Global Climate Change, Environment and Energy

Global Climate Change, Environment and Energy: Global Challenges and Opportunities to Global Stability

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To the Sustainability of Earth

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PREFACE

FILIZ KATMAN[1]

Climate change presents a fundamental challenge for global sustainable development. Global climate change is both an environmental and sustainable development issue. On 17 April 2007, for the first time, climate change was raised as an issue at the United Nations Security Council. The Security Council held its first-ever open debate exploring the relationship between energy, security and climate. The UN Security Council stressed the need to consider economic, social and political factors in maintaining international peace and security at its 6479th Meeting, on 11 February 2011. The effects of climate change were addressed as factors that have an increasingly serious impact on development and security (SC/10172). The European Council has drawn attention to the impact of climate change on international security and, in June 2007, invited the High Representative and the European Commission to present a joint report to the European Council. In March 2008, Higher Representative Javier Solana and the European Commission presented a report to the European Council entitled *Climate Change and International Security,* analysing the consequences of the adverse effects of climate change on international security (S113/08). Global climate change is the combination of natural climate change and climate change due to human impacts that, directly or indirectly, damages global atmosphere components observed over a comparable time period. It has both a direct and an indirect impact on earth. On the other side of the coin, it brings opportunities such as the possibility of a green economy.

This book[2] aims to cover both sides of the coin in providing comprehensive information concerning climate change, environment and

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[2] The author(s) of each article bear full responsibility for the scientific content of their papers and compliance with scientific and ethical rules. The views/ figures/tables expressed by the authors are entirely their own, and the editors shall

energy. It comprises selected articles discussing these issues from a multidimensional perspective and elaborating upon their interdependence. The articles are based upon contributions to an International Symposium on Global Climate Change, Environment and Energy-Global Challenges & Opportunities for Sustainability, organized by the Istanbul Aydin University Energy Politics and Markets Research Centre on 25 April 2011, held at Istanbul Aydin University. The aim of the conference, and this volume, is to fulfil the responsibility owed to the earth and to humanity; and it would not be available without generous support of Prof. Dr. Hasan Saygın.

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INTRODUCTION

GLOBAL CLIMATE CHANGE, ENVIRONMENT AND ENERGY: GLOBAL CHALLENGES AND OPPORTUNITIES TO GLOBAL STABILITY

FILIZ KATMAN[1]

Global climate change refers to an increase in the temperature of the atmosphere and the oceans. Some gases, such as carbon dioxide (CO_2), Methane (CH_4), nitrous oxide (N_2O) and hydro fluorocarbons (HFCs) lock some of the thermal energy disseminated through radiation from sun and earth, leading to an increase in the temperature of the atmosphere. This is called the greenhouse effect, and gases that create this effect are called greenhouse gases. The greenhouse effect is a situation present in nature. The problem of global warming originates in the intensification, to dangerous levels, of the level of greenhouse gases in the atmosphere, and originates in human activity. Although carbon resources, primarily CO_2, are at a stable level, the strongest temperature catcher, greenhouse gas emissions in the atmosphere, have increased rapidly due to modern human activities accompanying production-consumption processes. Global warming due to increasing greenhouse gas concentrations in the atmosphere has reached very dangerous levels. Today, there is an academic consensus that 90% of global warming originates in human activities (Saygin, 2007: 38-39). Global climate change is the most serious consequence of global warming. The rise in the temperature of the atmosphere and the oceans due to increasing greenhouse gas emissions is

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the combined effect of natural climate change and climate change due to human impact. This damages global atmosphere components and has both direct and indirect impacts on the earth.

Changes in the global climate may affect human life and the ecology of the planet in several ways: water floods originating from increased sea levels due to melting ice; loss of soil on the shore; clean water being mixed with sea water; other issues relating to drinkable water, fires, and droughts originating from the excessive vaporisation caused by temperature increase; an approximate 20% decrease in lake and river waters; the depletion of some types of plants and animals due to such changes; epidemic diseases caused by the mutation in viruses due to excessive temperature increase, and overcapacity in local and global carriage due to possible migration waves. These are just some of the possible problems that may arise in the near future (Saygin, 2007: 38-39). Thus, combating global warming and climate change originating from global warming is very high on the agenda of many countries, primarily developed countries. As a result, the term 'global warming' has entered into everyday terminology.

Risks associated with global climate change are of enormous significance to the future of international society. It is a reality accepted by international society that the problem of climate change will have a serious impact upon future energy systems. It was in the nineteenth century that international agreements concerning the management of environmental issues first emerged. The River Commissions and The International Maritime Organisation are the first examples. 1960 was the year in which environmental concern grew rapidly, particularly in developed countries. Oil pollution at sea, the widespread use of DDTs, radioactive fall-out, transboundary air pollution, and acid rain were the principal global concerns that led to the organization of the 1972 Stockholm Conference. This was a UN Conference on the Human Environment which investigated the prospects for an international framework and a coordinated effort to fight pollution and other such environmental issues. Its outcomes (principles, institutions, and programs) represented an important beginning.

