow well in dry conditions.

## Types of innovation

This section describes different types of innovation, followed by examples of how the innovation can be used in different contexts.

Before you begin, watch the video [Back to the Roots: How Flood-hit Odisha farmers are Turning to Traditional Crops](#) by the Council on Energy, Environment and Water, a think tank in New Delhi, India. (Licence: Open access.)

### Process innovation

This means making a process more efficient. It normally means:

- making a process faster so that a product is made in less time, or
- using a natural resource in an optimal manner so that there is little or no wastage of the raw material or natural resource during the entire production process.

Using a cheaper new technology — for example, installing a simple device to trap moisture, or mechanising or automating a process instead of relying on manual labour — can help greatly with process innovation.

Here are some examples of process innovation:

- Timing the planting of seeds — for example, grains, pulses, vegetables, fruits — around the beginning of the dry season or rainy season would help farmers harvest their crops more easily and efficiently without having to dry their harvests to minimise rot and pest infection.
- Transporting goods to nearby markets using roads or railways constructed by governments for rural communities in response to the impacts of climate change can increase efficiency. Access to lorries (either run by a local co-operative or government-subsidised vehicles) to transport farmers' goods to nearby markets minimises the time between harvesting and reaching local consumers.

### Institutional innovation

This refers to government policies and legislation developed and put in place to help communities affected by climate change to be resilient by

making local livelihoods more sustainable. Public sector innovations can contribute to finding new models for sustainable livelihoods. The groups involved may seek feedback from local stakeholders and villagers to assess the success and impact of the innovations.

Here are some examples of institutional innovation:

- An early warning system in the local language that alerts farmers and fishers to bad weather in a timely manner so they can act quickly to protect their goods and harvests from environmental catastrophes.
- Smallholders are recognised as equal players — for example, small rural farmers are given the same access and rights to sell their goods or produce as large suppliers. For this to happen, legislation must be developed to support fair markets.
- The government provides support in the form of subsidies or implements equal access to transport for local farmers and fishers to transport their goods to nearby markets in an efficient manner to prevent food spoilage or rot.

## Product innovation

This means that a totally new product is created or an existing product is improved.

Here are some examples of product innovation:

- Creating a new livelihood — for example, activities associated with nature-based tourism, such as being a guide or building walking trails; making handicrafts with local plant species; making boats for the local fishing sector using local species of timber; setting up a nursery in a special area suitable for young seedlings to grow plant species that are drought-tolerant, waterlog-tolerant or pest-resistant.
- Improving existing products — for example, using new methods or materials to improve packaging for farm produce to increase its shelf life.
- Switching to new varieties of crops — for example, rice, wheat, maize, vegetables or fruits that can grow in the landscapes affected by climate change. Local agricultural experts and scientists who are employed by government agencies to tackle local livelihoods that are impacted by climate change can provide advice on making this type of switch.

The diagram below illustrates the different types and categories of innovation.

Innovation categories	
 <p>New Product: agricultural and marine goods, vegetables and fruits (raw or processed), timber and handicraft</p>	 <p>Institutional: New legislation to support innovation. Government engaging with locals to share information on local weather. Subsidies given to households to innovate</p>
 <p>New Process: making a process more efficient and which makes the process faster such that the product created in a shorter time frame</p>	 <p>Service innovation supports and enhances the use of the products. Transport of goods to end user in a quicker manner</p>

*Categories of Innovation Potentially Possible in One's Own Context.* Images licensed under Creative Commons share licences and compiled by Sundari Ramakrishna.

## Support and resources required for innovations to be successful

Different innovations are suitable for different locations and contexts. No one innovation fits all situations — for example, an innovation that was implemented in a village that is frequently flooded would not be suitable for a village that has a shortage of water and often experiences drought. Innovations can therefore be described as site-specific, as they depend on the type and availability of natural resources in the area where the innovation will be implemented.

Support should come mainly from local government agencies that have the authority to operate at village or small township levels with some assistance from grassroots organisations. The support is crucial to the successful implementation of the chosen innovation.

Support and resources for innovations that are suitable for a specific context can take the following forms:

- Knowledge dissemination — for example, information about local weather is accessible, and early warning systems for hazards like severe drought or rainfall or typhoons are in place.
- Subsidies or financial assistance to buy new resilient seeds and/or crop varieties, equipment to harvest more efficiently, improved packaging for food or new equipment to speed up processing of grains or flour.
- Technological assistance — for example, researchers and scientists can provide advice on and workable solutions for choosing what crops to plant and when to plant them, watershed management techniques, buying water control equipment and building small dams to ensure paddy fields and plantations are not flooded. They can also advise on techniques for proper soil management to enhance its fertility.

