CLIMATE REPORTING HANDBOOK

Table of Contents

SECTION I

BASICS OF CLIMATE CHANGE

1. What is climate change?

Climate change refers to long-term shifts in temperature and weather patterns. These shifts may be natural such as those caused by the variations in the solar cycle. But since the industrial revolution in the 1800s, human activities have been the main driver of climate change, mainly due to the burning of fossil fuels like coal, oil, and gas.

Greenhouse gases are the main causes of climate change and burning fossil fuels generate greenhouse gases which act like a blanket wrapped around the earth, trapping the sun's heat and increasing temperature.

Two notable greenhouse gases causing climate change are carbon dioxide and methane. These gases are produced, for example, while using fossil fuels for your car. Clearing land and forests also release carbon dioxide while landfills for garbage are a major source of methane emissions. Some other primary emitters include industries, transport, buildings, agriculture and land use.

Greenhouse gas concentrations are at their highest levels in 2 million years

Emissions are rising as we speak. As a result, the earth is today about 1.1°C warmer than it was in the late 1800s. The last decade (2011-2020) was the warmest on record.

Many people think that climate change mainly means warmer temperatures. But temperature rise is only the beginning of the story. Because the earth is a system, where everything is connected, changes in one area can influence changes in all others.

The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity.

People are experiencing climate change in diverse ways

Climate change spares no one and no country. It can affect our health, ability to grow food, housing, safety and work. Some people are already more vulnerable to the impacts of climate change, such as people living in small island nations and developing countries. Even mountain countries like Bhutan are increasingly facing nature's wrath which is only expected to worsen with time. Conditions like sea-level rise and saltwater intrusion have advanced to the point where whole communities have had to relocate, and protracted droughts are putting people at risk of famine. In the future, the number of 'climate refugees' is expected to rise.

Every increase in global warming matters

In a series of UN reports, thousands of scientists and government reviewers have agreed that limiting global temperature rise to no more than 1.5°C would help us avoid the worst

climate impacts and maintain a livable climate. Yet, based on current national climate plans, global warming is projected to reach around 3.2°C by the end of the century, which is alarming on all grounds.

The emissions that cause climate change come from every part of the world and affect everyone, but some countries produce much more emission than others. The 100 least carbon emitting countries which are mostly poorer economies generate a meagre 3 percent of total global emissions. The 10 countries with the largest emissions, mostly richer economies, contribute a massive 68 percent which shows a big divide between rich and poor countries. Everyone must take climate action, but people and countries contributing to the problem more have a greater responsibility to act first.

The challenge is daunting but there are many solutions

Many climate change solutions can deliver economic benefits while improving lives and protecting the environment. There are global frameworks and agreements to guide progress, such as the Sustainable Development Goals, the UN Framework Convention on Climate Change (UNFCCC) and the Paris Agreement.

Three broad categories of action are: cutting emissions, adapting to climate impacts and financing required adjustments.

Switching energy systems from fossil fuels to renewables like solar or wind will reduce the emissions driving climate change. But we have to start right now. While a growing coalition of countries is committing to net zero emissions by 2050, about half of emissions cuts must be in place by 2030 to keep warming below 1.5°C. Fossil fuel production must decline by roughly 6 percent per year between 2020 and 2030.

Adapting to climate consequences protects people, homes, businesses, livelihoods, infrastructure and natural ecosystems. It covers current impacts and those likely in the future. Adaptation will be required everywhere, but must be prioritised now for the most vulnerable people with the fewest resources to cope with climate hazards. The rate of returns can be high. Early warning systems for disasters, for instance, save lives and property, and can deliver benefits up to 10 times the initial cost.

We can pay the bill now, or pay dearly in the future

Climate action requires significant financial investments by governments and businesses. But climate inaction is vastly more expensive. A solution is for the rich and industrialised countries to meet their commitment, which they have agreed in the global climate change conferences, to contribute and give developing countries US$ 100 billion annually to enable them to adapt and transition to greener economies. This would allow the developing countries to pollute less, which would lower global emissions.

2. Causes of Climate change

Fossil fuels – coal, oil and gas – are, by far, the largest contributors to global climate change, accounting for over 75 percent of global greenhouse gas emissions and nearly 90 percent of all carbon dioxide emissions.

As greenhouse gas emissions blanket the earth, they trap the sun's heat. This leads to global warming and climate change. The world is now warming faster than at any point in recorded history. Warmer temperatures over time are changing weather patterns and disrupting the usual balance of nature. This poses many risks to human beings and all other forms of life on earth.

Globally, there are numerous factors that cause climate change but some major causes identified by the UN include:

Generating power

Generating electricity and heat by burning fossil fuels causes a large chunk of global emissions. Most electricity is still generated by burning coal, oil, or gas, which produces carbon dioxide and nitrous oxide – powerful greenhouse gases that blanket the earth and trap the sun's heat. Globally, only a little more than a quarter of electricity comes from wind, solar and other renewable sources which, as opposed to fossil fuels, emit little to no greenhouse gases or pollutants into the air.

Manufacturing goods

Manufacturing and industry produce emissions, mostly from burning fossil fuels to produce energy for making things like cement, iron, steel, electronics, plastics, clothes, and other goods. Mining and other industrial processes also release gases, as does the construction industry. Machines used in the manufacturing process often run on coal, oil, or gas. Some materials like plastics are made from chemicals sourced from fossil fuels. The manufacturing industry is one of the largest contributors to greenhouse gas emissions worldwide.

Cutting down forests

Cutting down forests for urbanisation and agriculture, or for other reasons, causes emissions, since trees, after they are cut, release the carbon they have been storing. Each year, approximately 12 million hectares of forest are destroyed. Since forests absorb carbon dioxide, destroying them also limits nature's ability to keep emissions out of the atmosphere.

Deforestation, together with agriculture and other land use changes, is responsible for roughly a quarter of global greenhouse gas emissions.

Using transportation

Most cars, trucks, ships, and planes run on fossil fuels. That makes transportation a major contributor of greenhouse gases, especially carbon dioxide emissions. Road vehicles account for the largest part due to the combustion of petroleum-based products in internal combustion engines. But emissions from ships and planes continue to grow. Transport accounts for nearly one quarter of global energy-related carbon dioxide emissions. And trends point to a significant increase in energy use for transport over the coming years.

Producing food

Producing food causes emissions of carbon dioxide, methane, and other greenhouse gases in various ways, including through deforestation and clearing of land for agriculture and grazing, digestion by cows and sheep, the production and use of fertilisers and manure for growing crops, and the use of energy to run farm equipment or fishing boats, usually with fossil fuels. All this makes food production a major contributor to climate change. And greenhouse gas emissions also come from packaging and distributing food.

Powering buildings

Globally, residential and commercial buildings consume over half of all electricity. As they continue to draw on coal, oil, and natural gas for heating and cooling, they emit significant quantities of greenhouse gas. Growing energy demand for heating and cooling, with rising air-conditioner ownership, as well as increased electricity consumption for lighting, appliances, and connected devices, has contributed to a rise in energy-related carbon dioxide emissions from buildings in recent years.

Consuming too much

Your home and use of power, how you move around, what you eat and how much you throw away all contribute to greenhouse gas emissions. So does the consumption of goods such as clothing, electronics, and plastics. A large chunk of global greenhouse gas emissions is linked to private households. Our lifestyles have a profound impact on our planet. The wealthiest bear the greatest responsibility because the richest 1 percent of the global population contribute more greenhouse gases than the 50 percent of the world's poor population.

3. Effects of climate change

Climate change has many effects and most effects make the world a more difficult place to live in and bring forth multiple challenges.

Some of the global effects of climate change include:

Hotter temperatures

As greenhouse gas concentrations rise, so does the global surface temperature. The last decade, 2011-2020, is the warmest on record. Since the 1980s, each decade has been warmer than the previous one. Nearly all land areas are seeing hotter days and heat waves. Higher temperatures increase heat-related illnesses and make working outdoors more difficult. Wildfires start more easily and spread more rapidly when conditions are hotter. Temperatures in the Arctic have warmed at least twice as fast as the global average.

More severe storms

Destructive storms have become more intense and more frequent in many regions. As temperatures rise, more moisture evaporates, which exacerbates extreme rainfall and flooding, causing more destructive storms. The frequency and extent of tropical storms is also affected by the warming ocean. Cyclones, hurricanes, and typhoons feed on warm waters on the ocean surface. Such storms often destroy homes and communities, causing deaths and huge economic losses.

Increased drought

Climate change is changing water availability, making it scarcer in more regions. Global warming exacerbates water shortages in already water-stressed regions and is leading to an increased risk of agricultural droughts affecting crops, and ecological droughts, increasing the vulnerability of ecosystems. Droughts can also stir destructive sand and dust storms that can move billions of tonnes of sand across continents. Deserts are expanding, reducing land for growing food. Many people now face the threat of not having enough water on a regular basis.

A warming, rising ocean

The ocean soaks up most of the heat from global warming. The rate at which the ocean is warming strongly increased over the past two decades, across all depths of the ocean. As the ocean warms, its volume increases since water expands as it gets warmer. Melting ice sheets also cause sea levels to rise, threatening coastal and island communities. In addition, the ocean absorbs carbon dioxide, keeping it from the atmosphere. But more carbon dioxide makes the ocean more acidic, which endangers marine life and coral reefs.

Loss of species

Climate change poses risks to the survival of species on land and in the ocean. These risks increase as temperatures rise. Exacerbated by climate change, the world is losing species at a rate 1,000 times faster than at any other time in recorded human history. One million species are at risk of becoming extinct within the next few decades. Forest fires, extreme weather, and invasive pests and diseases are among many threats related to climate change. Some species will be able to relocate and survive, but others will not.

Not enough food

Changes in the climate and increases in extreme weather events are among the reasons behind a global rise in hunger and poor nutrition. Fisheries, crops, and livestock may be destroyed or become less productive. With the ocean becoming more acidic, marine resources that feed billions of people are at risk. Changes in snow and ice cover in many Arctic regions have disrupted food supplies from herding, hunting, and fishing. Heat stress can diminish water and grasslands for grazing, causing declining crop yields and affecting livestock.

More health risks

Climate change is the single biggest health threat facing humanity. Climate impacts are already harming health, through air pollution, diseases, extreme weather events, forced displacement, pressures on mental health, and increased hunger and poor nutrition in places where people cannot grow or find sufficient food. Every year, environmental factors take the lives of around 13 million people. Changing weather patterns are spreading diseases, and extreme weather events increase deaths and make it difficult for healthcare systems to keep up.

Poverty and displacement

Climate change increases the factors that put and keep people in poverty. Floods may sweep away urban slums, destroying homes and livelihoods. Heat can make it difficult to do outdoor jobs. Water scarcity may affect crops. Over the past decade (2010–2019), weather-related events displaced an estimated 23.1 million people on average each year, leaving many more vulnerable to poverty. Most refugees come from countries that are most vulnerable and least ready to adapt to the impacts of climate change.

Glaciers are retreating

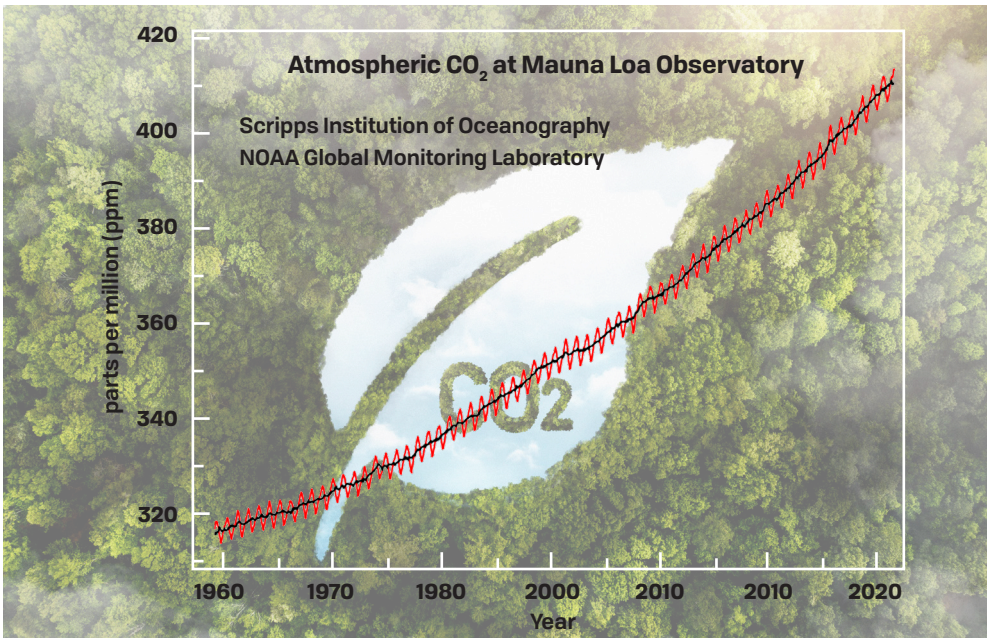
Glaciers are retreating almost everywhere around the world, including the Himalayas, Alps, Andes, Rockies, Alaska and Africa. All glacial water eventually finds its way to the sea. A retreating glacier loses more water than it gains and so causes sea levels to rise. Over a billion people depend on meltwater from alpine glaciers for year-round drinking water supplies. Disappearance of many alpine glaciers in the Himalayas could be disastrous for

the Indian subcontinent. Accelerated melting of the glaciers will first afflict downstream populations with increased flooding, then with water shortages as glacier-fed rivers dry up. However, a shortage of data on glacier-fed river flow makes it difficult to predict the timing and magnitude of such events.

