The Academic Language of Climate Change

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The Academic Language of Climate Change: An Introduction for Students and Non-native Speakers

EDITED BY

EVANGELOS MANOLAS
Democritus University of Thrace, Greece

AND

WALTER LEAL FILHO
Hamburg University of Applied Sciences, Germany
Manchester Metropolitan University, UK

United Kingdom – North America – Japan – India – Malaysia – China

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Contents

List of Tables and Figures *ix*

Preface *xi*

Chapter 1 Climate Change: Causes and Impacts
Walter Leal Filho and Evangelos Manolas *1*

Chapter 2 Climate Change and Agriculture
Chrysovalantou Antonopoulou *7*

Chapter 3 Climate Change and Tourism: Challenges and Prospects
Fotini Bantoudi and Maria Pentaftiki *13*

Chapter 4 Climate Change: Health and Safety of Workers
Panagiota Barbouti-Baloti, Angeliki Kouna and Constantina Skanavis *21*

Chapter 5 Gender and Climate Change
Efthalia Gerou and Dimitrios Geros *27*

Chapter 6 Adapting to Climate Change: Adaptation Options and Forms
Hacer Gören *35*

Chapter 7 Climate Change and Human Mobility
Hacer Gören *43*

Chapter 8 Climate Education Experience at University of Latvia
Indra Karapetjana and Maris Klavins *51*

Chapter 9 Climate Change and Energy
Evangelia Karasmanaki *57*

Chapter 10 Solastalgia: Looking into the Implicit Impacts of Climate Change on Mental Health
Eirene Katsarou *63*

Chapter 11 Health and Climate Change
Margarita-Eleni Manola and George Tribonias *71*

Chapter 12 Climate Change and Food Production
Ioanna Mantzourani *79*

Chapter 13 Climate Change and Deforestation
Diamantis Myrtsidis *85*

Chapter 14 Climate Change and Art
Dimitra Pantiora, Ioannis Theodoulou and Constantina Skanavis *91*

Chapter 15. Utilising the Systems Thinking Approach to Assess the Impact of Climate Change on Organisations
Christian Virgil and Kit Fai Pun *97*

Chapter 16 Climate Change and the Agro-food System
Elena Raptou *105*

Chapter 17 Droughts and Climate Change
Manuel Salvador da Conceição Rebelo *115*

Chapter 18 Climate Change and Employment
Paschalina Siskou *121*

Chapter 19 Climate Change and Tourism: Towards a Sustainable Future
Ioanna Vasileiadou *129*

Chapter 20 Climate Change, Land Use and Land Management in Africa: The Case of the Gambia
Franziska Wolf *137*

Chapter 21 The Impacts of Climate Change on the Forest Ecosystems of the Mediterranean
Aikaterini Zerva *145*

Chapter 22 Climate Change and Health: The Case of Infectious Diseases
Evangelia Tsagaki-Rekleitou, Vasiliki Oikonomou, Archonto-Dimitra Boukouvala, Maria Tsatsou, Theodora Skreka and Constantina Skanavis *151*

Chapter 23 Climate Change: Five Scenarios for the Future
Evangelos Manolas and Walter Leal Filho *159*

Key to Chapter Exercises *165*

Biographical Notes *225*

Index *233*

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List of Tables and Figures

Table 1.	Examples of Adaptation Options as Received from IPCC's Report (2014).	36
Table 2.	Most-cited Adaptation Forms as Adapted from Smit et al. (2000), Malik et al. (2010) and IPCC (2014).	37
Fig. 1.	Risk Assessment Process.	98
Fig. 2.	Internal and External Interactions of a Small Vegetable Farm.	99
Fig. 3.	Systems Approach of Examining the Impact of CO_2 Regulations on a Farm.	100

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Preface

Climate change is one of the greatest challenges of our time. For the sake of human civilisation and life on the Earth, we must do all we can to keep global warming at the lowest possible level. Addressing climate change is everyone's duty and that includes teachers of English.

This book has two aims: (1) to provide an introduction to climate change via basic texts addressing different and important dimensions of climate change and (2) to help students acquire basic language skills, which will allow them to study similar or more difficult texts.

The audiences the book addresses are undergraduate or postgraduate students whose first language is not English. It can cover an entire course or be useful for teaching part of a course in which the subject of climate change needs to be addressed. The book has been written on the assumption that students have basic knowledge of English grammar, syntax and vocabulary.