- Both local and regional governments can provide support by continuously monitoring and evaluating the impacts of climate change and the progress of innovations that are put in place to address those impacts.
- Community members should participate in networking and connecting with community-based organisations (CBOs) or grassroots organisations that have the resources — that is, the knowledge and funds — to assist the farmers or fishers whose livelihoods are affected by climate change.
- Rural district councils can organise regular educational and awareness campaigns for the most vulnerable communities on soil conservation techniques, post-harvest management techniques, watershed management, climate-responsive livestock production practices and other related topics to promote food security and resilience.
- Community leaders can ask local authorities to invite key players to come to discuss and explore new livelihoods and implement pilot projects on climate-smart interventions that use mainly locally sourced materials and resources.
- Policies and legislation designed to help farmers, small land owners and fishers — for example, to secure rights to land and water or provide access to markets and financial institutions.

Adapted from Shiferaw, B.A., Okello, J., & Reddy R.V. (2009). Adoption and adaptation of natural resource management innovations in smallholder agriculture: Reflections on key lessons and best practices. *Environment, Development and Sustainability*, 11, 601-609. <https://doi.org/10.1007/s10668-007-9132-1>

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## Unit summary



### Summary

In this unit you learned about the different categories of innovations. You identified one or two categories of innovation that could be applied and developed in your own village to address local community issues and concerns and improve and sustain local livelihoods.

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## Assessment



### Assessment

#### Multiple choice questions: 2

1. Which of the following statements **does not** describe an innovation that is climate-responsive?
  - A. National policy to manufacture cars that run on petrol
  - B. Using rain-fed irrigation system for agriculture
  - C. Planting crops that are drought-resistant
  - D. Engaging in eco-tourism as an alternative livelihood
2. Choose the word that **best** describes an innovation that is working well.
  - A. Expensive
  - B. Synthetic
  - C. Efficient
  - D. Fragile
3. Enabling policies that support climate-resilient livelihoods also contribute to innovation at a local level.

#### True or false?



### Reflection

Think about what livelihoods are currently impacted by climate change in your village or household.



### Group activity

#### Formative assessment 2: Group activity

In this group activity, the group leader assigns different tasks to the group members. This activity can be carried out at the village level or in the immediate vicinity of where the group members live.

- 1 Identify and list the natural resources found locally — for example, plant and timber species, availability of water (including streams and waterlogged areas), types of soil and their conditions (dry, fertile, hill slopes, ponds to rear fish or ducks, natural landscapes) — and heritage or historical feature that would interest eco-tourists.
- 2 Discuss with local government representatives and village leaders potential opportunities to innovate — for example, installing a machine or device to make a process or processes more efficient; introducing new products such as new fruit or vegetable varieties; or providing a new service to wrap and package locally produced goods (in this example, girls and women could be involved in packaging and post-harvest activities).



## Unit 3

# Supports required for innovating: Developing an innovation ecosystem

## Introduction

In Unit 2 we discussed the different types of innovation and briefly looked at the resources that are needed to support innovations. In this unit we will look at the need to develop innovation at different levels in the community by using the three categories of innovation. Various types of support and resources are required to transform innovation from an idea into a practical, relevant application. We will look at those types of support and resources in detail.

On completion of this unit you will be able to:

- *identify* support systems for specific innovations, including the resources and networking that you will need to turn an idea into a practical application to address local concerns.



### Outcomes



### Terminology

#### **Sustainable development:**

An organising principle that concurrently supports human development goals and protects natural systems so that they continue to provide the natural resources and ecosystem services that humans need to survive.

#### **Accountability:**

Refers to a person or organisation accepting responsibility for their actions, behaviour or decisions.

#### **Transparency:**

Easily seen through. In the context of information and decisions, it means being disclosed and shared openly.



- Gender equality:** The rights, responsibilities and opportunities of a person do not depend on whether they are male or female.
- Cost-effective:** Produces the desired results without costing a lot.

## Innovation ecology: Why do we need to develop holistic innovation?

In Unit 2 you learned that the three types of innovation are process, product and institutional. We will refer to those terms again in this unit. You also learned that a fourth type of innovation, service innovation, refers to improving the process of making products available or improving the quality of products.

Any category of innovation that is implemented in response to climate change **must** have some elements of all six of the characteristics listed below:

- 1 The innovation must improve the monthly incomes of villagers and householders who are affected by climate change.
- 2 The innovation must be environmentally friendly — that is, it does not have any negative effects on the surrounding air, water, soil conditions and biodiversity. The quality of the air, water, soil and biodiversity, including natural resources, must not deteriorate or be depleted as a result of the innovation that is implemented.
- 3 The innovation must be socially and culturally accepted by the villagers and by the government agencies that have jurisdiction over the village or households.
- 4 There must be transparency — that is, all the relevant information shared and decisions made during official government meetings must be shared with all the parties who are involved during local or village meetings.
- 5 A deep sense of accountability must be instilled in the people who are implementing the innovation and the parties that have agreed to develop the idea behind the innovation — that is, if the innovation does not work, it must be clear who will take responsibility and be answerable to the failure or ineffectiveness of the innovation.
- 6 The innovation must support gender equality and social equality — that is, everyone will have equal rights, responsibilities and opportunities to access and benefit from the implementation of the innovation, regardless of whether they are male or female or from a rural or urban setting.

