CLIMATE CHANGE EDUCATION

Resource Book for Science and Geography

Key Stage II & III

Centre for School Curriculum Developement
Department of School Education
Ministry of Education and Skills Developemnt

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CENTRE FOR SCHOOL CURRICULUM DEVELOPMENT
DEPARTMENT OF SCHOOL EDUCATION
MINISTRY OF EDUCATION AND SKILLS DEVELOPMENT

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Foreword

In the heart of the Himalayas lies Bhutan, a country renowned for its deep spiritual heritage and its commitment to preserving the natural environment. As a nation that values Gross National Happiness over Gross Domestic Product, Bhutan has consistently demonstrated profound respect for nature, advocating for sustainable development and environmental stewardship. This dedication is particularly significant in the context of global climate change, a pervasive challenge that affects every corner of our planet, including the serene landscapes and vibrant communities of Bhutan.

This Climate Change Education Resource Book is crafted specifically for the schools of Bhutan, recognizing the urgent need to integrate climate literacy into our educational frameworks. By empowering our young learners with knowledge about climate change, its impacts, and the strategies for mitigation and adaptation, we are preparing them to be conscientious global citizens and proactive guardians of their natural heritage. The content of this resource book is designed to resonate with the unique cultural, geographical, and environmental contexts of Bhutan. It includes not only the scientific basis of climate change but also local case studies that demonstrate the real-world impacts and responses relevant to Bhutanese communities.

Through this book, educators are provided with a comprehensive toolkit to engage students in meaningful discussions and activities that enhance their understanding of climate science. It encourages critical thinking and proactive responses, aiming to cultivate a generation that is well-informed and motivated to take action for the sustainability of their environment.

We extend our gratitude to the various contributors, educators, and environmental experts who have made this resource possible. Their collective expertise and insights ensure that the information is both accurate and applicable. We also thank the schools and teachers who will bring this resource to life in classrooms across the country, inspiring students to learn, reflect, and act.

As we present this Climate Change Education Resource Book, we invite all educators and students in Bhutan to embark on this educational journey. Together, let us strengthen our resolve to protect our beautiful country and the planet at large, ensuring a harmonious balance between human development and environmental preservation.

(Karma Galley)
Director General
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Key Stage III

Background

Bhutan, a small Himalayan kingdom, has made significant strides in incorporating climate change education into its school curriculum, recognizing the urgent need to prepare its young population for the uncertainties and impacts of climate change. This educational initiative aligns with Bhutan's overarching commitment to environmental conservation and sustainability, which is also reflected in its constitutional mandate to maintain at least 60% of its land under forest cover for all future generations. In support of this, the Ministry of Education and Skills Development had undertaken significant initiatives including the institutionalisation of Nature Clubs in collaboration with the Royal Society for Protection of Nature (RSPN) since 1989, and the introduction of Environmental Science as an optional subject at the secondary level in 2017. Furthermore, by contextualising school curricula to Bhutanese social, cultural, economic, and physical contexts, environmental and climate change themes are comprehensively embedded in the Bhutanese school curriculum.

Climate change education in Bhutan is supported by national policies that emphasise environmental stewardship. The inclusion of climate change topics within the Bhutanese education system is not just a response to global environmental trends, but also a part of the country's broader educational reforms aimed at creating a more informed and proactive citizenry. The curriculum developed by the Ministry of Education and Skills Development includes comprehensive themes on climate science, local impacts of climate change, and sustainable practices that can mitigate these impacts. Educational materials are designed to be interactive and practical, encouraging students to engage with their local environments and communities.

The primary goal of climate change education in Bhutan is to instil a deep understanding of climate change processes, its local and global implications, and the ways individuals and communities can contribute to climate resilience. Objectives include developing students' ability to explore, investigate and think critically about environmental issues, fostering a sense of responsibility towards natural resources, and promoting active participation in environmental conservation efforts.

Despite the strong policy framework, Bhutan faces challenges in implementing climate change education effectively across all schools. These challenges include limited resources, varying levels of teacher training, and the need for localised research to inform educational content. However, the country's unique position as a carbon-negative nation provides a powerful platform for practical learning about sustainable practices. Additionally, Bhutan's rich biodiversity and traditional knowledge offer a unique perspective on adapting to and mitigating climate change impacts in a way that is culturally and environmentally appropriate.

Looking forward, Bhutan aims to further integrate climate change education with its Gross National Happiness philosophy, which promotes holistic development and well-being. Enhancing teacher training programs, increasing community involvement, and updating curricular materials to include the latest scientific research are key steps planned to bolster climate change education (National Environment Commission, 2020). This approach not only prepares students for the environmental challenges ahead but also embeds them within the fabric of Bhutanese identity and cultural heritage, ensuring that climate action is a shared endeavour.

Introduction

Climate Change Education Resource Book, a comprehensive guide designed for Bhutanese schools is to navigate the complexities of climate change while fostering environmental stewardship among students. This resource aligns with Bhutan's deep-rooted commitment to sustainability and conservation, principles that are embodied in its nation's policies and practices, including maintaining a constitutional mandate to keep at least 60% of the land under forest cover (Constitution of Bhutan, 2008).

As a forward-thinking country, Bhutan recognizes the importance of educating its youth about climate change—a global challenge with distinctly local impacts. This resource book is developed in response to the urgent need to integrate climate science, adaptation strategies, and mitigation techniques into the school curricula. By equipping students with knowledge, skills, and values, students are prepared to act as informed citizens and custodians of the natural heritage.

According to the COP28 -

> Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas.
>
> From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale.
>
> *(UN, n.d.). [https://www.un.org/en/climatechange/what-is-climate-change]*

This initiative directly supports the United Nations Sustainable Development Goals (SDGs), particularly SDG 4, which emphasises inclusive and equitable quality education and promotes lifelong learning opportunities for all, and SDG 13, which calls for urgent actions to combat climate change and its impacts. Through this resource book, it is aimed to deliver an educational experience that not only meets international standards, but also addresses local needs and realities (United Nations, 2015).

The chapters in this resource book cover a wide range of topics essential for understanding and addressing climate change:

1. Climate Science Basics: Understanding the fundamental scientific principles of climate change.
2. Local and Global Impact: Exploring the effects of climate change globally and in Bhutan's unique environmental context.
3. Adaptation and Mitigation: Learning about strategies to adapt to climate change impacts and mitigate their severity.
4. Sustainable Practices: Promoting sustainable lifestyle choices and conservation efforts that students can undertake.
5. Community Engagement: Encouraging students to engage with their communities in climate action initiatives.
6. Integrating Traditional Wisdom: Recognizing the value of Bhutan's rich cultural heritage, this book also integrates traditional Bhutanese wisdom with modern scientific knowledge. This approach not only enhances the relevance of the material but also fosters a deeper connection between students and their cultural identity as they learn about climate change.

Each chapter includes interactive elements, such as case studies, projects, and discussion questions, designed to stimulate critical thinking and active engagement with the material.

As the MOESD embarks on this educational journey, it is hoped that this resource will inspire and empower the young minds of Bhutan to appreciate their role in environmental conservation and to act with conviction in the face of climate challenges. By educating youth, the MOESD is investing in a resilient, sustainable future for all, honouring the nation's commitments under the SDGs, and preserving the beauty and balance of the natural environment for generations to come.

Structure of the Climate Change Education Curriculum

Goal

To cultivate a well-informed, proactive, and resilient generation of Bhutanese youth who are equipped with the knowledge, skills, and values necessary to address the challenges posed by climate change, promote sustainable development, and contribute positively to both local and global environmental stewardship in alignment with the national imperatives and the United Nations Sustainable Development Goals.

This goal aims not only to prepare students to face the challenges brought about by climate change but also to empower them as agents of change in their communities, contributing to the preservation of Bhutan's unique natural heritage and the global effort towards sustainability. By achieving these educational objectives, Bhutan can ensure that its youth are ready to lead and support sustainable development well into the future.

What is Climate Change Education?

Climate change refers to significant and lasting alterations in the Earth's climate patterns over extended periods, primarily attributed to human activities such as the burning of fossil fuels, deforestation, and industrial processes. These activities release greenhouse gases like carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) into the atmosphere, which trap heat and lead to global warming, causing shifts in weather patterns, rising sea levels, and other environmental disruptions (IPCC, 2021).

Climate change education plays a crucial role in raising awareness about these phenomena, their causes, impacts, and potential solutions. It encompasses formal education in schools, universities, and vocational training programs, as well as informal education through public outreach campaigns, media, and community initiatives. By educating individuals about climate change, its scientific basis, and its societal implications, we empower them to make informed decisions, advocate for policy changes, and adopt sustainable behaviours (UNESCO, 2020).

Climate change education emphasises interdisciplinary learning, integrating concepts from environmental science, ecology, economics, sociology, and policy studies. It promotes critical thinking, problem-solving, and systems thinking skills to address the complex and interconnected nature of climate change issues. Moreover, it fosters

values such as environmental stewardship, equity, and global citizenship, encouraging individuals to take collective action at local, national, and international levels (NAAEE, 2016).

Climate change is a pressing global challenge driven by human activities, and climate change education is essential for building knowledge, fostering awareness, and empowering individuals and communities to mitigate its impacts and adapt to a changing climate. Hence, climate change education is the teaching and learning about the causes of climate change, its impacts and risks, and the skills and motivations to take action to reduce global warming and its effects (UNESCO, 2021).

Why Climate Change Education?

Climate Change Education (CCE) aims to empower students, educators, and communities with the knowledge and skills necessary to address the complex issue of climate change. Through a focused educational framework, CCE equips individuals to understand climate science, recognize the impact of climate change on their environments, and engage in meaningful actions that contribute to sustainability and resilience.

The following education objectives explain the rationale for climate change education.

i. **Enhancing Knowledge and Awareness**: The primary purpose of CCE is to enhance understanding the basic principles of climate science, including the causes, impacts, and mechanisms of climate change. This foundational knowledge helps learners grasp the severity of climate issues and the urgency of addressing them (UNESCO, 2017)

ii. **Developing Skills**: CCE aims to develop critical thinking, problem-solving, and decision-making among students. These skills are essential for analysing climate-related information, assessing risks, and devising practical solutions to environmental challenges (UNESCO, 2017).

iii. **Strengthen Community Engagement and Leadership**: Inspire students to take leadership roles in community-based environmental projects, enhancing their capacity to mobilise others and advocate for sustainable practices and policies related climate change.

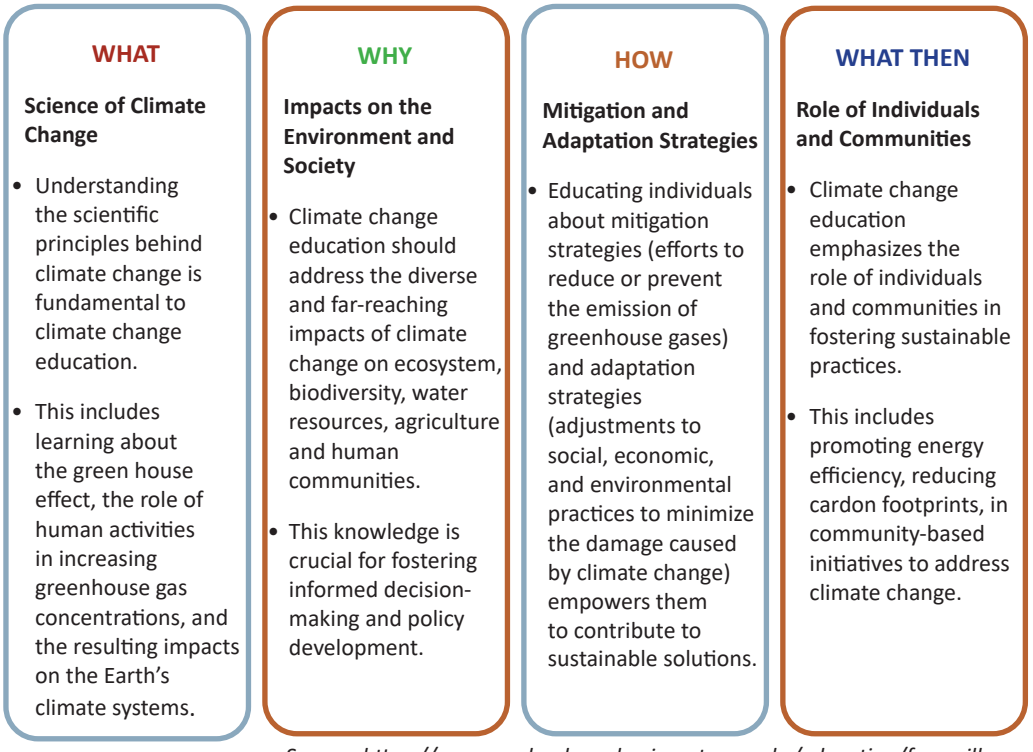
iv. **Promoting Attitudes and Values**: CCE fosters positive attitudes towards the environment and reinforces values such as responsibility, conservation, and respect

for nature. It encourages learners to adopt sustainable lifestyles and participate in community efforts to mitigate environmental degradation.

v. **Facilitating Behavioural Change**: One of the core purposes of CCE is to inspire behavioural change, leading to active engagement in climate action. This includes both individual actions, such as reducing waste and conserving energy, and collective initiatives, like community-based adaptation projects.

vi. **Aligning with Gross National Happiness (GNH) and Sustainable Development Goals (SDGs)**: CCE upholds the philosophy of GNH through the conservation of natural environment and sustainable socio economic development. It directly contributes to the achievement of the Sustainable Development Goals, particularly SDG 4 and SDG 13. By integrating climate change education into the curriculum, schools are advancing SDG 4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Moreover, by focusing on climate action (SDG 13), CCE encourages students and communities to take urgent action to combat climate change and its impacts.

In summary, CCE is all about:



Source: https://www.nucleodoconhecimento.com.br/education/four-pillars

Figure 1 *Four pillars of CCE*

How is Climate Change Education delivered?

The integration of CCE into educational systems is crucial for preparing a generation that is informed, skilled, and motivated to take meaningful action against climate change. By leveraging educational resources aligned with global goals, CCE not only enhances individual competence but also contributes to broader societal resilience and sustainability.

Strategies:

1. Incorporate Climate Change into Formal Curriculum

Incorporating climate change into the formal curriculum is a strategic approach to ensure that students are equipped with necessary knowledge and skills to address global environmental challenges. This strategy involves integrating climate change education across various disciplines and not just limiting it to science subjects.

i. **Interdisciplinary Approach**: Climate change education is inherently interdisciplinary. For instance, the Climate Action Through Education (CATE) program developed at MIT engages students by weaving climate change themes into various subjects including history, science, mathematics, and language arts. This approach enables students to understand the multifaceted impact of climate change and its relevance across different aspects of society and the economy.

ii. **Adaptation to Local Contexts**: Successful implementation of climate change education requires it to be adaptable to local contexts and educational standards. Programs need to be flexible enough to allow integration into various educational frameworks across different countries, which might have specific local environmental issues or educational policies.

iii. **Teacher Training and Resources**: Providing teachers with adequate resources and training is crucial. The CATE program emphasises supporting teachers, particularly those from non-science backgrounds, by providing them with the necessary resources to confidently implement climate change education. This support helps in integrating climate education into existing curricula and encourages an educational environment that fosters discussions on sustainability

iv. **Global Curriculum Guidelines:** UNESCO has been a proponent of integrating climate education into the formal curricula globally. Their guidelines suggest that climate education should not only focus on environmental aspects but also incorporate economic and social pillars of sustainability. This broader approach ensures that

students are well-prepared to think critically and act on climate issues within a global context.

v. **Digital platform:** Digital platforms as a strategy for the delivery of climate change education involve using online tools and technologies in the integration of Climate Change Education (CCE) into the formal curriculum. These platforms can host interactive content such as simulations, virtual labs, and multimedia resources that make complex concepts more accessible and engaging for students. They also facilitate collaborative projects where students can work with peers globally, fostering a deeper understanding of climate issues and their global impact. Additionally, digital platforms can provide real-time data and case studies, enhancing learning with up-to-date information and real-world applications.

2. Child motivated activities

Child motivated activities as a strategy in delivering climate change education involves engaging children in hands-on, interactive, and engaging activities that highlight the impacts and understanding of climate change. This method leverages children's natural curiosity and active learning style to enhance their awareness and motivate positive action towards climate issues.

Key Components of Child Motivated Activities in Climate Change Education:

i. **Hands-On Experiments**: Activities such as simulating the greenhouse effect using simple materials like thermometers and glass jars or conducting ice-melting experiments to illustrate sea level rise are effective in teaching children about the scientific concepts behind climate change. These activities help demystify complex topics and make them accessible and engaging for young learners (We Are Teachers).

ii. **Use of Visual and Creative Tools**: Employing tools like trading cards of atmospheric gases or conducting activities that involve making edible models of greenhouse gases can make learning fun and memorable. These tools not only explain the scientific basis of climate change but also keep the children engaged through visual and tactile experiences (We Are Teachers).

iii. **Incorporation of Storytelling and Role Play**: Integrating storytelling about the effects of climate change on different species and ecosystems, or role-playing activities can help children understand the broader environmental impact. For

instance, activities that simulate how animals are affected by melting ice can cultivate empathy and a deeper understanding of ecological interconnections (We Are Teachers).

iv. **Project-Based Learning**: Encouraging children to undertake projects that have real-world applications, like designing solutions for reducing waste or energy consumption in their homes or schools, promotes active learning and empowerment. Children learn best by doing, and project-based activities foster critical thinking and problem-solving skills (Save the Children International).

v. **Global and Cultural Perspectives**: Introducing children to how different cultures and countries are affected by and respond to climate change can broaden their perspective. This can include discussions on global climate initiatives and how young people around the world are taking action against climate change (Save the Children International).

By focusing on child-motivated activities, climate change education can be made more appealing and effective for young learners, fostering a generation that is knowledgeable, concerned, and proactive about the environment. These activities not only educate but also empower children, giving them the tools and motivation to be part of the solution to global climate challenges. For further exploration of child-centred activities in climate change education, websites like We Are Teachers and Save the Children offer numerous resources and ideas.

3. Extra-curricular activities

In Bhutanese schools, extracurricular activities, including club activities, can be key vehicles for delivering climate change education. These platforms provide an informal setting where students can engage in environmental learning beyond the traditional classroom. Key elements of this strategy include hands-on projects, such as tree planting or waste recycling, which enhance practical understanding of environmental stewardship. Club activities can also involve community outreach projects, raising broader awareness on climate issues. This approach allows for a comprehensive and participatory learning experience that can be crucial in fostering proactive environmental attitudes among students (UNESCO, n.d.).

4. Assessment strategies

Assessment is crucial in climate change education in evaluating students' understanding of climate change concepts, skills and behavioural change towards climate change. It measures how effectively students are learning about the impacts and challenges of climate change. Through assessment, educators can evaluate whether students understand the scientific concepts, can analyse the socio-economic impacts, and are able to propose viable solutions. It also helps educators identify areas where students need more support or deeper knowledge, ensuring that learning is comprehensive and aligned with educational goals.

Assessing learning outcomes for Climate Change Education is done using a variety of strategies:

i. **Project-Based Assessments**: Evaluate students on projects that require them to apply their knowledge to real-world situations, such as designing a sustainable energy solution for their school.

ii. **Portfolios**: Students compile a portfolio of their work related to climate change topics throughout the course, demonstrating their understanding and progress.

iii. **Presentations**: Students present their research or projects on climate change to their peers or a panel, showcasing their communication skills and understanding.

iv. **Tests and Quizzes**: Traditional methods can assess students' factual knowledge and understanding of scientific concepts related to climate change.

v. **Peer Assessment**: Encourage students to assess each other's contributions in group projects or discussions, promoting critical thinking and collaborative skills.

vi. **Simulations and Role-Play**: Use simulations or role-play exercises where students must make decisions based on climate change scenarios, assessing their problem-solving and decision-making abilities.

vii. **Environmental Journaling**: Students live in the bounty of the nature, and they are are aware of changes in the nature. Encouraging students to record changes in the environment, for instance climate change and its effects, help them to realise the realities of climate change. Such awareness inspires students to change their attitude and behaviour towards the environment.

These methods aim to assess both the depth of students' knowledge and their ability to apply this knowledge in practical and meaningful ways, and their behavioural changes.

The Conceptual Framework of Climate Change Education (CCE) is illustrated in Figure 2.

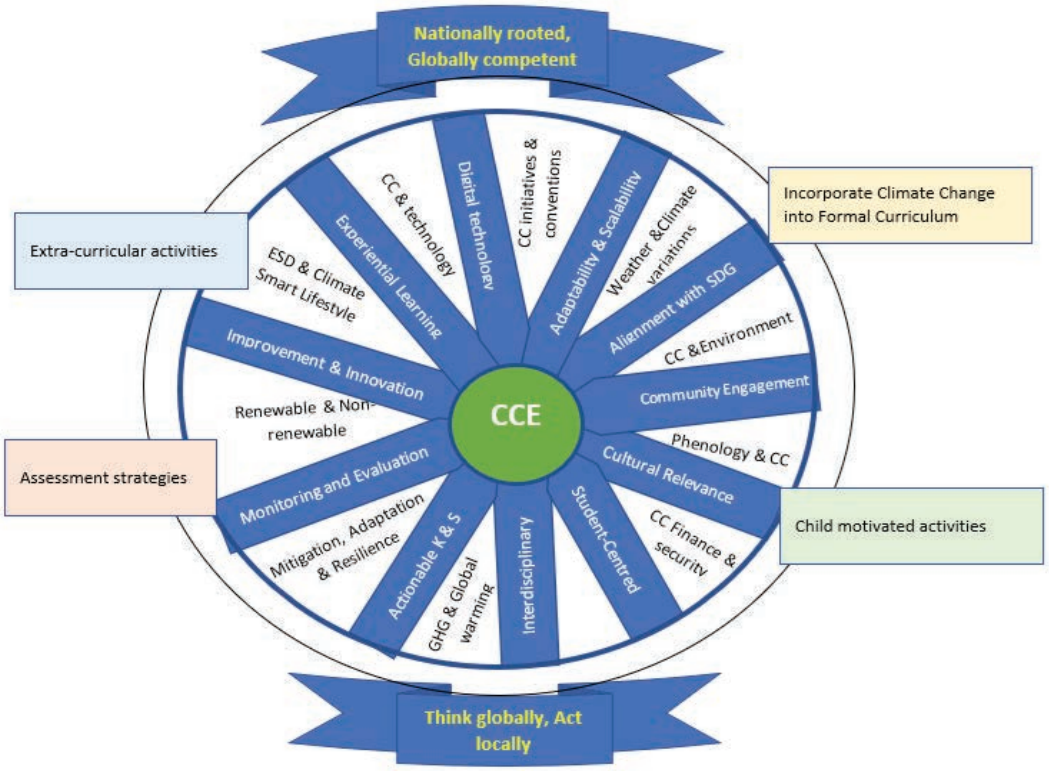


Figure 2: *Conceptual Framework of Climate Change Education*

The figure 2 illustrates the conceptual framework of climate change education. Wherein, the 11 guiding principles guide the selection and defining the 10 CCE themes and their strategies. The outer circle represents the potential platforms for the delivery of the CCE. Thus, the ultimate vision of CCE is to nurture "nationally rooted, globally competent" youths with the competency to "think globally, act locally" vital in engendering them as the custodians of Bhutan's future environment.

Guiding Principles

To effectively address the unique environmental challenges and educational needs in Bhutan, while also aligning with the United Nations' priorities, the development of a Climate Change Education (CCE) resource book is guided by several foundational principles:

1. **Cultural Relevance and Integration**:
   Integrate Bhutan's rich cultural heritage, traditional knowledge, and Buddhist values of interdependence and compassion into the climate change curriculum. This helps foster a deeper connection between students and their environment, enhancing their understanding of why preserving nature is crucial not just globally, but as a part of their cultural identity.

2. **Holistic and Interdisciplinary Approach**:
   Develop content that is interdisciplinary, drawing on subjects such as science, social studies, economics, and ethics. This approach ensures that students can understand climate change from multiple perspectives, highlighting the complexity and interconnectedness of environmental issues (UNESCO, 2017).

3. **Focus on Actionable Knowledge and Skills**:
   Emphasise practical skills and actionable knowledge that students can apply in their daily lives and communities. This includes teaching adaptation and mitigation strategies, sustainable farming techniques, and ways to reduce carbon footprints, tailored to the Bhutanese context.

4. **Student-Centred Learning**:
   Employ student-centred teaching methods that encourage active learning, critical thinking, and engagement. Use project-based learning, field trips, and hands-on activities that allow students to engage directly with their environment and community (UNESCO, 2017).

5. **Community and Stakeholder Engagement**:
   Involve community members, local environmental groups, and government agencies in the development and implementation of the CCE curriculum. This collaboration ensures the relevance of the content and encourages community-based education that extends beyond the classroom.

6. **Alignment with Sustainable Development Goals (SDGs)**:
   Align the curriculum with the SDGs, especially SDG 4 (Quality Education) and SDG 13 (Climate Action). This alignment helps frame climate change education within the context of global sustainability goals and emphasises the role of education in achieving these goals (United Nations, 2015).