4. 10 facts proving the world is in a climate emergency

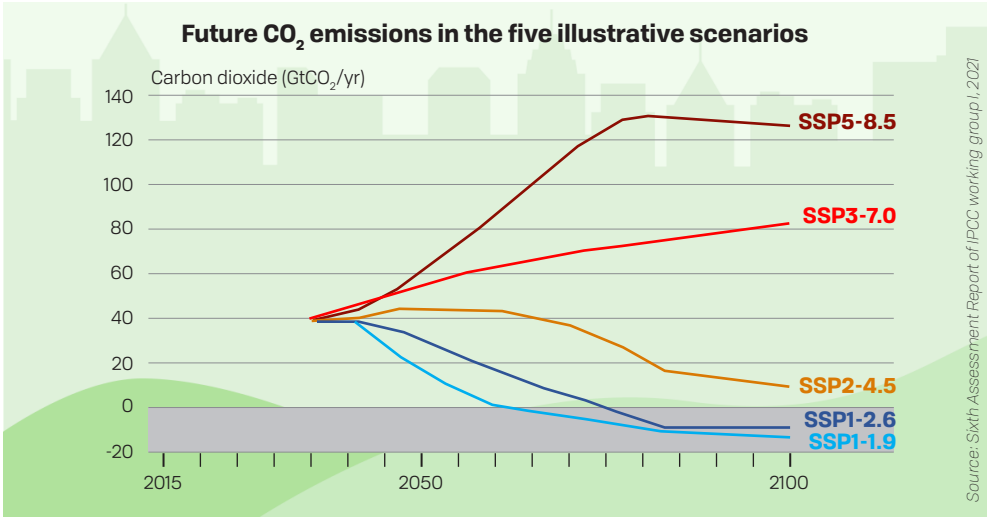
There is more carbon dioxide in our atmosphere than at any time in human history

In February and March 2021, the Mauna Loa observatory in Hawaii recorded a historic level of carbon dioxide in the earth's atmosphere. The last time earth's atmosphere contained this much carbon dioxide was more than three million years ago, when sea levels were several metres higher and trees grew at the South Pole.



We are on the path to exceeding 1.5°C of warming

In 2015, the nations behind the Paris Agreement set an ambitious target for keeping global warming below 1.5°C. The latest IPCC report models five different future emission scenarios – from very high emissions to very low emissions – and in each scenario global surfaces are expected to hit at least 1.5°C. Based on current emissions, the world is likely to hit between 2.7°C and 3.1°C of warming by 2100.



Scenario	Narrative
SSP1-1.9 Most optimistic: 1.5C by 2050	The IPCC's most optimistic scenario, describes a world where global CO2 emissions are cut to net zero around 2050. This first scenario is the only one that meets the Paris Agreement's goal of keeping global warming to around 1.5 degree Celsius above preindustrial temperatures, with warming hitting 1.5C but then dipping back down and stabilising around 1.4C by the end of the century.
SSP2-2.6 Next Best: 1.8C by 2100	In the next-best scenario, global CO2 emissions are cut severely, but not as fast, reaching net-zero after 2050. It imagines the same socioeconomic shifts towards sustainability as SSP1-1.9. But temperatures stabilise around 1.8°C higher by the end of the century.
SSP2-4.5 Middle of the road: 2.7C by 2100	This is a "middle of the road" scenario. CO2 emissions hover around current levels before starting to fall mid-century, but do not reach net-zero by 2100. Socioeconomic factors follow their historic trends, with no notable shifts. Progress towards sustainability is slow, with development and income growing unevenly. In this scenario, temperatures rise 2.7C by the end of the century.
SSP3-7.0 Dangerous: 3.6C by 2100	On this path, emissions and temperatures rise steadily and CO2 emissions roughly double from current levels by 2100. Countries become more competitive with one another, shifting toward national security and ensuring their own food supplies. By the end of the century, average temperatures have risen by 3.6C.
SSP5-8.5 Avoid at all costs: 4.4C by 2100	This is a future to avoid at all costs. Current CO2 emissions levels roughly double by 2050. The global economy grows quickly, but this growth is fueled by exploiting fossil fuels and energy-intensive lifestyles. By 2100, the average global temperature is a scorching 4.4C higher.

Our remaining carbon budget is tiny

Between 1850 and 2019, humans released around 2,390 gigatons of carbon dioxide into the atmosphere (One gigaton equals one billion metric tonnes). To have a 50/50 chance of staying under 1.5C of warming, we can only release an extra 500 gigatons of carbon dioxide – and that includes emissions from the beginning of 2020. In 2019, we emitted over 36 gigatons, and as emissions are still yet to peak, it looks extremely likely that the world will eventually sail past that carbon budget.

Extreme heat events have become more frequent and severe

Recent devastating wildfires in Australia, California or southern Europe show that climate change is leading to more frequent and more severe hot weather events. The kind of extreme heat event that would have only happened on average once every 10 years between 1850 and 1900 now likely occurs 2.8 times every 10 years. The kind of heavy one-day rain that 150 years ago would have only happened once every 10 years is now happening 1.3 times every 10 years.

Humans have already caused 1.07C of warming

The IPCC report estimates that global surface temperatures are now 1.07C warmer than they were between 1850-1900. Since 1970, global surface temperatures have risen faster than in any 50-year-period over the last 2,000 years and this has been particularly pronounced in recent years, with 2016-2020 being the hottest five-year period recorded since at least 1850.

Sea levels are rising faster today than ever before

Melting ice sheets and glaciers, and warming oceans lead to higher sea levels. Since 1900, sea levels have risen faster than in any preceding century in at least the last 3,000 years and this is set to continue for a very long time. Because oceans take a long time to warm, a lot of sea level rise is already baked-in. If warming is limited to 1.5C then over the next 2,000 years, global mean sea level will rise to between two and three metres above current levels.

Arctic sea ice is rapidly diminishing

Temperatures in the Arctic are rising faster than almost anywhere else on the planet. Between 2011 and 2020, annual Arctic sea ice reached its lowest level since at least 1850 and late summer Arctic sea ice was smaller than at any time in at least the past 1,000 years. Under all the future emissions scenarios in the IPCC report, the sea ice minimum will fall below one million square kilometres at least once before 2050 – making the area practically free of sea ice altogether.

Two-thirds of extreme weather events in the last 20 years influenced by humans

The number of floods and heavy rains has quadrupled since 1980 and doubled since 2004. Extreme temperatures, droughts and wildfires have also more than doubled in the last 40 years. *Carbon Brief*, a UK-based website covering climate science, found that 68 percent of all extreme weather events studied in the last 20 years were made more likely or more severe by human-caused climate change. Heatwaves account for 43 percent of such events, droughts make up 17 percent and heavy rainfall or floods account for 16 percent.

A volunteer pours water on pedestrian during a heatwave in southern Pakistan, May 2022

Dengue fever could spread to more places by 2050

Dengue is the world's fastest-growing mosquito-borne virus, currently killing some 10,000 people and affecting around 100 million per year. As global temperatures rise, the mosquitoes that carry the disease could thrive in places that were previously unsuitable for them. A recent study published in the scientific journal *Nature* warned that, in a warming world, dengue could spread to the US, higher altitudes in central Mexico, inland Australia and to large coastal cities in eastern China and Japan.

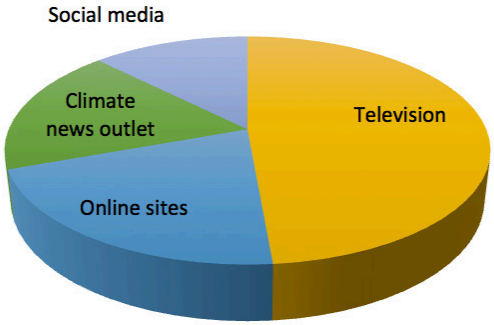
Average wildlife populations have dropped by 60 percent in just over 40 years

The average size of vertebrate (mammals, fish, birds and reptiles) populations declined by 60 percent between 1970 and 2014, according to the biennial *Living Planet Report.* An international panel of UN-backed scientists argue that climate change is playing an increasing role in driving species to extinction. It is thought to be the third biggest driver of biodiversity loss after changes in land and sea use and overexploitation of resources.

5. Climate change and journalism: a global trend

Climate change is undeniably one of the greatest challenges facing humanity but most people find it difficult to engage with and understand it because of which climate information is mostly disseminated through the media. An online survey data from 40 countries show that in 2020, news media were the most widely used sources of information on climate change. The study shows that 35 percent of respondents across countries used television to inform themselves about climate change, 15 percent used online sites of major news organisations, 13 percent used specialised climate news outlets, and 9 percent used alternative sources such as social media and blogs.

Access to information on Climate Change



Climate change-related content shared on social media stems from news media. Studies also show that the level of trust in mainstream news media in many countries is still higher than trust in other sources. It means that news media are still crucially important for how individuals, organisations, and societies understand climate change and how they evaluate and act upon it. Therefore, climate journalism, as the production process behind news media presentations of climate change, has also become a crucial object of analysis that is receiving increasing scholarly attention globally.

Changes in the global media ecosystem

Climate journalism has to be understood from the changes taking place in the media ecosystem globally, which include the infrastructural and organisational landscape of journalistic media themselves, the range of communicators surrounding them, and the variety of ways in which they are used.

In many countries in the Global North, news media is on a downward spiral. In the USA, Europe and Canada, the traditional news business model – selling of news in return for advertising and subscriptions – is in a crisis. This has led many media houses to cut costs by reducing salaries of journalists, reducing publication frequency, and moving to online publications.

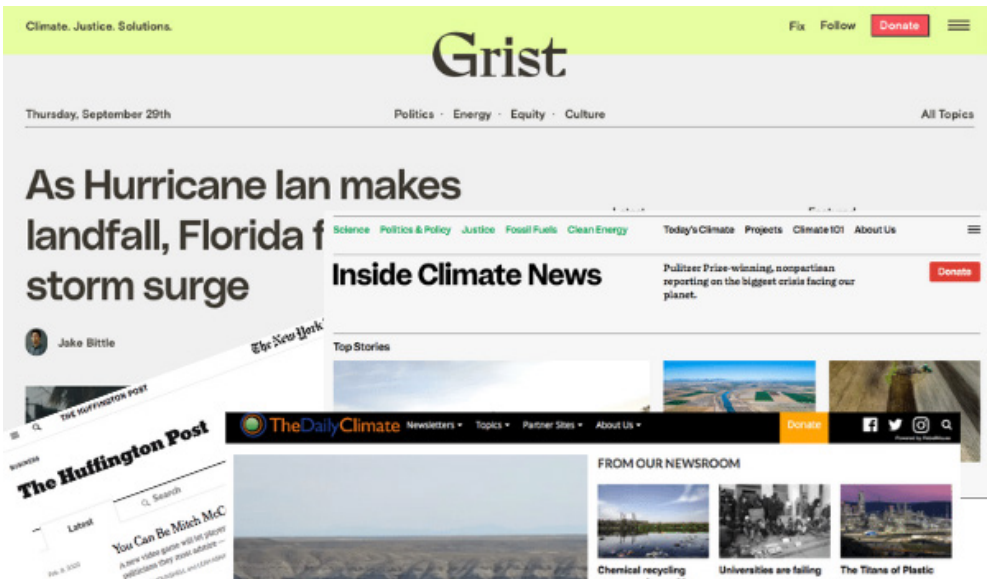
Journalists are mandated to produce more and more diverse outputs for more channels, including social and mobile media with fewer resources.