A holistic approach to implementing innovations in response to climate change must also account for social context, also known as the social pillar. “Social pillar” refers to greater social and cultural acceptance with regard to implementing the innovation. A researcher named P. James introduced the social pillar aspect to define ecologically sound innovations in terms of how the innovation is used, rather than in terms of being a product.

Adapted from Eco-innovation. (2023, 25 November). In *Wikipedia*.  
<https://en.wikipedia.org/wiki/Eco-innovation>  
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A new idea or new economic activity that leads to an innovation that is identified and agreed upon at the village level should be holistic — that is, all three pillars of sustainability are taken into consideration (i.e., social, economic and environment). The innovation must be efficient, the resources it uses must be used in a responsible manner and the innovation must lead to higher incomes for the villagers. The innovation should reduce stress on the environment but community opinion and responsiveness should be demonstrated. The social sustainability pillar ensures that the innovation includes better health and safety aspects, pays fair and equal wages for men and women/boys and girls and helps to create liveable communities that can sustain themselves.

Adapted from James, P. (1997). The sustainability cycle: A new tool for product development and design. *Journal of Sustainable Product Design*, 2, 52-57.  
<https://cfsd.org.uk/journal/archive/index.html>

## The resources and local support systems needed to turn an idea into an innovation

### Resources

Resources are anything that is useful and adds value to your life. Air, water, food, plants, animals, minerals, metals and everything else that exists in nature and benefits humankind is a resource.

The two categories of resources are natural resources and human-made resources. Natural resources do not need to be alive. For example, animals, plants, sunlight, wind, water and forests are natural resources, but so are rocks, stones and metals, all of which are non-living components of nature.

When humans use natural resources to make something new that provides a benefit and adds value to our lives, we call them human-made resources. For instance, when humans use metals, wood, sand and solar energy to make buildings, machinery, vehicles, bridges, roads, etc. they become human-made resources. Technology is also a human-made



resource. We use technology to build bridges, vehicles and power lines and to create new packaging materials for farm produce, for example.

The story of climate change is, in many ways, a story about water, whether it is floods, droughts, rising sea levels or even wildfires. Investing in more efficient irrigation is crucial for our future, as agriculture accounts for 70 per cent of all global freshwater use. Both local and national governments are encouraged to develop holistic water management plans, known as integrated water resource management, that take into account the entire water cycle: from source to distribution, treatment, reuse and return to the environment.

More resilient crops are required to cope with changes in the climate. High temperatures can cut annual crop productivity, lead to droughts and cause more rainfall, all of which can lead to longer or shorter crop seasons. Farmers who grow crops on land that is vulnerable to the effects of climate change will need seeds that can withstand higher temperatures, fluctuating water supplies and fluctuating crop cycle times.

Local governments, with technological assistance from national research institutes, play an important role in helping farmers acquire better irrigation methods or water management practices, supplies of drought-tolerant seeds, and knowledge and information about the climate-responsive design of homes.

## Support systems

Communities need local support systems to help them become resilient in the wake of climate change. In particular, they need these systems when they want to turn ideas into innovations. Any innovation is likely to be a challenge to implement if there are no support systems to aid in its development and formulation.

A relatively reliable Internet connection is a great asset in rural settings to help communities respond to climate change. For example:

- Information about climate resiliency can be shared easily with communities when computer literacy rates and Internet connectivity are good. Farm produce can be sold and marketed via the Internet, with suppliers and buyers able to interact without having to travel to discuss the prices of farms' produce or supply of goods. This cuts down the time it takes for farm produce to reach buyers and wholesalers.
- Early warning systems that alert people to imminent heatwaves or storms, for example, are one of the most cost-effective ways to help people cope with severe weather events. It is estimated that the

damage from severe weather can be reduced by 30 per cent when people have 24 hours' warning to prepare. Early warning systems are generally provided by local government agencies with help from their national governments.

Adapted from United Nations. (2022, 15 October). *Adapt and survive: 5 ways to help countries cope with the climate crisis*.

<https://news.un.org/en/story/2022/10/1129532>

Licence: Open access

Google's Flood Hub alert system uses machine learning technology to warn people in harm's way when rivers, oceans and lakes pose a threat to life or property. Flood Hub alerts include easy to understand inundation [areas prone to flooding] maps, with details of the at-risk area and flood heights relative to adult body height.

Google has been providing flood alerts since 2018. The early focus was on high-risk areas in Bangladesh and India. In 2021, the system sent out 115 million alerts in an area that's home to 360 million people.