7. **Adaptability and Scalability**:
   Design the curriculum and resources to be adaptable to different educational levels and scalable across various regions within Bhutan. This flexibility allows for localised adjustments based on specific environmental challenges and educational needs (UNESCO, 2017).

8. **Continuous Improvement and Innovation**:
   Encourage continuous improvement and innovation in teaching practices and learning materials based on feedback and emerging research. Keeping the curriculum dynamic and up-to-date ensures that it remains effective and relevant (UNESCO, 2017).

9. **Monitoring and Evaluation**:
   Establish robust mechanisms for monitoring and evaluating the effectiveness of the climate change education initiatives. Regular assessment helps in refining educational strategies and achieving desired learning outcomes (UNESCO, 2017).

10. **Real-world Application / Experiential Learning**:
    i. Emphasise experiential learning where students can apply theoretical knowledge to real-world scenarios, enhancing their understanding and retention of climate change impacts.

    ii. Develop field-based experiences, such as visits to local ecosystems, engagement in community-based environmental projects, and participation in sustainability workshops, which allow students to observe and study environmental processes and human impacts firsthand.

    iii. Encourage the use of simulations and role-playing games that model ecological and meteorological processes, enabling students to make decisions and see the outcomes of those decisions in a controlled environment.

iv. Implement problem-based learning projects where students tackle existing climate-related issues in their communities, proposing and testing solutions, which will cultivate a sense of responsibility and empowerment among students to act on climate issues.

v. Foster partnerships with local businesses and environmental organisations to create internship opportunities that place students in real-world settings where they can contribute to ongoing climate action initiatives.

11. I**ntegration of digital technology**:

Integrating digital technology in climate change education is crucial for modernising how we teach and learn. This involves using digital tools to create interactive content and simulate complex concepts, making learning both accessible and engaging. By harnessing technology, educators can leverage global datasets to deepen understanding of climate science and its solutions. Digital platforms also facilitate worldwide collaboration among students, fostering a global perspective on climate issues. Furthermore, adaptive learning technologies can be employed to tailor educational experiences to individual needs, enhancing engagement and effectiveness. This strategy prepares students for a future where technology and sustainability intersect.

By adhering to these guiding principles, the development of a Climate Change Education resource book for Bhutanese schools not only educates students about the critical issue of climate change but also empowers them to become proactive stewards of their environment.

Climate Change Education Themes

The climate change education is guided by eleven guiding principles contextualised in ten themes and delivered through four suggested strategies. The ten themes include the following:

	CCE Themes	Description
1	Weather and Climate variations	Weather is the atmospheric condition in a short period in a place. The climate is an average condition of weather for a longer period. Humans have been causing a shift in climatic conditions.
2	Climate Change and Environment	Climate change is the long-term shifts in temperatures and weather patterns. This shift directly affects the health of the environment.
3	Climate Change Mitigation, Adaptation and Resilience	Mitigation refers to measures of reducing or preventing the emission of greenhouse gases. Adaptation on the other hand actions taken to reduce the vulnerability to climatic conditions of places.
4	Renewable and Non-renewable Energy	Renewable energy is generated from natural sources which can be replenished, while non-renewable energy is produced using sources which cannot be replenished.
5	Phenology and Climate Change	Phenology is the science of understanding the relationships between behaviour of living organisms with the climatic condition variations. It is one of the means of ascertaining the climatic conditions of places.
6	Education for Sustainable Development (ESD) and Climate Smart Lifestyle	Education for sustainable development (ESD) focuses on the knowledge, skills, and values towards addressing interconnected global challenges including climate change, loss of biodiversity, unsustainable use of resources, and inequality. The ESD influences the economic and social life of people. Living attuned to the climatic conditions can help to reduce the vulnerability of climate change.
7	National and Global Climate Change initiatives and conventions	The pledges and actions to combat dangerous human interference with the climate system, address threats of climate change
8	Climate change technology	Technologies used to address climate change. Climate technologies help to reduce GHGs by using renewable energies such as wind energy, solar energy and hydropower.

9	Greenhouse gasses and Global warming	Greenhouse gases released due to human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases used for cooling and refrigeration. They trap the sun's heat, making the Earth warm. They bring about climatic change with diverse implications for the environment and people.
10	Climate Finance and Security	Climate finance refers to financial resources and instruments used to support action on climate change. Climate security refers to evaluating, managing, and reducing the risks to peace and stability caused by changes in the planet's climate, including weather extremes and natural disasters, ocean acidification and sea-level rise, loss of biodiversity, food and water insecurity, health risks, economic disruption, displacement, and even violent conflict.

Key Stage II

Science

Class IV ~ VI

Theme One

Weather and Climate Variations

Sunny, rainy, snowy, cloudy, partly cloudy, and windy are the conditions of the atmosphere of a place for a short time. This is known as weather. The weather keeps changing over the day. It can be different from morning to evening or change from one day to the next.

The weather of a particular place for a longer duration is called climate. It is affected by factors such as temperature, precipitation (rain, snow), humidity, and wind patterns. These factors cause variations of climate resulting in seasons: winter, spring, summer and autumn.

Weather and climate affect everything around us. They influence the growth of plants and animals, what people wear, eat and how they live. Have you observed the change in weather and climate in your locality over the last few years? How has this change been affecting your life?

Class IV

Topic 1: Climate Change and Plant Growth

Curriculum linkages:

a. Subject:
Science KS II
(Class IV)

b. Competencies targeted:
Investigate the conditions required for the growth of plants, and identify parts of a flower to understand its role in reproduction.

Introduction

Plants are amazing living things that grow almost everywhere. Like a human, a plant needs certain things to grow such as air, light, warmth, water, and nutrients. If a plant does not have one of these conditions, it either affects the growth or survival. Do you know that weather and climate change affect the growth of plants?

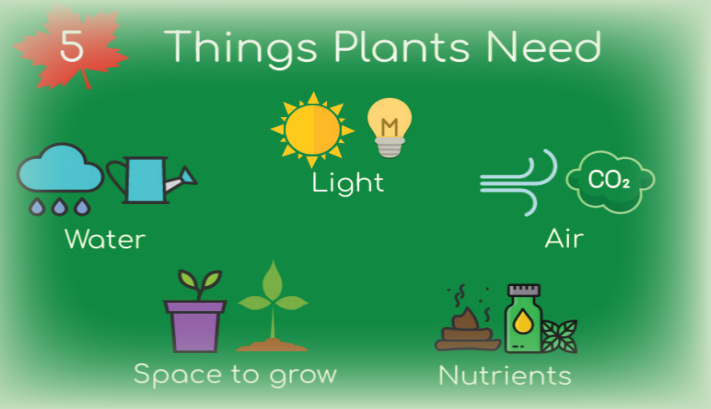


Figure 1: *Needs of plants*

Learn more about weather and climate through suggested link https://www.youtube.com/watch?app=desktop&v=i-A23Sm-HI4I.

Learning Objectives

i. Investigate the effect of light on the growth of a plant
ii. Investigate the effect of air on the growth of a plant.
iii. Investigate the effect of temperature on the growth of plants.
iv. Investigate the effect of water on the growth of a plant.
v. Explain the interdependence of various growth factors for healthy plant development.

c. Climate facts!

The characteristics of the rings inside a tree can tell scientists how old a tree is and what the weather conditions were like during each year of that tree's life. Very old trees can offer clues about what the climate in an area was like long before measurements were recorded.

Learning Experiences

Weather and climate affect the growth of plants. Extreme changes in climate such as rise in temperature and precipitation patterns results in droughts, rise in sea level and floods. These changes affect plant growth.

Engage in the following activity to understand more about weather and climate, conditions required for growth of plants, and the impacts of climate change on plant growth.

Activity 1: Understanding the impact of climate change on plants' growth

Watch the videos on weather and climate, conditions required for plant growth, impacts of climate change on plants' growth from the suggested links

- https://youtu.be/vH298zSCQzY,
- https://tinyurl.com/3wrbv4dh and
- https://tinyurl.com/242frzzb

Questions

1. How does climate change affect the growth of plants?
2. Why is the growth rate of plants in winter lower than in the summer?
3. How does climate change affect people?

Check Your Learning

Complete the worksheet given in the suggested links

- https://www.liveworksheets.com/w/en/science/219457
- https://www.liveworksheets.com/w/en/english-second-language-esl/2221369

Class V

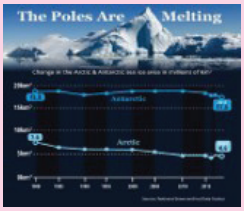
Topic 2: Change of States of Matter in Nature

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Explore the properties of matter, various changes, and the interconversions occurring in and around oneself to understand their effects in nature.

c. Climate facts!



Introduction

The interconversion of matter involves the change of state matter from one state to another due to changes in temperature and pressure. Key processes include melting, evaporation, condensation, and freezing. However, some substances undergo sublimation.

The change in states of matter occurs in nature due to temperature and pressure changes. The rate of change is affected by climate change which contributes to increasing the earth's temperature. This causes ice and snow to melt faster and increases the amount of rainfall and water in rivers and streams causing floods. Therefore, global warming and climate change are closely linked to each other. They are the pressing global issues that need to be addressed by finding ways to stop the earth from getting too hot.

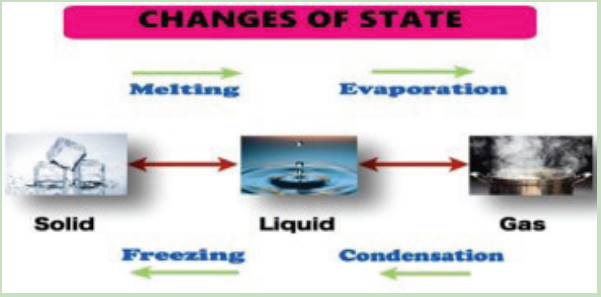


Figure 2: *Change of State of Matter*

Learning Objectives

i. Investigate the process of melting, freezing, evaporation, condensation, and sublimation using experiments.
ii. Examine the influence of climate change on the interconversion of matters in the local environment.

Learning Experiences

Observing the natural transformations of matter - melting, freezing, evaporation, condensation, and sublimation in nature is fun. Through experimentation and discussion, learner understands how these processes are related to climate change affecting the living things around.

Activity 1: Observing change of states of matter

The learner conducts the experiment to study the change of states of matter that occurs in natural setting.

Materials Required:

1. ice cubes
2. measuring cylinders

Procedures

1. Place an ice cube in two measuring cylinders. Keep one cylinder in the sun and the other in the room.
2. Predict what will happen to the ice in both locations.
3. Record the temperature of both the places.
4. Observe the setup after every five minutes and record the observation in the table.

Table : Effect of temperature

Table 1: *Observation table*

Time (min)	Observation (Record the amount of water)			
	Cylinder in sun	Tempera-ture	Cylinder in room	Temperature
5				
10				
15				

Questions

1. What conclusion can you draw from the experiment?
2. Relate this experiment to GLOF (Glacial Lake Outburst Flood) in Punakha in 1994.
3. Have you felt or observed any temperature change in your locality recently? Elaborate.
4. Suggest some ways to stop the earth from getting hotter.

Check Your Learning

Complete the quiz from the suggested link https://quizizz.com/admin/quiz/5e6e960cf958e4001b5c36ac?source=quiz_share.

Class VI

Topic 3: Climate Change and Ecological Balance

Curriculum linkages:

a. **Subject:**
Science KS II
(Class VI)

b. **Competencies targeted:**
Analyze the trophic levels of the ecological pyramid and their roles in maintaining the ecological equilibrium to understand the flow of energy in the ecosystem.

c. **Climate facts!**

Introduction

Trophic levels represent the different positions that organisms occupy in a food chain, or food web based on their feeding relationships.

Trophic levels are a crucial concept in ecology, helping us understand the flow of energy through ecosystems and maintaining ecological equilibrium. Trophic interactions may be altered through climate-dependent changes in either predator food preferences or prey communities.

Ecological equilibrium refers to a state of balance and stability of population sizes of various species, energy flow and nutrient cycling. However, climate change due to human activities disrupt ecological equilibrium affecting the health of the ecosystem.

Learning Objectives

i. Examine the impact of climate change on the trophic levels in the food chain.
ii. Explain the significance of energy flow in maintaining ecological equilibrium.

Learning Experiences

Whenever the living and nonliving things in a geographic area are in balance, the ecosystem is in equilibrium. However, this balance in the ecosystem are disrupted by natural or human-caused activities.

Activity 1: Observing change of states of matter in nature

Watch the video through the suggested links https://tinyurl.com/5a7p43fh and https://rb.gy/0e2znr on climate change and ecological equilibrium.

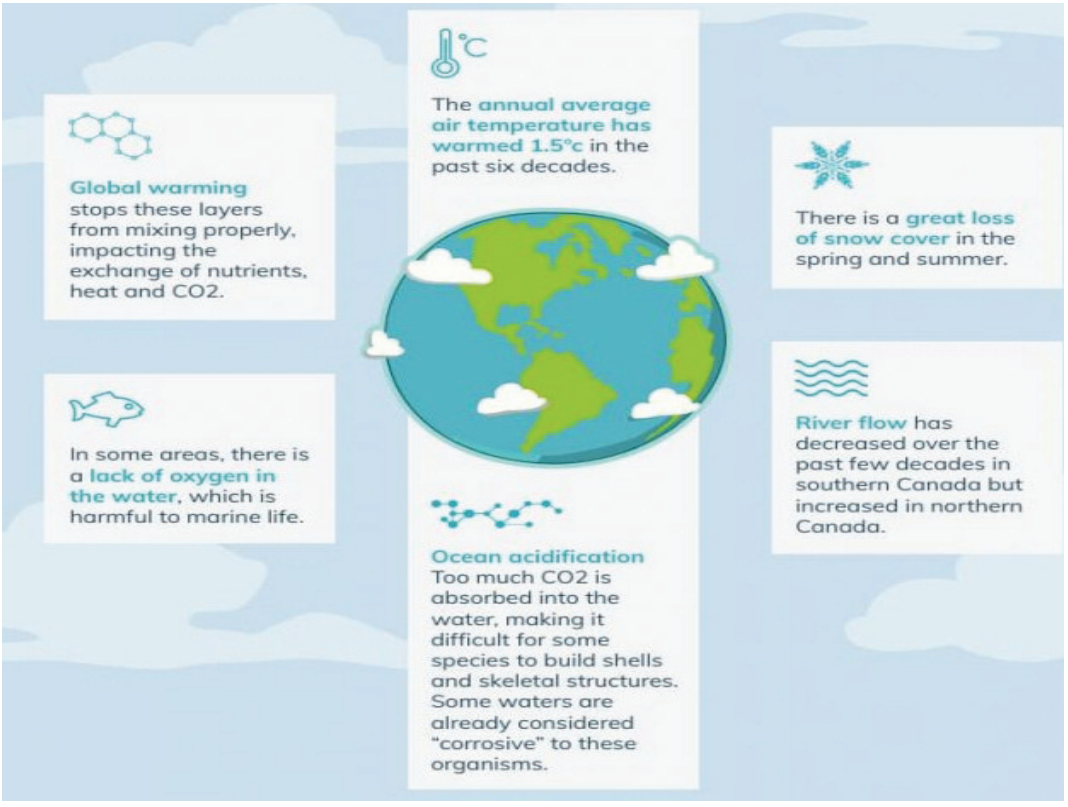
Questions

1. Identify factors that disrupt the energy flow in an ecosystem.
2. Why do plants and animals go extinct when there is a rise in temperature?
3. Explain the relationship between climate change and ecological equilibrium.
4. How does the disturbance in ecological balance affect farmers?

Check Your Learning

1. Why is climate change a serious problem?
2. Illustrate the impact of climate change on the plants and animals after ten years if the temperature of earth increases at the current pace. How will it affect human well being?

Theme Two
Climate Change and Environment



The importance of understanding climate change lies in its widespread impacts. It affects water supplies, agriculture, power and transport systems, the natural environment, and even our health. In regions like Bhutan, the melting of glaciers poses risks of glacial lake outburst floods (GLOF), and changes in seasonal patterns which can disrupt traditional farming practices.

The feeding relationship and the interdependence ensure the stability and sustainability of the ecosystem. Feeding relationships and interdependence in ecosystems are crucial aspects that are significantly affected by climate change. Mitigating climate change is essential for the sustainability of the planet's ecosystems, for protecting communities, and for ensuring the health of future generations. It also involves preserving the biodiversity and maintaining the natural beauty of the environment, which are integral to cultural and spiritual values in Bhutan.

Class V

Topic 4: Ecological Harmony: Feeding Relationships and Climate Change

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Explain the feeding relationships and interdependence of organisms to and understand the impacts of human activities on their feeding relationship.

c. Climate facts!

Introduction

A feeding relationship is the transfer of energy between organisms within an ecosystem, in which micro-organisms, animals, and plants are mutually dependent on one another. It is important that they are protected to maintain balance in nature, ensuring that food is available for everyone.

A feeding relationship is disturbed by factors such as pollution and deforestation, which have harmful effects on both plants and animals. The irregular weather patterns due to climate change caused by human activities also affect the feeding relationship.

Figure 1: *Threats to Habitat*

Learning Objectives

i. Explain various human activities that cause climate change and pose a threat to habitat.
ii. Discuss measures to conserve the habitat.
ii. Justify how climate change influences the health of the environment.

iv. Identify the threatened animals and plants in your locality.
v. State the significance of saving the threatened animals and plants in your locality.

Learning Experiences

Human activities significantly impact climate change and cause habitat destruction. Activities such as burning fossil fuels, deforestation, industrial activities, agricultural practices and waste disposal cause climate change and threats to the habitats.

Activity 1: Exploring information on human activities causing climate change

Explore information on various human activities that cause climate change and pose threats to the habitats of plants and animals from the video in the suggested link http://surl.li/pvbig.

Questions

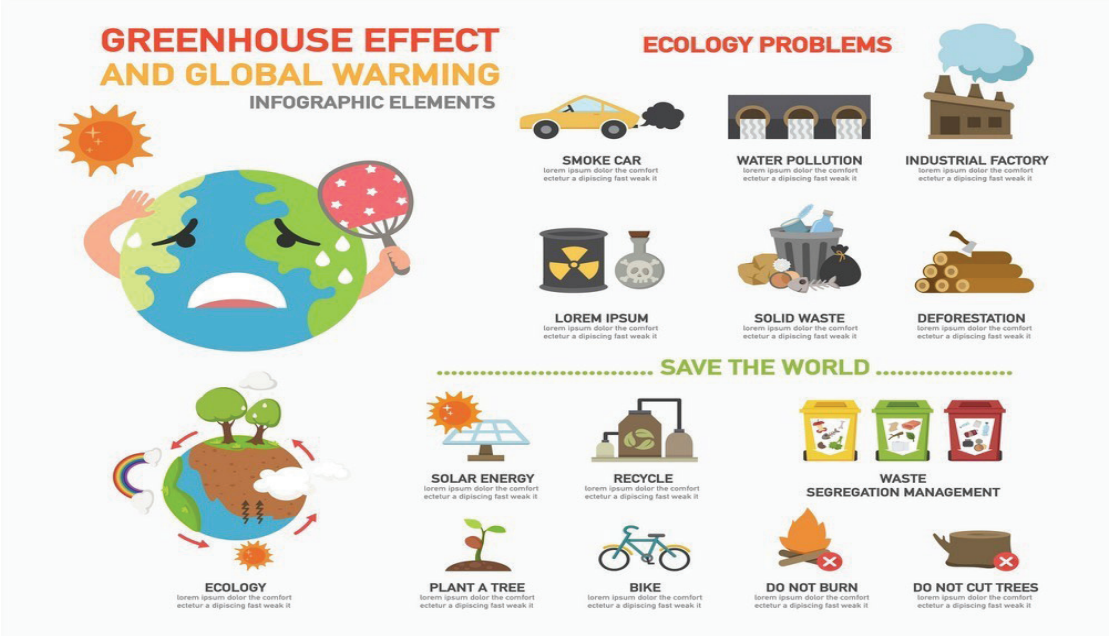
1. Identify two human activities that pose threats to the habitat.
2. Describe how human activities cause climate change.
3. How does climate change endanger the habitat of animals?
4. State at least three measures to conserve habitat.

Check Your Learning

Complete the quiz from the suggested link https://n9.cl/fvha7v.

Theme Three

Greenhouse Gases and Global Warming



There are gases such as water vapour, carbon dioxide, methane, and nitrous oxide in the air. These gases are greenhouse gases. They allow the sunlight to enter the Earth but prevent the escape of its heat back into space. This causes the Greenhouse Effect. This effect maintains the temperature of the Earth, suitable for the survival of living beings. However, due to human activities, greenhouse gases in the air increase leading to an increase in the temperature of the Earth. This is known as Global Warming.

Global Warming causes the drying of water sources, the melting of glaciers , and the dying of vegetation . These changes can cause floods, loss of plants and animals, and crop failure. People around the world are worried about the impact of global warming on the Earth.

Class IV

Topic 5: Waste Management and Climate Change

Curriculum linkages:

a. Subject:
Science KS II
(Class IV)

b. Competencies targeted:
Explore the characteristics of things to classify them into living and non-living, biodegradable, non-biodegradable things.

c. Climate facts!
Recycling can make one person's trash another person's treasure! One metric ton of electronic scrap from personal computers contains more gold than that recovered from 17 tons of gold ore.

Introduction

Things on the Earth are classified into living and nonliving. They are also classified into biodegradable and non-biodegradable things. Biodegradable things produce biodegradable waste. Non-biodegradable things produce non-biodegradable waste.

Waste is unwanted and unusable materials. Waste can be in different forms such as food waste, plastic waste, paper waste, electronic waste, organic waste and hazardous waste. Biodegradable wastes are waste materials that can be easily decayed. Non biodegradable wastes are those which cannot be decayed.

Figure 1: *Types of Waste*

Learning Objectives

i. Investigate the role of microorganisms in the decomposition of biodegradable waste by making compost.
ii. Identify the consequences of improper waste management and suggest ways to address the problem related to waste.
iii. Explain the consequences of improper waste manage ment to suggest solutions.

Learning Experiences

Waste can affect the environment and our lives if we do not take care of it properly. Improper waste management leads to many problems, including climate change. When biodegradable waste decomposes, carbon dioxide and methane gases are produced. Non biodegradable waste contributes to greenhouse gas during their manufacturing process, and when burning them.

Activity 1: Exploring more about waste

Explore ways for the disposal of waste from the suggested links

- https://tinyurl.com/mr2m5j7j
- https://tinyurl.com/294tpryh

Watch the video on the consequences of improper waste management from the suggested link https://tinyurl.com/pdydv5n3.

Questions

1. What are the consequences of improper waste management?
3. Why is burning waste discouraged?
2. How does the improper management of waste contribute to climate change?

Activity 2: Conducting waste audit

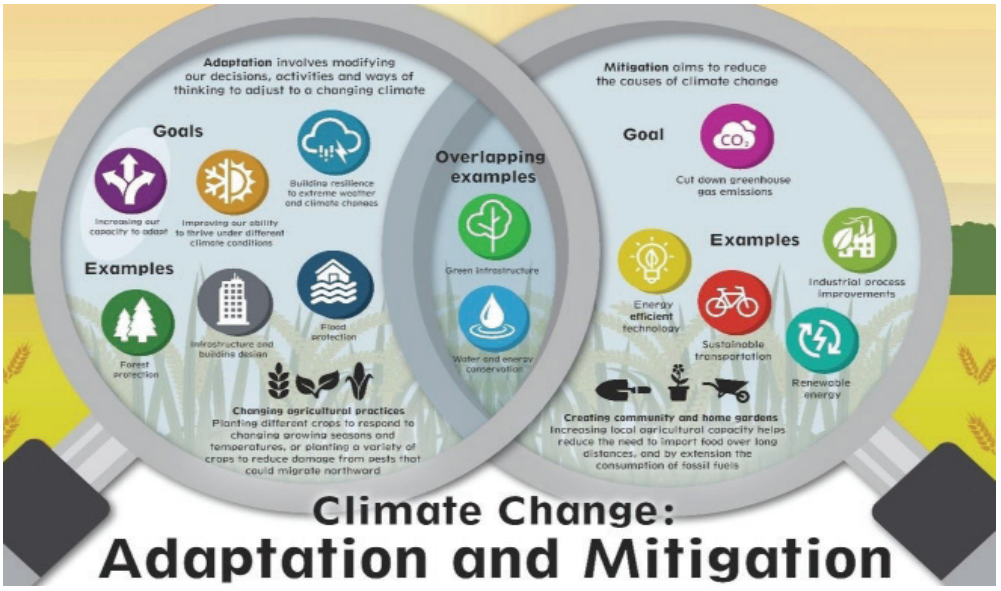
Walk around the school to observe and record the types of wastes you see. Discuss and suggest solutions to reduce wastes in the school environment.

Check Your Learning

Complete the worksheet given in the suggested links

- https://www.liveworksheets.com/w/en/english-second-language-esl/1207172
- https://www.liveworksheets.com/w/en/social-studies/327296

Theme Four
Climate Change Mitigation, Adaptation, and Resilience



People plant trees, manage wastes, minimise the consumption of energy and water, and prefer to use energy from hydropower, solar and wind. All these practices relate to mitigation, adaptation, and resilience in order to minimise the effect of human activities on climate. Mitigation is like turning off the lights when you leave a room to save electricity. Just as turning off the lights reduces energy waste, mitigation involves taking actions to reduce the causes of climate change, like using renewable energy sources instead of fossil fuels.