The primary concern was the responsibility of states to cooperate in the effort to manage global common resources and environmental resources. The main clash arose with regard to the share of responsibility for environmental issues. Developing countries argued that they shouldered less responsibility than developed countries and that sustainable development should be the main focus of such efforts. In a milestone development, it was at this meeting that the relationship between environment and development with regard to the North-South axis

formally emerged. It involved the participation of several non-governmental environmental organizations, which put political pressure on the participants. This conference was the first of several further agreements on the environment held during the 1970s and 1980s. Twenty years later, a mature environmental politics was created when a UN Environment Program was established as a key institution coordinating environment-related activities. This also led to the establishment of green movements and green parties. In 1989, the so-called Rio Conference was organised by the UN General Assembly—the "Earth Summit", UN Conference on Environment and Development (UNCED)—in order to focus systematically on sustainable development.

By the 1990s, at least 120 multilateral environmental agreements and hundreds of bilateral ones were signed (Owen, 1997: 324). After this large number of environment agreements, the next step in the development of the institutionalised approach was the formation of an international regime on the environment, composed of several phases, including agenda formation, negotiation and decision-making, implementation and further development. Ozone layer depletion is an important and effective international environmental regime based on The Montreal Protocol of 1987. In terms of agenda formation, the first steps towards this protocol were taken during the 1970s.

The Rio Conference in 1992 succeeded in establishing three new conventions on limiting climate change, preserving biodiversity and combating desertification: however, the last two regimes stalled in 1996. In terms of agenda-setting, The Intergovernmental Panel on Climate Change (IPCC), composed of scientists under the auspices of the UN Environment Program and the World Meteorological Organisation, examined the impact of anthropogenic greenhouse gas emissions. The report prepared by the IPCC in 1990 (by the representatives of 137 countries at the Second World Climate Conference in Geneva) warned the international community of the urgency of the situation, and led to the signing of the Framework Convention on Climate Change (FCCC) at the Rio Conference. Furthermore, concern for natural habitats and species led to the Convention on Biological Diversity in 1991, based on a range of expert reports. As regards desertification, concern for deforestation (particularly of the tropical rainforests) led to the Convention to Combat Desertification, which was widely supported by industrialised countries despite the fact that the issue was of primary concern to African countries. In addition, the Rio Declaration contributed to the agenda-setting for the Rio Conference, in setting out a list of agreed principles called Agenda 21.

The United Nations Framework Convention on Climate Change-UNFCCC in Rio de Janeiro in 1992 was the ground of global efforts to combat global warming. It aimed to prevent dangerous activities leading to climate change. The parties involved agreed to take mutual but proportionate responsibility. It was agreed, firstly, that developed countries had the largest share of greenhouse gas emissions; secondly, that emissions per person in developing countries were still low; thirdly, that greenhouse gas emissions in the latter countries would continue to increase in order to complete the process of economic and social development.

Framework Conventions were subject to ratification by a minimum number of parties, as defined in the treaty, and these were enforced very rapidly (within 2 years). Conferences of parties were organised, and the first of these was held in Berlin in 1995. Its purpose was to negotiate a limitation on greenhouse gas emissions. Almost all the OECD countries and the European Union member states agreed to stabilise their emissions at 1990 levels by 2000, but progress towards achieving this goal was not sustained. One critical impact of climate change has been the increase in sea levels resulting in inundation, and this led the Alliance of Small Island States to advocate for a reduce emissions by 20 percent in 2005. This move, however, was met with strong resistance by the OPEC countries (Greene, 1997: 324).

The EU and Western countries supported the reduction of emissions by 5-10 percent in 2010, but several other developed countries rejected this proposal. Reports on national greenhouse gas emissions and limitation measures were reviewed while negotiations were ongoing. This reflects the fact that an effective climate change regime requires long-term processes, involving development and implementation of the international environmental regime under an umbrella framework made up of UNCED agreements.