Source: Torkington, S. (2023, 1 February). *Google Flood Hub*. World Economic Forum. <https://www.weforum.org/agenda/2023/02/technology-climate-change-adaptation/>

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Membership in local non-profit organisations or state-run agencies or co-operatives will help local farmers to find information, technical know-how and perhaps some financial assistance to turn an idea into an innovation in response to climate change.



### Assessment

#### Formative assessment 3: Individual activity

Make an appointment to see or speak to a government official to discuss the type of support and resources required to implement an idea before it can become an innovation. Take notes during your discussion or phone call.



### Group activity

Watch the video *Climate Smart Agriculture for Policy Makers*, by the Food and Agriculture Organization of the United Nations, with local government representatives. Use your observations from the video for the group activity below.

- 1 Identify a specific local issue or concern (use what you learned in Unit 1).
- 2 Think of a solution to the local issue (use what you learned in Unit 2 and Unit 3). Use the innovation categories to map out possible solutions, from ideas to innovation, and discuss your ideas with other course participants.
- 3 Identify resources and support systems to make the solution work and implementable (use what you learned in Unit 3).
- 4 Contact the local government representative you spoke with when you did your formative assessment and ask them for information and feedback about the ideas you discussed with your peers.

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## Unit summary



### Summary

In this unit you learned about different types of support systems and identified one or two support systems that would be helpful for the specific local innovation that you want to carry out. You learned that climate issues are site-specific and that your ability to turn your idea into an innovation depends on the availability of the resources you need and your local government's help.

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## Assessment



### Assessment

#### Multiple choice questions: 3

1. Which of the following **does not** describe a resilient crop?
  - A. Brightly coloured seeds
  - B. Drought-tolerant seeds
  - C. High-yield variety
  - D. Water-tolerant seeds
2. Support systems are important to help communities implement a climate-responsive innovation. Which one of the following is not an example of a support system?
  - A. Climate modelling tools such as Google's Flood Hub and weather forecasts
  - B. Supporting smallholder farmers by providing them with access to credit
  - C. Government investment in infrastructure such as adequate irrigation systems and storage facilities for food produce
  - D. Relocating farmers and their families to other areas during floods
3. Which of the following is not a natural resource?
  - A. Rocks
  - B. Metals
  - C. Cement
  - D. A paddy plant



## Unit 4

### Total or near total biomass use: Basic principles

#### Introduction

In this unit we will focus on:

- agricultural crops and their residues, and
- animal waste from livestock.

In farming communities, the main source of biomass is crops. The agricultural residue tends to be whatever is left on the fields after the crops have been harvested — for example, rice straw, wheat straw, rice husk and corn stalks and cobs. This residue can be used for fodder, as fill-up material in landfills (with a view to using the landfill for other purposes after it has been decommissioned) or as a heating fuel.

Forestry residue consists of branches, leaves, bark and other pieces of wood. This residue can be converted into fuel and fertiliser pellets.

The conversion of residues into useful products is an example of total biomass use.

Upon completion of this unit you will be able to:

- *explain* the link between human habitat, natural resources and optimal use of natural resources through total or near total biomass use.



#### Outcomes



**Manure:** Animal dung and waste used as fertiliser.

**Livestock:** Domestic animals raised in farm settings to provide milk, eggs, meat, fur and leather for human consumption and use.



<b>Terminology</b>	<b>Fodder:</b>	Food, especially dried hay or straw, for cattle and other livestock.
	<b>Fermentation:</b>	The chemical breakdown of a substance by bacteria, yeasts or other micro-organisms.
	<b>Renewable energy:</b>	Energy that comes from a source that can be reused indefinitely — for example, solar energy (from the sun), wind energy and geothermal heat.
	<b>Optimisation:</b>	Making the best or most effective use of a resource.
	<b>By-products:</b>	Something that is produced as a result of making something else — for example, buttermilk is a by-product of butter production.

## Total biomass use

### What is biomass?

Biomass is renewable organic material that comes from plants and animals. It contains stored chemical energy from the sun that is produced by plants through photosynthesis.

### Sources of biomass

- Wood: dead trees, stray branches, stumps, chips and clippings
- Plants: corn, sugarcane, sunflowers, palm nuts, copra (coconut) cotton, rice, wheat
- Waste: solid waste (municipal waste from cities and towns/ garbage) human waste, animal waste from livestock

Plants are a good source of biomass because it takes relatively little energy to harvest them. They also offer a high yield of biomass per hectare.