Resilience is similar to wearing a helmet when riding a bike. Wearing a helmet helps protect your head in case of a fall, just as resilience helps communities and nature bounce back from the impacts of climate change, like building stronger houses to withstand storms.

Adaptation is like wearing a raincoat when it is raining outside. Just as wearing a raincoat helps you stay dry in a wet weather, adaptation involves making changes to cope with the effects of climate change like building higher walls to prevent flooding in areas with rising sea levels.

Class IV

Topic 6: Climate change and Safe drinking water

Curriculum linkages:

a. Subject:
Science KS II
(Class IV)

b. Competencies targeted:
Demonstrate various methods of separation of mixtures (sedimentation, decantation, and filtration) to illustrate their applications in everyday scenarios.

Introduction

People use water for many purposes. They use water for drinking, cooking and washing. People need safe drinking water for good health and their wellbeing. However, not all water available is safe for drinking. Water becomes unsafe for drinking when contaminated with the dumping of wastes and chemicals from homes, industries and farmlands. Water can also become unsafe for drinking due to extreme weather events caused by climate change.

Figure 1: *Keep water clean*

Learning Objectives

i. Explain ways to make water safe for drinking.
ii. Design a simple filter for purifying muddy water to make it drinkable.
iii. Justify that safe drinking water is important for people.
iv. Justify the occurrence of waterborne disease due to climate change

Learning Experiences

The extreme weather events due to climate change causes flooding, and growth and spread of pathogens in water bodies. These contaminate water and cause water-borne diseases.

c. Climate facts!

Climate change is exacerbating both water scarcity and water-related hazards (such as droughts), as rising temperatures disrupt precipitation patterns and the entire water cycle.

Activity 1: Exploring safe drinking water

Watch the video on safe drinking water from the suggested link https://tinyurl.com/2srs3hbx or any other sources.

Classify the following list of activities under the column " Safe for drinking and Not safe for drinking"

1. boiling water
2. throwing waste in river
3. bathing in river
4. filtering water

Table

Safe for drinking	Not safe for drinking

Activity 2: Exploring the effects of climate change on safe drinking water

Watch the video on the effects of climate change on safe drinking water from the suggested link https://tinyurl.com/46rvt3mb.

In small groups, discuss:

1. How does climate change cause water borne diseases?
2. List waterborne diseases caused due to climate change.
3. How you can make your drinking water safe at home?

Check Your Learning

Design a poster to create awareness on how climate change affects safe drinking water.

Class V

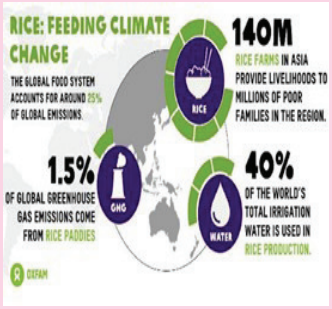
Topic 7: Organism Diversification in Response to Climate Change

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Explore variations among organisms and their traits to understand the significance of the existence of diversity in life forms.

c. Climate facts!



Introduction

Living things exist in different forms and have different ways of surviving. These life forms change with changing environmental conditions by the process of adaptation. This process is important for the survival of organisms as it helps them adapt to changing temperatures, rainfall patterns, and other climatic factors. By the adaptation process, living things become resilient.

As the climate changes, habitats can alter and affect the survival of living things unless they adapt. Adaptation includes changes in physical characteristics, behaviours, and reproductive systems. Understanding how organisms diversify in response to climate change is important for maintaining a healthy ecosystem.

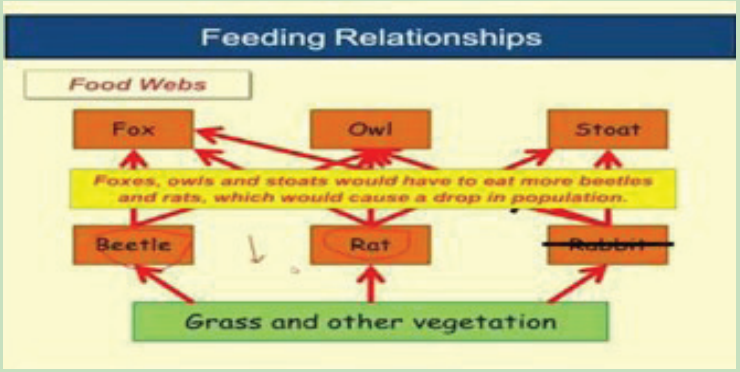


Figure 1 *Feeding Relationship*

Learning Objectives

i. Explore the variations in plants and animals based on their size, colour, and shape.
ii. Explain the significance of the diversity of plants and animals in the ecosystem.
iii. Explain how climate change affects the diversity of plants and animals.

Learning Experiences

Understanding the impacts of climate change on biodiversity is important in our effort in protecting ecosystems. Rising temperatures and changing weather conditions threaten the survival of species, diminish habitats, and disrupt food chains.

Activity: Analysing the impact of climate change on an ecosystem.

Watch the video from the suggested link https://tinyurl.com/yc7rxf2p that explains the effects of climate change on the environment.

List the consequences of climate change on the biodiversity and measures to consequences of climate change in the table:

Table 1

Record the consequences of climate change and its measures

Sl No.	Consequences of climate change on plants and animals	Measures
1	E.g.: Extinction of species	Protect habitat
2		
3		
4		

Questions

1. What have you learned from the video?
2. Have you noticed similar consequences that you saw in the video in your locality? Explain.
3. What actions can you take to prevent or avoid such consequences?

Check Your Learning

Complete the worksheet in the suggested link https://tinyurl.com/39x5wkcd.

Class VI

Topic 8: Photosynthesis: The Lifeline of Organisms in a Changing Climate

Curriculum linkages:

a. **Subject:**
Science KS II
(Class VI)

b. **Competencies targeted:**
Explain the life process of plants (nutrients, photosynthesis and reproduction) to understand its importance in the growth and development of plants.

c. **Climate facts!**

Introduction

Photosynthesis is the process by which green plants, algae, and some bacteria convert light energy, usually from the sun, into chemical energy, in the form of glucose. It is a vital process for life on Earth as it is responsible for producing food and oxygen for all living organisms.

Climate change brings frequent and extreme weather events, including extreme rainfall, wind disturbance, heat waves and drought. These affect the flowering and fruit developmental processes, and reduce yields.

Learning Objective

i. Justify the importance of photosynthesis for the survival of organisms.

Learning Experiences

Increase in carbon dioxide in the atmosphere brought about by anthropogenic activity. This increase though expected to increase plant yield and growth, scientific stud ies proved that the rate of photosynthesis has slowed down.

Activity 1: Understanding the impact of climate change on photosynthesis

Explore how climate change impacts photosynthesis by reading the article from the suggested link https://rb.gy/g2mdjp.

Further, watch thevideo on how climate change im pacts food security and nutrition from the suggested link https://n9.cl/k9l81r.

Questions

1. How does climate change affect photosynthesis?
2. How can climate change impact food security and nutrition in our country?

Activity 2: Identifying the climate change impact in Bhutan

Bhutan has already been experiencing impacts of climate change such as crop loss to unusual outbreaks of diseases and pests, erratic rainfalls, windstorms, hail storms, droughts, flash floods and landslides annually. Explore some of the evidence on the impacts of climate change felt in Bhutan using the suggested link https://n9.cl/6epkh.

Questions

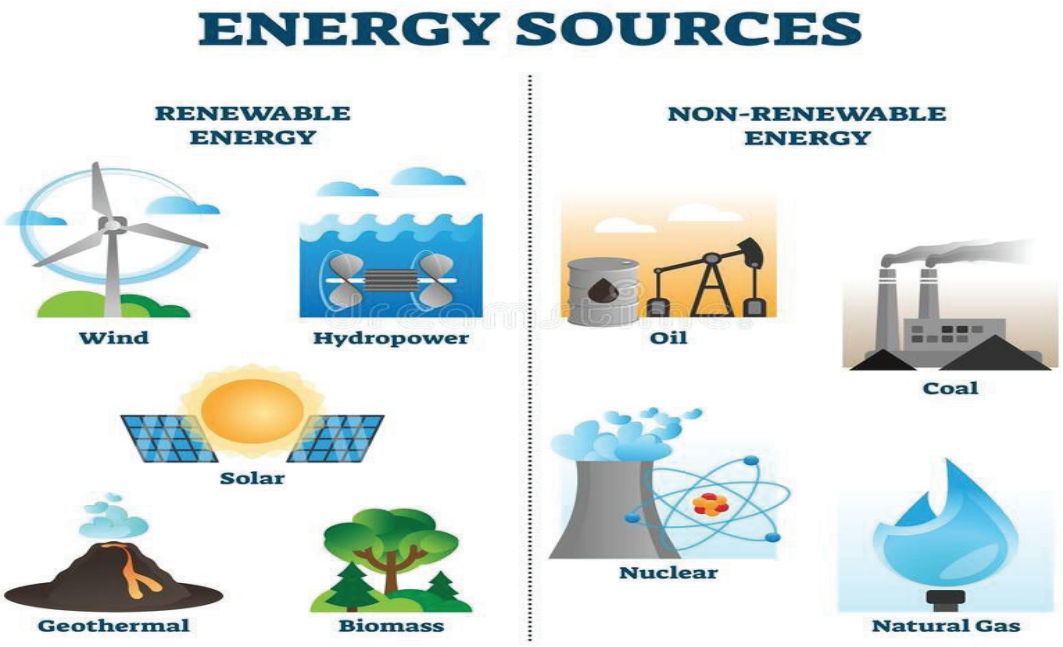
1. Which are the most common climate change events in Bhutan since 1994?
2. What were some of the impacts of these climate change events?

Check Your Learning

1. Is it too late to do anything about climate change? Comment.
2. Can we slow down global warming by planting more trees? Justify.

Theme Five

Renewable and Non-renewable Energy



The sun that shines or the wind that blows are natural events that occur regularly. Solar energy can be trapped to make electricity usingsolar panels. Wind energy can be used to turn wind turbines to generate electricity. Similarly, water is used for generating hydro-power. These are called renewable energy because they never run out.

Non-renewable energy is the energy that runs out over time. Fuel used in our cars, such as petrol or diesel is non-renewable energy. This type of energy takes millions of years to form.

Therefore, opting for alternative sources such assunlight and wind to generate energy reduces pressure on non-renewable energy sources. This ultimately helps in reducing the release of pollutants that enhance climate change.

Class V

Topic 9: Sustainable Energy Sources in Changing Climate

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Explain circuits, conductor, insulator, magnetic poles, generation of electricity from renewable sources and construct a series circuit to understand their uses in different appliances.

c. Climate facts!

Introduction

Renewable energy comes from natural sources that can replace themselves over a short period. It produces little to no pollution. It never runs out, unlike coal or oil. Some common examples of renewable energy are solar energy, wind energy, and hydroelectric energy.

These energy sources do not produce harmful gases when they generate electricity. By replacing non-renewable energy sources, we can reduce the release of greenhouse gases. This helps to slow the warming of the planet and reduces the impacts of climate change.

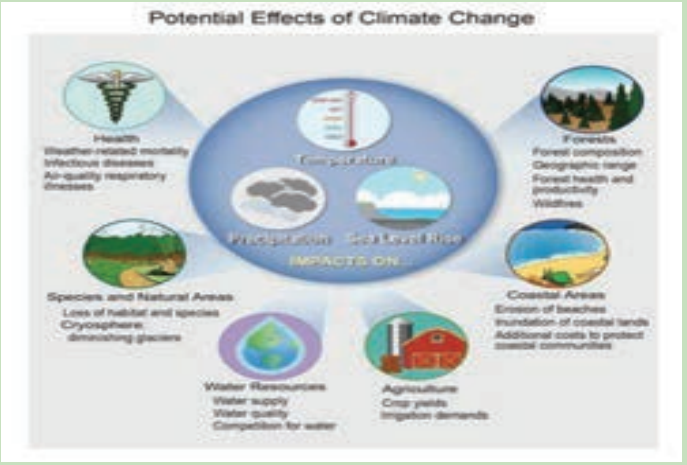


Figure: *Difference between Weather and ClimateOIP.jpeg*

Learning Objectives

i. Explain the generation of electricity using hydropower.
ii. Explain the generation of electricity using solar energy.
iii. Explain the generation of electricity using wind energy.
iv. Justify hydropower, solar, and wind energy as clean energy sources

Learning Experiences

There are many benefits of using renewable energy sources. Explore alternative energy sources and the fastest-growing source of energy in the world. How can we use these to combat climate change?

Activity 1: Exploring renewable energy

Explore information on the importance of renewable energy and its benefits by watching the video from the suggested link https://n9.cl/xu0do0.

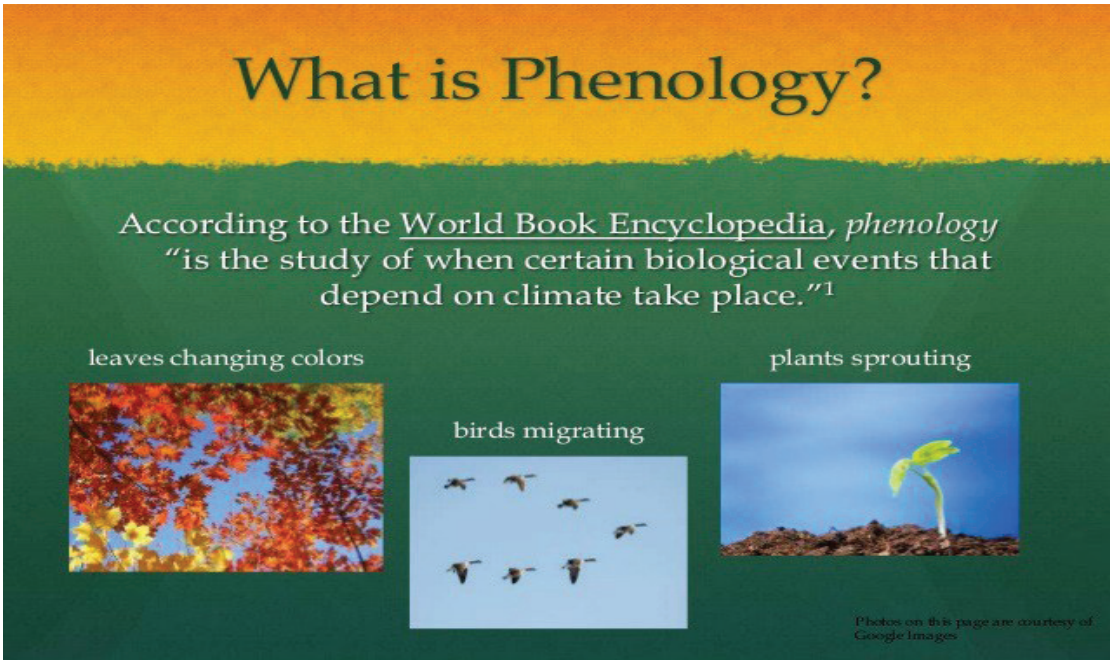
Questions

1. Renewable energy sources are clean. Justify the statement.
2. Suggest strategies to encourage the community to use renewable energy.

Check Your Learning

Complete the interactive quiz from the suggested link https://n9.cl/c3azw.

Theme Six
Phenology and Climate Change



Climatic conditions such as temperature, rainfall, and day length have a direct effect on the behaviour of all living things. In plants, flowering, leafing, and fruiting take place at different times of the year in response to the changes in weather and climate. Likewise, in animals, the laying of eggs, and migration are affected by weather and climate change. The study of the timing of these events in plants and animals is known as phenology.

Climatic conditions affect the phenophases of plants and animals. For example, plants may bloom before butterflies emerge to pollinate them, or caterpillars may emerge before migratory birds arrive to feed them to their young ones. This changing behaviour has adverse effect on the life of plants and animals.

Class IV

Topic 10: Climate Change and Flowering of Plants

Curriculum linkages:

a. Subject:
Science KS II
(Class IV)

b. Competencies targeted:
Investigate the conditions required for the growth of plants, and identify parts of a flower to understand its role in reproduction

c. Climate facts!
Climate change is causing UK plants to flower almost a month earlier on average, according to a study.

Introduction

The life of plants begins with the germination of seeds. They grow, bloom flowers, produce fruits, and complete their life cycle. These events of plants are affected by changes in climatic conditions. Overall, the growth of plants is affected by air, light, temperature, water, and nutrients. Any changes in these conditions due to climate change affect the overall growth and other processes like flowering.

Figure 1: *Sharp Drop in Flower Abundance Caused by Climate Crisis*

Learning Objective

i. Explain the impact of climate change on the flowering of plants.

Learning Experiences

The flower is the reproductive part of the plant. It has different parts: petals, sepals, stamens and carpels. Climate change affects the flowering of plants. For example, an increase in temperature delays flowering, changes flower colour, and damages the formation of fertile pollen grains.

Activity 1: Understanding the impacts of climate change on the flowering of plants.

Learn the impacts of climate change on the flowering of plants from the suggested link https://tinyurl.com/s3uzst39.

Questions

1. Fill in the blanks with the correct words from the word bank:

temperature	rainfall	seasons	flowering

   i. Climate change can affect the timing of _____ in plants.
   ii. Warmer _____ can cause plants to bloom earlier or later than usual.
   iii. Changes in _____ patterns can disrupt the flowering of plants that need specific moisture levels.
   iv. Shifts in _____ can confuse plants, making them flower at the wrong time.
2. What would happen to the plants if the temperature of the earth rises to 50°C?
3. Would the plant bloom if it receives water continuously? Explain.
4. How would the impact of climate change on the flowering of plants affect you?

Check Your Learning

Complete the quiz in the suggested link https://tinyurl.com/59t2h583.

Class VI

Topic 11: Impact of Climate Change on Plant Reproduction

Curriculum linkages:

a. Subject:
Science KS II
(Class VI)

b. Competencies targeted:
Explain the life process of plants (nutrients, photosynthesis and reproduction) to understand its importance in the growth and development of plants.

c. Climate facts!

Did you know ?

Without climate change adaptation, **800 million** (or **44** percent) people in **South Asia** will be living in moderate or severe climate hotspots by **2050** which will push millions of people below the poverty line.

(Source: World Bank, 2021)

Introduction

The process by which different species of plants grow from a single seed into a plant is called germination. This process influences both the quality and quantity of crop yields.

Figure 1: Germination of Seed

Climate change has influence on the distribution of plants, and affects the reproductive phases of several species.The increase in temperature during early seed development can decrease seed size, number, and fertility. It also delays germination and increases seed dormancy in crops such as cereals, legumes, and vegetable crops.

An investigation on the seed quality can help to understand how to combat the effects of climate change for better plant reproduction.

Learning Objectives

i. Explain pollination and its significance in plants.
ii. Identify the agents for seed dispersal.
iii. Explain the impacts of climate change on germination.

Learning Experiences

An increase in the number of days with extreme temperatures or rain can cause a decline in the quality and size of seeds. The availability of quality seeds is the basis for ensuring food security but climate change has been posing a threat to this very foundation.

Heat stress can also trigger early or delayed flowering. High-temperature stress before seeds reach maturity can reduce germination by inhibiting the ability of the plant to supply the nutrients necessary for the germination process.

Agricultural scientists consider improved seeds and varieties adapted to regions with different agricultural climates as an effective solution to the problem. This is the reason for developing disease and climate resilient varieties of seeds in the last few decades.

Activity 1: Investigating the impact of climate change on seed germination

Watch the video from the suggested link https://n9.cl/a3sty and read the article from the suggested link https://n9.cl/gp18i to complete the table below:

Table

Climate Change and its Impact on Production and Seed Germination

Climate change conditions	How is the germination impacted?
Temperature	
Rainfall	
Salinity	

Questions

1. The major food crops that are going to be affected worldwide by climate change are wheat, corn, and rice. How will these impact food security in our country?
2. How do disturbances in germination cause disturbances in the diversity of plant communities?
3. How does climate change impact seed dormancy and germination rates in temperature-sensitive crops?
4. What methods can be used to enhance seed germination under these changing conditions?

Check Your Learning

Study the figure and draw a conclusion based on the concept of climate change's impact on seed germination.

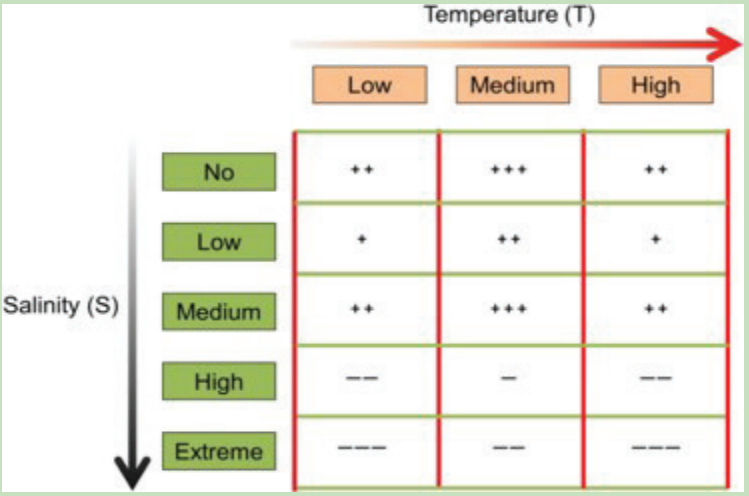


Figure 1: *Relationship between Salinity and Temperature on Seed*

Note: *The expected effects of temperature (three levels: low, medium, and high) and salinity (five levels: no, low, medium, high, and extreme) on seed germination, where "+" and "–" refer to the positive and negative effect, respectively. More "+" or "–" indicates a stronger effect.*

Theme Seven

Education For Sustainable Development and Climate Smart Life lifestyle

Air, water, and natural resources are important for the well-being and survival of living things on the Earth. With the increase in population, these resources are used more and may soon get depleted. To maintain the supply of these resources for a longer duration, people must use them wisely for the future generations. This is known as sustainable use of resources. The developmental activities that ensure the use of resources wisely without impacting the future generation are known as sustainable development.

People use resources based on their lifestyle and generate wastes that impact the environment.We all leave a mark on the Earth in the form of resource consumption, and the production of waste and pollution. This mark is the individual's carbon footprint. In other words, carbon footprint represents the amount of resources used and waste generated thus, contributing to climate change.

In order to keep our carbon footprint small and minimise its impact on climate change, we must practise climate smart lifestyle. For example, use less energy, walk or use bicycles instead of driving vehicles, and put off light when not in use.

Class IV

Topic 12: Sustainable Use of energy

Curriculum linkages:

a. Subject:
Science KS II
(Class IV)

b. Competencies targeted:
Demonstrate an understanding of different forms of energy and their uses to recognise the importance of saving energy.

Introduction

When you play with your favourite toy car, you push it and the toy moves. This is due to the energy that you applied to the toy. Energy helps us to do all the work in our life. Therefore, energy is the ability to do work.

Energy comes from different sources and it is present in different forms required to do different types of work.

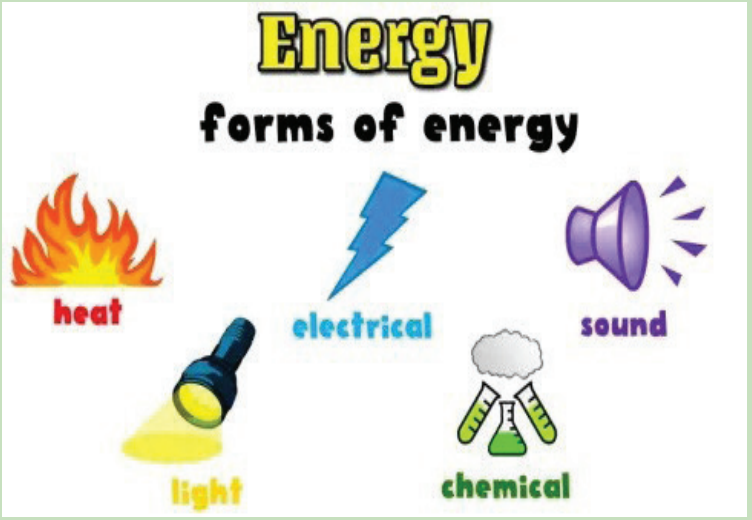


Figure 1: *Forms of Energy*

Learning Objectives

i. Suggest ways to save energy.
ii. Explain the importance of sustainable use of energy.
iii. Explain why the government encourages the use of renewable energy.

Learning Experiences

People use energy to do work. We also waste energy resulting in the wastage of resources. The sources of energy can finish over time. Thus, we must use energy wisely.

c. Climate facts! Investments in renewable energy need to triple by 2050, and the supply of electricity from clean energy sources must double within the next eight years, to put the world on a net-zero emissions trajectory by 2050 (WMO).	This lesson consists of two activities. In the first activity, learners identify energy sources. In the second activity, the learner explores sustainable ways of using and saving energy. **Activity 1: Identifying the sources of energy** Watch the video from the suggested link https://tinyurl.com/4camm6su on renewable and non-renewable energy. Solve the jumbled words on renewable and non-renewable energy and write the correct word next to each jumbled words: 1. usn: ..... 2. wnid: ..... 3. oacl ..... 4. trwae: ..... 5. ilo: ..... **Activity 2: Exploring ways of saving energy** Watch the video from the suggested link https://www.youtube.com/watch?v=nklNsdCFrqY on ways of saving energy. Design a poster/pamphlet/multimedia to illustrate your ways of saving energy at home and in school. **Check Your Learning** 1. Why is it important to use energy wisely? 2. Why should Bhutan use renewable energy rather than non-renewable energy?