In response to the situation, new journalistic players have emerged that try to balance editorial independence with sustainable business models. They include 'digital-born' news media organisations such as *Buzzfeed, Vice,* and *Vox,* which use the affordances of social and mobile media and try to produce viral content to generate user traffic and, thus, advertisement revenue. Other journalistic models rely on philanthropy, crowdfunding, or audience donations, but their success is hard to evaluate.

The growing importance of online and social media has also revolutionised the media industry. Social media facilitate more interactive many-to-many forms of communication that enable more people to participate and user-generated content to be distributed. They also afford users more freedom to select the brands and content they want to follow. In these media environments, journalists are not gatekeepers of the news flow.

Moreover, people today get news from search engines like Google or social sites like Facebook which are in many countries more popular than news sites. The news through such sites is not journalistically but algorithmically curated. Such trends have led to circumventing journalist gatekeepers. This situation has raised concerns over quality control in news media, where fewer journalists have fewer resources available to sift through an increasing amount of professionally produced material produced by outside stakeholders.

In the United States, studies show that the public service media is weak and the commercialised private sector is strong. It has also seen the emergence of major digital-born players like the *Huffington Post* and climate-specific niche sites such as *InsideClimate News, Grist,* and the *Daily Climate.*



Western Europe media shows different landscapes. While 'democratic-corporatist' media systems are dominant in Scandinavia and German-speaking countries, the UK has public service broadcasting but also strongly commercialised private media. In 'polarised pluralist' countries such as Italy, Greece, and Spain, broadcasters fare better but newspaper companies struggle to attract readerships.

This cross-country variety is even more pronounced among developing countries and emerging economies. In Africa, the Middle East, Australasia, and Latin America, print circulation dropped between 2011 and 2016, whereas it grew by 40% in Asia. The rise of print media was particularly pronounced in India and China. The media landscape in China has changed rapidly in recent years with the arrival of several important commercial players, particularly in the fields of print, online, and social media, accompanied by the continuously strong presence of the state television channel, CCTV, and other government-owned news media.

In South America, while Brazil has historically been a television nation, survey research shows that social media overtook TV news as the most widely used source of climate change-related news in 2020. Similar patterns have been found in Argentina and Chile. In Mexico, television and radio, while less favoured than online and social media remain crucial for millions of people who are not online.

In India, by contrast, state-owned media are marginal, but the number of privately-owned TV news channels has increased significantly from around 30 in 2006 to more than 100 in 2017. This is in addition to the more than 90,000 print media titles currently available. At the same time, many Indians access news via online media, especially search engines, social media and messaging services.

Such trends and their national and regional variations must be considered when analysing climate journalism.

New forms of climate journalism

Over the years, new and mainly digital-born players have established themselves as general news providers in several countries. Their target audiences are under 35, and in some markets, they have managed to successfully rival legacy media outlets. Examples include international brands such as the *Huffington Post* and *BuzzFeed,* both of which have presence in several languages and countries. Many of these outlets, including the *Huffington Post, BuzzFeed, Vice, Vox, and Quartz,* focus specifically on environmental issues such as climate change and often have feature sections or indexes on these topics, partly because such issues are of interest to their young target audience.

Online surveys suggest that such online-born players have larger audience shares than legacy media in countries where consumers are particularly interested in environmental news. In the UK in 2016, the *Huffington Post* was used by 19% of consumers interested in environmental issues, which is comparable to the figures for *The Guardian* (18%). In the US, the *Huffington Post* was used by 36% of news users, making it the most popular online news

medium for the US audience.

Generally, it has been shown that the online-born media base their editorial decisions on audience metrics and algorithms to a much greater extent than most legacy media outlets do. However, they differ somewhat in how they distribute climate-related content. The *Huffington Post* relies heavily on blogs, while *Vice* relies on 'personal narration' videos; *BuzzFeed* depends on a mix of listicles, quizzes, photo galleries, and irreverent content, and *Vox* focuses on 'explainers'. These differences provide some background information on the 'how' and 'why' of climate change.

Online-born players in France, Germany, Spain, and the UK have been shown to be editorially distinct: some seek to offer stand-out, in-depth journalism, and investigative reporting on a few issues, while others cover a broad range of topics.

India also has a wide range of digital start-ups that follow different journalistic models, most of which are content-based, aggregation-based, or non-profit entities. Some new players, such as *IndiaSpend, Scroll, The Wire, Gaon Connection,* the *Caravan,* and the *News Minute,* include extensive coverage of climate change within their general news offerings.

Overall, however, little is known about the organisational aspects of climate journalism, such as the presence of specialist climate beats, the employment status and working conditions of journalists, or the organisation of the newsroom, among these new players.

Several environmental correspondents who had formerly worked for legacy media now work for digital-born news players and niche sites covering climate issues.

The new climate media houses

Some popular online sites based in the US and the UK include *Carbon Brief* and *InsideClimate News,* which offer highly specialised, in-depth, high-quality coverage on the scientific and socio-political aspects of climate change, along with additional services such as an aggregated news service. Others, such as *Grist* and *Climate Progress* are more advocacy-oriented. Some outlets, such as the *Daily Climate,* have moved from mere aggregation or commentary to original reporting, and some offer environmental stories as part of a specialist (partly investigative) approach, while others, including Climate Central, are hybrid journalistic-scientific enterprises.

Niche sites are not restricted to the US and the UK. *China Dialogue* is a leading specialist site covering environmental issues with a strong focus on climate change. It targets both Chinese- and English-speaking audiences. Its sister site is *India Climate Dialogue,* which was set up in 2018 as a dedicated outlet for impartial and objective news on all aspects of climate change. *Carbon Copy* also focuses on energy issues in India but covers several aspects other than climate change.

In Brazil, *Observatório do Clima* (Climate Observatory), a network founded in 2001, brings together several civil society organisations to offer climate news in English and Portuguese.

One aspect common to all of these sites is that former journalists from legacy media occupy senior managerial or editorial positions. However, not much formal study has been done to analyse the nature of climate journalism offered by these sites, including the degree to which they pursue an editorial line independent of government, NGOs, or other interest groups. Some have argued that niche sites generally only reach small audiences who are already well-informed about climate change, resulting in echo-chambers of like-minded people.

However, a 2020 survey of 40 countries suggests that specialist outlets covering climate issues rank third for general audiences as a source of climate news after television and online sites of major news organisations. Given the variety of these sites, the novel formats they use to present climate information, and their apparent popularity with mainstream journalists and policymakers, more in-depth research on their organisational practices, professional backgrounds, and editorial approaches is needed. This is also true for other emergent online formats, such as climate-related fact-checking sites, data-based network initiatives, start-up news companies acting as intermediaries between legacy media organisations and freelance reporters and intermediary organisations such as Science Media Centers.

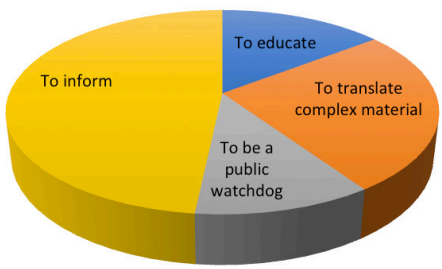
What are climate journalists doing?

A 2011 study shows that the role of climate journalists has evolved from gatekeeping to that of a curator. As a gatekeeper, a journalist is primarily responsible for selecting the topic, information and voices and disseminating it to the public. But as a curator, climate journalists uncover relevant content, restructure it, and present it after value adding and embellishing it to their audiences. As a curator, climate journalists act like 'pathfinders' and 'scouts' unlike the traditional 'gatekeeper' where the journalist functions in a top-down manner to provide information to their audience.

However, research shows that there are cases, particularly in the Global South, where climate journalists still perform the traditional gatekeeping roles.

An international survey of 592 science journalists from all continents revealed that 43 percent believed their role was 'to inform', 23 percent 'to translate complex material', and 13 percent 'to educate'. Less than 10 percent thought their role entailed 'mobilising or entertaining the public' or being a 'public watchdog'.

What the journalists believed their role was



Similarly, a survey of more than 60 climate journalists from India, Germany, Switzerland, the US, and the UK identified the presence of a common transnational 'interpretive community' in support of the mainstream consensus on anthropogenic climate change and had more traditional self-perceptions as explainers of a complex phenomenon.

Climate journalism versus advocacy journalism

A new debate is brewing when on climate journalism. It is regarding more pronounced advocacy roles of journalists. Advocacy journalism presents news from a distinct point of view, does not separate facts from values, and is motivated often by a political or social agenda.

A 2013 study found environmental journalists in Australia were often perceived by colleagues and editors as advocates. A 2010 study found 26 percent of environment journalists in Greece were advocates and called them 'scientifically objective, environmentally responsible journalists', 'environmental crusaders', or 'objective-pure journalists'. A 2010 study found that more than one in three environmental journalists in the US believed they should, at times, advocate for the environment.

Research also shows that advocacy roles are more pronounced among online journalists. There have been recent examples of legacy media adopting advocacy positions on climate change. For example, *The Guardian's* 'Keep it in the Ground' campaign was aimed at pressuring the Wellcome Trust and the Gates Foundation to stop investing in fossil fuel companies. The campaign revealed divisions among the newspaper's environmental journalists with regard to their role conceptions.

The Guardian appears to be an outlier in terms of its adoption of a specific climate campaign, but other prominent media outlets have followed its example of favouring the terms 'climate emergency' or 'climate crisis' over 'climate change', which might be interpreted as a form of communication advocacy. These include *Der Spiegel* in Germany, *Gazeta Wyborcza* in Poland, the *Canadian Broadcasting Corporation* (CBC), the Spanish news agency *EFE,* and *Noticias Telemundo,* the leading Spanish-language news provider in the United States. Moreover, around 400 media organisations around the world joined the 'Covering Climate Now initiative (www.coveringclimatenow.org) launched in April 2019 to produce more and better climate coverage, prompting warnings that it could become an echo chamber for activism.

The omnipresent climate-sceptic sources

Media sceptics mainly consist of powerful sponsors and vocal front groups and they make up a notable portion of news sources and it has been particularly noted in Anglosphere countries, such as Australia, the US, and the UK. Research shows that between 1988 and 2002, about half of all US press and TV accounts of climate change featured sceptic sources. In the mid-2000s, such sources featured in about a third of all US news articles and a fifth of British articles on climate change. More recent studies show that counter climate

movements of organisations like the Heartland Institute and the Heritage Foundation had strong media presence and enjoyed more popularity after Trump became the US president.

Various studies show that climate sceptics are largely absent from the media in other countries of the Global North and the Global South. One study covering 10 countries' coverage of the IPCC AR5 report of 2013-14 show that the UK had a higher presence of sceptical voices than Japan, France, South Africa, Bangladesh, and Brazil. In general, not enough is known about the (possible) presence of climate-sceptic groups and their influence on journalists in countries outside the Anglosphere.

6. Climate governance in simple terms

There are several national, international, and private structures established to respond to the threats and opportunities of climate change and an umbrella term used to describe it is climate governance. In simple terms, climate finance is the money invested to help countries prevent global warming and adapt to its worse effects.

There are multiple actors involved in climate governance, including governments, development banks, non-governmental organisations and private companies. These actors decide and implement policy related to climate finance.

A country spends most of its climate finance within its geographical boundaries but a significant portion is spent overseas. International climate finance is money pledged by rich, carbon-emitting countries to poorer and more climate vulnerable nations.

Climate finance is normally discussed under three broad topics:

» Adaptation Finance: money to fund projects to adapt to the impacts of climate change. An example could be what the government invests in providing a new high-yielding variety of paddy in paddy-growing areas.

» Mitigation Finance: money to fund projects that limit or mitigate the onset of climate change. It can be understood as projects that would stop or slow down in advance the impacts of climate change. An example could be renewable energy projects, reforestation efforts and other low-carbon initiatives.

» REDD+: It is the money invested in forest protection and reforestation projects, sometimes through carbon trading schemes.

Q1. Climate finance sounds a bit like international aid. Is it a type of aid?

No. The definition of climate finance is enshrined in UN conventions, and it makes a deliberate distinction between aid and climate finance.

There's a very good reason for this. In UN parlance, climate finance must be 'new and additional' to any aid money previously pledged, and must be specifically pledged to climate projects.

Q2. Does climate finance only come from governments?

Climate finance can come from public or private sources. Even though countries are considered responsible for the flow of climate funds, climate finance can come from the private sector, too. You may hear about 'leveraged' climate finance, for instance in which some climate finance from a government gets a project started to the point it becomes economically viable for companies to invest in it as well.

Q3. How much money are we talking about, here?