The book contains 23 chapters each of which is designed as follows: First a text of two pages is provided followed by climate change or other related environmental science terms and six to eight exercises on grammar, syntax and consolidation of terminology. Every chapter ends with a references section addressing the needs of readers who wish to pursue the subject further. The book ends with a key to the exercises of each chapter and biographical notes of the authors of each chapter.

The editors
Evangelos Manolas
Walter Leal Filho

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Chapter 1

Climate Change: Causes and Impacts

Walter Leal Filho and Evangelos Manolas

Abstract

This chapter provides an overview of climate change and its impacts and outlines some of the challenges that need to be considered in order to address them.

Keywords: Climate change; causes; impacts; adaptation; mitigation; participation

Global warming is attributed to the expansion of the greenhouse effect, which occurs when the atmosphere traps heat radiating from the Earth towards space. Certain gases in the atmosphere prevent heat from escaping. Gases that do not respond physically or chemically to changes in temperature are called 'climate change forcers'. Gases, such as water vapour, that respond physically or chemically to changes in temperature are seen as 'feedbacks'.

The most important gases that act as forcers are carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs). Carbon dioxide and methane are released through both natural processes and human activities while nitrous oxide and chlorofluorocarbons are produced by human activities.

With regard to carbon dioxide, natural processes include respiration and volcanic eruptions while human activities include deforestation, land use changes and burning fossil fuels. Since the industrial revolution carbon dioxide concentration in the atmosphere due to human activities has increased by 48%. With regard to methane, human activities include decomposition of wastes in landfills, agriculture, ruminant digestion and manure management. Nitrous oxide is produced by soil cultivation practices, fossil fuel combustion, nitric acid production and biomass burning. CFCs are synthetic compounds totally of industrial origin used in many applications, for example aerosol sprays and refrigerants.

The Academic Language of Climate Change:
An Introduction for Students and Non-Native Speakers, 1–6

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According to the Intergovernmental Panel on Climate Change, there is a more than 97% probability that human-produced greenhouse gases have caused much of the observed increase in the Earth's temperatures over the past 50 years (NASA, n.d.). Also, in the last 150 years, industrial activities have raised atmospheric carbon dioxide levels from 280 parts per million to 416 parts per million. The global warming that we have seen in the last 150 years is also called anthropogenic greenhouse effect.

With respect to pre-industrial levels, the average temperature of the Planet has risen by 0.98°C, and the trend that has been observed since 2000 would suggest that unless action is taken, it could reach +1.5°C between 2030 and 2050. The last decade (2009–2019) was the hottest ever recorded and 2020 was the second hottest year ever, only just behind the record year of 2016 (Enel, n.d.).

The effects of climate change have been worsening over the recent years. The increased frequency of climate-related events including droughts, hurricanes, heatwaves, flooding and wildfires has imminently caused turmoil around the globe. Aside from the environmental effects, the impact on people has been severe (Clayton, 2020).

One of the societal challenges faced due to climate change is climate anxiety. Such problems arise when people are scared or have perceptions about climate change. This may be due to direct exposure to climate-related events or observations made through societal communication and media. People may experience chronic distress due to environmental changes that influence opinions about climate change (Clayton, 2020).

In other cases, climate change has created or exacerbated social inequalities. In China, it was found that elderly people were more susceptible to climate-induced migration, which caused stress. The unequal environmental conditions in areas resulted in older people being forced to relocate and placed pressure on social services to provide aid and relief (Wang et al., 2020). Conversely, it was noted that migration following natural disasters was seen in advantaged groups. This is mainly due to richer people having the money and resources to relocate to more favourable areas leaving disadvantaged individuals in disaster stricken areas (Logan et al., 2016).

Furthermore, the creation of climate change mitigation policies has created social inequalities or worsened existing problems. More specifically, it is found that such policies are pro-rich and does not account for people living in poverty. This is mostly attributed to countries dedicating resources and finances to mitigation, which lessens finances available to alleviate poverty (Markkanen & Anger-Kraavi, 2019).

In Vietnam, it was noted that climate change created gender inequalities as farmers who are predominately female faced more challenges. This was linked to the government demanding greater agricultural output in a country that is highly vulnerable to erratic weather patterns and extreme flooding. Policies created placed little to zero emphasis on the burden experienced by female farmers but rather looked at technical adaptation strategies (Phan et al., 2019).