Class V

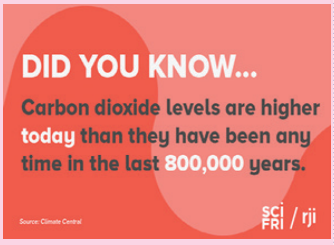
Topic 13: Energy Transformation and its Effect on Climate

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Examine various forms of energy transformations and relate the law of conservation of mass based on energy transformation to recognize the significance of energy changes in everyday life.

c. Climate facts!



Introduction

Energy changes from one form to another. Imagine you are on the top of a slide. The energy you have while sitting there is called potential energy or energy at rest. When you slide down, the potential energy changes into kinetic energy or energy in motion. This change in energy from one form to another is called transformation of energy.

The transformation of energy is important because it helps things to work, to move, and to change direction. During this change, there is the release of pollutants into the atmosphere altering the climate. For example, the chemical energy of petrol is converted to electrical and mechanical energy to run the vehicles releasing carbon dioxide, carbon monoxide, and nitrous oxides. These gases are called greenhouse gases which lead to global warming and climate change.

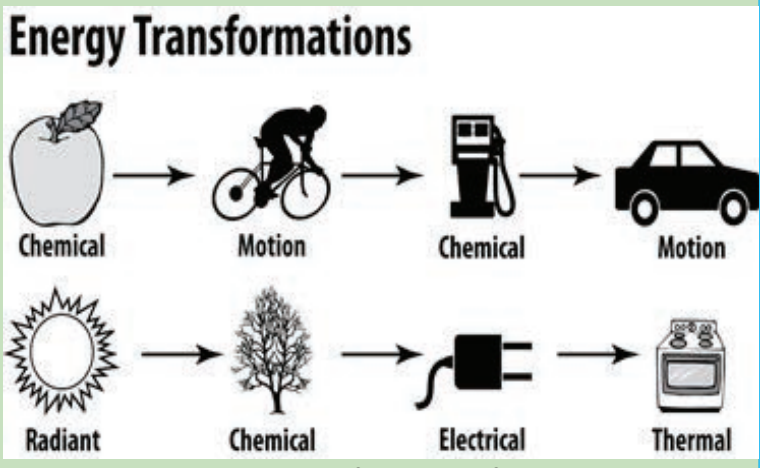


Figure 1: *Transformations of Energy*

Learning Objective

i. Explain how the conversion of energy can cause climate change.

Learning Experiences

Renewable sources of energy are available in nature and are sustainable. These resources of energy can be naturally replenished and are safe for the environment. A non-renewable resource is an energy resource that does not replenish at the same speed at which it is used. They take millions of years to replenish.

Activity 1: Classifying energy sources

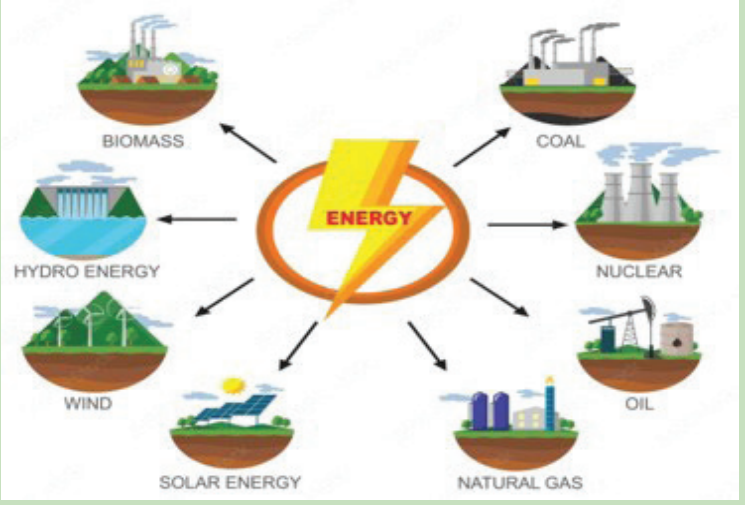


Figure 1: *Sources of Energy*

Use the Table 1 to categorise the sources of energy in Figure 1 into renewable or non-renewable sources;

Table 1

Classify Renewable and Non-renewable Source

Renewable source	Non-renewable source

Activity 2: Analysing energy conversion and its effect on climate

Watch the video from the suggested link https://n9.cl/3riuui to learn on energy conversion and its effects on climate change.

Questions

1. Which non-renewable energy source is primarily responsible for releasing carbon dioxide when burned for energy?
2. How does the conversion of firewood to heat energy affect the climate?
3. What is the primary greenhouse gas that is emitted while burning fossil fuels for energy?
4. Which renewable energy source does not contribute to greenhouse gas emissions?

Activity 3: Assessing the impacts of utilising non-renewable resources

In groups, choose a specific non-renewable energy source. Discuss the advantages and disadvantages of their use on the environment, climate, and social aspects. Present the work to the class.

Questions

1. How does the use of coal affect social well-being?
2. How does the burning of fossil fuels affect climate change?
3. Suggest ways to reduce the impact of using non-renewable energy on climate change.

Check Your Learning

Watch the video and complete the activity that follows from the suggested link https://n9.cl/c01f8.

Class V

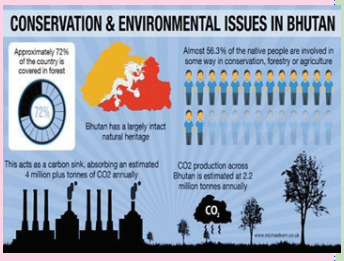
Topic 14: Relieving Stress on the Habitats

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Explain the feeding relationships and interdependence of organisms to understand the impacts of human activities on their feeding relationship.

c. Climate facts!



Introduction

The homes of living organisms are called habitats and they come in different shapes and sizes. From the towering trees of the rainforest to the sandy shores of the beach, habitats provide food, and shelter for the survival of organisms.

Habitats are facing big challenges. Human activities such as deforestation, pollution, and climate change are putting habitats at risk.

Figure 1: Types of Habitats

Learning Objective

i. Design a poster on the reduction of threats to habitats.

Learning Experiences

When habitats are destroyed or damaged, plants and ani mals lose their homes and cannot survive. We need to work together to protect habitats and keep our planet healthy.

Activity 1: Investigating the impact of human activi ties on habitats

Watch the video from the suggested link https://n9.cl/uy4ak to understand the effect of humans on wildlife hab itats, deforestation, and energy resources.

Questions

1. List the human activities that cause climate change.
2. Suggest ways to minimise issues related to climate change.

Activity 2: Protecting habitats

1. In groups, explore different habitats. Identify at least two major threats for the identified habitats. Gather information on the causes of the threats.
2. Create a poster or multimedia clip to advocate the importance of protecting habitats. Share your poster or multimedia on social media of your choice.

Check Your Learning

1. How do human activities alter the habitats?
2. How does climate change affect habitats?
3. Suggest some measures to protect habitats.

Class VI

Topic 15: Eco-Friendly Separation Techniques of Mixtures

Curriculum linkages:

a. Subject:
Science KS II
(Class VI)

b. Competencies targeted:
Examine the concept of solutions, liquid-liquid mixtures and techniques of separating them according to their characteristics for appropriate use in daily life.

c. Climate facts!

Introduction

Eco-friendly separation techniques of mixtures prioritise sustainability in chemical processes, aiming to minimise environmental impact. Techniques include green solvent extraction, membrane separation, and chromatography using eco-friendly solvents, and the reduction of waste and emissions. These methods promote resource conservation and support global sustainability goals.

Eco-friendly separation techniques of mixtures are essential for reducing environmental impact and promoting sustainable practices in chemical processes. These techniques aim to minimise energy consumption, waste generation, and the use of harmful chemicals, thereby contributing to environmental preservation and resource conservation. By adopting eco-friendly separation methods, industries can achieve efficient separation of components from mixtures while mitigating their ecological footprint.

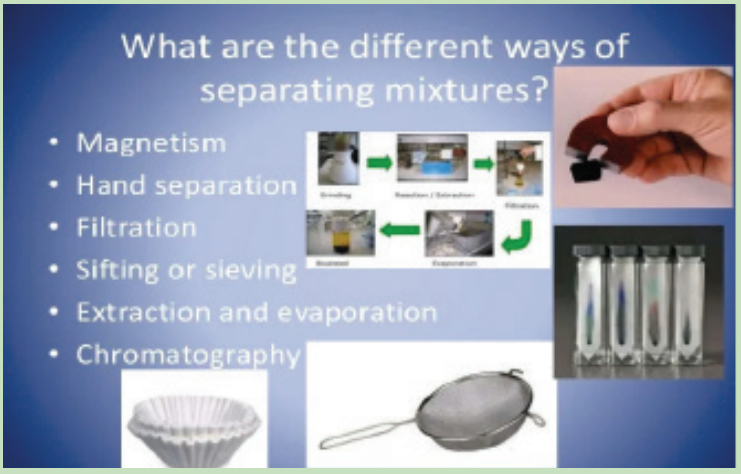


Figure 1: Some of the Techniques to Separate Mixtures

Learning Objective

i. Design a separation technique that is environment-friendly.

Learning Experiences

Activity 1: Identifying eco-friendly separation techniques of mixtures

Explore how eco-friendly separation techniques of the mixture can reduce environmental impacts through the suggested link https://tinyurl.com/3x375ffh.

Complete the table:

Table 1

Understanding Eco-friendly Separation Techniques

Novel Separation techniques	Description	Application	How is it Eco-friendly
Membrane Separation			
Chromatography			
Centrifugal Separation			

Questions

1. What is novel separation?
2. Why are novel separation techniques regarded as efficient and environmentally friendly production processes?
3. Design a model using any one of the eco-friendly techniques to reduce carbon dioxide emissions at home.

Check Your Learning

Study the following mixtures:

Saline water, mixture of dyes, and milk. Identify the eco-friendly separation technique from the figure which can separate above mixtures.

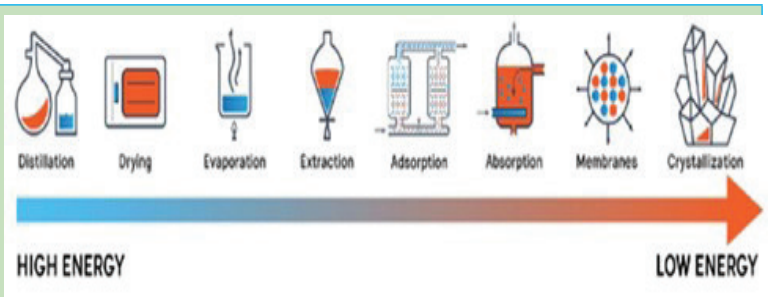


Figure 1: Example of Thermal and Nonthermal Processes

You can attempt this quiz through the suggested link https://www.liveworksheets.com/node/7054211.

Theme Eight
National and Global Climate Change Initiatives and Conventions

The Earth's climate is undergoing significant shifts. Climate change primarily stems from human activities such as burning fossil fuels, deforestation, and excessive waste production. In response to these urgent challenges, nations worldwide are joining forces to tackle climate change. Through collaborative efforts, they are moving towards cleaner energy sources such as solar, wind, and hydroelectric power. Additionally, initiatives such as the Paris Agreement serve as a crucial framework for international cooperation in reducing greenhouse gas emissions.

Central to these endeavours is the preservation and restoration of forests, aiming to maintain forest cover for future generations. By replenishing natural carbon sinks, countries strive to offset carbon emissions and mitigate the impacts of climate change.

At the individual level, simple actions such as recycling and conserving water play a vital role in supporting these global initiatives. Educating oneself about climate change and actively participating in sustainability efforts contribute to the collective goal of safeguarding the Earth for future generations.

Class V

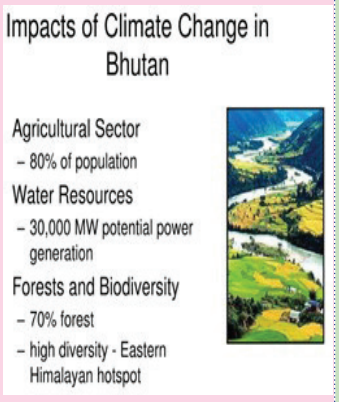
Topic 16: Environmental Conservation Initiatives in Bhutan

Curriculum linkages:

a. **Subject:**
Science KS II
(Class V)

b. **Competencies targeted:**
Explain the feeding relationships and interdependence of organisms to understand the impacts of human activities on their feeding relationship.

c. **Climate facts!**



Introduction

Human activities have disrupted the balance of nature, posing significant threats to both plants and animals. Pollution release and rampant deforestation are increasing the challenges faced by ecosystems and biodiversity. Additionally, the phenomenon of climate change further compounds these issues, manifesting irregular weather patterns and rising global temperatures.

Across the globe, nations are increasingly prioritising environmental conservation and climate resilience efforts. Bhutan commits to preserving nature as integral to their societal well-being. Bhutan's requirement to maintain 60% forest cover mandated by the Constitution of the Kingdom of Bhutan is a holistic approach to national development, aligning with the principles of Gross National Happiness.

Figure 1: 60% of Green Forest in Bhutan

Learning Objective

i. Identify national initiatives (interventions and legal) undertaken in protecting the environment.

Learning Experiences

The majority of Bhutan's existing environmental legislation concerns the conservation of forests and the protection of wildlife and their habitats.

Activity 1: Exploring conservation initiatives in Bhutan

Watch the videos from the suggested links

- https://n9.cl/12oj9
- https://n9.cl/lum3d5

Analyse some of conservation initiatives undertaken in Bhutan.

Questions

1. Mention three initiatives that make Bhutan a carbon-negative country.
2. Complete the table:

Table: Analysis on Environmental policies

Policy	How it helps to protect the environment
Constitution of the Kingdom of Bhutan	Maintaining 60% forest coverage of the total land area at all times.
Forest and Nature Conservation Rules 2023	
Environmental Protection Act 2007	
Waste Prevention and Management Act 2009	
Waste Prevention and Management Regulation 2016	

Check Your Learning

Answer the questions from the suggested link https://shorturl.at/uyIP9.

Theme Nine
Climate Change Technology

Every day, the Earth is becoming hotter due to global warming. Climate change technology is a strategy to fight climate change. Climate change technology that helps to reduce the emissions of greenhouse gases include renewable energies such as wind energy, solar power and hydropower. To adapt to the adverse effects of climate change, we use climate technologies such as drought-resistant crops, early warning systems and flood barrier walls.

Using a flood barrier protects communities from floods caused by extreme weather and changing climatic conditions. Growing drought-resistant crops and vegetables makes people have enough food supply during droughts. There are also soft climate technologies, such as energy-efficient practices or training for using equipment. Using these technologies keeps the Earth safe and helps to reduce the impacts of climate change.

Class V

Topic 17: Green Living: Saving Energy, Saving Earth

Curriculum linkages:

a. **Subject:**
Science KS II
(Class V)

b. **Competencies targeted:**
Examine various forms of energy transformations and relate the law of conservation of mass based on energy transformation to recognize to significance of energy changes in everyday life

c. **Climate facts!**

Introduction

In today's fast changing world, the concept of green living has become an important part of our daily lives. Green living revolves around the idea of saving energy and resources to reduce the impact of human activities on the environment. Saving energy should be an important part of our lifestyle. It reduces our dependence on fossil fuels and reduces harmful emission of greenhouse gases contributing to climate change.

There are countless ways for people to contribute to a greener and more sustainable future. Simple actions such as turning off lights when not in use can save energy. The choices of using green technology can bring benefits both to the planet and its inhabitants.

Figure 1: Save Energy Save Life

Learning Objective

i. Suggest a climate-smart lifestyle to conserve energy.

Learning Experiences

We need energy to do work. We use electricity to cook rice. Vehicles need petrol, diesel and electricity to work.

We get petrol and diesel from underground sources of oil. However, the amount of oil underground is limited. Thus, we must save and use them wisely.

Activity 1: Examining lifestyles to save energy

Work in groups;

Design flash cards on climate-smart lifestyles to save energy. Share with your friends in the class.

Questions

1. Identify the types of lifestyles that consume more energy.
2. How would you change your lifestyles that consume more energy?

Check Your Learning

Watch the interactive video from the suggested link https://shorturl.at/svRU6.

Class VI

Topic 18: Mitigation of Climate Change using Green Technology

Curriculum linkages:

a. Subject:
Science KS II
(Class VI)

b. Competencies targeted:
Construct a parallel circuit in contrast to a series circuit and explore methods of preparing permanent ,and temporary magnets, and enhancing the electromagnetic power to improve functionality in home appliances.

c. Climate facts!

Introduction

Magnets are used in emerging renewable and green energy technologies such as turbines and generators, which convert mechanical energy into electrical energy. About 99% of the power generated by burning fossil fuels, nuclear and hydroelectric energy, and wind comes from systems that use magnets in the conversion process.

Green technology is a term that uses science and technology to create products and services that reduce negative impacts on the environment. It is also known as "Environmental Technology."

Learning Objectives

i. Identify the uses of magnets in everyday life.
ii. Explore the uses of magnets in green technology that mitigates climate change.

Learning Experiences

According to the Intergovernmental Panel on Climate Change (IPCC) report published in August 2021, global temperatures are to rise 1.5°C above pre-industrial levels by 2040, and even as early as 2030. Countries around the world have pledged climate action to reduce greenhouse gas emissions, and green technology plays an important role.

Explore types of green technology by watching the video from the suggested link https://n9.cl/g31y0.

Activity 1: Using magnets in green technology

Magnets, once primarily associated with household utility, have now become an integral part of the progression towards a cleaner, and greener future.

Magnets have a magnetic field that can be used to make electricity in wind turbines and generators. This helps us to create energy without harming the environment. Explore more information on the use of magnets in green technology from the suggested link https://n9.cl/77hff.

Question

1. Explain the role of magnets in green technology in mitigating climate change?

Activity 2: Designing a green technology model

Read the information on green technology from the suggested links

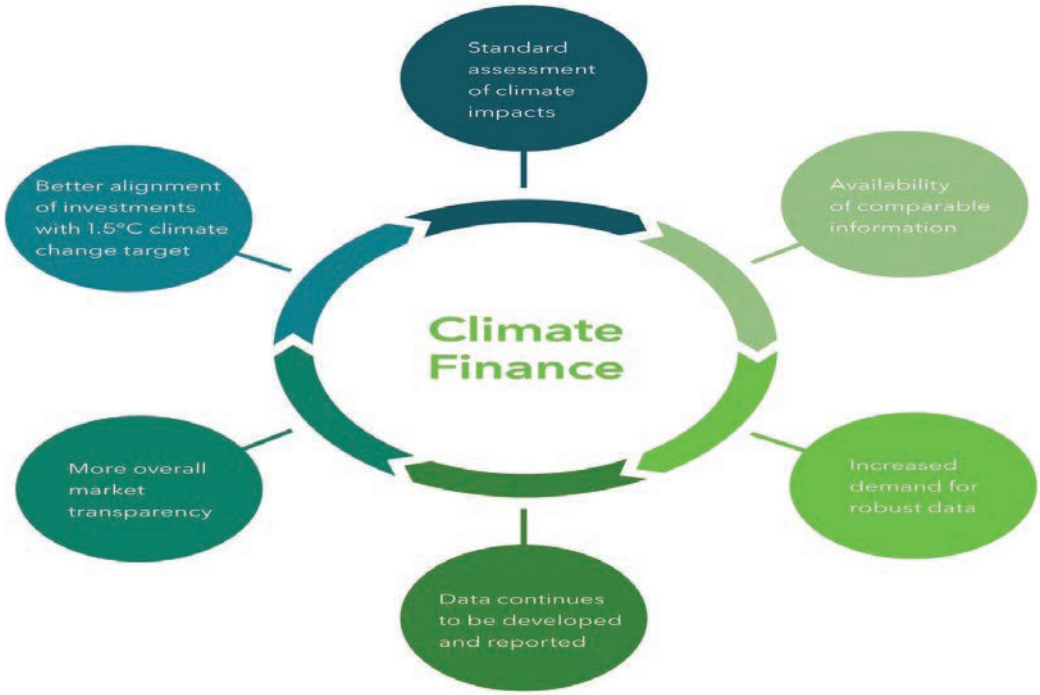
- https://rb.gy/z3xeqy
- https://n9.cl/p6iwnh

Design a model that uses a magnet to mitigate climate change based on the information from the article. Digital tools or any other tools can be used to design 2D or 3D models.

Check Your Learning

1. How is our country adopting green technology to combat climate change?
2. How does green technology differ from traditional technologies?
3. Complete the quiz on green technology from the suggested link https://n9.cl/5cx32.

Theme Ten
Climate Finance and Security



Melting of ice caps, shrinking of glaciers, and extreme weather events are some of the indications of climate change. If these events keep on happening, the safety of the Earth and the well-being of people will be at stake. Unless investment is made towards mitigation, adaptation, and building resilience in reducing carbon emissions and protecting forests, the impacts of climate change will continue to affect the environment and the people. Such investment is known as climate financing.

Climate financing is important to support people with resources as it minimises the effect and the impacts of climate change. This measure helps people to improve the environmental conditions and reduce threats such as food shortages, conflicts over resources, and migration.

Class IV

Topic 19: Healthy Food and Healthy Climate

Curriculum linkages:

a. **Subject:**
Science KS II
(Class IV)

b. **Competencies targeted:**
Explain nutrition and food groups, and structure and function of teeth to understand the importance of eating all food groups and maintaining oral hygiene

Introduction

Eating healthy food is important to maintain good health of our body. The climate change's impact on the environ ment also impacts the quality of food we consume every day. It is essential to consume different foods that help us grow, get energy and protect against diseases.

The choice of food and eating habits may impact the environment that enhances climate change. The unhealthy eating habits like junk foods not only affects our health, but also impacts the environment. Therefore, to reduce the impact on the environment, people must minimise eating junk foods.

Figure 1: Climate Change and Food Insecurity

Learning Objective

i. Explain the importance of eating foods from all food groups to maintain good health.

Learning Experiences

The food that we eat and our eating habits contribute to climate change.

c. Climate facts! Over 17 % of food is wasted, and up to 10 % of global greenhouse gas emissions are associated with food that is not consumed.	At the same time, climate change can also affect the productivity and quality of food. **Activity 1: Understanding the importance of food** Watch the video on the importance of eating foods from the suggested link https://n9.cl/kdz7f and complete the quiz from the suggested link https://n9.cl/e5wmx. **Activity 2: Explore the relationship between food and climate change** Watch the video on the relationship between climate change and healthy food from the suggested link https://n9.cl/np8c0. **Questions** 1. How does the food we eat affect the climate? 2. What changes would you like to make in your eating habits to minimise the impact on climate? 3. Can climate change affect the availability of food for you? Why? **Check Your Learning** Watch the nutrition songs from the suggested links • https://tinyurl.com/ffbneufv • https://tinyurl.com/mt8v879t

Class V

Topic 20: Impact of Junk Food on Environment

Curriculum linkages:

a. Subject:
Science KS II
(Class V)

b. Competencies targeted:
Explain different life processes (circulation, movement, and reproduction), nutrients, and types of nutrients to recognize their roles in the proper functioning of an organism.

c. Climate facts!

Introduction

The manufacturing of junk foods impacts the environ ment and harms our health. Eating junk foods affects our health. In Processed food packaging contributes to signifi cant waste issues and it ends up in landfills or as litter, polluting ecosystems and harming wildlife.

Figure 1: Junk Food Waste

Learning Objective

i. Identify the junk/fast food waste produced in the home to understand its negative impacts on the natural environment.

Learning Experiences

The junk food packaging often ends up in landfills or as litter in the surroundings causing pollution and harming the ecosystem. Therefore, reducing the consumption of junk foods has a positive impact on the environment.

Activity 1: Exploring junk food waste and its impact on the environment

Materials Required:

Notebook or digital device for recording data and taking pictures,pen or pencil.

Procedures:

1. Introduction (Day 1)
    - Discuss what is junk food and why is it considered bad for both health and the environment?
    - Explain waste and its environmental impacts, focusing on plastic and organic waste from junk food.
    - Record all the junk food waste produced from the household for one week.

2. Data Collection (Week-long activity)
    - Note down every junk food waste immediately after consumption. Record the type of junk food in the *Observation Table.*
    - Where might this waste end up (landfill, recycling, etc.)

Table 1

Observation Table

Days	Types of junk food	Types of waste	Weight in grams	Degradable or Non-degradable
Monday	Noodles (Maggi)	Plastic	0.01	Non-degradable
Tuesday				
Wednesday				
Thurdsday				
Friday				
Total				

3. Report writing (Day 8)

The report should consist of following:

- types of waste most commonly produced.
- total waste produced per category.
- potential environmental impact of wastes on the environment.
- strategies to reduce the waste generation.
- solutions to reduce the impact on the environment.

