

Chapter 1

Climate Change Overview

ABSTRACT

There is overwhelming scientific evidence that we are experiencing global warming, and that is it due to human-made greenhouse gas emissions, not to a “natural” cycle. Two key indicators of climate change had record-breaking years in 2016: the global mean surface temperature was the highest since recording began in 1880, and the average Arctic sea ice extent was the smallest annual average since record-keeping began in 1979. The greenhouse effect, caused by the burning of fossil fuels, has accelerated as carbon dioxide concentration in the atmosphere has soared to more than 400 parts per million (ppm). As a result of global warming, sea levels are projected to rise at least one-meter (39.4 inches), possibly two meters (78.7 inches), by 2100. It is vitally important that the nations of the world reduce CO₂ emissions to slow down global warming. This chapter gives an overview of domestic and global trends in, and impacts from, climate change.

INTRODUCTION

“Yes, Virginia, there *is* climate change.” Despite the protestations of some politicians, there is overwhelming scientific evidence that we are experiencing global warming, and that is it due to human-made carbon emissions, not to a “natural” cycle (NOAA, 2017, NASA, 2017, USGCRP, 2016, Union of Concerned Scientists, 2017). Rather than burying our heads in the sand, we need to stand up and work together to adapt to climate change, mitigate its future impacts, and cultivate resilience. The long-term goal is to create a

DOI: 10.4018/978-1-5225-3414-3.ch001

sustainable world, one that uses renewable energy sources rather than fossil fuels, that has enough clean water and food for all, and where everyone has access to decent sanitation and living conditions. As a first step in planning for a sustainable future, we need to understand the breadth and scope of the threats facing our planet from climate change. The global challenges of rising temperatures, rising sea levels, and increased frequency of extreme weather events are creating economic, geographic, and health impacts felt around the world.

The use of technical innovations in many fields-- environmental science, healthcare, architecture, agriculture, and hydrology, to name a few—will make the job of creating a sustainable world significantly easier to achieve. In each field, when a technology is invented, the target users have to be educated about the innovation and agree to adopt it. The new technology has to fit in with the knowledge, skills, and culture of those employing it. The adoption of new technologies can be accomplished using the Diffusion of Innovations (DOI) Theory, which began as a tool to encourage farmers to adopt more efficient technologies; it has evolved into one of the most widespread theoretical frameworks for social change. This book uses the DOI framework as an underpinning for addressing the health impacts of climate change, and arriving at a new world order that uses advanced technology to achieve sustainability.

This first chapter presents an overview of global warming and greenhouse gas emissions, key indicators of climate change, regional trends in the United States, and global trends and impacts. Chapters 2 and 3 explore the major health impacts of climate change, and their impact on vulnerable populations. Chapter 4 explores climate change and environmental justice, while Chapter 5 describes the DOI Framework. Chapter 6 focuses on sustainable development, based on the 17 Sustainable Development Goals (SDGs) for the world adopted by the United Nations in 2015, and Chapter 7 discusses strategies for cultivating resilience. Chapter 8 discusses climate change solutions for adapting to and mitigating the impacts of climate change.

GLOBAL WARMING AND GREENHOUSE GAS EMISSIONS

The Earth's average temperature has been rising over the past century; this phenomenon has been confirmed by many recorded observations of air and water temperatures, sea level, and ice. According to the Intergovernmental Panel on Climate Change (IPCC), the leading international body for the

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