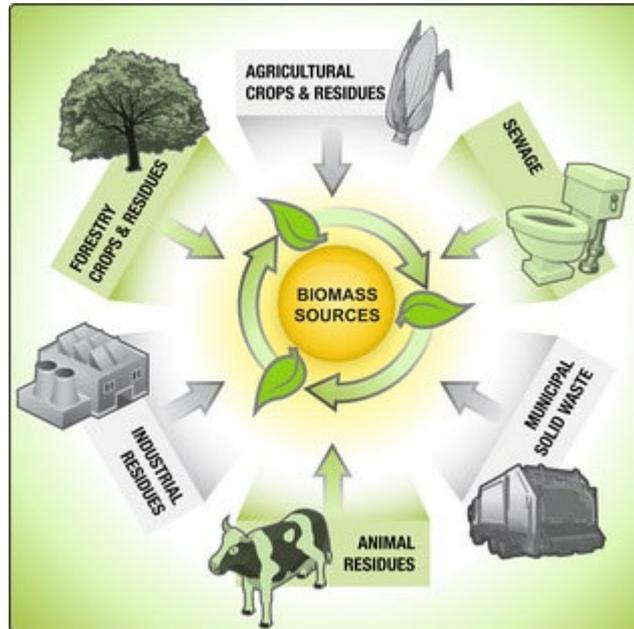


Image source: Zafar, S. (2023, 9 February). *Biomass as renewable energy resource*. BioEnergy Consult. <https://www.bioenergyconsult.com/tag/types-of-biomass/>

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## What is biomass use?

Biomass can be used as a source of energy. By-products from forestry activities, plants and animal waste from farms, even sewage and some waste from landfill can be burned as fuel or used to generate electricity.

## Concept of total biomass use

A biomass use system uses agricultural processes to cultivate crops and industrial processes to convert the biomass obtained from farmland into products such as foods, fuels, chemicals and electricity. The industrial processes are usually developed by local entrepreneurs, but sometimes the government finances the industrial process.

In fish markets, for example, more than 60 per cent of by-products are categorised as waste — for example, skin, internal organs, trimmings (usually the head and tail), eggs and bones. This waste can be collected as biomass and converted into feed or agricultural fertilisers. Fish waste biomass is a nutrient-rich, locally available resource.

Adapted from Sahu, B.B., Barik, N.K., Paikaray, A., Agnibesh, A., Mohapatra, S., & Jayasankar, P. (2016). Fish waste bio-refinery products: Its application in organic farming. *International Journal of Environment, Agriculture and Biotechnology*, 1(4), 837-843. <http://dx.doi.org/10.22161/ijeab/1.4.30>



Wood pellets made from forest biomass.

Image credit: Viet Nam News. (2023, 19 July). In Vietnam wood pellet industry set for expansion. *The Star*. <https://www.thestar.com.my/business/business-news/2023/07/19/vietnam-wood-pellet-industry-set-for-expansion>

The biomass from trees — wood clippings, branches, leaves — can be converted to pellets in a wood pellet mill using technology and specialised machinery. Wood pellets are a type of fuel made from compressed wood which can be used for heating and cooking in domestic stoves and furnaces. They are a good example of total biomass use: they are a form of renewable energy because their source is forest trees and agricultural residues and they are converted into a reusable form, creating minimal wastage.

Rural farmers grow a variety of crops and practise crop rotation so that they can grow a variety of crops suitable for the dry, wet and cold seasons. When many of these crop varieties are harvested, the parts of the plant that are not required are left in the field to dry out or rot. For example, when maize plants are harvested, the cobs, leaves and stalks are left in the fields to dry out or rot because they are not used in the final production of the dry corn as a grain. These parts of the plant are the residue. Agricultural residues are a good source of biomass. They can be converted to fuel to use in stoves for cooking or heating homes or to fodder for livestock. This is an example of optimisation and total biomass use at the farm level.

Farmers who raise livestock like cattle, goats, sheep, poultry and ducks can collect and use waste from their livestock as manure for the crops in the field. This practice is common on a small scale in rural farm settings and is another example of total biomass use.

On a typical farm, waste is generated through crop residues and livestock. This waste is a source of biomass that can be used as fuel or fodder. It can be considered as one way to conserve natural resources within the farm area and, in addition, the by-products of the biomass are returned to the farmland as manure for crops or fodder for animals. Some agricultural residue can be converted to fuel for burning and cooking.

Animal waste is rich in nitrogen, phosphorus and potassium and can be used as:

- fodder for animals
- an energy source
- fertiliser for crops

The benefits of animal waste or manure include the following:

- It contains valuable nutrients — for example, phosphorous, nitrogen and carbon — that benefit the soil while protecting natural resources.
- Adding animal manure to the soil can increase the soil's organic matter.
- Manure helps the soil particles become less dense and compact.
- Animal waste increases the ability of water to pass through the soil.

## Natural resources for total biomass use and to mitigate the effects of climate change

### Locally available natural resources

The natural resources found in the area where you live might include agricultural crops — for example, vegetables and fruits — or fish and shellfish harvested from the sea or river. They can also include domestic animals — for example, cows, pigs, ducks, goats and sheep — reared for household or village use. Patches of forest around a village, both the trees and shrubs, are also considered to be a natural resource.