4. Presentation (Day 9)

- Share the report with the class.
- Design and create awareness on junk food and its impacts on the environment.

Check Your Learning

Watch the video from the suggested link https://n9.cl/vnlh6 and answer all the questions given in the video.

Key Stage III
Science and Geography
Class VII ~ VIII

Theme One
Weather and Climate Variations

Weather and climate are integral aspects of Earth's atmosphere that influence our daily lives and long-term environmental patterns. The atmospheric condition of a place in a short period is called weather, while the average condition of weather for a longer period is called climate.

Humans have been causing shifts in climatic conditions. Human activities such as burning fossil fuels for energy, deforestation, industrial processes, agriculture, and waste management contribute significantly to greenhouse gas emissions. Gases such as carbon dioxide(CO_2), Methane(CH_4), and Nitrous Oxide (N_2O) trap heat from the sun in the Earth's atmosphere, leading to the warming of the Earth. This warming of the Earth is called Global Warming, which is the global concern.

Class VII

Topic 21: Impacts of Climate Change on Plant Life

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Investigate the conditions required for the photosynthesis and germination of seeds to understand their importance in plant life.

c. Climate facts!
Three-quarters of the land-based environment and about 66% of the marine environment have been significantly altered by human actions.

Introduction

Plants are the primary producers that can prepare their own food by the process of photosynthesis. The germination, flowering and photosynthesis of a plant respond to a variety of environmental conditions. Plants need specific conditions to grow and thrive in a particular environment. The process of germination, flowering, photosynthesis and productivity depends on the availability of suitable conditions. These suitable conditions are influenced by climate change.

The various human activities contribute to increasing the temperature of the Earth which might influence different processes in plant life. Understanding causes of the climate change and its impacts on plant life is not just about conservation, it is about safeguarding our future.

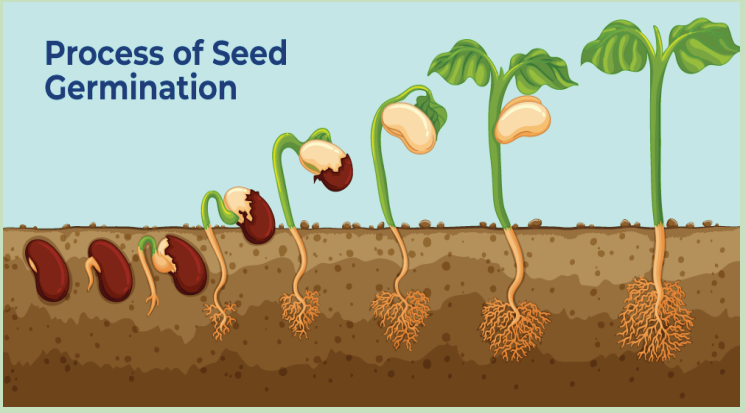


Figure : Germination of Seed

On the International Day for Biological Diversity, the UN Secretary-General urged an end to the 'senseless and destructive war against nature'.

Learning Objective

i. Explain the impact of climate variation on germination.

Learning Experiences

High yielding crops maintain a steady food supply for the increasing world population as these crops are productive under increasingly variable conditions. For this, crops need to be successful and uniformly established under altered environmental conditions.

Activity 1: Investigating climate variation and germination

Create the scenario of desert, marshy land and fertile land with suitable conditions to investigate the germination and growth of the plant in various climatic conditions.

Record your observations after every three days and draw conclusion based on your observations.

Questions

1. In regions prone to more frequent and intense droughts as a result of climate change, how can the germination of crop seeds be affected?
2. How does the rising global temperatures cause plant diseases and increase pest populations?
3. What could be the consequences of climate change on plant health and agricultural productivity?

Check Your Learning

Analyse a scenario where a farmer in a drought-prone region is experiencing low germination rates in their crops. Propose a plan of action considering both short-term and long-term strategies to address this issue.

Class VII

Topic 22: Earth's Atmosphere Shapes our Life

Curriculum linkages:

a. Subject:
Geography KS III
(Class VII)

b. Competencies targeted:
Explore the impact of atmosphere on people and the environment to understand its significance.

c. Climate facts!
Carbon dioxide (CO_2) levels in Earth's atmosphere have increased by over 40% by human activities.
The Earth's average surface temperature has risen by about 1.2°C (2.2°F) since the late 19th century.

Introduction

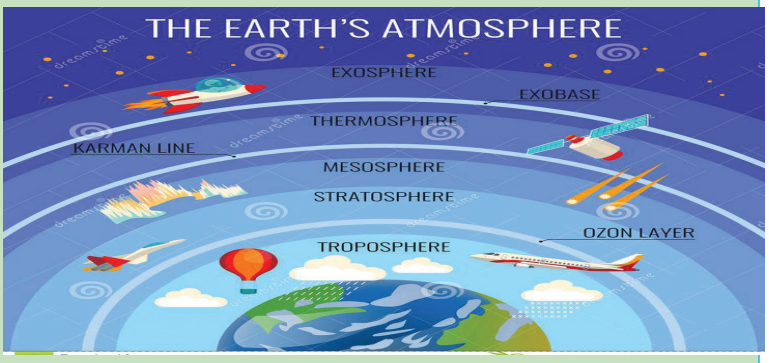


Figure 1 : *Layers of Atmosphere*

The atmosphere is like a protective blanket, supporting the Earth with life-sustaining gases and weather phenomena. It is a dynamic system that not only influences the climate and weather but also impacts every aspect of life. Understanding Earth's atmosphere is crucial as it reveals the interconnectedness of our planet's systems, from air to oceans. The disruption in the Earth's system results in environmental challenges such as climate change and pollution.

Understanding how human activities affect Earth's atmosphere and its efftects on people's lives is crucial in making people responsible for safeguarding the atmosphere for the future generations.

Learning Objectives

i. Discuss the impacts of human activities on the atmosphere.
ii. Explain the structure of the atmosphere and its significance.
iii. Demonstrate the use of weather instruments.

The ocean has absorbed about 30% of the CO2 emitted by human activities, leading to ocean acidification and affecting marine life, coral reefs, and fisheries.

Birds are migrating earlier, and their migration patterns are changing.

Learning Experiences

The condition of the atmosphere is changed by greenhouse gases produced by human and natural activities. This change impacts the lives of people and the environment.

To understand how greenhouse gases like carbon dioxide can trap heat in Earth's atmosphere and contribute to global warming, conduct a simulation as in the following.

Activity 1: Investigating how CO_2 traps heat

Materials Required:

1. Two clear glass jars (with lids)
2. Thermometers
3. Sunlight

Procedure:

1. Fill a clear jar with water and place the jar under sunlight. Record the initial temperature.
2. Cover the jar with a transparent material (plastic wrap or glass) to simulate the greenhouse effect.
3. Observe the temperature inside the jar after every 5 minutes for 15 minutes.
4. Record the observation in the Table 1:

Table 1

Observation Table

Time	5 mins	10 mins	15 mins
Temperature			

Questions

1. What does transparent material represent in the experiment?
2. What conclusion can you draw from this experiment?
3. Relate this experiment to the greenhouse effect.
4. Debate, "Life on the Earth with and without greenhouse gases".

Plants are blooming earlier in the spring. Arctic sea ice is declining rapidly in both thickness and extent.	**Check Your Learning** 1. As an individual, do you contribute to global warming? Explain. 2. What changes can you adopt in your lifestyle in minimising your contribution to global warming? 3. What can you do at the community level to minimise the effect of global warming?

Class VIII

Topic 23: Sustainable Farming Practices

Curriculum linkages:

a. **Subject:**
Science KS III
(Class VIII)

b. **Competencies targeted:**
Analyse the functions and significance of farming types in delivering valuable benefits to human agriculture and ecosystems.

c. **Climate facts!**
Agriculture is the world's largest industry. It employs more than one billion people and generates over $1.3 trillion dollars worth of food annually.

Introduction

Farming for the future is a holistic agriculture approach to ensure food production while tackling environmental impacts and addressing climate change. It interconnects agricultural systems with ecological and social systems. Farming for the future also embraces innovation and technology that improves efficiency and productivity, while decreasing the environmental impacts.

This practice of farming calls for commitment to cultivating a more sustainable and resilient food system that can meet the needs of current and future generations.

Learning Objective

i. Explain how agricultural practices are affected by climate change.

Learning Experiences

Activity 1: Exploring the impact of climate change on agriculture

Read the article from the suggested linkhttps://shorturl.at/BIKNP.

Questions

1. Propose two strategies to mitigate the impacts of climate change on agriculture which can enhance global food security.
2. Explain how each strategy addresses specific challenges identified in the article.
3. How does climate change contribute to future food insecurity?

Pasture and cropland occupy around 50 percent of the Earth's habitable land and provide habitat and food for a multitude of species (WWF).

Activity 2: Investigating the effect of climate change on agriculture

Watch the video from the suggested link https://www.youtube.com/watch?v=RzzQHpSze1U on the effect of climate change on agricultural practices in Bhutan.

Questions

1. How has the climate changed over the years in Bhutan?
2. Explain the impact of climate change on agricultural practices in Bhutan.
3. Suggest some alternative sustainable agriculture practices for the future of Bhutan.

Check your Learning

Design a sustainable farming plan to ensure food security and share with others.

Class VIII

Topic 24: The Shift in Temperature in the Heat Zones

Curriculum linkages:

a. **Subject:**
Geography KS III
(Class VIII)

b. **Competencies targeted:**
Investigate characteristics of various landforms to understand the process of gradation to relate the landforms to our culture

c. **Climate facts!**

Introduction

Different landforms play a significant role in shaping the heat zones of the world. Heat zones are the different zones of the Earth, where the sun's rays fall vary, thus causing different climate patterns. Landforms such as mountains, coastlines, and plains influence local climate conditions by affecting factors like temperature, precipitation, and wind patterns. For example, mountain ranges can create rain shadows, where one side of the mountain receives ample rainfall while the other side experiences dry conditions. Coastal areas often have milder climates due to the moderating influence of nearby oceans or seas, while inland regions may experience more extreme temperature fluctuations.

Landforms can also influence the formation of microclimates, leading to variations within heat zones in relatively small geographic areas.

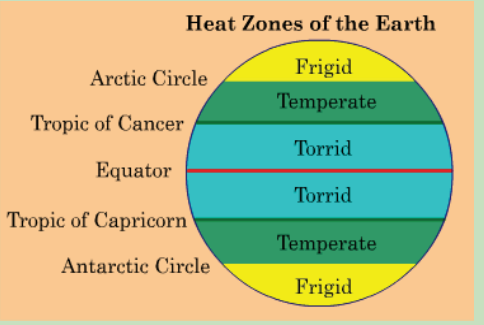


Figure *Heat Zones*

Learning Objective

i. Explain the world's heat zones.

Learning Experiences

Climate change profoundly impacts the world's heat zones by driving temperature rise, shifting precipitation patterns, altering ecological zones, and intensifying extreme weather events contributing to sea level rise.

These changes collectively reshape the global climate patterns, leading to shifts in temperature and precipitation distribution across regions. As a result, areas historically characterised by specific heat zones experience variations in their climatic conditions, with implications on ecosystems, economies, and human wellbeing.

Activity 1: Analysing the causes of change on the Earth

Watch the video on changes on the Earth through the timelapse by using the suggested link https://www.youtube.com/watch?v=uFlLDcppwpI.

Questions

1. Analyse the changes that occurred on the Earth through the timelapse.
2. Explain the reasons that caused the changes.
3. What measures should Bhutan take to be resilient to prevent the occurrence of such changes?

Activity 2: Analysing the impact of the rise in temperature

In groups, refer to the suggested link https://shorturl.at/ijvD8 or any other relevant sources to analyse the effect of an increase in temperature (heat). Make a summary of your understanding.

Check Your Learning

Interpret the image to reflect on how concerned you are.

Theme Two
Climate Change and Environment

Climate change is a critical global issue that profoundly impacts the environment and human societies. Climate change refers to the long-term alteration of temperature, precipitation patterns, and other climatic factors on the Earth. These changes result from various factors, including natural processes and human activities.

Climate change affects nature in many ways. Due to its effect on weather patterns, extreme weather such as erosion, flood and storm can damage crops and properties of people, and the habitat of animals. Climate change also affects water resources for lives on land. In the coastal regions, it makes ocean level rise and oceans become more acidic, which harms sea creatures by affecting their health, habitat and food sources.

With the increase in population, the degradation of the environment is inevitable, thereby accelerating climate change. How would extreme climatic events caused by climate change affect the wellbeing of people and the environment? The emerging extreme events create uncertainties in the world. Therefore, what should people do to mitigate the rising global warming and climate change so that the stability of the environment is maintained? Such dilemmas can not be ignored if we are to protect our planet and make sure everyone has enough to live well.

Class VII

Topic 25: Healthy Planet, Healthy People: Our Role in Climate Action

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Explore nutrition, health, and organ systems to understand how they contribute to the proper functioning of the human body.

Introduction

The health of our body is determined by what we eat, drink and breathe. The food we eat is processed to provide energy, the air we breathe in is circulated in our body and water we drink keeps our body hydrated. The quality and quantity of these foods, air and water depend on the wellbeing of our Earth's ecosystems.

However, the quality and quantity of these foods, air, and water is affected by climate change. This results in the deterioration of human health, physical environment, and socio-economic development.

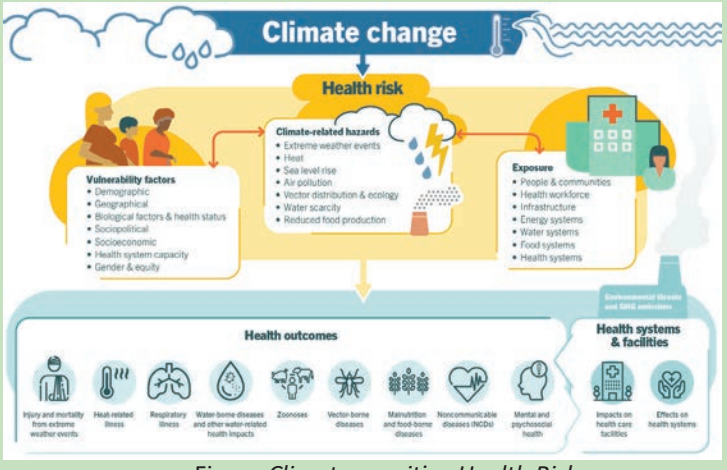


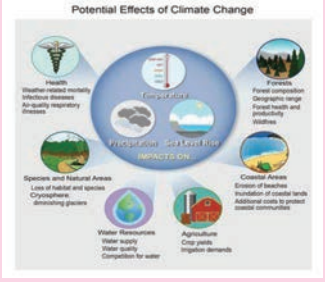
Figure *Climate-sensitive Health Risks*

Learning Objective

i. Design strategies to mitigate the outbreak of communicable diseases due to climate change.

c. Climate facts!

Research shows that 3.6 billion people already live in areas highly susceptible to climate change. Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from undernutrition, malaria, diarrhoea and heat stress alone.



Learning Experiences

The Sixth Assessment Report (AR6) on The Intergovernmental Panel on Climate Change (IPCC) concluded that climate risks are appearing faster and will become more severe sooner than previously expected, and it will be harder to adapt with increased global heating. Climate change affects food availability, quality, and diversity, worsening food and nutrition crises. In addition, the spread of vector-borne diseases has been enhanced with the changes in climate.

Activity 1: Mitigating outbreak of communicable diseases

Work in groups. Assign each group with a specific communicable disease affected by climate change. Suggestive examples are malaria, diarrhoea, cholera, HIV/AIDS and tuberculosis.

Discuss and develop strategies to mitigate the outbreak of communicable diseases resulting from climate change. Consult with health professionals to validate your strategies and share them with your class members.

Check Your Learning

1. How does climate change contribute to the spreading of communicable diseases? Give an example.
2. What responsibilities do individuals and communities have in addressing the health ramifications of climate change?

Class VII

Topic 26: How are We to Blame for Climate Change?

Curriculum linkages:

a. Subject:
Geography KS III
(Class VII)

b. Competencies targeted:
Analyse the interaction between human and environment to understand the ecosystem for human wellbeing.

c. Climate facts!
Water Vapour (H_2O), Carbon dioxide (CO_2), Methane (CH_4), Ozone (O_3), Nitrous Oxide (N_2O), and Chlorofluorocarbon (CFC)

Introduction

Figure Interaction between Human and Environment

What we do every day from how we use energy to what we throw away, has an impact on the Earth. These actions are like pieces of a puzzle when put together to show how humans are changing Earth's climate.

The climate change brings about hazards and disasters, especially in places like Bhutan, where its natural beauty meets environmental challenges. Therefore, it is important to understand how the health of the ecosystem is influenced by humans and what steps should be taken to protect the environment.

Learning Objectives

i. Explain how human activities contribute to climate change.
ii. Discuss potential hazards and disasters in Bhutan.
iii. Suggest measures to reduce disasters.
iv. Exhibit life-saving skills during disaster.

Learning Experiences

Human activities such as burning fossil fuels, deforestation, and industrial emissions release greenhouse gases, leading to climate change. This altered climate pattern results in extreme weather events such as floods and droughts, causing widespread destruction of ecosystems and human habitats.

Activity 1: Analysing the consequences of climate change.

Case Study

Urgent Call for Resilience and Preparedness as Climate Change Impacts Bhutan

Figure Flash Flood

Bhutan, renowned for its natural beauty and environmental commitment, faces a paradox. Even though it absorbs more greenhouse gases than it emits, this place still faces worsening climate effects like sudden floods and landslides. A recent flash flood in Ungar village claimed 23 lives and devastated infrastructure and agriculture. Investigations point to heavy rainfall triggering landslides and forming an artificial lake that burst.

This disaster, unanticipated in flood hazard assessments, emphasises the urgent need for comprehensive disaster preparedness. Even though Bhutan works hard to conserve its environment, it is still vulnerable to disasters. That is why it needs to focus on building resilience, early warning systems, and strong infrastructure that can withstand climate challenges.

Working together with the global community is vital to create a safer and sustainable future with a focus on climate-friendly development.

Source:Adapted from Kuensel, July 27, 2023

Questions

1. Explain the paradox that Bhutan faces despite being an absorber of greenhouse gases.
2. Describe the impact of the flash flood in Ungar village and the factors that contributed to it.
3. What are some of the key priorities Bhutan must focus on to address the climate change challenges it faces?

Activity 2: Examining the impacts of lifestyle on the environment

Watch the video from the suggested link https://www.youtube.com/watch?v=FgduwTULE4o to understand the impact of lifestyle on the environment.

Based on the lesson learnt, describe what changes can you make in your lifestyle.

Check Your Learning

Test your climate change knowledge from the suggested link https://cleanet.org/clean/literacy/climate/quiz.html

Class VIII

Topic 27: Interconnection of Biomagnification and Climate Change

Curriculum linkages:

a. Subject:
Science KS III
(Class VIII)

b. Competencies targeted:
Examine how species within an ecosystem adapt and employ feeding strategies to comprehend the crucial interdependence among living organisms, both among themselves and with their surroundings.

Introduction

Biomagnification is the process through which the concentration of a substance, typically a pollutant, increases in organisms at higher trophic levels of a food web, compared to concentrations in organisms at lower trophic levels.

Biomagnification and climate change are interconnected environmental phenomena that influence each other in various ways. Human activities in the environment produce waste and pollutants which alters the climatic patterns. This influences change in ecosystem dynamics and biodiversity. As oceans warm due to climate change, some pollutants become more soluble in water. This means they are more easily absorbed by tiny organisms at the base of the food chain and accumulate more toxins in their bodies.

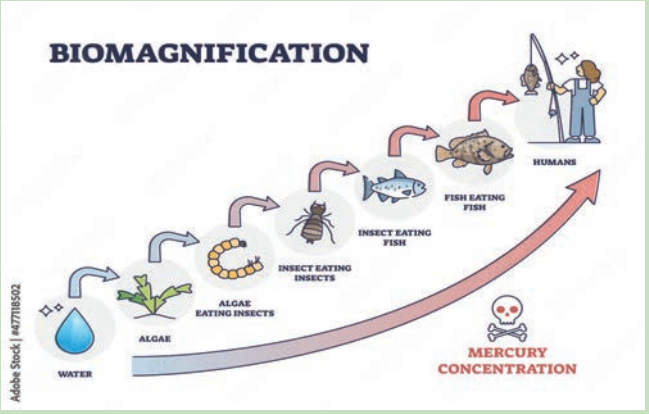


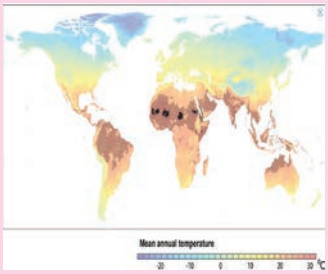
Figure 1 *Biomagnification in the Food Chain*

Learning Objectives

i. Explain the causes of biomagnification.
ii. Analyse the impacts of biomagnification in an ecosystem.

c. Climate facts!

A study by Xu et al. (2020) called "Future of the Human Niche" found that by 2070, under a high emissions scenario, these unbearable temperatures could expand to affect up to 3 billion people (black hashes).



Learning Experiences

The food that animals consume may contain chemicals, pollutants and toxins. As animals depend on each other for food and survival in the upper trophic levels, the accumulation of toxins and pollutants increases with the increase in the trophic levels. These compounds are not digested by their body. Predators accumulate higher toxins than prey. Biomagnification happens in all ecosystems and food chains.

Even though seafood is high in nutrients, eating too much of it is not recommended because it contains pollutants and heavy metals like mercury that are bad for human health.

Activity 1: Exploring effects of biomagnification on ecosystem

Explore biomagnification and its effect from the suggested link https://rb.gy/ysgnld.

Answer the questions present in the video. To understand more about biomagnification and bioaccumulation, watch the video from the suggested link https://rb.gy/9qfvfo.

Activity 2: Exploring relation between climate change and biomagnification

Ice in the Arctic region is melting due to increasing temperature. This melting ice water runs over the surface carrying pollutants like Mercury into water. The dissolved Mercury in water is absorbed by small organisms like plankton which are then eaten by fish. . These smaller fishes are eaten by bigger fish where the mercury levels get even higher in the body of bigger fish. Animals at the top of the food chain, such as seals and polar bears, end up with the most mercury in their bodies (biomagnification).

The mercury can cause serious health problems such as brain damage and sterility in humans and other animals. For example, the Inuit people, who eat a lot of fish and marine animals, have noticed more mercury in their food.

The figure shows the hypothetical relation between climate change and biomagnification through the presence of pollutants.

POP - Persistent Organic Pollutants

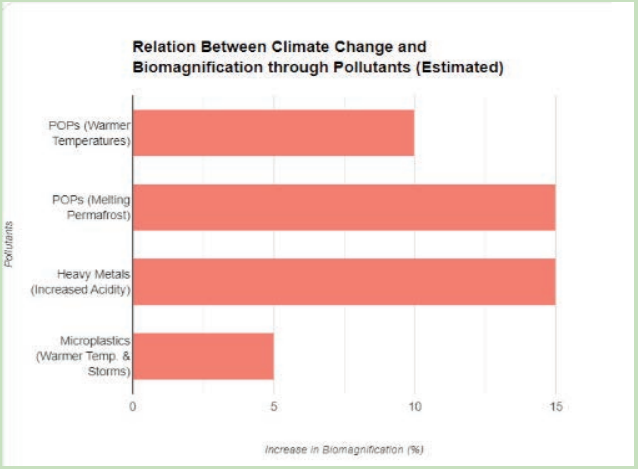


Figure *Relation between Climate Change and Biomagnification*

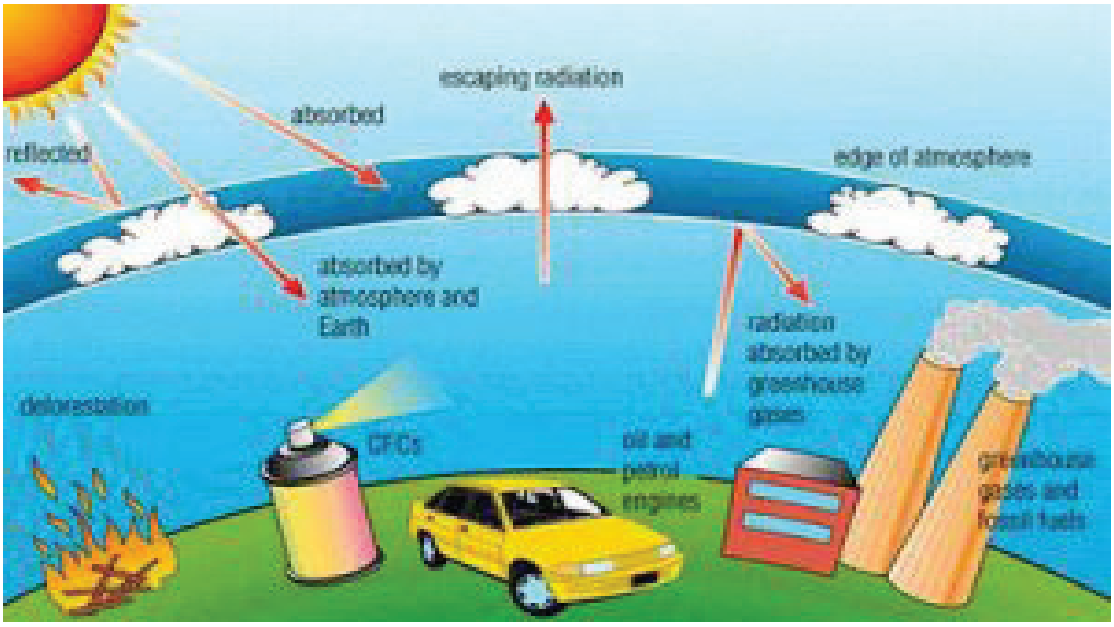
Create educational materials or outreach projects to raise awareness about the interconnection between biomagnification and climate change. This could include designing posters, brochures, or multimedia presentations targeted at their peers, local communities, or policymakers.