The UN's target was to 'mobilise' $100 billion a year by 2020. The important word here is 'mobilise', which means that while governments (and international financial institutions, i.e. the climate funds) must take the lead in finding money, it does not say how much of the money must come from government pockets and how much from the private sector.

This $ 100 billion is supposed to flow through a purpose-built organisation called the Green Climate Fund. Two years have passed since the target year 2020 and the target of $100 has still not been achieved with global negotiation stuck for various reasons, including accounting methods. It shows how tricky it can become to save this planet.

Q4. How much is any given country supposed to give?

This is a fraught issue. While governments have agreed to climate finance in principle, there is nothing to dictate how much any government should give or receive.

7. Climate change in Bhutan

As a small mountainous and landlocked country, Bhutan's population and ecosystems stand vulnerable to climate change. Bhutan remains committed to protect the natural environment with constitutional provisions and its global commitments, but it experiences the impacts of global climate change caused by emissions in other countries.

Extreme and unusual weather events have become a common phenomenon. Studies indicate that incremental changes are also likely to unfold. Factors, including income poverty, remoteness from economic activity, schools or hospitals; limited local governance capacity and; little awareness of risks and other markers of disadvantage define an individual's or community's vulnerability to climate change.

Thus, it remains critical for Bhutan to sustain progress and confront the demands of equity. The concept of Gross National Happiness (GNH) and policy directives open avenues to address these concerns useful to tackling climate change risks.

Climate change poses a significant threat to human development and it can also be responded to in ways that usher in advances in private sector development and protect investments. Integrating climate change response with poverty reduction in Bhutan can be a useful strategy. Drawing on social policy lessons from other countries holds further potential

to help protect vulnerable and poor communities and individuals.

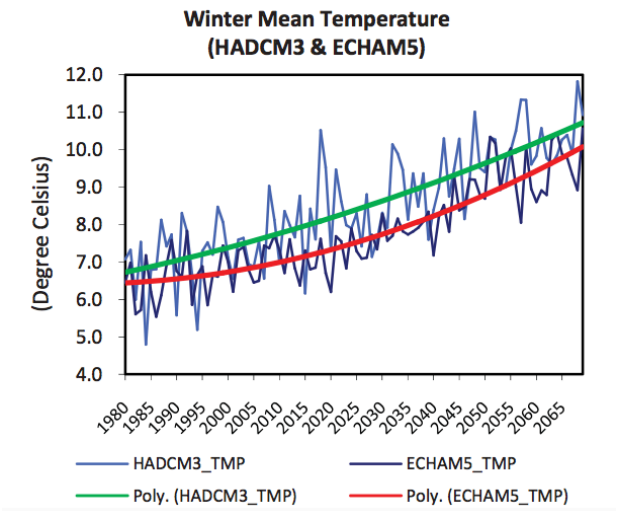
Risks in the shape of climate-related disasters, from water scarcity to glacial lake outburst floods, pose significant challenges to maintaining ecosystems and resources protected for current and future Bhutanese generations. Bhutan's socioeconomic gains and heavily protected environment remain fragile when confronted with rising climate change risk, making adapting to the inevitable effects of a changing climate a necessary national priority. Despite aiming to maintain a net carbon sink status, Bhutan will continue to suffer from the effects of a phenomenon not of its own making.

8. Impacts of climate change in Bhutan

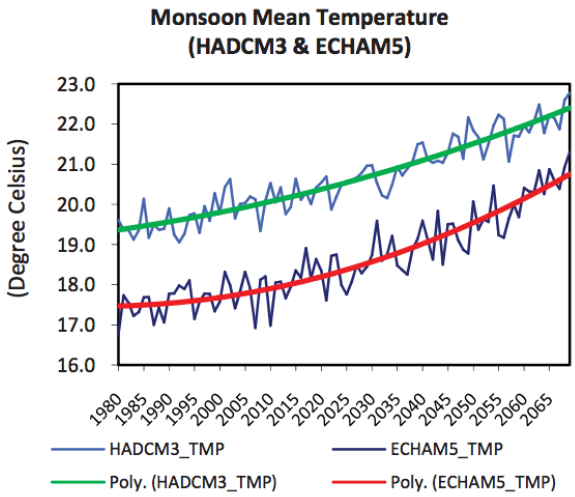
The main impact of climate change is that it will increase the average temperature which will trigger numerous other impacts if adaptation and mitigation measures are not taken. Different regions and altitudes are expected to be impacted differently.

Increase in average temperature

Climate models show a likely increase in Bhutan's annual average temperature by 1°C from 2010 to 2039, and by 2°C from 2040 to 2069. These projected temperature changes vary by season. The monsoon or wet season in Bhutan is estimated to experience a 3°C temperature increase by both climate models reported in Bhutan's draft Second National Communication to the United Nations Framework Convention on Climate Change. Winter and dry season air temperature changes, however, are projected to increase at a greater magnitude between 3.5°C and 4.0°C.



Annual trends of winter-dry mean air temperature from 1980 to 2069 for Bhutan according to the PRECIS downscaled HadCM3Q0 and ECHAM5 scenarios.



Annual trends of monsoonal mean air temperature from 1980 to 2069 for Bhutan according to the PRECIS downscaled HadCM3Q0 and ECHAM5 scenarios

Change in rainfall patterns

Climate models project changes in the amount and seasonality of precipitation, with wetter conditions in the warm monsoon months, and slightly drier conditions in the dry winter months. The change in the amount and seasonality of precipitation will likely affect not only the hydropower and domestic water sector of Bhutan, but also water for irrigation.

Shrinking glaciers

One of the most visible impacts of climate change in Bhutan is the retreat of glaciers, many at higher rates than glaciers in other mountain ranges. The shrinking glaciers would result in the formation of more glacial lakes and the existing lakes could be pushed beyond their carrying capacity, causing floods down streams and posing direct risks to people.

The permanent snow line has moved significantly higher, although the observations are too few to be able to quantify the actual loss of snow cover in the region. Continued deglaciation could have a profound impact on the water in the 10 large river basins originating in the Hindu Kush Himalayan region. River discharges are likely to increase for some time due to accelerated melting, but the flow is then likely to be lower as the storage capacity of the glaciers goes down. The effects are likely to be felt most severely in parts of the region, which are already dry.

Glacial lake outburst floods (GLOF)

Glacial lakes have formed in many places in the area left at the foot of retreating valley glaciers. An inventory compiled by the International Centre for Integrated Mountain Development (ICIMOD) identified 8,790 glacial lakes within selected parts of the Hindu Kush-Himalayas.

The October 1994 glacier lake outburst flood in Bhutan underscores the nature of the risk. Occurring 90 km upstream from Punakha Dzong, the outburst flood from Lugge Tsho led to massive flooding of the Pho Chu River, damaging the Dzongchung and causing casualties.

With the emerging risk of glacial lake outburst floods from Thorthormi and Raphstreng Tsho, a National Adaptation Programme of Action project is underway to artificially lower the water level of Thorthormi Tsho.

Punakha (GOLF flod in 1994)

Flash floods and landslides

Bhutan is prone to flash floods, especially in the eastern and southern foothill regions, due to the steep terrain and fragile geology. Flash floods have become more frequent and intensified in the last decade due to increasing of rainfall, and untimely start and end of monsoons. Landslides are a recurring phenomenon in Bhutan and closely linked with flooding events.

In May 2009, cyclone Aila, originating in the Bay of Bengal, resulted in incessant rainfall causing one of the worst disasters in Bhutan. Record breaking rainfall, measuring up to 76 mm over a 24-hour period, was recorded as one of the highest in recent years, according to the Thimphu Meteorology Department (UNDP 2009-2011).

Subsequently, the rainfall also led to swelling of rivers and streams to dangerous levels. These rivers and streams were never recorded to have such volumes of water in the past 40 years. In fact, river-gauging stations in the Punatsangchu show that the water flow in the river during cyclone Aila exceeded the water flows during the 1994 GLOF.

In 2010, landslides and flash floods damaged more than 2,000 acres of agriculture land, affecting some 4,165 households across 20 *dzongkhags*, and damaged farm roads and irrigation channels, affecting 529 households (DoA, MoAF 2010).

Based on the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) 2007, tropical cyclones will become more intense, with larger peak wind speeds and heavier precipitation.

Windstorms

Windstorms have been recorded in the national newspaper, *Kuensel,* as early as 1994, and incidents of windstorms have been recorded every year. However, the severity and frequency of windstorms in Bhutan have increased over the past few years, especially in the pre-monsoon season.

In April 2008, windstorms damaged 249 rural houses in lower Trashigang. Lumang *gewog* was the worst hit, with 148 households affected; followed by 41 in Kangpara, 39 in Khaling, 21 in Thrimshing, and one each in Sakteng and Shongphu. Eight school buildings, four *lhakhangs* and one forest office were also damaged by the windstorm (*Kuensel,* April 2008).

In recent years, farmers have had to deal with increasing frequency of hail and windstorms. In 2010 alone, more than 5,000 acres of agriculture crops were affected by hail and windstorms, damaging a wide range of staple crops, such as maize, rice, potato, chilli, buckwheat and others (Project profile, DOA, MoAF April 2011). Windstorms damaged 432 houses in 2010 (DDM, MoHCA 2010).

Droughts

Bhutan has been experiencing extreme variations in its climate and weather patterns. Although evidential data and information are limited, there are cases where individual municipalities or agencies have made observations on selected sites. The winters of 2005 and 2006 were unusually dry with no rain and snow (NDRMF 2006).

The majority of Bhutan's population depends on subsistence farming, for which timely precipitation is necessary. Drought and erratic rainfall make the Bhutanese communities, especially the rural population, highly vulnerable to impacts of extreme weather patterns. Drought also increases the chances of forest fires as forests remain largely dry.

Land degradation and soil erosion

Bhutan has a geologically fragile mountainous ecosystem with rugged and steep terrain, which makes it prone to different forms of land degradation and soil erosion. Land degradation is a serious threat to Bhutan, as there are limited resources of productive land due to the topography and altitude of the country, as expressed in the National Environment Strategy (NEC 1998) and the Bhutan Vision 2020 document. Widespread forms of both in-situ and physical land degradation are reported in the country.

Some of the physical forms of land degradation are topsoil capping, sheet erosion, rill erosion, gullies, mass wasting of soils and landslip.

It is also estimated that 8.6 metric tonnes (MT) of soil per hectare (or 3.48MT/acre) is lost to erosion, especially during the rainy season in traditional farming practices (DoA, 2010).

Landslides on highways, agricultural land and other infrastructure, that cause economic loss and risk to human lives are a constant and major concern in Bhutan. However, extreme rainfall episodes exacerbate the situation.

Depleting springs

Springs, one of the major sources of water for human need and livelihood in Bhutan, are reportedly depleting. Such incidents are increasing, especially during the longer dry season, posing threat to people's livelihood and the rural economy.

Because of the seasonal dry winters and more frequent incidences of springs drying up, water shortages have been reported in most places in eastern and southern regions of Bhutan. This is happening in spite of the fact that Bhutan has one of the highest per capita availability of 109,000 cubic metres of water in the region.

The poor communities have been the most vulnerable to this impact of climate change. They confront challenges when it comes to access to safe drinking water and water for irrigation. Farms are left fallow and some farmers have migrated to urban areas looking for better opportunities, thus eventually lowering food production and driving the poor communities into harsher situations.

Pests and diseases

Global warming increases the spread of pests and diseases in areas where they never existed before. Bhutan has also experienced outbreak of pests and diseases, which are related to change in climatic conditions.

Bhutan also suffers from high rates of a series of climate-sensitive health burdens. Climate factors increase incidence of vector-borne diseases, particularly malaria and dengue, which have become major public health problems in countries like Bhutan (NEC 2011).

The induced spread of infectious diseases due to changing environmental conditions are projected to increase the incidences of vector-borne diseases as they move to higher

altitudes due to warming. Increasing temperatures are also complicating control of vector-borne diseases in Bhutan.

Climatic factors, such as temperature, rainfall, humidity, and anomalous weather events, have a direct influence on malaria transmission by either hindering or enhancing vector and parasite development and survival.

Dengue is a significant emerging infectious disease in Bhutan. Dengue was first documented in Bhutan in 2004 and is now endemic during the monsoon season (MoH 2010).

Bhutan's mountainous topography is highly vulnerable

Bhutan's larger regional and topographical context will shape the extent to which climate change affect the country. Mountainous regions are particularly vulnerable, both because warming trends are often higher, and because impacts are magnified by the extreme changes in altitude over small distances. The Himalayan mountain range – known as the rooftop of the world – is especially likely to experience acute climate changes.