Furthermore, climate change results in increased competition for resources. Resources such as water and food become scarce in areas that are severely affected by global warming. This results in more advantaged groups being able to acquire resources as opposed to disadvantaged people, which creates societal problems and conflict issues (Thomas et al., 2019). Conflict issues have been observed during resources wars arising from forced migration (Sofuoğlu & Ay, 2020) or in simple competition of resources in businesses such as the fishery industry (Mendenhall et al., 2020).

Additionally, climate change has resulted in the increased spread and burden of diseases with specificity to water-borne and vector-borne diseases and other health problems (Cissé, 2019; Rocklöv & Dubrow, 2020). Such problems increase the pressure on health-care systems and social services to ensure people receive the necessary treatment. In most developing countries, this is not possible resulting in various social inequalities and vulnerabilities among residents (Curtis et al., 2017; Pendrey et al., 2021).

As this text has shown, climate change is a complex process, which needs to take into account a variety of elements so that it is duly addressed. One of them is in relation to health issues, which makes it a matter of direct interest to society as a whole.

Vocabulary

global warming	climate-related events
greenhouse effect	flooding
climate change	hurricanes
climate change forcers	heatwaves
climate change feedbacks	droughts
carbon dioxide	wildfires
methane	mitigation
nitrous oxide	adaptation
chlorofluorocarbons	climate-induced migration

Answer the Following Questions:

1. What do we mean by the phrase expansion of the greenhouse effect?
2. What are the most important greenhouse gases which act as climate change forcers?
3. What kind of human activities contribute most to carbon dioxide concentrations into the atmosphere?
4. Under what conditions, do problems such as climate anxiety arise?
5. Why do climate change mitigation policies affect the poor more than the rich?

Finish the Following Sentences:

1. The global warming that we have seen in the last 150 years is also called ……
2. Carbon dioxide and methane are released through both…… ……
3. Carbon dioxide emissions into the atmosphere via natural processes occur through…….
4. The creation of climate change mitigation policies has created…… …….
5. Countries dedicating resources and finances to mitigation lessen …… ……
6. Climate change-related diseases increase the pressure on health-care systems and social services to ensure ……

Match the Words or Phrases of Column A with the Words of Column B:

Column A	Column B
greenhouse	output
volcanic	anxiety
biomass	effect
agricultural	eruptions
climate	burning

Complete the Following Chart:

Verb	Noun	Adjective
respond		
	action	
		productive
	migration	
observe		
		starving
increase		

Find if the Following are True or False:

1. Gases that do not respond physically or chemically to changes in temperature are called feedbacks. True/False

2. Nitrous oxide and chlorofluorocarbons are produced by human activities. True/False
3. In the last 150 years, industrial activities have contributed to reducing atmospheric carbon dioxide levels from 416 parts per million to 280 parts per million. True/False
4. One of the societal challenges faced due to climate change, is climate anxiety. True/False
5. Conflict issues have been observed during resources wars arising from forced migration. True/False

Put the Verbs in Parentheses into Their Correct Form:

Climate change (result)_____ in increased competition for resources. Resources such as water and food (become)_____ scarce in areas that are severely (affect)_____by global warming. This results in more advantaged groups being able to acquire resources as opposed to disadvantaged people which (create)_____ societal problems and conflict issues. Conflict issues have been (observe)_____ during resources wars (arise)_____ from forced migration or in simple competition of resources in businesses such as the fishery industry.

Fill in the Blanks with a Suitable Word:

Climate change has created or exacerbated social _____. In China, it was found that elderly people were more _____ to climate _____ migration, which caused stress. The unequal environmental conditions in areas _____in older people being forced to _____ and placed pressure on social services to provide aid and relief. Conversely, it was noted that migration following natural _____ was seen in advantaged groups. This is mainly due to richer people having the money and resources to relocate to more _____ areas leaving disadvantaged individuals in disaster _____ areas.

Complete the Following Sentences:

1. The increased frequency of climate-related events including droughts, hurricanes, heatwaves, _____ and _____ has imminently caused turmoil around the globe.
2. Climate change has created or exacerbated social _____.
3. Conflict issues have been observed during resources wars arising from forced _____.
4. Resources such as water and food become scarce in areas that are severely affected by_____.