Check Your Learning

1. Discuss the implications of pesticides releasing into river ecosystems, which then bioaccumulate in higher trophic levels.
2. Explain the mechanisms by which climate change can influence biomagnification processes in ecosystems.
3. Identify examples of pollutants that are known to bioaccumulate and biomagnify in Bhutanese environments, considering both terrestrial and aquatic ecosystems.
4. Analyse the potential impacts of bioaccumulation and biomagnification on Bhutanese wildlife, including endangered species and key habitat areas.

Theme Three

Greenhouse Gases and Global Warming



Greenhouse gases are a group of gases in the Earth's atmosphere that trap heat from the Sun and maintain the Earth's temperature. This natural process is crucial for maintaining a stable temperature, favouring life to thrive. However, human activities have been significantly increasing the concentration of greenhouse gases, leading to global warming. Global warming refers to the long-term increase in Earth's average surface temperature.

Global warming is a global concern as it leads to sea level rise, extreme weather, and ecosystem disruptions. Do you think that these changes can affect agricultural patterns, food security, and the ecosystem?

Class VII

Topic 28: Plant Power: How Plants Grow and Thrive

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Investigate the conditions required for the photosynthesis and germination of seeds to understand their importance in plant life.

c. Climate facts!
The first photosynthesizing single-celled bacteria evolved over 3.5 billion years ago.

Introduction

Have you ever wondered how a tiny seed buried in the soil transforms into a towering tree? and how flowers bloom with such vibrant colours? One of the most fascinating powers of plants is the ability to make their own food through a process called photosynthesis. Germination is another crucial process for plant growth and development that needs the right environmental conditions.

During photosynthesis, plants not only nourish themselves but also feed us. It is the main source of oxygen in the atmosphere and the foundation of the food webs. Plants are not just passive inhabitants of our planet; they are dynamic and essential to every ecosystem. However, human activities intensify the greenhouse effect by increasing greenhouse gases in the atmosphere. Therefore, understanding photosynthesis and seed germination is crucial in enhancing the absorption of greenhouse gases like CO_2.

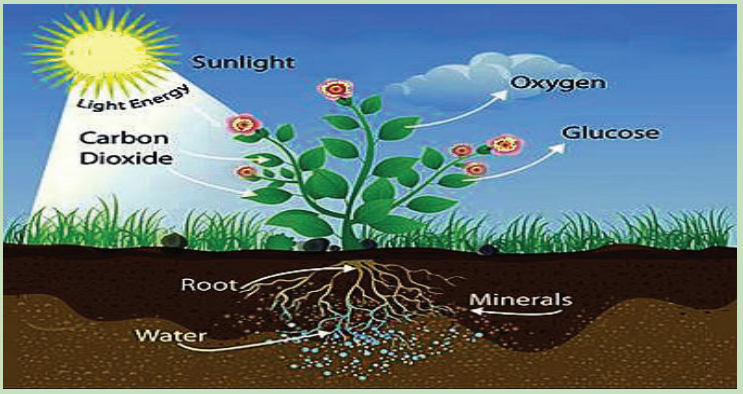


Figure Essential Components Required for Growth of Plants

Learning Objective

i. Explain the significance of photosynthesis.

Learning Experiences

Most organisms depend on plants for survival. Plants form the backbone of natural ecosystems, and they absorb about 30% of carbon dioxide each year. However, the amount of CO_2 has increased due to increase in human activities, which has resulted in higher temperatures affecting the growth of plants.

Activity 1: Investigating the significance of photosynthesis on climate change

1. Carry out the Photosynthesis Relay Race with the following procedure:
   a. Divide the class into groups and designate a starting and finish line.
   b. Place index cards with photosynthesis-related tasks or facts (e.g., "absorb CO_2," "Produce Oxygen," "Store Carbon") along the path between the starting line and the finish line.
   c. On command, the first student from each group runs to the first index card, reads the task or fact aloud, and then runs back to tag the next students in line.
   d. Learners in each group complete the course.

2. Reflect on what you have learned about photosynthesis and its role in combating climate change.
3. Create a poster illustrating the importance of photosynthesis for the mitigation of climate change.
4. Discuss the collective impact of photosynthesis on global climate patterns and the importance of preserving and restoring plant ecosystems.

Check Your Learning

How does photosynthesis contribute to the protection of the environment?

Class VII

Topic 29: Effects of Greenhouse Gases on Ecosystem

Curriculum linkages:

a. Subject:
Geography KS III
(Class VII)

b. Competencies targeted:
Analyse the interaction between human and environment to understand the ecosystem for human wellbeing.

c. Climate facts!
Climate Engineering or Geoengineering ia an alternative methods to slow or reduce global warming by injecting reflective particles into the upper atmosphere to scatter and reflect sunlight back to space.

Introduction

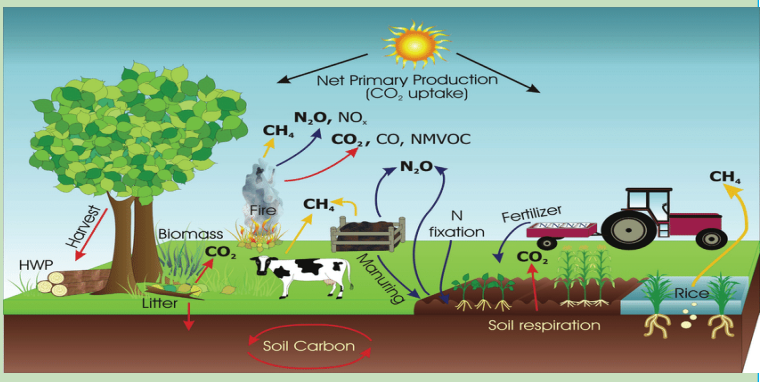


Figure Sources of Greenhouse Gases

Greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) trap heat in the Earth's atmosphere, causing global temperatures to rise. These gases are the largest contributors to climate change, and they can cause extreme weather patterns. Thus, making the Earth hostile to different species.

By examining these interactions, we gain insights into the complexities of ecosystems and the need for sustainable practices to mitigate the adverse effects of climate change on both nature and society.

Learning Objectives

i. Investigate the sources of gases that contribute to global warming.
ii. Explain Ecosystem and its importance for human wellbeing.
iii. State some ways to combat environmental problems.

COP28 stands for the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change

Learning Experiences

Human activities and natural phenomena produce greenhouse gases which envelope the Earth trapping heat from the Sun and do not allow heat to escape.

Therefore, it is important to understand the main source of greenhouse gases in minimising their impacts on ecosystems and human wellbeing.

Activity 1: Understanding the effects of greenhouse gases on global warming and environment

Watch the video on how greenhouse gases contribute to climate change from the suggested link https://youtu.be/d4BF-gtU0hJU.

Questions

1. What are greenhouse gases and how do they contribute to climate change?
2. Explain how the burning of fossil fuels such as coal and natural gas contributess to the emission of greenhouse gases.
3. From the video, why is carbon dioxide considered as one of the most harmful greenhouse gases?
4. How does climate change affect the environment?
5. Suggest ways to combat climate change.

Check Your Learning

1. Why is it important to protect and conserve ecosystems?
2. How can human activities negatively impact ecosystems? How do these impacts affect human wellbeing?

Class VIII

Topic 30: Causes, Impact, and Prevention of Acid Rain

Curriculum linkages:

a. Subject:
Science KS III
(Class VIII)

b. Competencies targeted:
Investigate the properties of acid and base to understand its classification, applications, and impact on the environment.

c. Climate facts!
The world is in a climate emergency. Unless greenhouse gas emissions fall dramatically, warming could pass 2.9°C this century (UNEP)

Introduction

Acid rain is an phenomenon that exemplifies the impact of acidic substances on the world around us. The formation of acid rain is the product of human activities. It is important to understand the causes, impacts, and prevention methods of acid rain.

Through this, we become aware of environmental and ecosystem health, and draw connections between scientific concepts and real-world situations. Further, we can design solutions to prevent and mitigate acid rain impacts and become informed citizens who advocate for the health and safety of our environment.

Learning Objectives

i. Explain the causes, impact, and prevention of acid rain.
ii. Design a poster to create awareness to mitigate the causes of acid rain.

Learning Experiences

There is a difference between normal rain and acid rain. Normal rain contains carbon dioxide which makes it slightly acidic. It usually has a pH of about 5.6. However, acid rain is any form of precipitation (including rain, fog, mist, snow, and particles) that contains high concentrations of nitric and sulphuric acids. It has a pH range between 4.2 to 4.4.

According to USEPA (United States Environmental Protection Agency), the burning of fossil fuels, vehicles, manufacturing companies, and oil refineries are the major sources of composition of acid rain.

Activity 1: Exploring the acid rain and its impacts on environment

Explore the causes, impacts, and prevention of acid rain from the suggested link https://rb.gy/nomb17.

Questions

1. What are the main sources of pollutants that contribute to the formation of acid rain?
2. How can individuals in a community become responsible for reducing the generation of pollutants that cause acid rain?

Activity 2: Sensitising the causes and effects of acid rain

In groups, design a poster illustrating the causes, effects,and mitigations of acid rain, and display it.

Check Your Learning

Explain the formation of acid rain based on the information given in the picture.

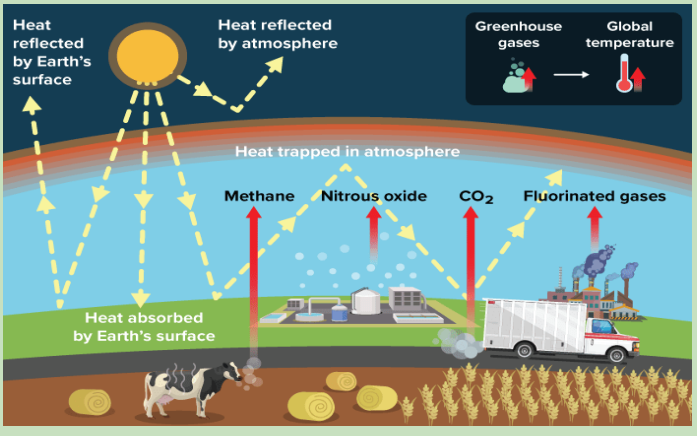


Figure 1 *Formation of Acid Rain*

Theme Four
Climate Change Mitigation, Adaptation and Resilience

The scale of climate change's effects on the people and environment is real. Its effects have no boundary. People around the world are adopting climate change mitigation, adaptation, and resilience as strategies and approaches to reduce and respond to climate change.

Mitigation focuses on reducing the causes of climate change. This includes efforts to decrease greenhouse gas emissions, such as transitioning to renewable energy sources, improving energy efficiency, and promoting sustainable practices in industries like transportation and agriculture.

Adaptation involves adjusting to the effects of climate change that are already happening or expected to occur. This may include actions such asdeveloping drought-resistant crops, building flood defences and infrastructure, implementing water conservation measures, and creating early warning systems for extreme weather events. Resilience refers to the ability of systems, communities, and individuals to withstand and recover from climate-related shocks and stresses.

Mitigation, adaptation and resilience together form a comprehensive approach to addressing climate change. By reducing emissions, adapting to changes, and building resilience, we can create a sustainable and climate-resilient future for generations to come. However, who can make these strategies work? How can these strategies help in reducing the occurrence and impacts of climate change? are questions the world is confronted with.

Class VII

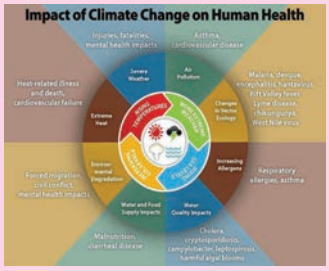
Topic 31: Climate Champions: How Our World Shapes Our Well-being

Curriculum linkages:

a. **Subject:**
Science KS III
(Class VII)

b. **Competencies targeted:**
Explore nutrition, health, and organ systems to understand how they contribute to the proper functioning of the human body.

c. **Climate facts!**



Introduction

There is a significant correlation between human health and environmental health. Climate change greatly impacts the environment, leading to poor air, food, and water quality. Since humans depend on the environment for these essential resources, the deterioration of their quality severely affects human health.

Human activities are the major contributor to climate change that degrade air, water, and food quality. Therefore, it is crucial for humanity to innovate and implement measures to mitigate activities that contribute to climate change.

Learning Objective

i. Suggest measures to mitigate the human activities that contribute towards climate change impact.

Learning Experiences

There are several human activities that result in climate change. Understanding the impact of climate change and exploring ways to mitigate it is crucial for ensuring a healthy future for everyone on the Earth.

Activity 1: Exploring human activities that contribute towards climate change

Watch the video from the suggested link https://www.youtube.com/watch?v=uLQC-mgl2qk to explore some of the human activities that contribute towards climate change.

Complete the table based on information from the video.

Table: Observation of human activities

Human activities that contribute to climate change	Measure to mitigate human activities

Check Your Learning

In this era, the use of gadgets has been increasing rapidly. In Bhutan, the common gadgets used are smartphones and laptops. Do you believe that using these devices is effective or not for climate change? Justify.

Class VII

Topic 32: Resilience to Climate Change

Curriculum linkages:

a. Subject:
Geography KS III
(Class VII)

b. Competencies targeted:
Use indigenous and scientific knowledge to understand measures to manage and addr**ess disasters**

c. Climate facts!
Methane is a powerful pollutant with a global warming potential over 80 times greater than CO2 during the 20 years after it is released into the atmosphere. (Methane Emissions fact sheet, UNEP)

Introduction

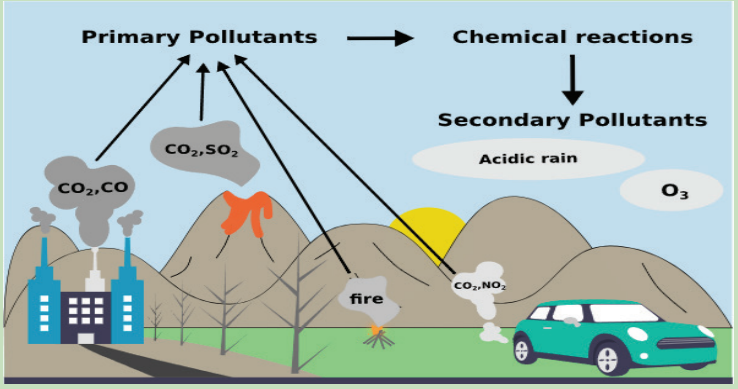


Figure *Sources of Air Pollution*

Resilience to climate change, especially related to pollutants, means finding ways to handle and adjust to the harmful effects of pollutants. This involves using pollution control technology, restoring ecosystems, involving communities, making strong policies, and finding better solutions to protect the environment and people's health and wellbeing.

Pollutants are substances or contaminants that enter the environment and cause harm to living organisms and ecosystems. They include pollutants such as particulate matter, nitrogen oxides, sulphur dioxide, volatile organic compounds, and heavy metals, which pose serious health risks and environmental challenges that require urgent mitigation and adaptation strategies.

Learning Objective

i. Identify the pollutants in the locality that cause health issues.

Learning Experiences

Human activities and natural phenomena result in the production of wastes and pollutants of all types. Generally, three major forms of pollution are identified that are linked to natural resources. The three forms of pollutions are:

- air pollution
- water pollution, and
- land pollution

The following activity engages learners to peek into the main pollutants in the environment.

Activity 1: Identifying the types of pollution

Procedure

1. Study the pictures in the Table.
2. Identify and write the form(s) of pollution and common pollutants in *column 2* of the table.
3. List their likely health impacts in *column 3*.
4. Share your notes with other students.

Picture	Form(s) of pollution and common pollutants	Likely health impact
		
		
		

Questions

1. How have humans contributed to these pollutions?
2. Explain how pollution is related to climate change.
3. How can communities be resilient in dealing with health problems and environmental issues caused by pollutants?
4. As a member of the local community, how can you reduce the use of materials that contribute to pollution and pose health risks?

Check Your Learning

Fill in the blank with the correct words from the word bank below:

Pollutants, harmful, policies, sulphur, protect

1. Contaminants that enter the environment and cause harm to living organisms and ecosystems are _____.
2. Resilience to climate change means finding ways to handle and adjust to the _____ effects of pollutants.
3. Pollution control technology, restoring ecosystems, and making strong _____ are ways to build resilience to climate change.
4. Pollutants such asparticulate matter, nitrogen oxides, and _____dioxide pose serious health risks.
5. Researching for better solutions is crucial to _____ the environment and people's health.

Class VIII

Topic 33: Competition among Species in Changing Environment

Curriculum linkages:

a. Subject:
Science KS III
(Class VIII)

b. Competencies targeted:
Examine how species within an ecosystem adapt and employ feeding strategies to comprehend the crucial interdependence among living organisms, both among themselves and with their surroundings.

c. Climate facts!
We are losing 1.2 trillion tons of ice every year

Introduction

Climate change has challenged the survival of various species of plants, animals and microorganisms due to alteration of availability of resources such as food, water, and habitat. In the ecosystem, species of plants and animals compete for the resources to survive. This competition cause the depletion of the resources.

It is crucial to understand the mechanism of competition for resources which is getting limited due to climate change. The competition among various species for limited resources and habitat in the changing climatic and environmental conditions help us to understand the changing pattern of interdependence among living organisms. The changing pattern of interdependence includes how they respond to changing climatic conditions and environment.

Learning Objective

i. Explore the effects of climate change on intraspecific and interspecific competition.

Learning Experiences

Organisms in the environment compete for resources- food, water and space for their survival. There are two types of competition: intraspecific competition and interspecific competition.

Activity 1: Exploring competitions in the environment

Explore the competition in the environment by using the suggested link https://n9.cl/lczs7. Sign up as a student to play the simulation exercise. Write a reflection on the changes that take place during the simulation exercise. Share your reflection with the class.

Activity 2: Investigating the survival of Polar Bears

Watch the video from the suggested link https://www.youtube.com/watch?v=ZtziVubrcpg about the effect of climate change on the competition among the polar bears.

Questions

1. How does climate change affect competition within the polar bear species?
2. Climate change is altering the Arctic habitat of polar bears and impacts their survival. Justify with evidence.

Check Your Learning

Visit local ecosystems to observe and record interactions between species, such as competition for food or territory. Discuss how these interactions are influenced by changing climate conditions.

Class VIII

Topic 34: Climate Change and Disaster

Curriculum linkages:

a. Subject:
Geography KS III
(Class VIII)

b. Competencies targeted:
Use indigenous and scientific knowledge to understand measures to manage and address disaster.

c. Climate facts!
Disasters fueled by climate crises are already worse than what scientists originally predicted.

(*IPCC Report, 2024*)

Introduction

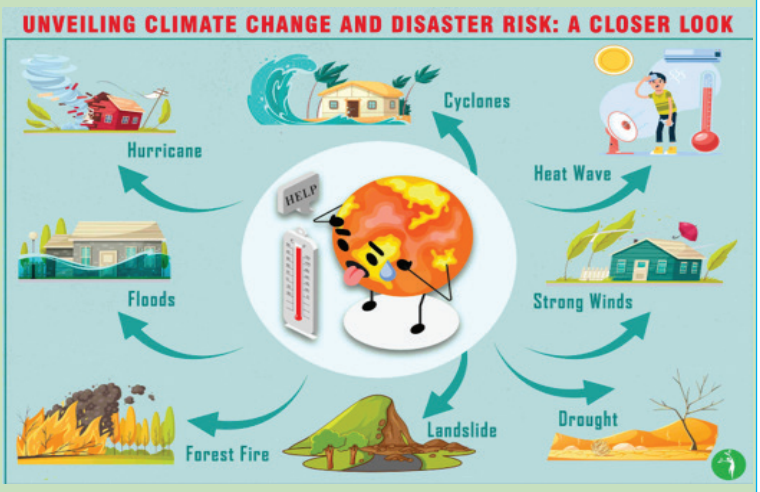


Figure *Climate Change and Disaster*

Climate change is one of the most significant challenges impacting various aspects of Earth's natural systems. As human-induced climate change accelerates, the Earth is warming, leading to a rise in the frequency and severity of natural hazards. From devastating hurricanes and floods to prolonged droughts and wildfires. These disasters destroy communities worldwide, causing loss of life, displacement, economic disruptions, and environmental degradation.

Understanding the connections between climate change and disasters is important for effective disaster preparedness, mitigation, and adaptation strategies to build resilience and safeguard human lives in the face of changing climate.

Learning Objective

i. Explain the disaster in relation to climate change

Learning Experiences

Explore the suggested link https://www.youtube.com/watch?v=LSsJpSCtfSs that investigates the impacts of climate change to discover and understand the connection between climate change and disaster. This understanding is important in proposing measures to mitigate its devastating effects.

Activity 1: Analysing climate crisis that increases natural disasters

Watch the video from the suggested link to analyse the relationship between climate change and the occurrence of climatic disasters https://www.youtube.com/watch?v=LSsJpSCtfSs.

Questions

1. Explain the relationship between natural disasters and climate change.
2. How have governments and international organisations been responding to the growing threat of climate-induced disasters?
3. Explain natural disasters that Bhutan experienced in the past based on the perspective of climate change.

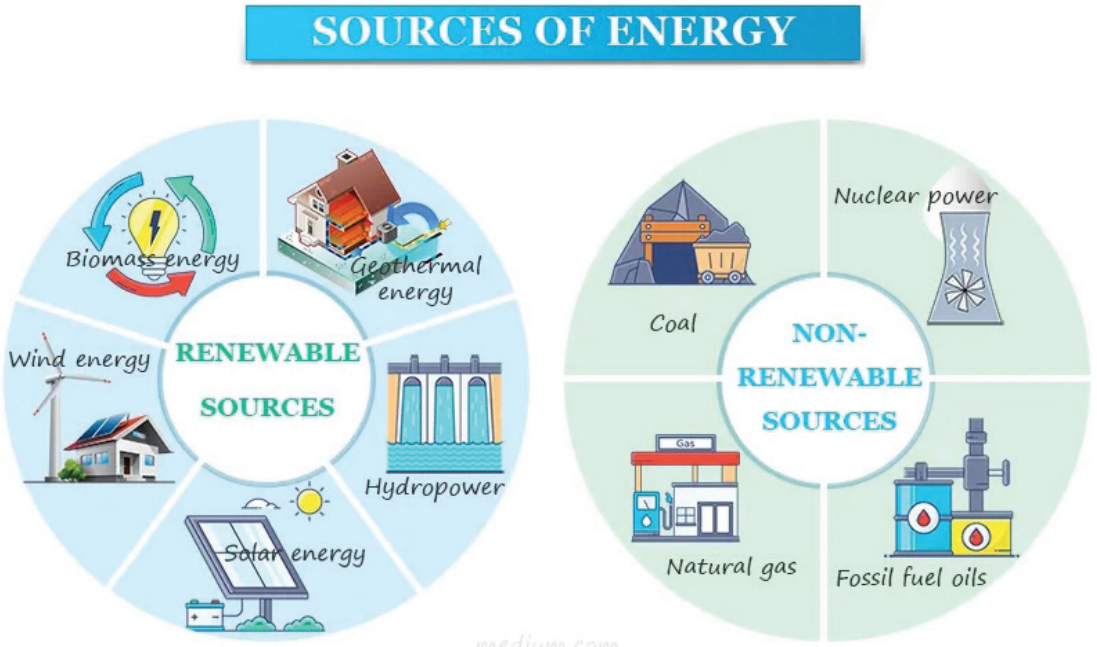
Check Your Learning

Explore more on climate change and disaster from the suggested link https://rb.gy/xpbi0m.

Write a reflection on how would have Bhutanese in the past prevented the occurrence of disasters.

Theme Five

Renewable and Non-renewable Energy



People use energy in diverse forms in doing different works. Renewable energy is energy derived from sources that are naturally replenished on a human timescale. These sources include sunlight, wind, water (hydroelectric power), biomass (organic materials like plants and waste), and geothermal heat. These sources are virtually inexhaustible and do not deplete over time. On the other hand, non-renewable energy, refers to energy derived from finite resources that cannot be readily replaced within a short timeframe. This category includes fossil fuels such as coal, oil, natural gas, and nuclear energy.

In general, renewable energy offers a sustainable and environmentally friendly alternative to non-renewable energy sources, playing a crucial role in addressing climate change, promoting energy security, and ensuring a cleaner and healthier planet for future generations.