### Habitat conservation through natural resource management

Habitats are places where humans live — for example, farmlands, coastal areas, forest — and where plants and animals normally live and grow. If natural resources are conserved — that is, managed well — in the habitat, there will be enough food for animals and humans alike. In addition, the waste generated in farms and fisheries production can be used as biomass. The concept of total biomass use is a useful approach to manage natural resources in places where farmers and fishermen live and work to ensure minimum wastage of agricultural and marine residues. The residues can be collected as biomass and converted into useful materials for animal feed, fodder and manure (fertiliser).



## Innovation and biomass use

Total biomass use can be considered as an innovation in places where agricultural waste is converted into something useful — usually, a fertiliser product. Efficient processes and equipment are crucial for converting agricultural and animal residues effectively. These processes and machinery can also be classed as innovations, and villagers can receive technical knowledge and training and financial assistance from local government to implement them. Governments must pass new legislation and enforce the enactment of relevant policies — an example of institutional innovation — to help farmers implement the total biomass use concept.

## Climate change mitigation and total biomass use

Converting biomass to fuel, fertiliser or energy (electricity) is an important climate change mitigation measure because it makes fuel or fertiliser for local use and reduces dependence on fossil fuels. Forests and their residues play an important role in climate change mitigation because the biomass from forest residues can be converted to energy through the use of the appropriate technology.



### Group activity

#### Formative assessment 4: Group activity

Using what you learned in Unit 3 and Unit 4, identify a natural resource in your local area that would be appropriate for total biomass use. The facilitator will engage you and the other participants in smaller group discussions and then bring the discussion points to the whole group to consider and discuss.

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## Unit summary



### Summary

In this unit you learned about the link between human habitat — where humans live — natural resources — see Unit 3 for a list of these — and optimal use of resources through total biomass use. Converting natural resources into another form to get maximum use out of them is called total biomass use.

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## Assessment



### Assessment

#### Multiple choice questions: 4

1. Which of the following is **not** an example of agricultural residue?
  - A. Corn cobs
  - B. Saw dust
  - C. Rice husk
  - D. Sand grains
2. Which of the following statements about total biomass use is **false**?
  - A. Biomass can be converted to fertiliser
  - B. Biomass from animal waste can be converted to fuel
  - C. Biomass can be converted to cement
  - D. Biomass production is a sustainable practice in agriculture
3. Natural resource management is a pathway towards sustainable development. Which one of the following phrases **does not** describe natural resource management as a sustainable practice?
  - A. Harmonious to humanity
  - B. Waste converted to biomass
  - C. Exploitation of natural resources
  - D. Soil is enriched with nutrients



## Unit 5

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# Total or near total biomass use: Traditional best practices

### Introduction

Traditional and local knowledge is the collective body of knowledge, innovations and practices of Indigenous Peoples and local communities.

In this particular context, “traditional” means that the knowledge has accumulated across the generations from experience in a specific place or ecosystem. Traditional knowledge is also known as Indigenous knowledge. Indigenous knowledge, innovations and practices are a series of connected systems that may be very familiar to specific groups of people, but completely unknown by people outside of those groups. They usually have a very strong focus on natural resource management — including a strong awareness of the environment and an appreciation for conservation and continuity — encourage sustainable innovation and see the long-term well-being of the community as the ultimate goal of all activities.

Sources:

Curci, J. (2010). *The protection of biodiversity and traditional knowledge in international law of intellectual property*. Cambridge University Press.  
<https://doi.org/10.1017/CBO9780511770685>

Lasimbang, J. (2006). *Natural resource management country studies*. [Regional Synthesis Paper]. Regional Indigenous Peoples' Programme, UNDP.  
[https://www.undp.org/sites/g/files/zskgke326/files/migration/asia\\_pacific\\_rbp/RBAP-DG-2006-NRM-Regional-Synthesis-Paper.pdf](https://www.undp.org/sites/g/files/zskgke326/files/migration/asia_pacific_rbp/RBAP-DG-2006-NRM-Regional-Synthesis-Paper.pdf)

Secretariat of the Convention on Biological Diversity. (1992). *Convention on biological diversity: Text and annexes*. United Nations Environment Programme.  
<https://www.cbd.int/doc/legal/cbd-en.pdf>

Upon completion of this unit you will be able to:



### Outcomes

*discuss* the link between human habitat and the available natural resources: how to use and conserve natural resources to address the multiple needs of a traditional community and help them develop relevant skills for total biomass use.