Life in the Hindu Kush-Himalayan region relies on monsoon systems, and it may be altered by climate change. Shifts in cropping seasons and, likelihood of extreme weather events increase as a result. Shifts of crop habitat to higher altitudes constraining the agricultural space and adaptive capacity of the societies is another anticipated impact specific to mountain ecosystems. Locally, people's ability to adapt will be challenged. But changes in Bhutan and the Himalayas also have direct impacts on the broader region, affecting the lives and livelihoods of 1.3 billion people living in the river basins downstream.

9. Bhutan's climate change commitments

The Paris Agreement requests each country to outline and communicate their post-2020 climate actions, known as the Nationally determined contributions (NDCs). It constitutes efforts by each country to reduce national emissions and adapt to the impacts of climate change. The Paris Agreement (Article 4, paragraph 2) requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs) that it intends to achieve.

Bhutan's climate commitments are outlined in the Second Nationally Determined Contributions published in June 2021. Through the second NDC, Bhutan reiterated its commitment to remain carbon neutral for all times to come. It means Bhutan's emission of greenhouse gases will not exceed carbon sequestration by its forests and sinks. Bhutan first made the carbon neutral commitment at the Conference of Parties 15 (COP15) in Copenhagen in 2009.

The NDC 2021 outlines mitigation commitments and does not include adaptation commitments which are expected to be outlined in the National Adaptation Plan (NAP).

The major mitigation commitments are outlined below:

Commitments to conserve and manage forests

Bhutan has established the national REDD+ framework and produced the National REDD+ Strategy (NRS) which outlines four strategy options towards forest conservation and management. The four strategies are:

i. Strengthening Forest Management Practices
ii. Climate-smart Primary Production
iii. Integrated Land Use Planning
iv. Improved Rural Livelihoods

The government forecasts that implementing the NRS will require approximately USD 54.5 million. Among the activities and interventions within the four strategy options, the following targets until 2030 are highlighted.

	Actions	*Targets*
1	Improve forest management and conservation	Maintain 436 million tonnes of forest carbon stock outside protected area system
2	Maintain at least 50% of land area under protected area	Maintain 201 million tonnes of forest carbon stock in protected area 51.44% of Land area and 31% of forest area
3	Enhancement of forest carbon stock through climate smart restoration	2000 ha of plantation and restoration work
4	Initiate and promote agro-forestry (12FYP)	15 acres
5	Conservation of wetlands (SRF Land)	Conduct wetland assessment for understanding organic carbon content

Commitments to food security

Emission from agriculture and livestock constitutes 14.5 percent of national emissions. The Low Emission Development Strategy (LEDS) for food security identifies six mitigation actions aimed at reducing emissions and increasing carbon sequestration. The prioritised mitigation measures and targets until 2030 have cumulative mitigation potential of up to 710 Gg CO2e and is expected to cost US$ 61.65 million.

The six mitigation actions are:

	Mitigation Measures	*Targets*
1	Switch from synthetic to organic fertilisers	5% annually
2	Improved agricultural practices	14,971 ha
3	Increased biomass through increased perennial crop production	17,495 ha
4	Small and medium scale domestic biogas production	10,254nos

5	Reduction of continuous rice flooding	200 ha/year
6	Improved dairy cattle production through breed improvement and feeding management	8,333 nos

Commitments to human settlement

With rapid urbanisation, lowering emissions in the human settlement sector looked at activities like energy in buildings, transport, infrastructure, waste management, land-use in urban areas, and information communication and technology. To improve the human settlement sector in the short-term and medium-term between 2020-2030, the government outlines eight strategies which will lead to a cumulative mitigation of 4,122 Gg CO2e and it would require an investment of US$ 101.84 million to achieve it.

The eight strategies include:

i. Rollout of solar PV on buildings
ii. Replacement of LPG and firewood by electricity
iii. Increase in composting and recycling
iv. Energy efficient and green building design
v. Efficient street lighting
vi. Wastewater management
vii. Rollout of energy efficient appliances
viii. Solar water heaters

Commitment for Industries

The greenhouse gas emission from the industry sector is projected to grow by almost a factor of three by 2035 under a business-as-usual scenario. The government's strategy is to identify opportunities for mitigation through technical measures and diversification of the sector away from heavy industries to promote industries with higher value-addition and manufacturing products with cross-cutting benefits in other sectors.

It recommends the establishment of a revolving fund mechanism, green loans, concessional financing, establishing a cleaner production centre (to be managed by the Association of Bhutanese Industries), technology transfer, and capacity building to realise the mitigation potentials.

Commitment to better surface transport

Transport emissions are projected to increase by a factor of three by 2050 compared to 2020 levels under the business-as-usual scenario. Major expenditures in the transport sector are in the areas of infrastructure development to introduce low emission transport modes. Identified activities are dated across the short-term (2021-2025), medium-term (until 2030) and long-term (until 2050).

Major strategies include:

i. Mass transit through improvements in bus systems and the introduction of open-bus rapid transit (BRT) network (electric and diesel) and light rail transit.

ii. Promotion of electric passenger vehicles (taxi, two wheelers, light vehicles, buses).

iii. Low emission freight transport system for heavy and commercial trucks and freight trains.

iv. Non-motorised transport system through public bicycle systems and improved sidewalks, crosswalks.

v. Improve fuel-efficiency in internal combustion engines through stringent vehicle and emission standards.

vi. Private vehicle demand management through shared mobility, traffic system management, carpooling, ride sharing and rental services, import restriction on internal combustion engine cars from 2030 and introducing an annual import quota system.

Commitments to waste management

The government has set an ambitious commitment to set the goal to achieve Zero Waste Bhutan whereby the current trend of disposing over 80% to the landfill is brought down to less than 20% by the year 2030 based on the principles of circular economy.

Commitment to develop sustainable hydropower

Clean hydropower will prove crucial to lower the emission levels and maintain the carbon neutral status of the country. The government believes that further development of hydropower projects will mitigate emissions beyond Bhutan.

Future development of hydropower will be as per the revised Sustainable Hydropower. Policy 2021 and enhances climate resilience through reservoir/pumped storage schemes to ensure energy and water security.

Currently, hydropower projects expected to be commissioned before 2030 include Punatsangchu-I (1,200MW), Punatsangchu-II (1,020MW), and Nikachu (118MW) hydroelectric projects (HEP) with uncertainties surrounding the Kholongchu (600MW) project. In addition, the Sunkosh HEP (2,585 MW), Dorjilung HEP (1,125 MW) and Nyera Amari (404MW) have been identified as priority projects.

Commitments to alternative renewable energy

An alternative renewable energy programme consisting of mini hydro, solar, wind and waste-to-energy technologies will be pursued as a priority programme with the aim of reducing deforestation in rural communities and diversifying the energy portfolio as adaptation measures to changing water flows, particularly in the dry seasons.

Medium-term targets from 2020-2028 include:

i. 71.11 MW of utility scale solar and wind energy (17.38 MW solar in Sephu, 30.73 MW solar in Shingkhar and 23 MW wind in Gaselo).

ii. Alternative renewable energy project to install roof-mounted solar PV on 300 rural households. The regulatory policies and tariff structure for solar feed-in tariff will be prepared.

iii. An 80-kW decentralised solar PV plant shall be developed to provide reliable and sustainable electricity supply to the Aja Ney community which is inside the Bumdeling Wildlife Sanctuary.

iv. More than 50 Solar Water Heating Systems (SWHS) of 1,000 litres per day (LPD) capacity shall be installed in various public institutions like schools, monasteries, hospitals etc.

v. The remote Lunana community will be provided with a 500-kW mini-hydel to meet the energy demands of the community.

vi. The feasibility of a waste to energy plant of utility scale in Thimphu will be undertaken and implemented to convert the organic waste to energy and reduce landfill emissions.

Commitment to green hydrogen roadmap

In line with the Sustainable Hydropower Policy 2021, the potential for the use of hydrogen created from green renewable electricity in Bhutan will be pursued. Towards this end, a study has been initiated with the objective of exploring production of hydrogen fuel, green ammonia, and other hydrogen products for the end-uses of energy storage and substitute fossil fuel usage.

SECTION II

MEDIA TOOLKIT FOR BHUTANESE JOURNALISTS

10. Climatejournalists give hope for a better world

Climate change is probably the biggest story of this generation because it impacts everyone irrespective of whether nations contribute to carbon emission. Nobody is spared. The earth is heating up and this warming of the globe is changing everything inside the planet and gradually dragging the earth towards its doom.

In this light, climate journalism fulfils a unique and significant role in covering climate change. The coverage includes latest environmental predictions, climate summits and conventions, latest discoveries and findings, all of which contribute to debate and understanding on the subject among the masses. Serving as critical watch dogs, climate journalists, together with scientists and activists, play a vital role in raising awareness, advocate for solutions and in finding solutions to overcome the climate crisis.

A multi-dimensional approach is needed to fight the climate crisis. Limiting global temperature rise at 1.5°C is the first step towards sustaining life on earth. This can only be achieved through collective work of non-governmental organisations (NGOs), the wider public, business, industry, and governments. A crucial component of this collective work is imparting scientific discoveries to all these parties and delivering them accurately, responsibly, and in an easily understandable form.

Climate science is a relatively new branch of science and many terminologies used are open to misunderstandings. It is here that journalists play the vital role of preventing and clearing misunderstandings and addressing the spread of misinformation and disinformation.

An ideal example of the consequence of not having committed, high-quality climate journalism is of ExxonMobile. The oil giant discovered the relationship between fossil fuels and climate change nearly half a century ago but they hid the information and robbed humanity of a generation's worth of time to reverse climate change for the continuity of cash flow and short-term profit.

In this age, accessing credible information and critical coverage of topics of public interest is of crucial importance. Having united journalists, scientists, and activists, climate journalism carries the duty to communicate the verified, impartial, and accurate messages of public importance with regard to climate change and climate crisis. Thus, climate journalism plays a vital role in shaping the public discourse on the climate crisis in a responsible manner, enabling the people to act and shape the green and sustainable future that they want for themselves, their children, and the future of life.

Media organisations' pioneering initiatives

In 2019, the British newspaper, *The Guardian,* changed its style guide to include more 'accurate' and 'scientifically precise' terms to describe the environmental crisis facing the

world. The newspaper chose 'climate crisis' or 'climate emergency' over climate change and 'global heating' instead of global warming.

Talking about it, the editor-in-chief, Katharine Viner, said, 'The phrase "climate change", for example, sounds rather passive and gentle when what scientists are talking about is a catastrophe for humanity,' and added, 'People need reminding that the climate crisis is no longer a future problem – we need to tackle it now, and every day matters.'

In 2019, the *Columbia Journalism Review* and the *Nation* founded an initiative called the *Covering Climate Now* (https://coveringclimatenow.org/) with the *Guardian* as the lead partner to address the urgent need for stronger climate coverage. More than 400 newsrooms from around the world – with a combined audience nearing 2 billion people – have joined Covering Climate Now.

Today, Covering Climate Now is the world's largest media collaborative that helps newsrooms tell stories related to climate change. It has today become a platform for journalists and newsrooms to demonstrate leadership among their peers and to show that they are committed to telling climate stories with rigour, focus and urgency it deserves. As members, journalists join a supportive community in which they can expand their reporting opportunities, collaborate with fellow journalists, and forge a path towards an all-newsroom approach to climate reporting.

Bhutanese journalists covering, or interested to cover, climate stories could open new doors by joining such global initiatives.

11. Tips for climatejournalists

If a journalist googles for tips to cover climate stories, he/she could be overwhelmed with tips of all manifestations, from personal experiences to professional cues. It would be futile to suggest a thumb rule or a set of rules to become an effective climate journalist because it will only come with experience and knowing the subject – as is the case in all areas of journalism. But there are pointers that climate journalists could benefit from.

Here are ten tips offered by *Covering Climate Now* to climate journalists (tweaked for Bhutanese journalists):

Say 'yes' to the science

There cannot be two sides to a fact. Science has undeniably proven climate change and its impacts are disastrous for the world. Journalists must write about climate change with the same clarity of scientists who have been sounding the alarms for decades. Journalists should be careful to provide space to climate sceptics in an effort to 'balance' their stories because it not only misleads the public but is also inaccurate.

The climate story is a story for every beat

There is a misconception among journalists that climate change is an environmental story and it is particularly true for Bhutanese journalists. But climate change is a global story touching every beat and every aspect of human life. Climate angles exist in every beat whether you cover business, health, housing, education, food, national security, entertainment or any other subject. Journalists should also prioritise the coverage of the human side of the climate story.