Class VII

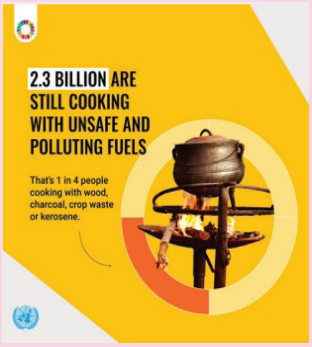
Topic 35: Powering Our Future, Protecting Our Planet

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Explore various sources of energy, and understand the impact of renewable and non-renewable energy on climate change

c. Climate facts!



Introduction

Energy is what makes things work. It powers our homes, schools, cars, and everything around us. Basically, there are two different types of energy. Some energy comes from sources that do not run out and others from the sources that will run out.

The advantages of renewable energy sources include their extended lifespan and little pollution. In contrast, non-renewable energy sources significantly impact the environment and are highly polluting. Since non-renewable energy is easier to obtain than renewable energy, it is used more frequently. Understanding the impact of renewable and non-renewable energy on climate change helps in ensuring a sustainable future.

In today's world, the choices and informed decisions we make help in mitigating environmental degradation and safeguard the planet for future generations.

Learning Objectives

i. Classify renewable and non-renewable sources of energy.
ii. Identify sources of energy contributing to climate change.
iii. Suggest ways to promote the sustainable use of energy.

Learning Experiences

The decisions we make about energy sources have a sig nificant impact on our world due to climate change. The accumulation of greenhouse gases in the atmosphere is the primary cause of climate change.

Our everyday existence depends on energy, but where does it originate from and what effect does it have on the environment?

Activity 1: Identifying energy sources and climate change

Use images from the suggestive link https://shorturl.at/lnqGP or printed images on different energy sources.

Complete the table by identifying the energy sources into two categories with justification.

Table 1

Renewable and Non-renewable Resources

Energy Sources	Renewable	Nonrenewable	Reasons

Check Your Learning

How do you practise sustainable use of energy?

Class VII

Topice 36: What Makes Energy Sustainable?

Curriculum linkages:

a. Subject:
Geography KS III
(Class VII)

b. Competencies targeted:
Evaluate the importance of natural resources for balanced socio-economic development of a country.

c. Climate facts!
To prevent warming beyond 1.5°C, we need to reduce emissions by 7.6% every year from this year to 2030.

Introduction

Figure 1 *Climate-Smart Ways for a Sustainable World*

The balanced socio-economic development of a country hinges on the sustainable management of both renewable and non-renewable resources. A climate-smart way is an approach or practice that takes into account the challenges posed by climate change without compromising in fulfilling the needs of people. This balanced approach is known as sustainable development.

A balanced approach that maximises the benefits of both renewable and non-renewable sources while minimising environmental impacts is essential for a sustainable energy future.

Learning Objective

i. Suggest climate-smart ways for sustainable use of energy at home.

Learning Experiences

Climate-smart way of using natural resources is a strategy to sustainable use of resources. Understanding of this strategy empowers learner to become agents of positive change, contributing to a more sustainable and resilient world for future generations.

Activity 1: Understanding sustainable use of energy Watch the video on sustainable use of energy from the suggested link https://youtu.be/jSMD5ZnYeMo.

Questions

1. How is sustainable use of energy a climate smart energy practice?
2. What are the benefits of using energy sustainably?
3. In what ways can you make your energy consumption sustainable?

Check Your Learning

Design a poster on the topic “Together We can Create a Greener Future” to advocate the practice of sustainable use of energy in smart ways.

Class VII

Topic 37: Green Energy for Sustainable Future

Curriculum linkages:

a. **Subject:**
Science KS III
(Class VIII)

b. **Competencies targeted:**
Explore various sources of energy and their types to understand the sustainable use of energy in real life.

Introduction

Green energy for a sustainable future explores the various sources of energy available to human societies, their impact on the environment and sustainability. Energy is important for powering human activities. It is derived from natural resources found on the Earth.

Energy plays a crucial role in driving technological advancements and meeting societal needs. The sun is the primary source of energy on the Earth.

Figure 1 *Green Energy*

It is important to understand different sources of energy to address resource depletion, environmental degradation, and its impact on climate change. Classification of energy into renewable and non-renewable sources helps us to understand the limited nature of energy resources like fossil fuels.

Societies around the world are shifting their choice to renewable energy sources because of the impact of fossil fuels on climate change and environmental conservation.

It has become crucial to understand the effects of their energy choices on the planet's long-term sustainability.

c. Climate facts!

United Nation Environmental Program (UNEP) has identified possible sectors that could contribute to the development of the green economy, which includes green buildings, sustainable agriculture and forest, water management, clean technologies, waste management, renewable energy and green transport.

Learning Objectives

i. Evaluate sources of energy contributing to climate change.
ii. Suggest ways for sustainable use of energy and its role in the ecosystem.

Learning Experiences

The energy derived from renewable sources such as, sun, wind, river, ocean tides, plants, algae, and hot springs is considered as 'green' or 'clean' energy because it does not emit pollutants and hazardous wastes. In contrast, fossil fuels are non-renewable. It takes millions of years to replenish fossil fuels once the supply is depleted. The growing population and development around us applies huge pressure on the supply of energy available.

Abilities of humans to use alternate sources of energy and devise sustainable management practices can promote the availability of energy for future generations.

Activity 1: Understanding energy and climate change

Read the article to understand about energy and its impact on climate change from the suggested links:

- https://rb.gy/7n73xm
- https://rb.gy/xnj8s3
- https://t.ly/3b6BP

Questions

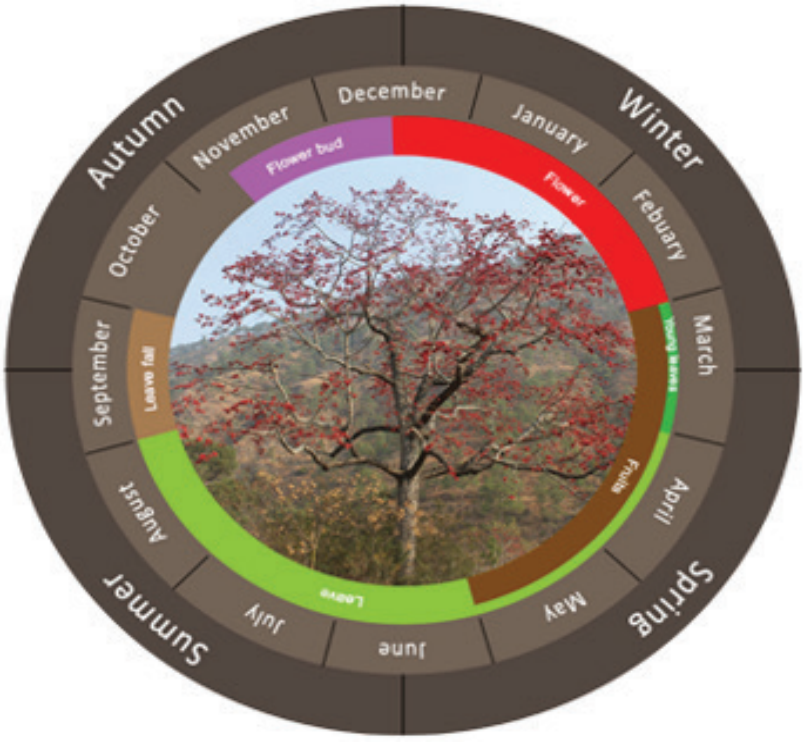
1. Compare the environmental impact of coal power plants to renewable energy sources like wind and solar power.
2. How does the use of fossil fuel impact the environment?.
3. Why is transitioning to renewable energy sources important for mitigating the impact of fossil fuels?
4. Energy-efficient appliances and technologies reduce climate change. Justify.

Check Your Learning

Create a model (2D or 3D) to mitigate climate change due to use of non-renewable energy sources over renewable sources of energy.

Theme Six

Phenology and Climate Change



For centuries, Bhutanese farmers have been using the indigenous knowledge of weather and seasons to decide the time for crop plantation and harvest. This knowledge is phenology which is about studying natural cycles in living things. This relates to time or season, when plants bloom, birds migrate, and animals breed. These phenomena are mainly dependent on environmental conditions of warmth and precipitation. As climate change affects weather conditions, it affects these cycles, making things happen earlier or late, or behave differently. This can disrupt ecosystems and impact how plants and animals live and reproduce.

Watching these changes help us understand how climate change affects nature. We can understand the risk it poses on the survival and life cycle of living things. It also helps people understand what and how urgent it is to do things to reduce climate change and adapt to its effects. Thus, through phenology, people can understand how nature and environment are changing because of the climate change.

Class VII

Topic 38: Why are We Different?

Curriculum linkages:

a. Subject:
Geography KS III (Class VII)

b. Competencies targeted:
Analyse the natural characteristics of a place and its influence on culture and identity

c. Climate facts!
2019 was the second hottest year on record.

Introduction

Figure 1 *Influence of Nature on Community*

The influence of physical features on culture and identity is closely intertwined with the effects of climate change and phenology. Physical features such as mountains, rivers, and forests not only shape the landscape but also dictate the local climate and biodiversity.

Climate change, in turn, alters phenological patterns, affecting the timing of natural events such as flowering, fruiting, and animal migrations.The changing environment affects how communities follow traditions, making them adapt over time.

Learning Objective

i. Examine the influence of physical features on culture and identity.

Learning Experiences

Physical features such as mountains, rivers, and forests shape the environment in which phenological events unfold. These natural landmarks influence the timing of plant blooming, animal migrations, and seasonal changes, which in turn impact cultural practices and identities.

The following activity aims to help learners understand how physical features influence the culture and identity of communities.

Activity 1: Exploring the influence of physical features on culture and identity

Procedure

1. In groups, discuss and complete Table 1.
2. Present your findings to the class.

Table 1: *Influence of Physical Features on Culture and Identity*

Dzongkhag	Physical Features (landscape, climatic conditions, vegetation, natural resources etc.)	Lifestyles (food habits, dress, agriculture, seasonal activities etc.)
Thimphu		
Trashigang (Merak)		
Bumthang		
Sarpang (Gelephu)		
Gasa		

Questions

1. Do you think the crop growing seasons are the same for all regions? Justify your findings.
2. How do people adapt to changes in the phenology due to climate change in agriculture practices?
3. Justify why communities in Bhutan have diverse cultures.

Activity 2: Investigating the use of phenology

Procedure

1. Discuss with elders when farmers in Bhutan plant and harvest crops
2. Complete Table 2.

Table 2

Cropping Seasons

Crop	Month of plantation	Month of harvest
Rice		
Maize		
Chili		
Potatoes		

Check Your Learning

Despite having limited scientific knowledge cropping, our ancestors were successful in producing crops needed for their living. Explain.

Class VIII

Topic 39: Diverse Impacts of Climate Change

Curriculum linkages:

a. Subject:
Geography KS III (Class VIII)

b. Competencies targeted:
Explore the natural characteristics of a place and their influence on culture and identity.

c. Climate facts!
2023 had a global-average temperature of 14.98°C, 0.17°C higher than the previous highest annual value in 2016

Introduction

Figure *Threat of Climate Change*

Climate change has been emerging as a growing concern, causing notable shifts in settlement patterns and ways of life globally. These alterations force communities to adjust their settlement strategies, frequently resulting in relocation from areas vulnerableto flooding and severe weather phenomena.

The disturbance of age-old livelihoods such as agriculture and fishing, driven by evolving environmental conditions, poses significant challenges to the economic stability of local populations.

In recent years, Bhutan has been experiencing similar situations due to the fast economic developmental activities. This has been causing the emergence of numerous settlements and shifts in lifestyles of people.

Such changes generally cause environmental pollution and degradation contributing to climate change. Therefore, it is essential to understand how these changes can affect our community, from alter ing local weather patterns to threatening ecosystems and wildlife habitats.

Learning Objective

i. Discuss the impact of climate change on the settlement pattern and livelihood of people in the locality.

Learning Experiences

Climate change causes challenges that affect communities worldwide, including Bhutan. Bhutan experiences various effects, such as changes in weather patterns, melting glaciers, and more frequent natural disasters like floods and landslides. These changes affect settlement patterns, people's ways of life, and agriculture practices which is the crucial sector of Bhutan's economy.

Activity 1: Examining the impacts of climate change in Bhutan

Study the effects of climate change on settlement patterns and people's way of life from the suggested link https://www.youtube.com/watch?v=RzzQHpSze1U.

Questions

1. Explain how climate change impacts farmers in Bhutan.
2. Describe two key measures identified in the national adaptation plan to address the challenges posed by climate change in Bhutan.

Check Your Learning

Narrate the effects of climate change on living standards of people in Bhutan.

Theme Seven

Education for Sustainable Development (ESD) and Climate Smart Lifestyle

Education for sustainable development (ESD) focuses on the knowledge, skills, and values towards addressing interconnected global challenges including climate change, loss of biodiversity, unsustainable use of resources, and inequality. The ESD is learning about the judicious use of natural resources and deals with the wellbeing of nature and society, and development in the community.

The ESD influences the economic and social life of people. Living attuned to the climatic conditions can help to reduce the vulnerability of climate change. Its goal is to help people make smart choices for a better world by being aware of their consumption patterns of resources and the impacts of waste generated on the environment. Therefore, Climate Smart Lifestyle, in ESD, is about being responsible by "thinking globally and acting locally" and doing things that help the environment. It means using less energy and natural resources, creating less waste, and choosing renewable energy sources from fossil fuels. Global climate change is the doing of humans.

The Climate Smart Lifestyle is one of the strategies of Education for Sustainable Development (ESD) crucial for addressing urgent global challenges such as climate change, biodiversity loss, and social inequalities.

Class VII

Topic 40: How Animals and Plants Cope with Climate Change

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Analyse adaptation, variation and ecosystem to understand the significance of interdependence for the survival of organisms.

c. Climate facts!
2023 was the hottest year on record

Introduction

Adaptation is like nature's survival plan, helping animals and plants fit into their changing environment. It is all about being resilient.

Everything in nature is interdependent; for example, plants provide the oxygen that animals need to breathe, and animals in turn aid in the growth of plants by supplying them with carbon dioxide. Certain animals have specialised means of survival, such as the ability to live anyplace, while others have homes of their own. Humans harm the environment through their actions.

Climate change has significant impacts on both animals and plants. Rising temperatures directly affect their habitats, food sources, and water availability. We need to understand and protect how living things rely on each other, or else we could all be in trouble.

Learning Objectives

i. Explain the causes and impacts of climate change.
ii. Discuss the strategies to protect ecosystems that are vulnerable to climate change.

Learning Experiences

Human activities release greenhouse gases (GHGs) into the atmosphere resulting in climate change. We need to be concerned about climate change due to its extensive impacts on both natural environments and human societies.

Activity 1: Investigating causes and impacts of climate change

Watch the video to learn about the causes of climate change and its impact on the environment from the suggested link https://n9.cl/p7t0a.

Discuss more on what causes climate change and its impact on the environment.

Questions

1. What are the primary human activities contributing to climate change? How do they interact with natural processes to worsen its effects?
2. How is climate change related to the global economy, international politics, and social dynamics?

Activity 2: Exploring an ecosystem through field trip

Explore an outdoor area to observe a natural ecosystem. Record the observations (sketches, descriptions, questions or reflection).

1. List down the living and non-living components of the ecosystem.
2. Identify and discuss the interconnections between different components of ecosystems.

Activity 3: Saving ecosystems from climate change (Eco Guardians)

Ecosystems provide a wide range of services essential for human well-being. so therefore, need to be protected with various strategies. Strategies to protect ecosystems include both mitigation (reducing greenhouse gas emissions) and adaptation (helping ecosystems cope with changing conditions).

Watch the video from the suggested link https://n9.cl/a4v4qj on how climate change affects ecosystems.

List all the possible strategies to protect the ecosystems from the impacts of climate change.

Choose a strategy and design a poster to create awareness for protecting the ecosystem. Share with your friends or post it on any social media.

Check Your Learning

Explore and observe ecosystems in the locality and suggest some strategies to maintain the biodiversity richness in the ecosystem.

Class VII

Topic 41: Afforestation in Combating Climate Change

Curriculum linkages:

a. **Subject:**
Geography KS III
(Class VII)

b. **Competencies targeted:**
Evaluate the importance of natural and human resources for balanced socio-economic development of a country

c. **Climate facts!**
Research in Crowther Lab showed that one trillion new trees could absorb one-third of CO2 emissions made by humans(World Economic Forum, 2021).

Introduction

Figure Trees to Combat Climate Change

Education for sustainable development (ESD) focuses on the knowledge, skills, and values towards addressing interconnected global challenges including climate change, loss of biodiversity, unsustainable use of resources, and inequality.

Afforestation is one approach to conserving loss of biodiversity, and it is planting trees in barren areas. It is one of the easiest ways to combat climate change. Trees absorb carbon dioxide emitted from various sources from the atmosphere, reducing greenhouse gases that contribute to global warming. Planting trees also increases the variety of life in the ecosystem, makes the soil healthier, and provides ecological and utility services such as preventing erosion, fresh air and clean water.

Understanding the importance of afforestation is crucial for sustainable environmental management vital in mitigating climate change and its adverse effects on life and the environment.

Learning Objective

i. Design a poster to create awareness on the importance of afforestation.

Learning Experiences

Afforestation and climate-smart ways help protect nature, keep air and water clean, and ensure a healthy planet for everyone now and in the future.

This calls for action from the people. Advocacy and awareness on the critical roles of trees and the climate-
smart ways of living are important in motivating people to act for the environment.

Activity 1: Designing a poster

1. Design a poster on "Plant for a Greener Tomorrow." in a group.
2. Present to the class on the poster you have designed.

Activity 2: Discussing a climate-smart lifestyle

1. Discuss as a group the ways in which you practise a climate-smart lifestyle at home.
2. Present your discussion to the class.

Questions

1. Explain "Plant for a greener tomorrow".
2. How can one become climate smart?
3. Are Bhutanese farmers climate smart? Explain.

Check Your Learning

Test your knowledge on being Eco-Friendly by taking the quiz from the suggested link https://www.tryinteract.com/quiz/how-can-you-be-more-eco-friendly/.

Class VIII

Topic 42: Smart Lifestyle for Safe Environment

Curriculum linkages:

a. **Subject:**
Science KS III
(Class VIII)

b. **Competencies targeted:**
Explain various life processes (digestive system, movement, respiratory system and reproduction), sense organs, environment, lifestyle and health to understand their significance in proper functioning of the human body.

Introduction

All living beings are interconnected with the environment they live in. The air they breathe, the water they drink, and the food they consume are the products of the Earth's environment. However, the environment is affected by human activities, leading to environmental degradation. This has environmental consequences.

By understanding these interrelationships, individuals are empowered to make informed decisions that prioritise a healthy planet for current and future generations. One approach is to adopt climate smart lifestyle for a safe environment.

Learning Objectives

i. Explain substance abuse and its effects on the wellbeing of an individual and social issues in the society.
ii. Examine the effect of the lifestyles of humans on the environment.

Learning Experiences

The impact of human activities on the environment has become evident through climate change. Changes in climatic conditions have caused effects such as hurricanes and droughts disturbing livelihoods and devastating human properties. Additionally, it has displaced animals and other organisms resulting in extinction of species and loss of habitat.

Activity 1: Identifying the impacts of human activities on environment

Use interactive simulation from the suggested link https://media.hhmi.org/biointeractive/click/anthropocene/ to explore key impacts of human activities on the environment and what effects they have had over time.

c. Climate facts!

The UN's Intergovernmental Panel on Climate Change (IPCC) warns 'It's Now or Never' as the increase in global annual temp of 1.5 degree Celsius becomes more out of reach.

Questions

1. What are the human activities that affect the environment?
2. How does the environment change over a period of time with an increase in human activities?
3. Individual lifestyle influences environmental sustainability. Justify.

Activity 2: Examining the Impacts of Lifestyle on the Environment

Watch the video from the suggested link https://www.youtube.com/watch?v=FgduwTULE4o to understand the impact of lifestyle on the environment.

Questions

1. Identify the lifestyle of your locality. Explain how it affects the environment.

Lifestyle	Impacts on environment

2. What type of lifestyle should we adopt to reduce impacts on the environment?
3. How do our everyday choices such as products we buy, and the food we eat affect the environment?
4. What are some lifestyle changes that you and your family can make to live more sustainably?

Check Your Learning

Firewood, junk foods, deforestation, generating wastes, industrialisation, agricultural practices, loss of biodiversity, use of smartphones, eating plant-based products

Write a letter to your friend using the words in the box explaining the impacts of lifestyle on the environment. Ask your friend to write a reply suggesting the solutions to the impacts.

Class VIII

Topic 43: Sustainable Resource Management for Secured Future

Curriculum linkages:

a. Subject:
Geography KS III
(Class VIII)

b. Competencies targeted:
Evaluate the importance of natural and human resources for the balanced socio- economic development of a country.

c. Climate facts!
Each year, more than 12 million hectares of land are lost to desertification, land degradation, and drought.

Introduction

Sustainable resource management is an approach to utilising and preserving natural resources in a manner that meets the needs of the present without compromising the ability of future generations to meet their needs. It means using resources such as water, land, and energy in a smart way that does not harm the environment.

Sustainable management practices play an important role in combating climate change, as they involve preserving forests as carbon sinks. Promote the shift from the use of non-renewable to renewable energy sources, thus reducing greenhouse gas emissions and reducing the impact on climate.

Economically, sustainable resource management promotes stability by ensuring efficient resource use, leading to cost savings and increased productivity. It also fosters social equity by addressing differences in resource access and considering the needs of affected communities, thereby re ducing conflicts and promoting inclusive development.

Learning Objective

i. Explore strategies to manage resources to address the brunt of climate change for future generations.

Learning Experiences

The growing population and diverse economic activities are accelerating the emission of pollutants and the degradation of the environment.

Considering their severe impacts in accelerating the climate change affecting humans and the environment, it is important to design innovative solutions that are environment-friendly and sustainable across various sectors.

Activity 1: Exploring innovative solutions for resource management

Watch the video on sustainable technology to manage resources effectively from the suggested link https://youtu.be/3ueENoqjF_0?si=625Zx8WYlk7uY1aJ.

Questions

1. Explain sustainable technologies used in conserving the resources in the video.
2. Hydroponics help to address the global water shortages and contribute to sustainability in agriculture. Justify.
3. What are the key challenges associated with the adoption of solar power in Bhutan? How do these challenges affect it as a sustainable energy source?

Check Your Learning

Explain the practices of sustainable use of water resources in your locality. Analyse the consequences if water is not managed properly.

Theme Eight

National and Global Climate Change Initiatives and Conventions

Rooted in the philosophy of Gross National Happiness (GNH), Bhutan's development provides importance to holistic well-being. It acknowledges the interplay between social, economic, spiritual, and environmental dimensions. At its core, ESD seeks to impart learners with the knowledge, values, and skills necessary to navigate the complexities of our interconnected world while fostering a deep appreciation for the delicate balance between human prosperity and environmental preservation. Within this framework, climate change and environmental education emerge as essential pillars, guiding learners towards informed decision-making and proactive engagement in sustainable practices.

The urgency of climate change and environmental degradation focuses on integrating these critical topics into education, particularly in Bhutan, where the principles of GNH provide importance to national development strategies. It helps to raise awareness about the interconnectedness of human actions, environmental degradation, and climate change. Thus, ESD is to instil responsibility for climate change and environmental degradation action. It empowers individuals and communities to take informed action, building resilience to climate impacts and promoting sustainable practices.

Class VIII

Topic 44: Green Policies for Sustainable Development

Curriculum linkages:

a. Subject:
Geography KS III (Class VIII)

b. Competencies targeted:
Analyse the interaction between human and environment to understand ecosystems for human well being.

c. Climate facts!
Denmark, Sweden, and Chile are leading countries in climate action (*Earth ORG Report-2023*)

Introduction

Figure Sustainable Oriented Development Plan

Prioritising sustainability principles such as resource efficiency, pollution prevention, biodiversity conser vation, climate resilience, and green policies seek to foster long-term environmental health while supporting economic growth and social equity. Green policies for sustainable development encompass a range of strategies and initiatives aimed at promoting environmental conservation, economic prosperity, and social well-being within a country.

In Bhutan, the Gross National Happiness principle informs the Green policies. These policies integrate environmental considerations into decision-making processes across sectors involving energy, transportation, agriculture, industry, and urban planning. They aim to foster long-term environmen tal health without compromising economic growth and social equity.

Through the analysis and understanding of green policies and their implementation, sstakeholders can be motivated to work towards a more resilient, equitable, and environmentally sustainable future.

Learning Objective

i. Examine National Environmental policies to understand the sustainable development practices in the country.

Learning Experiences

Environment policies are rules and regulations encompassing a wide range of measures in protecting the environment and promoting sustainable practices through a multi-sectoral approach. They cover various sectors such as air and water pollution control, waste management, conservation of biodiversity, renewable energy promotion, climate change mitigation and others. The intention is to encourage governments in striving to strike a balance between economic development and ecological sustainability.

Through case studies on national environmental policies in Bhutan, one can understand more about the Green Economy and its implementation strategies including how governments integrate environmental considerations into economic development without compromising the wellbeing of the ecosystem and people.

Activity 1: Understanding green economy

Explore Green Economy concepts from the suggested link https://www.youtube.com/watch?v=Hcbqri1mx5M

Questions

1. Explain Green Economy and write its core principles and objectives.
2. Provide three examples of Green Economy policies and practices implemented in Bhutan.