### Terminology

<b>Forest stewardship:</b>	Forests being managed in a way that preserves biological diversity, benefits the lives of local people and workers and sustains economic viability.
<b>Aquaculture:</b>	The breeding, rearing and harvesting of fish, shellfish, algae and other organisms in all types of water (e.g., salt water, fresh water and brackish water).
<b>Governance:</b>	The system, structures and processes for overseeing and guiding decision-making, accountability, control and behaviour in an organisation.
<b>Adaptation:</b>	A change in structure, function or behaviour that allows an individual or an entire species to improve their chances of survival in a specific environment.
<b>Sovereignty:</b>	The authority of a state to govern itself or its dominant power over the state.
<b>Marine protected areas:</b>	A part of the ocean that is set aside and managed for the long-term conservation of marine (ocean) resources.
<b>Indigenous Peoples:</b>	The earliest known inhabitants of an area and their descendants

## Conservation of natural resources using traditional best practices

Traditional knowledge and practices are often extremely useful for communities because they provide solutions that are based on centuries of accumulated wisdom and are tailored to meet the needs of the local context. They can be combined with modern technologies and innovations to help conserve natural resources and ecosystems.



Source: Thirdview. (2023, 28 April). *How traditional and modern approaches can work together for environmental protection.*

<https://thirdview.info/2023/04/28/how-traditional-and-modern-approaches-can-work-together-for-environmental-protection/>

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Here are three examples of tried and tested traditional (indigenous) practices. You can find out more about them from the sources listed in the reading box.

In all three examples you will see that the natural habitats and larger ecosystems in which the traditional communities live are conserved through practices that have been learned and passed on from one generation to the next. Biodiversity is conserved in Bangladesh through village conservation management; indigenous bamboo plants are used as food, animal fodder and construction materials in Nepal; and climate-smart management of marine protected areas is being used in tandem with traditional knowledge to plant salt-tolerant plant varieties in the Pacific Islands.

Information about these examples was drawn from United Nations Climate Change. (2022, 9 August), *How Indigenous Peoples enrich climate action.* <https://unfccc.int/news/how-indigenous-peoples-enrich-climate-action>. (Licence: Open access.)

## **Native tree planting in Nepal**

Planting native trees promotes cultural values associated with forest stewardship and provides a way to increase carbon storage. Bamboo forests, for example, provide food and rural materials to rural households that depend on them for their livelihoods. Young bamboo shoots are used in cooking and making pickles and have high nutrient value. Some species of bamboo are used as fodder for calves. In eastern Nepal, bamboo is used for a variety of purposes, including building homes, hut walls and structures for storing grain; thatching; flooring; scaffolding; and making walking sticks, baskets, furniture, fences and tool handles (see Das, 2003, for more information).

## **Community-managed natural forests (or village common forests) in Bangladesh**

These forests play a vital role in helping community members meet their daily needs and conserve local biodiversity. Village common forests are a source of fuel (wood), herbs, roots, bamboo shoots, wild fruits and vines or leaves for cooking or medicinal use, all of which are necessary to sustain the lives of the Indigenous communities in Bangladesh. This rich biocultural system has been in place for many centuries and is an excellent example of a natural resource management practice that combines the needs of humans with the needs of nature. It was made possible by traditional institutions governing the natural resources as common property based on social, cultural and religious beliefs. Traditionally the Indigenous communities in Bangladesh are relatively small (generally fewer than 100 families) and have strong social, cultural or religious connections. They are led by a variety of village elders or leaders (see Jashimuddin & Inoue, 2012, for more information).

## **Active revitalisation of traditional technologies connected to agriculture, aquaculture and natural resource management in the Pacific**

This is a key strategy in efforts to mitigate the effects of climate change. Pacific Island ecosystems are being degraded by pollution, overfishing and unsustainable development. They also increasingly face severe impacts of climate change, including rising sea levels, changing temperatures and erratic rainfall patterns. These impacts cause changes in food and water security, loss of identity, climate-induced migration and threats to sovereignty. Communities in the region have responded by using climate adaptation strategies, often combining traditional practices and cutting-edge science, to build the resilience of their communities and ecosystems in the face of increasing risk of damage from climate change. For example, some communities are implementing resilient networks of



marine protected areas. They are using the best available science and strengthening tribal governance to manage these networks, experimenting with salt- and drought-tolerant crops, revegetating coastlines with native salt-tolerant plants, revitalising traditional wells, and implementing climate-smart development plans (see Mcleod et al., 2019, for more information).



### Reading

Das, A. N. (2003). Bamboos in rural farming systems in the Terai and Midhills of Nepal. *Banko Janakari*, 13(2), 34–41.  
<https://doi.org/10.3126/banko.v13i2.17220>

Jashimuddin, M., & Inoue, M. (2012). Management of village common forests in the Chittagong Hill tracts of Bangladesh: Historical background and current issues in terms of sustainability. *Open Journal of Forestry*, 2(3), 121-137.  
<https://www.scirp.org/journal/paperinformation.aspx?paperid=21082>

Mcleod, E., Bruton-Adams, M., Förster, J., Franco, C., Gaines, G., Gorong, B., James, R., Posing-Kulwaum, G., Tara, M., & Terk, E. (2019). Lessons from the Pacific Islands: Adapting to climate change by supporting social and ecological resilience. *Frontiers in Marine Science*, 6(289). <https://doi.org/10.3389/fmars.2019.00289>

## Community resilience to mitigate climate change

### Community resilience

“Community resilience is the sustained ability of a community to use available resources [ . . . ] to respond to, withstand, and recover from adverse situations. [ . . . ] This allows for the adaptation and growth of a community after disaster strikes.”