Give voice to the poor and vulnerable communities

Environmental justice is key to the climate story. The poor and vulnerable communities are the first to suffer and worst affected by climate impacts. But their voices and stories are too often omitted from new coverage. Good climate reporting should highlight the travails of these people and recognise them as leading innovators at the forefront of the climate fight.

Transcend the political angle of the story

When issues take a political spin, be astute to find the real story and move beyond the political dogfight. By foregrounding partisanship in covering climate change, there is a risk of losing the audience who are dismayed with political divides.

Avoid 'doom-and-gloom' stories and angles

Journalists must understand the epochal consequences of climate change. But focusing too much on negative angles will create a readers' fatigue and people will feel hopeless and overwhelmed and would just want to avoid, deny and tune out. For every climate disaster, there are also people pioneering solutions and changing peoples' lives. Journalists can play a big role in showing that climate change is not a problem too big to understand – or to tackle.

Avoid jargon but K.I.S.S.

Your target audience is not scientists or fellow climate journalists. So, make it a habit to avoid jargon and K.I.S.S. every sentence and *Keep It Short and Simple.* Always assume that your audience is people without any climate knowledge and always avoid clustering technical terms and simplify information for your audience.

Beware of 'greenwashing'

Companies and big players around the world are waking up to public demands for eco-conscious business practices. Pledges to 'go green', however, often amount to little more than marketing campaigns that obscure unmitigated carbon footprints. Journalists should be careful of such attempts and cast a sceptical eye on grand promises of net-zero or carbon-negative emissions.

Extreme weather stories are climate stories

Incidents like incessant rainfall, floods, landslides, and record heat waves so often make it to the news. They are not all due to climate change. But it has to be understood that the increased frequency and intensity of such extreme weather certainly is. Yet much news coverage makes little to no mention of the climate connection, leaving audiences without context and unaware that humanity is already experiencing climate disruption. Journalists can play a big role in educating audiences.

Challenge the belief that climate stories don't sell

Newsrooms are often reluctant to cover climate stories citing readers' fatigue. But recent studies show that there is increasing appetite, particularly among the younger generation, for climate stories. Therefore, creative climate coverage is the future.

Recognise and avoid climate denialists

Climate science has been proven to be undeniable. Climate change is real. But there still exist climate denialists around the world spreading words of denial and promoting their surreptitious agendas. Journalists should be careful of such people and organisations and avoid giving them voices.

12. Dos and don'ts for climatejournalists

The Do's	The Don'ts
· Be mindful of clearly portraying the scale of the impact of climate change as it could be beyond ordinary people's understanding. Show how people like farmers are affected and bring their voice to the story. Always put a human face to the story as it adds a personal touch. · Be mindful when you provide numbers and put the story in perspectives so that people can relate to it. For example, if a windstorm costs the government Nu 10 billion, explain how many new schools or hospitals the money could have built. · Ensure that you understand a concept/topic before you write about it. If you have problems, consult a subject expert. · Teaming up with other journalists is a good way to share subject expertise, particularly on complicated topics, and double check facts. · Humanise your stories. People relate to the stories better if it is relevant to their health, wealth and children's future. · Consider starting a conversation by posting your stories on Facebook, Twitter, or Instagram. This can start a string of feedback and views from your readers, listeners or viewers. It will also help build your credibility in the subject area. · Provide practical suggestions on how people can get involved, call for change, or find out more about the issue in question. · Always think visually. Print journalists should use photos, infographics and visuals. Even radio journalists should think about painting visuals through words.	· Do not underestimate the audience. It is a common mistake to think that the audience does not know simply because they are ill-informed or less-informed. · Do not overestimate the audience. This is another common mistake. Don't assume that the audience knows everything. It leads a journalist to use jargons and not explain concepts, which has the potential to end up with a poor story. · Do not attribute everything to climate change. This is one of the most common mistakes climate journalists around the world make. Check your facts. · Do not lose the big picture of the story. Normally, one story has one big takeaway message. If one tries to tell everything in one story, it could only confuse the audience. Don't get overwhelmed by getting into the minutest of details. · Do not use jargon and technical language. Use simple language for ordinary people to understand. · Do not believe everything you hear. Double-check the science behind it and understand the agenda of those spreading or sharing the information with you. · Do not think that climate change is only an environmental story. This is what most people think. As a climate journalist, you are on the venture to 'show and not tell' that climate change includes almost all the beats a journalist can think of. · Do not take government reports as the bible in telling a story. Always get the voices from the ground to double check.

13. Finding climate stories in Bhutan

There is no set of golden rules on locating climate stories. But the following five tips offer an insight into how Bhutanese journalists could locate and find climate stories. The tips could also be followed to become an effective climate change journalist.

Stay informed – subscribe to news of your beat or interest areas

Bhutanese journalists juggle with their beats every day because they are expected to cover stories of all beats and their performance is tied to the number of stories they produce. This gives all the more reason to stay informed and know your beat. Subscribing to news related to your beat and interest areas is crucial to stay informed. This simple step will work wonders.

Follow international developments and narrow down to Bhutan angle

Journalists in Bhutan often complain about the lack of climate stories. Climate coverage is mostly dependent on climate workshops, conferences, and the release of official reports. It falls on each climate journalist to broaden their coverage beyond the official meetings and publications. An easy way to do it is to follow international developments, particularly the United Nation Framework Convention on Climate Change (UNFCCC) and other climate stakeholders, and narrow down the angle to Bhutan.

Keep track of websites of all stakeholders (both local and international)

Keeping track of websites of important climate organisations, both local and international, will give you a lot of new stories as well as follow-ups. While there are only a handful of local organisations in Bhutan, there are numerous global organisations studying climate change and related issues. An important organisation is the Intergovernmental Panel on Climate Change (IPCC) which is an intergovernmental body of the United Nations responsible for advancing knowledge on human-induced climate change. Keeping track of their websites will give a journalist a wide array of story ideas to choose from.

Maintain a calendar of upcoming stories and follow-ups

Maintaining a story calendar could prove to be the difference between a professional and effective journalist and an average one. Bhutanese journalists have often been blamed for not doing proper follow-up stories. Maintaining a story and follow-up calendar would be crucial to ensure that you don't miss out on critical stories. Journalists always hates to bang their head upon the realisation that a colleague has covered a story before them. The calendar could also be used to keep a tab on major international events and/or reports and/or commitments.

Build your contacts, join networks

Building contacts is a second nature of a journalist. A journalist is only as good as his/her contacts. Moreover, Bhutanese journalists often complain about the lack of local climate or environmental experts to quote in their stories. The good news is that many organisations worldwide have experts just to help the media. There are also networks meant only to help journalists. Bhutanese journalists could easily use such expertise and keep them in their contacts and join the international networks.

SECTION III

DIRECTORY OF RESOURCES

14. Environmental organisations in Bhutan

The department of Environment & Climate Change will function as the Secretariat to the NEC

The National Environment Commission is a high-level autonomous agency of the Bhutanese government which looks after all environmental issues in the country. It monitors the impact of development on the environment and puts in place the necessary legislation and regulations to achieve sustainable development through the judicious use of natural resources.

Department of Forests and Park Services (DoFPS)

Under the Ministry of Energy and Natural Resources, the Department of Forests and Park Services works to conserve, protect and sustainably manage forests, water resources and biodiversity through insightful application of good science and science-based management practices. It is responsible for ensuring the constitutional provision to keep 60 percent of the nation's land area under forest cover for all times to come.

Bhutan Trust Fund for Environmental Conservation

The Bhutan Trust Fund for Environmental Conservation (BTF) is the world's first environmental trust fund, established in 1991 as a collaborative venture between the Royal Government of Bhutan, United Nations Development Programme, and World Wildlife Fund. An endowment of US$ 20 million was set as target for an innovative mechanism for sustainable financing of conservation programmes in Bhutan. Donors to the trust fund include the World Wildlife Fund, Global Environment Facility, the governments of Bhutan, Denmark, Finland, the Netherlands, Norway and Switzerland. BTF was incorporated under the Royal Charter in May 1996, which was revised in 2021, 'keeping the present needs and ensure relevance and role of BTF to meet the future challenges'.

WWF Bhutan Programme

World Wildlife Fund (WWF) is Bhutan's oldest conservation partner. Beginning in 1977 by supporting capacity development of local conservation staff, the support gradually evolved into a full country programme with several collaborative conservation projects. WWF Bhutan has been supporting the royal government and people of Bhutan in a number of conservation efforts to protect and conserve Bhutan's natural capital and the immense biological diversity.

Royal Society for Protection of Nature (RSPN)

The RSPN is a citizen-based non-profit, non-governmental environmental organisation in Bhutan that supports environment conservation. It envisions becoming the leader in conservation, ensuring that future generations of Bhutan live in an environmentally sustainable society. The RSPN was established in 1987 and it has evolved as a complementary partner to the government in the preservation of Bhutan's rich natural heritage. It is registered as a Civil Society Organisation and is governed by six international and national advisory committees.

The Ugyen Wangchuck Institute for Conservation and Environment (UWICE)

The UWICE is a government-based research and training institute. It strives to foster better stewardship of the nation's natural heritage through rigorous research and transmission of cutting-edge science results to field practitioners, environmental leaders and policy makers.

Bhutan Foundation

Since its founding in 1986 and re-launch in 2002, the Bhutan Foundation has become an active organisation with offices in Thimphu, Bhutan, and Washington, DC as well as around 40 partner organisations in Bhutan and more than 20 international partners. Through its commitment to the shared values of Gross National Happiness, the Bhutan Foundation supports conservation efforts.

Bhutan Ecological Society

The Bhutan Ecological Society is a non-profit organisation that connects science, business, and policy with the goal of building and sustaining resilient communities and functional landscapes. Leveraging the power of enterprises, the BES aims to create and sustain functional physical environments that provide for human needs and foster prosperity while ensuring the integrity of ecosystems.

15. Learning platforms and media networks

Climate Funds Update

Climate Funds Update is an independent website (https://climatefundsupdate.org) providing information and data on the growing number of multilateral climate finance initiatives designed to help developing countries address the challenges of climate change. These multilateral climate funds play an important role in supporting countries to adopt low-emission, climate-resilient development trajectories. They have a role in capacity building, research, piloting and demonstrating new approaches and technologies, and removing barriers to other climate finance flows. The multilateral climate funds also hold critical political significance, reflecting an acknowledgement by developed countries for historical greenhouse gas emissions and in line with the commitments made by developed countries under the UNFCCC to support developing countries mitigate and adapt to climate change.

Climate Action Tracker

The Climate Action Tracker (https://climateactiontracker.org) is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement aim of 'holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C'. A collaboration of two organisations, Climate Analytics and NewClimate Institute, the CAT has been providing this independent analysis to policymakers since 2009. CAT quantifies and evaluates climate change mitigation targets, policies and action. It also aggregates country action to the global level, determining likely temperature increases during the 21st century using the *MAGICC climate model.* CAT further develops sectoral analysis to illustrate required pathways for meeting the global temperature goals.

Poynter. News University

The Poynter Institute's News University (https://www.poynter.org/newsu) is an online journalism training programme with more than 150 free low-cost courses such as 'Covering Water Quality: What You Need to Know' and similar other courses. For more information, see the NewsU.org website.

SciDev.Net

Sci.Dev.Net is one of the world's leading sources of reliable and authoritative news, views and analysis about science and technology for global development. Its mission is to use independent journalism to help individuals and organisations apply science to decision-making in order to drive equitable, sustainable development and poverty reduction. SciDev.Net is part of CAB International (CABI), a not-for-profit organisation that improves people's lives worldwide by providing information and applying scientific expertise to solve problems in agriculture and the environment.

Youtube Reporters' Center

The Youtube Reporters' Center features top journalists and news organisations sharing instructional videos with tips and advice for better reporting. It includes videos on topics such as how to conduct good interviews and how to find good sources of information.

World Federation of Science Journalists

The World Federation of Science Journalists offers the 'world's first online course in science journalism'. It is a not-for-profit, non-governmental organisation representing 67 science journalists' associations and 10,000 individual science and technology journalists from around the world. The WFSJ encourages strong, critical coverage of issues in science and technology, the environment, health and medicine, agriculture, and related fields. WFSJ members are national, regional, and international associations that represent science journalists, broadcasters, writers, editors, and communicators working across all media platforms. To become a member of the WFSJ, an association applies and is accepted in accordance with the WFSJ bylaws. Applications for membership are reviewed and decided upon by the WFSJ Board.