Activity 2: Analysing the environmental policies of Bhutan and the impacts of climate change

Explore the environmental policies of Bhutan and the impacts of Climate Change from the suggested link https://www.blueplanetprize.org/en/projects/2022hismajesty_wangchuck/hismajesty_wangchuck_s3.html.

Questions

1. How does Bhutan's developmental philosophy ensure environmental conservation?
2. How do Bhutan's environmental policies balance economic growth with preserving natural resources?
3. Provide evidence of climate change in Bhutan, and its urgency for action.

Check Your Learning

Explore how the Green economy can be implemented in your locality.

Theme Nine

Climate Change Technology

Climate change technology refers to innovations and tools designed to address the challenges posed by climate change. These technologies are used to reduce greenhouse gas emissions, increase energy efficiency, and promote sustainable energy use practices in various sectors like energy, transportation, agriculture, and waste management.

Renewable energy sources such as solar and wind power, and energy-efficient technology such as LED lights help in shifting the use of fossil to renewable energy sources. Thus, reducing greenhouse gas emissions. Similarly, electric vehicles and smart transportation systems improve air quality, while climate-smart farming and waste management technology mitigate environmental pollution and degradation.

As the world experiences devastating climate change impacts, smart technologies are crucial in mitigating climate change effects, creating a cleaner environment and maintaining a healthy planet. However, people need to be creative in exploring innovative ways of doing their work and in using energy. These ways can minimise the generation of pollutants that affect the climatic systems.

Class VII

Topic 45: Eco-Electric Engineers: Building Circuits to Save the Planet

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Construct electrical circuits with electrical components like ammeter, voltmeter, resistor, conducting wire, bulb, and switch to understand their functions, investigate electrical energy transformation and the effects of static electricity.

Introduction

The interconnection of different electrical components form a closed path for current to flow through. This is called an electrical circuit and is important for all the electrical devices we use everyday. When electric current moves through a circuit, electrical energy of current is converted to other forms of energy.

The different electrical components need to ensure the effective use of energy without any waste. Producing and using electricity more efficiently reduces both the amount of fuel needed to generate electricity and the amount of greenhouse gases and other air pollution emitted as a result.

Learning Objective

i. Develop a model based on the concept of electric circuit to reduce the impact of climate change

Learning Experiences

It is easy to use energy but difficult to harness, considering the impact on the environment. The most important aspect of clean energy is the environmental benefits as part of a global energy future.

Activity 1: Examining environment-friendly appliances

Household consumption significantly impacts the environment, and making sustainable choices help reduce our ecological footprint.

c. Climate facts!

Solar energy is almost 200 years old.

Investigate the household electrical appliances and complete the following table:

Table 1

Consumption of Power and Ways to Save Energy

Electrical Appliances	Power Consumed (watt)	Ways to save energy

Questions

1. Why is it essential to pay attention to energy labels when purchasing appliances?
2. If you had to choose between upgrading to energy-efficient appliances or implementing behavioural changes to reduce energy consumption, how would you decide which option to pursue?

Activity 2: Creating green energy model

Device a green energy model or equipment to reduce energy consumption.

Present the model with an explanation on how this model would help in reducing the impact of climate change.

Check Your Learning

Bhutan heavily relies on hydropower as a source of energy. Is this source sustainable from the perspective of climate change? Justify

Class VII

Topic 46: Intervention of Technologies in Reduction of Greenhouse Gases

Curriculum linkages:

a. Subject:
Geography KS III (Class VII)

b. Competencies targeted:
Use indigenous and scientific knowledge to understand measures to manage and address disasters

c. Climate facts!
CO_2 accounts for two-thirds of greenhouse gases largely the product of burning fossil fuel

Introduction

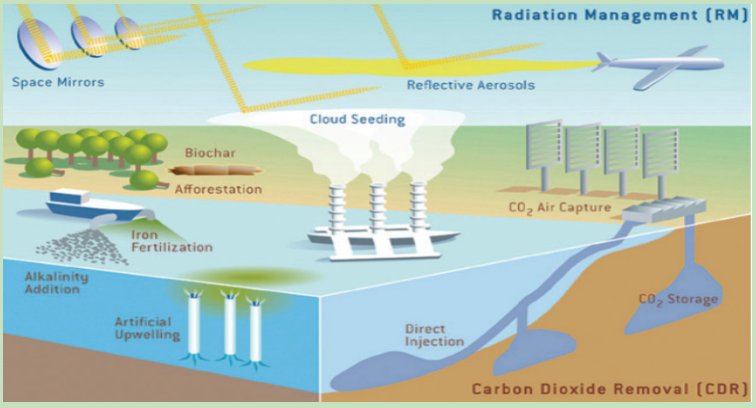


Figure *Innovative Solutions to Curb Emissions*

Climate technologies help to reduce GHGs by using renewable energies such as wind energy, solar power and hydropower. Technologies serve as innovative solutions in curbing pollution responsible for climate change. Technologies include devices that shift energy from non-renewable to renewable energy sources, carbon capture and storage.

These interventions are essential in mitigating climate change's adverse effects and transitioning towards a sustainable future.

Learning Objective

i. Explore the technologies that minimise the emission of greenhouse gases.

Learning Experiences

As the world faces accelerated climate change affecting the wellbeing of people and the environment, there is a need for innovative ways of mitigating, adapting and building resilience in addressing the climatic uncertainties. Based on the importance of climate change technologies, it is vital to explore various innovative technologies that minimise the emission of greenhouse gases into the environment.

Activity 1: Identifying climate smart energy technologies

Instruction:

Explore the internet for climate-smart technologies for energy generation with descriptions of how they work. Fill the empty cells in Table 1 with suitable innovations and descriptions.

Table 1

Climate-smart Technologies for Energy Generation

Energy Source	Technology	Description
Solar Power	E.g. Photovoltaic cell	Converts sunlight into electricity without emissions.
Wind Power		Uses wind energy to generate electricity, a clean source.
Power Plants and Industrial process	Carbon Capture and Storage (CCS) system	
Biomass Energy		Burns organic materials for energy, emissions vary.
Geothermal Energy	Geothermal energy generation	
Hydroelectric Power		Uses water energy to generate electricity.

Questions

1. Why do you consider technologies in column two as climate-smart devices?
2. Compare and contrast conventional technologies of energy generation with climate-smart technology.
3. What climate-smart energy technology does your family use? Justify.

Check Your Learning

Test your knowledge on climate-smart energy from the suggested link https://cleanet.org/clean/literacy/energyquiz.html.

Class VIII

Topic 47: Innovative Biodiversity Conservation

Curriculum linkages:

a. Subject:

Science KS III

(Class VIII)

b. Competencies targeted:

Examine how species within an ecosystem adapt and employ feeding strategies to comprehend the crucial interdependence among living in organisms, both among themselves and with their surroundings.

Introduction

Biodiversity is essential for the healthy functioning of eco systems and is beneficial to humans. It provides clean air, water, fertile soil, natural resources and regulates climate change.

Biodiversity conservation is the practice of protecting, managing, and restoring the diversity of life on earth. It involves the efforts to maintain the balance of ecosystems, prevent the extinction of species, and ensure sustainable use of natural resources.

In this era of rapid environmental change, innovations to biodiversity conservation have become important. The use of advanced remote sensing techniques utilising satellites and drones to capture images of landscapes helps scientists and biodiversity specialists to monitor changes in habitats and track the distribution of species of organisms. This data helps identify areas of high biodiversity and prioritise conservation actions.

Community-driven initiatives such as habitat restoration, sustainable land management, and establishing protected areas are important to develop responsibility for local biodiversity. It empowers communities to actively participate in conservation activities using their traditional knowledge and cultural practices to protect ecosystems and species.

c. Climate facts!

Tropical forests are incredibly effective at storing carbon, providing at least a third of the mitigation action needed to prevent the worst climate change scenarios

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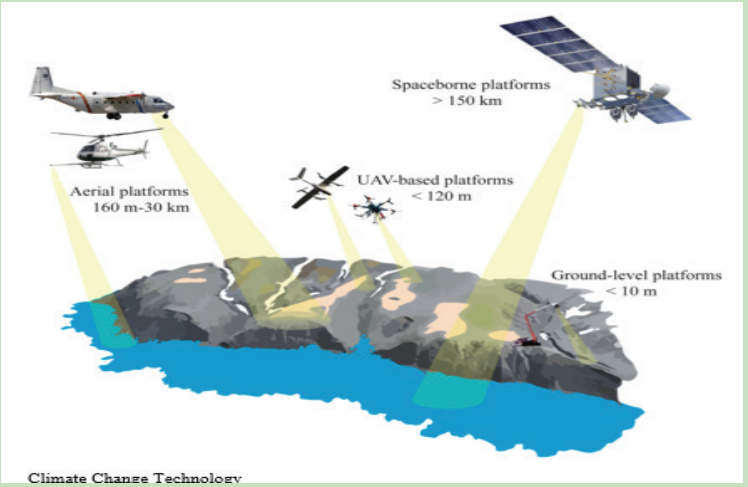

Figure *Remote Sensing and Drone*

Learning Objectives

i. Explain biodiversity
ii. Evaluate sustainable development practices in the locality in conserving the local biodiversity.
iii. Evaluate the religious and cultural practices that contribute to the conservation of biodiversity.

Learning Experiences

Our Earth is home to thousands of varieties of flora and fauna. Bhutan has a rich biodiversity due to varying altitude and climatic conditions. Legislations important to preserve the rich biodiversity of a country to ensure the sustainable use p of resources. For example, the Constitution of Bhutan mandates that 60 percent of the land area be maintained under forest cover at all times.

Activity 1: Understanding biodiversity in bhutan

Watch the video to explore biodiversity of Bhutan from the suggested link https://shorter.me/dQ7v3.

Questions

1. Explain the type of biodiversity that exists in Bhutan.
2. Why is biodiversity important to sustain the livelihoods of Bhutanese people?
3. Suggest strategies to maintain the richness of biodiversity.

Activity 2: Exploring biodiversity conservation efforts

In groups, conduct a survey in the locality to evaluate sustainable development practices and to examine religious and cultural practices which contribute to biodiversity conservation.

Use the following instructions to collect data during your field trip:

1. Preparation for the survey

- Take a notebook and camera (smartphones) to record your observations and findings.
- Seek prior permission from the school and community.
- Follow any safety guidelines provided by your teacher.

2. Sustainable Development Practices Evaluation

- Observe and document any sustainable development practices you notice in the local area that contribute to biodiversity conservation.
- Take notes or photographs to record your observations.

3. Religious and Cultural Practices Assessment
- Investigate any religious or cultural sites, rituals, or traditions in the area that are known to contribute to biodiversity conservation.
- Communicate with locals to learn about the significance of these practices in protecting local ecosystems and species.
- Take notes or record interviews after seeking permission.

4. Report writing
- Write a report on your observations and findings of the field trip.
- Critically analyse the effectiveness of the sustainable development practices and religious/cultural contributions to biodiversity conservation.

5. Panel discussion
- Conduct a panel discussion to share your findings and insights with your classmates.

Check Your Learning

1. What are the national strategies implemented for biodiversity conservation in Bhutan?
2. Biodiversity conservation ensures a safe future for humans. Explain.
3. Create a conservation model to protect black necked cranes, or any endangered species present in Bhutan.

Class VIII

Topic 48: Using Technology to Understand Climate Change

Curriculum linkages:

a. **Subject:**
Geography KS III
(Class VIII)

b. **Competencies targeted:**
Examine the importance of map reading skills and interpretation to demonstrate spatial reasoning skills

c. **Climate facts!**
"Greening" the oceans: This is basically fertilising them in order to boost algae and plant growth

Introduction

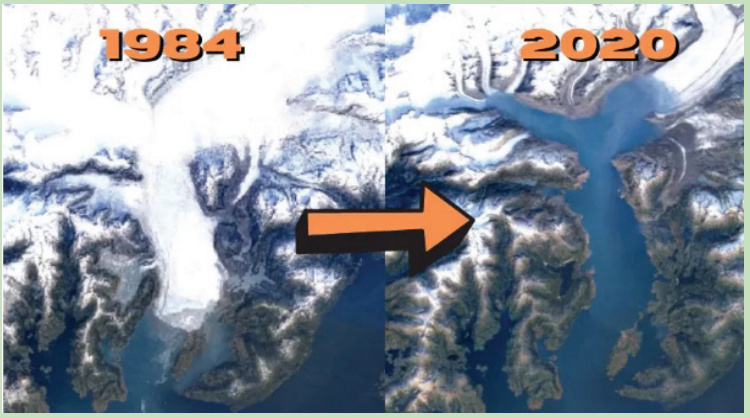

Figure Visualising the Climate Change with Technology

Climate change technology are tools designed to study and evaluate the occurrence and impacts of climate change. These technologies help in addressing challenges such as greenhouse gas emissions and promote sustainable development practices in various sectors.

Learning Objective

i. Study the impact of climate change on the environment with the help of Google Earth Engine.

Learning Experiences

Understanding map reading skills and using technology to comprehend climate change are crucial aspects of developing spatial reasoning abilities. Map reading enhances our ability to analyse geographic data, while technology provides tools for visualising and interpreting complex climate data. Together, these skills enable us to navigate environmental challenges with greater insight and precision.

Activity 1: Exploring glacier retreat in Bhutan

Access the Google Earth Engine platform from the suggested link provided https://earthengine.google.com/.

Materials Required:

1. Computer with internet connectivity

Procedure

1. Access the Google Earth engine to study the glacier retreat.
2. Using the Time Lapse tool, compare the Glacier Retreat in Bhutan over decades, specifically between 2011 and 2021.
3. Interpret data by identifying patterns and correlations with climate change factors such as temperature rise, precipitation, and human activities.
4. Analyse the findings and draw conclusions.

Questions

1. How does Google Earth Engine help to understand the effects of climate change on forests and rivers?
2. How has the amount of glaciers changed over time?
3. How does glacier retreat affect the hydropower generation?
4. Analyse the impact of glacier retreat on an environment and people living downstream.

Check Your Learning

1. Explore the Thorthormi Lake glacier outburst event in Lunana, focusing on its impacts on the environment and people downstream in Punakha.
2. Reflect on mitigation and adaptation strategies, considering their effectiveness and proposing innovative solutions to address the challenges posed by glacier outbursts.

Theme Ten

Climate Finance and Security

Environmental and climate change events are challenging humans all around the world. To address these challenges and make the world safe, people need resources. One form of this is Climate Finance. Climate finance refers to financial resources and instruments that are used to support action on climate change. Climate security refers to evaluating, managing, and reducing the risks to peace and stability caused by changes in the planet's climate, including weather extremes and natural disasters, ocean acidification and sea-level rise, loss of biodiversity, food and water insecurity, health risks, economic disruption, displacement, and even violent conflict.

It is about getting the money needed to work on climate change mitigation, adaptation and building resilience. This money is used for promoting the production and consumption of clean energy and addressing the impact of climate change. Climate security involves safeguarding people, animals, and nature from problems such as floods, storms, and h food and water scarcity under the effect of climate change. Understanding how money and safety are connected to climate change helps us make smart choices about how to use money to make things better and keep everyone safe from challenges posed by climate change.

Class VII

Topic 49: Human Actions, Climate Reactions: Protecting Our Health

Curriculum linkages:

a. Subject:
Science KS III
(Class VII)

b. Competencies targeted:
Explore nutrition, health, and organ systems to understand how they contribute to the proper functioning of the human body.

Introduction

Nutrition is about eating the right kinds of food to keep our body healthy. Our body needs different nutrients such as vitamins, minerals, proteins, fats, and carbohydrates for optimal functions of the organs. Organ systems do not work in isolation. Awareness on nutrition can empower individuals to make informed decisions about their diet and lifestyle.

Good nutrition helps us to grow, stay energetic, and avoid falling sick. Food should be accessible , affordable, and healthy for us. Everyone has access to nutritious food, we keep ourselves and our communities healthy and happy.

Learning Objectives

i. Explain the causes of diseases related to insufficient consumption of food nutrients
ii. Explain how human nutrition is related to food security.

Learning Experiences

About 800 million people worldwide lacksufficient food and even many people suffer from deficiencies in essential nutrients. Approximately 76% of the world's population derives most of its daily nutrients from plants. Climate change is already causing droughts and flooding that can destroy staple food crops. Additionally, an extra CO_2 in the atmosphere makes those crops less nutritious making it even more challenging to feed the world's growing population. Educating individuals about the importance of nutrition and how it affects organ systems and overall health can lead to better health choices and outcomes.

c. Climate facts!

Climate Change Hinders Crop Yields - Fewer crop yields are the more obvious impact of climate change on food security. Food production contributes 21% to 37% of global emissions annually.

Activity 1: Embarking on a nutrition detective quest

In a group,categorise the food items into different groups based on the nutritional content from the pictures or sample of different types of food provided by the teacher.

Table

Nutrition detective Quest

Food Items	Nutrient	Importance

1. With the change in climate, what will happen to the production of different food crops containing various nutrients?
2. How is the changing pattern of crop cultivation influenced by climate change impacting the ability to maintain a balanced diet?

Activity 2: Addressing food security challenges

Global food security requires that food be accessible, available, usable, and stable for all people.

Watch the video on global food security from the suggestive link https://n9.cl/t4cc1.

Questions

1. Identify challenges faced by communities due to economic hardships or environmental factors.
2. Develop strategies to address the challenges.

Check Your Learning

Create a short video clip reflecting on how you would contribute to global food security. Share it on social media.

Class VII

Topic 50: How do We Secure Global Food?

Curriculum linkages:

a. Subject:

Geography KS III (Class VII)

b. Competencies targeted:

Evaluate the importance of natural and human resources for balanced socio-economic development of a country

c. Climate facts!

Introduction

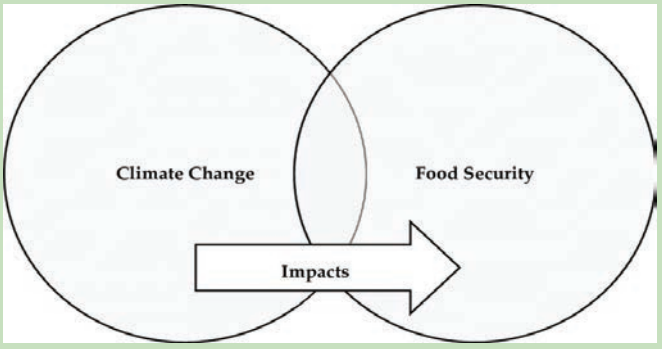

Figure *Climate Change and Food Security*

Climate security refers to evaluating, managing, and reducing the risks to peace and stability caused by changes in the planet's climate, including weather extremes and natural disasters, ocean acidification and sea-level rise, loss of biodiversity, food and water insecurity, health risks, economic disruption, displacement, and even violent conflict.

Securing global food means making sure there is enough food for everyone in a sustainable way. This is important because climate change is making it harder to grow and distribute food. It is important to understand the necessity of enough food under the challenges of climate change such as extreme weather and changing farming conditions.

Learning Objective

i. Analyse the relationship between climate change and global food security.

Learning Experiences

It is important to reflect and understand more about the unexpected effects of temperature changes on crop production and the potential implications of climate change on global food security.

In this context, climate finance is crucial for people, especially in underdeveloped or developing countries, to address the challenges caused by natural disasters due to climate change.

Activity 1: Understanding climate change and food security

Watch the video from the suggested link https://www.youtube.com/watch?v=jii7eesNecI&t=234s.

Questions

1. What does "food security" refer to?
   a. Having a variety of food choices available.
   b. Confidence in knowing where your food is com ing from and not going hungry.
   c. Not being concerned about the taste of the food.
   d. Having excessive amounts of food.
2. How does climate change influence food security?
   a. It has no impact on agriculture.
   b. It leads to a decrease in food prices.
   c. Changes in weather patterns affect agricultural production.
   d. It only affects the taste of food.
3. Which crops are mentioned as most vulnerable to climate change?
   a. Rice and soybean.
   b. Corn and wheat.
   c. Barley and oats.
   d. Potatoes and carrots.
4. Which organisation is mentioned as being concerned about bringing food-insecure people into a state of food security while preserving the environment?
   a. The Center on Food Security and the Environment(CFSE).
   b. World Health Organization (WHO).
   c. International Monetary Fund (IMF).
   d. Food and Agriculture Organization (FAO).

5. In the context of agriculture and climate change, what is the significance of cooler temperatures in the video?
   a. Cooler temperatures have no impact on crop production.
   b. Cooler temperatures have a more significant impact than wetter conditions on crop production.
   c. Cooler temperatures hinder agricultural growth.
   d. Cooler temperatures only affect certain crop varieties.

Check Your Learning

Why do you believe climate finance is crucial for developing countries like Bhutan? Provide reasons to support your response.

Class VIII

Topic 51: Human Actions and Environmental Reactions

Curriculum linkages:

a. Subject:
Science KS III
(Class VIII)

b. Competencies targeted:
Analyse types of chemical reactions and indicators to relate to chemical changes occurring in our everyday life.

Introduction

From the simple act of cooking to the more complex processes in industries, each action sets off a chain of reactions, which have significant effects on the environment.

Human activities generate a significant amount of waste, which comes in various forms. This waste poses challenges for our environment and society. The quantity of waste we produce is rising due to factors like expansion of cities and changing lifestyles. Some of these wastes break down naturally, while others stay and can be harmful. If we do not manage our waste properly, it can harm our environment and affect our health and wellbeing.

Hence, it is important to promote recycling and setting up proper disposal sites across the country to manage wastes properly

Learning Objectives

i. Explain the importance of disposing chemical waste safely in the environment.
ii. Formulate safety measures for managing chemical wastes.

Learning Experiences

Large amounts of waste in the form of solid, liquid, and gases are produced by humans every day. Most of the traditional Bhutanese lifestyle is environment-friendly, generating less waste because people generally used natural and organic materials.

c. Climate facts!

Analysis by NOAA shows that average global temperatures in 2023 were 2.12 degrees F (1.18 degrees C) warmer than the 20th-century average — and higher than any other year since records began in 1850.

However, with modernization, consumption patterns have changed, leading to an increase in waste production, especially non-degradable wastes. Non- biodegradable waste contains harmful chemicals that pollute our environment, posing threats to the health of the environment and other living organisms. It is important to understand the source, nature, and proper management of different types of waste to maintain the health of ecosystems and living organisms.

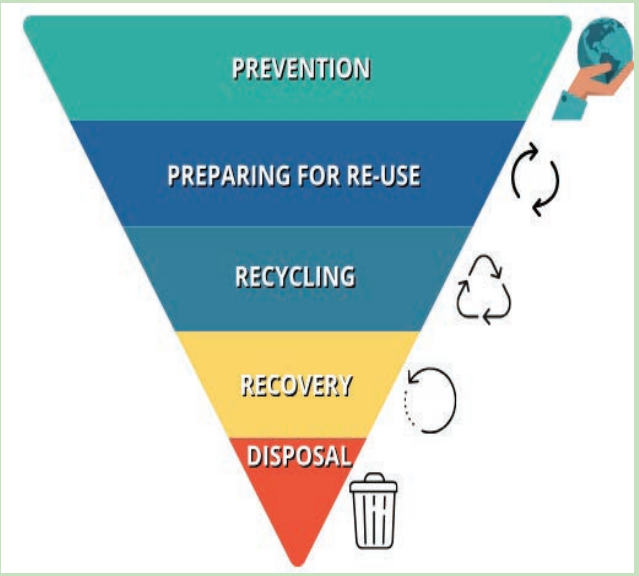

Figure *Waste Management Pyramid*

Activity 1: Exploring impacts of waste disposal on the environment

Watch the videos on waste disposal and environmental impact from the suggested links https://shorturl.at/elvR0 and https://shorturl.at/jkERW.

Carry out group discussion:

Questions

1. What are the impacts of improper plastic disposal to humans and wildlife?

c. Climate facts!

Analysis by NOAA shows that average global temperatures in 2023 were 2.12 degrees F (1.18 degrees C) warmer than the 20th-century average — and higher than any other year since records began in 1850.

2. Disposal of biodegradable and non-biodegradable wastes in landfills releases chemicals that harm the environment and change the climatic conditions. Justify.
3. Suggest possible methods to reduce the impact of waste disposal on the environment.

Activity 2: Understanding hazardous wastes

Explore hazardous wastes using flash cards from the suggested link https://shorturl.at/deKOP.

Write a reflection on what you learnt from the activity.

Check Your Learning

Make a short video clip on the impact of improper waste disposal on the environment to promote awareness in the locality. Share with your friends or on social media.

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SCHOOLS
FOR GREEN BHUTAN
Releasing the best of who we are and what we have through our body, speech and mind.
Discovering the grace of great ideas.
Looking into ourselves and connecting to a higher level of consciousness.
Appreciating the beautiful, the graceful, and the tasteful.
Learning to live together and learn together
Celebrating the vital link between the human and the natural.
Fostering goodness over cleverness, cooperation over competition, fair-play over victory at any cost.
Cultivating the gifts of our minds.
Cultural Greenery
Academic Greenery
Spiritual Greenery
Aesthetic Greenery
Social Greenery
Natural/Environmental Greenery
Intellectual Greenery