Source: Community resilience. (2023, 25 July). In *Wikipedia*.

[https://en.wikipedia.org/wiki/Community\\_resilience](https://en.wikipedia.org/wiki/Community_resilience)

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Communities can build resilience by working together to take action against the impacts of climate change. For example, they can have plans in place to organise themselves and respond to severe floods or fires. This will help to build capacity to deal with the impacts of climate change and will ultimately lead to increasing participation in collective decision-making.

Watch the video [Improving the Resilience of Family Farmers to Climate Change](#) by the Food and Agriculture Organization of the United Nations and discuss as a group what your local community can do to improve

farming techniques to increase crop produce and villagers' income. Use the information in the video and what you have learned from Units 1–4. Make notes about your ideas, then invite local government representatives to watch the video and discuss your ideas.



### Group activity

#### Formative assessment 5: Group activity

This assessment builds on the outcome of the group activity in Unit 4. Work as a group with the help of a leader or facilitator to do the following:

- 1 Identify what support systems are required to turn ideas about total biomass use into an innovation.
- 2 List the different types of assistance needed from each of the following groups to make the innovation happen: entrepreneurs, grassroots-level organisations, research institutions and the government.
- 3 Identify:
  - i what types of skills villagers need to learn in order to implement biomass use activities, and
  - ii what roles the village or local community can play in implementing such activities.

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## Unit summary



### Summary

In this unit you learned about the link between human habitats, the available natural resources and how to use and conserve those resources to address the needs of a traditional community. You read examples of community resilience in the wake of climate change. You also learned that total biomass use is an example of an innovation that reduces waste and mitigates the effects of climate change. You identified relevant skills and roles for total biomass use activities in a group activity.

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## Assessment



### Assessment

#### Multiple choice questions: 5

1. Which of the following statements **does not** give an example of community resilience to mitigate the impacts of climate change?
  - A. Fishermen are only allowed to fish during open seasons as defined by government authorities.
  - B. Traditional communities grow exotic and non-native plant species.
  - C. Villagers use manure from the animal waste generated from cattle and poultry farms.
  - D. Grassroots organisations help local communities to organise themselves and seek assistance from government to mitigate the impacts of climate change.
2. Which of the following definitions **does not** explain the expression “climate resilience”?
  - A. Adaptation and coping strategies
  - B. Having a low-carbon lifestyle
  - C. Learning from past experiences
  - D. Communities and households are not organised to work together
3. Society — for example, a local or traditional community, members of a household or a whole village — plays an important role in mitigating the impacts of climate change.

**True or false?**

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## Answer key

### Multiple choice questions: 1

1. Which one of the following is not a result of climate change?  
**B. High yield of agricultural crops**
2. Which one of the following statements does not describe sustainable livelihoods?  
**A. Displaces community knowledge and skills**
3. Which of the following are not positive outcomes of innovation?  
**D. Reduction in naturally occurring local tree and plant species**

### Multiple choice questions: 2

1. Which of the following statements **does not** describe an innovation that is climate-responsive?  
**A. National policy to manufacture cars that run on petrol**
2. Choose the word that **best** describes an innovation that is working well.  
**C. Efficient**
3. Enabling policies that support climate-resilient livelihoods also contribute to innovation at a local level.  
**True**

### Multiple choice questions: 3

1. Which of the following **does not** describe a resilient crop?  
**A. Brightly coloured seeds**
2. Support systems are important to help communities implement a climate-responsive innovation. Which one of the following is not an example of a support system?  
**D. Relocating farmers and their families to other areas during floods**



3. Which of the following is not a natural resource?

**C. Cement**

### Multiple choice questions: 4

1. Which of the following is **not** an example of agricultural residue?

**D. Sand grains**

2. Which of the following statements about total biomass use is **false**?

**C. Biomass can be converted to cement**

3. Natural resource management is a pathway towards sustainable development. Which one of the following phrases **does not** describe natural resource management as a sustainable practice?

**C. Exploitation of natural resources**

### Multiple choice questions: 5

1. Which of the following statements **does not** give an example of community resilience to mitigate the impacts of climate change?

**B. Traditional communities grow exotic and non-native plant species.**

2. Which of the following definitions does not explain the expression “climate resilience”?

**D. Communities and households are not organised to work together.**

3. Society — for example, a local or traditional community, members of a household or a whole village — plays an important role in mitigating the impacts of climate change.

**True**