Society of Environmental Journalists

The Society of Environmental Journalists offers unique educational programmes and services primarily for professional journalists, educators and students, including annual and regional conferences, tours, meet-ups and training events; daily EJT headlines and summaries, with supporting links; Twitter feed from @SEJorg; weekly SEJournal, TipSheet and other publications; Freedom of Information WatchDog project; SEJ Awards for Reporting on the Environment; mini grants through the Fund for Environmental Journalism; members-only listservs; mentoring program; website-based resources; and a lively membership network of journalists and academics.

Earth Journalism Network

Earth Journalism Network (EJN) was started in 2004 to enable journalists from developing countries to cover the environment more effectively. It is a global network working with reporters and media outlets in virtually every region of the world. It aims to improve the quantity and quality of environmental reporting. EJN trains journalists to cover a wide variety of issues, develops innovative online environmental news sites and produces content for local media – including ground-breaking investigative reports. EJN also establishes networks of environmental journalists in countries where they don't exist and builds their capacity where they do. It does so through workshops and the development of training materials and by offering fellowship programmes, grants to media organisations, story stipends, and support for story production and distribution.

International Journalists Network

IJNet works to deliver the latest on global media innovation, news apps and tools, training opportunities and expert advice for professional and emerging journalists worldwide. Produced by the International Centre for Journalists, IJNet follows the shifting journalism scene from a global perspective in eight languages – Arabic, Chinese, English, French, Persian, Portuguese, Russian and Spanish.

Reuters AlertNet and Thomson Reuters Foundation

The Reuters AlertNet online training module aims to help journalists in the developing world cover climate change. The free 45-minute course gives an overview of some of the pitfalls journalists may face, as well as suggests story ideas. There are several opportunities for journalists offered by the Thomson Reuters Foundation.

Climate News Network

The Climate News Network is a free, ready-to-use factual service that brings the latest news of climate change science. This network helps both scientists and journalists to overcome the difficulties they face in reporting the vital facts about climate change. They offer science an unbiased window to the world, while for journalists they offer news stories about climate change where the implications are spelt out explicitly and authoritatively as context and comment.

The Journalist's Resource

The Journalist's Resource works to provide journalists with a way to get up to speed on academic studies about complex problems and their potential solutions. Its mission is to inform the news by bridging the communication gap between academia and journalism and the goal is to get more high-quality information into the media stream. Everything it offers is free of charge. It publish written materials under a Creative Commons licence so anyone anywhere can use and share them at no cost, provided that appropriate credit is given. In their second decade, they have become an invaluable source of support, information and content for thousands of journalists worldwide.

IISD Climate-L Newsletter

The SDG Update compiles news, commentary and upcoming events that are published on the SDG Knowledge Hub, delivering information on the implementation of the 2030 Agenda for sustainable development. Climate-L is a news and announcement listserv that focuses on climate change policy and issues. Postings include announcements of workshops and conferences, job listings, and information on new publications and online resources.

Climate and Development Knowledge Network (CDKN)

The CDKN collaborates with decision-makers nationally, regionally and globally in support of locally owned and managed policy processes. It does so by combining knowledge, research and advisory services in support of locally owned and managed policy processes. The network works in partnership with decision-makers in the public, private and non-government sectors, nationally, regionally and globally. The English language site features projects in the 70+ countries where it has worked, and resources and blogs from those and more. The CDKN works to enhance the quality of life for people most vulnerable to climate change.

16. Glossary of climate change terms

Adaptation
Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.

Adaptive Capacity
The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Aerosols
Small particles or liquid droplets in the atmosphere that can absorb or reflect sunlight depending on their composition.

Afforestation
Planting of new forests on lands that historically have not contained forests.

Annex I Countries/Parties
A group of countries included in Annex I (as amended in 1998) to the United Nations Framework Convention on Climate Change, including all the developed countries in the Organisation of Economic Co-operation and Development, and economies in transition. By default, the other countries are referred to as Non-Annex I countries. Under Articles 4.2 (a) and 4.2 (b) of the Convention, Annex I countries commit themselves specifically to the aim of returning individually or jointly to their 1990 levels of greenhouse gas emissions by the year 2000.

Anthropogenic
Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities.

Biofuels
Gas or liquid fuel made from plant material. Includes wood, wood waste, wood liquors, peat, railroad ties, wood sludge, spent sulfite liquors, agricultural waste, straw, tires, fish oils, tall oil, sludge waste, waste alcohol, municipal solid waste, landfill gases, other waste, and ethanol blended into motor gasoline.

Biomass
Materials that are biological in origin, including organic material (both living and dead) from above and below ground, for example, trees, crops, grasses, tree litter, roots, and animals and animal waste.

Biosphere
The part of the Earth system comprising all ecosystems and living organisms, in the atmosphere, on land (terrestrial biosphere) or in the oceans (marine biosphere), including derived dead organic matter, such as litter, soil organic matter and oceanic detritus.

Black Carbon Aerosol
Black carbon (BC) is the most strongly light-absorbing component of particulate matter (PM), and is formed by the incomplete combustion of fossil fuels, biofuels, and biomass. It is emitted directly into the atmosphere in the form of fine particles ($PM_{2.5}$).

Borehole
Any exploratory hole drilled into the Earth or ice to gather geophysical data. Climate researchers often take ice core samples, a type of borehole, to predict atmospheric composition in earlier years.

Carbon Cycle
All parts (reservoirs) and fluxes of carbon. The cycle is usually thought of as four main reservoirs of carbon interconnected by pathways of exchange. The reservoirs are the atmosphere, terrestrial biosphere (usually includes freshwater systems), oceans, and sediments (includes fossil fuels). The annual movements of carbon, the carbon exchanges between reservoirs, occur because of various chemical, physical, geological, and biological processes. The ocean contains the largest pool of carbon near the surface of the Earth, but most of that pool is not involved with rapid exchange with the atmosphere.

Carbon Dioxide Fertilisation
The enhancement of the growth of plants as a result of increased atmospheric CO_2 concentration. Depending on their mechanism of photosynthesis, certain types of plants are more sensitive to changes in atmospheric CO_2 concentration.

Carbon Footprint
The total amount of greenhouse gases emitted into the atmosphere each year by a person, family, building, organisation, or company. A person's carbon footprint includes greenhouse gas emissions from fuel that an individual burns directly, such as by heating a home or riding in a car. It also includes greenhouse gases that come from producing the goods or services that the individual uses, including emissions from power plants that make electricity, factories that make products, and landfills where trash gets sent.

Carbon Sequestration
Terrestrial, or biologic, carbon sequestration is the process by which trees and plants absorb carbon dioxide, release the oxygen, and store the carbon. Geologic sequestration is one step in the process of carbon capture and sequestration (CCS), and involves injecting carbon dioxide deep underground where it stays permanently.

Carbon Capture and Sequestration
Carbon capture and sequestration (CCS) is a set of technologies that can greatly reduce carbon dioxide emissions from new and existing coal- and gas-fired power plants, industrial processes, and other stationary sources of carbon dioxide. It is a three-step process that includes capture of carbon dioxide from power plants or industrial sources; transport of the captured and compressed carbon dioxide (usually in pipelines); and underground injection and geologic sequestration, or permanent storage, of that carbon dioxide in rock formations that contain tiny openings or pores that trap and hold the carbon dioxide.

Chlorofluorocarbons
Gases covered under the 1987 Montreal Protocol and used for refrigeration, air conditioning, packaging, insulation, solvents, or aerosol propellants. Since they are not destroyed in the lower atmosphere, CFCs drift into the upper atmosphere where, given suitable conditions, they break down ozone. These gases are being replaced by other compounds: hydrochlorofluorocarbons, an interim replacement for CFCs that are also covered under the Montreal Protocol, and hydrofluorocarbons, which are covered under the Kyoto Protocol. All these substances are also greenhouse gases.

Climate Change
Climate change refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among others, that occur over several decades or longer.

Climate System (or Earth System)
The five physical components (atmosphere, hydrosphere, cryosphere, lithosphere, and biosphere) that are responsible for the climate and its variations. [3]

Conference of the Parties
The supreme body of the United Nations Framework Convention on Climate Change (UNFCCC). It comprises more than 180 nations that have ratified the Convention. Its first session was held in Berlin, Germany, in 1995 and it is expected to continue meeting on a yearly basis. The COP's role is to promote and review the implementation of the Convention. It will periodically review existing commitments in light of the Convention's objective, new scientific findings, and the effectiveness of national climate change programme.

Cryosphere
One of the interrelated components of the Earth's system, the cryosphere is frozen water in the form of snow, permanently frozen ground (permafrost), floating ice, and glaciers. Fluctuations in the volume of the cryosphere cause changes in ocean sea level, which directly impact the atmosphere and biosphere.

Deforestation
Those practices or processes that result in the conversion of forested lands for non-forest uses. Deforestation contributes to increasing carbon dioxide concentrations for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present.

Dryland Farming
A technique that uses soil moisture conservation and seed selection to optimise production under dry conditions.

Ecosystem
Any natural unit or entity including living and nonliving parts that interact to produce a stable system through cyclic exchange of materials.

Emissions
The release of a substance (usually a gas when referring to the subject of climate change) into the atmosphere.

Emissions Factor
A unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., grams of carbon dioxide emitted per barrel of fossil fuel consumed, or per pound of product produced).

Evaporation
The process by which water changes from a liquid to a gas or vapor.

Evapotranspiration
The combined process of evaporation from the Earth's surface and transpiration from vegetation.

Feedback Mechanisms
Factors which increase or amplify (positive feedback) or decrease (negative feedback) the rate of a process. An example of positive climate feedback is the ice-albedo feedback.

Fluorocarbons
Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Fossil Fuel
A general term for organic materials formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years. [4]

Geosphere
The soils, sediments, and rock layers of the Earth's crust, both continental and beneath the ocean floors.

Glacier
A multi-year surplus accumulation of snowfall in excess of snowmelt on land and resulting in a mass of ice at least 0.1 km2 in area that shows some evidence of movement in response to gravity. A glacier may terminate on land or in water. Glacier ice is the largest reservoir of fresh water on Earth, and second only to the oceans as the largest reservoir of total water. Glaciers are found on every continent except Australia.

Global Average Temperature
An estimate of Earth's mean surface air temperature averaged over the entire planet.

Global Warming
The recent and ongoing global average increase in temperature near the Earth's surface.

Global Warming Potential
A measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide.

Greenhouse Effect
Trapping and build-up of heat in the atmosphere (troposphere) near the Earth's surface. Some of the heat flowing back toward space from the Earth's surface is absorbed by water vapour, carbon dioxide, ozone, and several other gases in the atmosphere and then reradiated back toward the Earth's surface. If the atmospheric concentrations of these greenhouse gases rise, the average temperature of the lower atmosphere will gradually increase.

Halocarbons
Compounds containing either chlorine, bromine or fluorine and carbon. Such compounds can act as powerful greenhouse gases in the atmosphere. The chlorine and bromine containing halocarbons are also involved in the depletion of the ozone layer. [1]

Heat Waves
A prolonged period of excessive heat, often combined with excessive humidity. [9]

Hydrocarbons
Substances containing only hydrogen and carbon. Fossil fuels are made up of hydrocarbons.

Hydrochlorofluorocarbons (HCFCs)
Compounds containing hydrogen, fluorine, chlorine, and carbon atoms. Although ozone depleting substances, they are less potent at destroying stratospheric ozone than chlorofluorocarbons (CFCs). They have been introduced as temporary replacements for CFCs and are also greenhouse gases.

Hydrofluorocarbons (HFCs)
Compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They do not significantly deplete the stratospheric ozone layer, but they are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23).

Hydrologic Cycle
The process of evaporation, vertical and horizontal transport of vapour, condensation, precipitation, and the flow of water from continents to oceans. It is a major factor in determining climate through its influence on surface vegetation, the clouds, snow and ice, and soil moisture. The hydrologic cycle is responsible for 25 to 30 percent of the mid-latitudes' heat transport from the equatorial to polar regions.

Hydrosphere
The component of the climate system comprising liquid surface and subterranean water, such as: oceans, seas, rivers, fresh water lakes, underground water etc.

Ice Core
A cylindrical section of ice removed from a glacier or an ice sheet in order to study climate patterns of the past. By performing chemical analyses on the air trapped in the ice, scientists can estimate the percentage of carbon dioxide and other trace gases in the atmosphere at a given time. Analysis of the ice itself can give some indication of historic temperatures.

Indirect Emissions
Indirect emissions from a building, home or business are those emissions of greenhouse gases that occur as a result of the generation of electricity used in that building. These emissions are called "indirect" because the actual emissions occur at the power plant which generates the electricity, not at the building using the electricity.