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Chapter 2

Climate Change and Agriculture

Chrysovalantou Antonopoulou

Abstract

Agriculture is a sector highly dependent on climate, and thus it will experience multiple impacts from climate change. In contrast, agriculture is also one of the main contributors of climate change, emitting greenhouse gases, mainly related to land use, fertiliser application and livestock production. Higher temperature and atmospheric CO_2 concentration, changes in precipitation patterns and more frequent extreme weather events are expected to have a negative impact on crop productivity, water and soil resources. Coordinated mitigation and adaptation practices have to be a worldwide priority in order to maintain productivity levels and food production.

Keywords: Adaptation; agriculture; climate change; greenhouse gases; mitigation; crop

According to the United Nations Framework Convention on Climate Change (UNFCCC, 2015), climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere by accumulating greenhouse gases (GHGs). Even if emissions of GHGs stopped today, these changes would continue for many decades, due to the accumulation of the gases in the atmosphere.

Climate change is projected to alter land and climate conditions differently in different regions. As temperature increases and precipitation patterns change, dry regions are becoming drier – especially in summer – and wet regions wetter, particularly in winter. Projection for 2100, reports that temperature will have risen by 2.0–6.3°C above 1990 levels (IPCC, 2018). Climate change is also associated with higher atmospheric carbon dioxide (CO_2) concentration. Moreover,

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climate change has increased the frequency and magnitude of extreme weather events (IPCC, 2018), a term often been used to refer to the increasing risk of hazardous weather events due to climate change (heavy rainfalls, floods, hurricanes, heat waves, severe droughts and hailstorms). In addition, soil degradation due to desertification, erosion and carbon losses are expected to be significant.

Agriculture is one of the main drivers of climate change by emitting CO_2, methane (CH_4) and nitrous oxide (N_2O), GHGs mainly related to enteric fermentation of livestock, use of nitrogenous fertilisers, burning of plant biomass, paddy rice fields, ploughing of soil, manure management and drainage of wetlands to use for agriculture. According to the World Bank (2007), agriculture contributes about 13% of the total emissions of GHGs. However, agriculture also includes 'hidden emissions' attributed to other sectors, for example CO_2 emissions from fossil fuels and electricity used for the production of fertilisers, and pesticides are accounted for by the energy sector (Underwood et al., 2013).

Agriculture is the sector of economy that is very vulnerable, as crop production depends to a large extent on climate (Dalhaus et al., 2020). The impacts from climate change on agriculture can be positive or negative, depending on geographical areas, plant species, changes in temperature, precipitation patterns, atmospheric CO_2 concentration, and the adaptive responses of human systems (EEA, 2017; FAO, 2016).

Possible positive impacts of climate change on agriculture generally are related to longer growing seasons, enhanced photosynthesis, increase in crop yields and promotion of new cropping opportunities in northern latitudes. In contrast, at southern areas shortening of the growing season is observed, accompanied by a higher risk of frost damage due to delayed spring frosts. The possible benefits are counterbalanced by potentially negative impacts that include increased water demand and periods of drought, increased pesticide requirements and crop damage (Chmielewski et al., 2004; Menzel et al., 2003; Olesen & Bindi, 2002).

As global surface temperatures rise, climate change has increased the probability of extreme weather events, such as more frequent and more intense heat waves, floods, droughts and hailstorms, increasing the risk of crop losses, with consequent negative effects on food chain (Jones et al., 2003; Trnka et al., 2004). Perennial plants, such as fruit trees, are more affected by the negative effects of extreme weather events, compared with those with short production times (Blanke & Kunz, 2011). Warmer temperatures will lead to invasion of weeds, pests and diseases into new regions. Moreover, many insects can complete a greater number of reproductive cycles and overwinter in areas where they are now limited by cold, causing thus greater and earlier infestation the following crop season (Bale et al., 2002).

In order to counteract these impacts, the agricultural sector addresses climate change by following two main strategies. The first strategy includes mitigation actions undertaken to prevent or reduce the emission of GHGs into the atmosphere, or to enhance the 'sinks' that accumulate and store these gases (e.g. forests and soil). The second strategy promotes adaptation actions undertaken to reduce the vulnerability of agroecosystems to the impacts of climate change and to make