Industrial Revolution
A period of rapid industrial growth with far-reaching social and economic consequences, beginning in England during the second half of the 18th century and spreading to Europe and later to other countries including the United States. The industrial revolution marks the beginning of a strong increase in combustion of fossil fuels and related emissions of carbon dioxide.

Infrared Radiation
Infrared radiation consists of light whose wavelength is longer than the red colour in the visible part of the spectrum, but shorter than microwave radiation. Infrared radiation can be perceived as heat. The Earth's surface, the atmosphere, and clouds all emit infrared radiation, which is also known as terrestrial or long-wave radiation. In contrast, solar radiation is mainly short-wave radiation because of the temperature of the Sun.

Intergovernmental Panel on climate Change (IPCC)
The IPCC was established jointly by the United Nations Environment Program and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organised the development of internationally accepted methods for conducting national greenhouse gas emission inventories.

Inundation
The submergence of land by water, particularly in a coastal setting.

Landfill
Land waste disposal site in which waste is generally spread in thin layers, compacted, and covered with a fresh layer of soil each day.

Latitude
The location north or south in reference to the equator, which is designated at zero (0) degrees. Lines of latitude are parallel to the equator and circle the globe. The North and South poles are at 90 degrees North and South latitude.

Least Developed Country
A country with low indicators of socioeconomic development and human resources, as well as economic vulnerability, as determined by the United Nations.

Longwave Radiation
Radiation emitted in the spectral wavelength greater than about 4 micrometres, corresponding to the radiation emitted from the Earth and atmosphere. It is sometimes referred to as 'terrestrial radiation' or 'infrared radiation,' although somewhat imprecisely.

Megacities
Cities with populations over 10 million.

Methane (CH_4)
A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 25 times that of carbon dioxide (CO_2). Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.

Mitigation
A human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.

Natural Gas
Underground deposits of gases consisting of 50 to 90 percent methane (CH_4) and small amounts of heavier gaseous hydrocarbon compounds such as propane (C_3H_8) and butane (C_4H_{10}).

Nitrogen Cycle
The natural circulation of nitrogen among the atmosphere, plants, animals, and microorganisms that live in soil and water. Nitrogen takes on a variety of chemical forms throughout the nitrogen cycle, including nitrous oxide (N_2O) and nitrogen oxides (NO_x).

Nitrogen Oxides (NO_x)
Gases consisting of one molecule of nitrogen and varying numbers of oxygen molecules. Nitrogen oxides are produced in the emissions of vehicle exhausts and from power stations. In the atmosphere, nitrogen oxides can contribute to formation of photochemical ozone (smog), can impair visibility, and have health consequences; they are thus considered pollutants.

Ocean Acidification
Increased concentrations of carbon dioxide in seawater causing a measurable increase in acidity (i.e., a reduction in ocean pH). This may lead to reduced calcification rates of calcifying organisms such as corals, mollusks, algae and crustaceans. [8]

Oxidize
To chemically transform a substance by combining it with oxygen. [4]

Ozone
Ozone, the triatomic form of oxygen (O_3), is a gaseous atmospheric constituent. In the troposphere, it is created by photochemical reactions involving gases resulting both from natural sources and from human activities (photochemical smog). In high concentrations, tropospheric ozone can be harmful to a wide range of living organisms. Tropospheric ozone acts as a greenhouse gas. In the stratosphere, ozone is created by the interaction between solar ultraviolet radiation and molecular oxygen (O_2). Stratospheric ozone plays a decisive role in the stratospheric radiative balance. Depletion of stratospheric ozone, due to chemical reactions that may be enhanced by climate change, results in an increased ground-level flux of ultraviolet (UV-) B radiation.

Ozone Depleting Substance (ODS)
A family of man-made compounds that includes, but are not limited to, chlorofluorocarbons (CFCs), bromofluorocarbons (halons), methyl chloroform, carbon tetrachloride, methyl

bromide, and hydrochlorofluorocarbons (HCFCs). These compounds have been shown to deplete stratospheric ozone, and therefore are typically referred to as ODSs.

Ozone Layer
The layer of ozone that begins approximately 15 km above Earth and thins to an almost negligible amount at about 50 km, shields the Earth from harmful ultraviolet radiation from the sun. The highest natural concentration of ozone (approximately 10 parts per million by volume) occurs in the stratosphere at approximately 25 km above Earth. The stratospheric ozone concentration changes throughout the year as stratospheric circulation changes with the seasons. Natural events such as volcanoes and solar flares can produce changes in ozone concentration, but man-made changes are of the greatest concern.

Particulate matter (PM)
Very small pieces of solid or liquid matter such as particles of soot, dust, fumes, mists or aerosols. The physical characteristics of particles, and how they combine with other particles, are part of the feedback mechanisms of the atmosphere.

Parts Per Billion (ppb)
Number of parts of a chemical found in one billion parts of a particular gas, liquid, or solid mixture.

Parts Per Million by Volume (ppmv)
Number of parts of a chemical found in one million parts of a particular gas, liquid, or solid.

Parts Per Trillion (ppt)
Number of parts of a chemical found in one trillion parts of a particular gas, liquid or solid.

Perfluorocarbons (PFCs)
A group of chemicals composed of carbon and fluorine only. These chemicals (predominantly CF_4 and C_2F_6) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing. PFCs do not harm the stratospheric ozone layer, but they are powerful greenhouse gases: CF_4 has a global warming potential (GWP) of 7,390 and C_2F_6 has a GWP of 12,200. The GWP is from the IPCC›s Fourth Assessment Report (AR4). These chemicals are predominantly human-made, though there is a small natural source of CF_4.

Permafrost
Perennially (continually) frozen ground that occurs where the temperature remains below 0ºC for several years.

Phenology
The timing of natural events, such as flower blooms and animal migration, which is influenced by changes in climate. Phenology is the study of such important seasonal events.

Phenological events are influenced by a combination of climate factors, including light, temperature, rainfall, and humidity.

Photosynthesis
The process by which plants take CO_2 from the air (or bicarbonate in water) to build carbohydrates, releasing O_2 in the process. There are several pathways of photosynthesis with different responses to atmospheric CO_2 concentrations.

Precession
The wobble over thousands of years of the tilt of the Earth's axis with respect to the plane of the solar system.

Radiation
Energy transfer in the form of electromagnetic waves or particles that release energy when absorbed by an object.

Radiative Forcing
A measure of the influence of a particular factor (e.g. greenhouse gas (GHG), aerosol, or land use change) on the net change in the Earth's energy balance.

Recycling
Collecting and reprocessing a resource so it can be used again. An example is collecting aluminium cans, melting them down, and using the aluminium to make new cans or other aluminium products.

Reforestation
Planting of forests on lands that have previously contained forests but that have been converted to some other use.

Renewable Energy
Energy resources that are naturally replenishing such as biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Resilience
A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

Respiration
The process whereby living organisms convert organic matter to CO_2, releasing energy and consuming O_2.

Salt Water Intrusion
Displacement of fresh or ground water by the advance of salt water due to its greater density, usually in coastal and estuarine areas.

Sea Surface Temperature
The temperature in the top several feet of the ocean, measured by ships, buoys and drifters.

Sensitivity
The degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).

Sink
Any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere.

Snowpack
A seasonal accumulation of slow-melting snow.

Soil Carbon
A major component of the terrestrial biosphere pool in the carbon cycle. The amount of carbon in the soil is a function of the historical vegetative cover and productivity, which in turn is dependent in part upon climatic variables.

Solar Radiation
Radiation emitted by the Sun. It is also referred to as short-wave radiation. Solar radiation has a distinctive range of wavelengths (spectrum) determined by the temperature of the Sun.

Stratosphere
Region of the atmosphere between the troposphere and mesosphere, having a lower boundary of approximately 8 km at the poles to 15 km at the equator and an upper boundary of approximately 50 km. Depending upon latitude and season, the temperature in the lower stratosphere can increase, be isothermal, or even decrease with altitude, but the temperature in the upper stratosphere generally increases with height due to absorption of solar radiation by ozone.

Teragram
1 trillion (1012) grams = 1 million (106) metric tons.

Thermal Expansion
The increase in volume (and decrease in density) that results from warming water. A warming of the ocean leads to an expansion of the ocean volume, which leads to an increase in sea level.

Troposphere
The lowest part of the atmosphere extends from the surface to about 10 km in altitude in mid-latitudes (ranging from 9 km in high latitudes to 16 km in the tropics on average)

where clouds and "weather" phenomena occur. In the troposphere temperatures generally decrease with height.

Tundra
A treeless, level, or gently undulating plain characteristic of the Arctic and sub-Arctic regions characterised by low temperatures and short growing seasons.

Ultraviolet Radiation (UV)
The energy range is just beyond the violet end of the visible spectrum. Although ultraviolet radiation constitutes only about 5 percent of the total energy emitted from the sun, it is the major energy source for the stratosphere and mesosphere, playing a dominant role in both energy balance and chemical composition. Most ultraviolet radiation is blocked by Earth's atmosphere, but some solar ultraviolet penetrates and aids in plant photosynthesis and helps produce vitamin D in humans. Too much ultraviolet radiation can burn the skin, cause skin cancer and cataracts, and damage vegetation.

United Nations Framework Convention on Climate Change (UNFCCC)
The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognizes that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The Convention enjoys near universal membership, with 189 countries having ratified.

Vulnerability
The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed; its sensitivity; and its adaptive capacity.

Wastewater
Water that has been used and contains dissolved or suspended waste materials.

Water Vapour
The most abundant greenhouse gas, it is the water present in the atmosphere in gaseous form. Water vapour is an important part of the natural greenhouse effect. While humans are not significantly increasing its concentration through direct emissions, it contributes to the enhanced greenhouse effect because the warming influence of greenhouse gases leads to a positive water vapour feedback. In addition to its role as a natural greenhouse gas, water vapour also affects the temperature of the planet because clouds form when excess water vapour in the atmosphere condenses to form ice and water droplets and precipitation.

Weather
Atmospheric condition at any given time or place. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation. In

most places, weather can change from hour-to-hour, day-to-day, and season-to-season. Climate in a narrow sense is usually defined as the "average weather", or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system. A simple way of remembering the difference is that climate is what you expect (e.g. cold winters) and 'weather' is what you get (e.g. a blizzard).

17. Acronyms

ARDC: Agriculture Research & Development Centre, MoAF

AWS: Automated Weather Station

BES: Bhutan Ecological Society

BWP: Bhutan Water Partnership

CARLEP: Commercial Agriculture and Resilient Livelihoods Enhancement Program

CBS: Centre for Bhutan Studies

CERC: Centre for Environment & Climate Research, CNR

CLCS: College of Language & Cultural Studies, RUB

CNR: College of Natural Resources

CoE: Centre of Excellence, HRDC, DGPC

CRDS: Centre for Rural Development Studies, CNR

CSMA: Centre for Sustainable Mountain Agriculture, CNR

CST: College of Science & Technology, RUB

DGPC: Druk Green Power Corporation, DHI

DHI: Druk Holding & Investments

DRER: Department of Research & External Relations, RUB

GCBS: Gedu College of Business Studies, RUB

GCIT: Gyalpozhing College of Information Technology, RUB

GDP: Gross Domestic Product

GLOF/s: Glacial Lake Outburst Floods

GLORIA: Global Observation Research Initiatives in Alpine Environment

HEROES: Himalayan Environmental Rhythms Observation & Evaluation System, UWICER

HRDC: Hydropower Research & Development Center, DGPC

IFAD: International Fund for Agriculture Development

IPCC: Intergovernmental Panel on Climate Change

JICA: Japan International Cooperation Agency

JNEC: Jigme Namgyel Engineering College, RUB

KGUMSB: Khesar Gyalpo University of Medical Sciences of Bhutan

LDC: Least Developed Country

MoAF: Ministry of Agriculture & Forests

MoIC: Ministry of Information & Communications

NAP: National Adaptation Plan

NBC: National Biodiversity Centre, MoAF

NCCC: National Climate Change Committee, NEC

NCHM: National Centre for Hydrology & Meteorology

NDC: Nationally Determined Contribution

NEC: National Environment Commission

RIGSS: Royal Institute for Governance & Strategic Studies

RLDC: Regional Livestock Development Centre, MoAF

RSPN: Royal Society for the Protection of Nature

RUB: Royal University of Bhutan

SCE: Samtse College of Education, RUB

SDG/s: Sustainable Development Goals

TWG: Technical Working Group

UNDP: United Nations Development Program

UNFCCC: United Nations Framework Convention on Climate Change

UWICER: Ugyen Wangchuck Institute for Conservation & Environmental Research