The most crucial milestone in combating climate change is the Kyoto Protocol, which builds on the principles discussed above. Obviously, the primary goal of the Kyoto Protocol is to stabilise greenhouse gas in the atmosphere at a level that prevents anthropogenic climate change. After long negotiations, the Protocol was presented in Kyoto City in Japan, on 11 December 1997. For the purpose of legal enforcement, the condition was the acceptance of the obligations of the Protocol by 55% of the countries listed in Appendix I of the UN Framework Convention, since 50% of emissions in 1990 originated from these countries (Saygin, 2007: 38-39). Thus, the Protocol was well developed when the US, under the George W. Bush administration, announced the withdrawal of US support in 2001, on the grounds that exempting developing countries from

emission restrictions would prevent the success of the Protocol and damage the US economy. Australia, the first country on the list and with the highest level of emission per person, had initially led the negotiations, but then changed their position and refused to sign the Protocol at the last minute. Thus, US withdrawal from the Protocol had a dramatic effect, and led to serious suspicions and arguments about the feasibility of the Protocol. In order to analyse these developments, a summit was organized in Bonn in June 2001, with 180 countries in attendance. It was agreed that the Kyoto Protocol was on the brink of collapse, and that precautions should be taken to prevent this. The EU took the lead in designing strategies to ensure the sustainability of the Protocol without the participation of the US.

In 1997, the Kyoto Protocol on greenhouse gas emission abatement imposed an obligation on developed countries to decrease their dissemination to 5.2% below 1990s levels, over the period 2008-2012 (Saygin, 2005: 27). Three market-based mechanisms were formed in order to achieve these goals: (i) Emission trading (among Annex I countries) and international emission trading. This gave countries with greenhouse gas emission levels below the determined limits the right to sell their remaining emission rights. (ii) Joint Implementation (JI) allowed project-level emissions trading between Annex I countries, through funding opportunities for such projects, deducted from determined levels. (iii) The Clean Development Mechanism allowed Annex I countries to deduct from their total emission targets, in case of investing in project-level emissions through funding (as in JI).

In order to be implemented, this agreement was subject to the approval of at least 55 countries contributing to CO_2 emissions of developed countries in 1990. The withdrawal of the US from the agreement was the primary shadow cast over the original vision of the Protocol. The US, under the Bush administration, had argued that the economic cost was too high and that it was unacceptable to exempt developing countries from the primary emission targets. The US officially announced its withdrawal in March 2001. This influenced the environmental and cost efficiency of the Protocol, and many questioned the applicability of the Kyoto Protocol in the absence of US participation. In June 2001, the possible collapse of the Kyoto Global Warming Agreement within 10 years was identified, during negotiations between representatives of 180 countries in Bonn. The decision was taken to prevent this collapse by any available means. The EU took the lead, forming strategies in order to secure the sustainability of the Protocol without US participation.

On the other hand, the participation of former Soviet Union countries (primarily Russia and Ukraine) and Eastern European countries (Japan) was crucial in achieving the required majority for the enforcement of the Protocol. Strategies for preventing a possible collapse, subject to the participation of these countries, led to the granting of privileges that risked diminishing the primary impact of the Protocol. Thus, the primary goals of the Kyoto Protocol were reviewed at the meetings held first in Bonn, then in Marrakesh. New options in Bonn, such as meeting one part of the limitations on CO_2 emissions through CO_2 stored in forests and farming areas materialised, and these were finalised in Marrakesh. The primary outcome of the Marrakesh Agreement was the addition of CO_2 sinks, a substantial number of CO_2 credits called sink credits (for countries such as Australia, Canada, New Zealand, Japan and Russia), to be deducted from the targeted total amount for emission abatement for forests and farming areas storing greenhouse gases. Importing CO_2 sink credits is the most crucial step in softening and weakening the impact of the primary Kyoto Protocol, and reflects the latest version of the protocol, after the Marrakesh meeting. This newer version of the Protocol tends towards meeting all abatement obligations through emission trading, and creates a space between permitted amounts and emissions for sale; it does not project the possibilities for contradiction into the essence or the principles of the Protocol. In fact, Russia played a critical role in the negotiations, as a key country in the enforcement of the Protocol, and it was 'a success' that doubling CO_2 absorption credit via the Marrakesh Agreement went through at Russia's request.

In December 2011, a summit organised in different countries and cities was held in Durban City in South Africa. At this summit, it was decided to determine the greenhouse gas abatement and the financial and technological obligations of developed countries after the first obligation period of the Kyoto Protocol. It was also agreed to ensure the enforcement of the Green Climate Fund in 2013.

The last summit was held in Qatar, the most problematic country in terms of CO_2 emissions. Several developed countries, including EU member countries and Australia, agreed to reduce their CO_2 emissions until 2020. However, the non-participation of the USA, China and India, the most atmosphere polluting countries, made the Protocol meaningless. Ironically, the next summit (the 19th Conference of the Parties to the United Nations Framework Convention on Climate Change) will be convened in Warsaw, Poland, a nation with a heavy dependence on coal that prevents it from meeting the strict emission targets of the EU.

In the lead up to the 19th Conference, two critical steps have been taken by the US, in terms of contributing efforts to the problem of climate change. In July 2013, President Obama of the US and President Xi of China reached an important agreement to jointly phase down production and consumption of hydro fluorocarbons, and it was agreed to take further steps in the coming months. In a speech at the White House in 2013, President Obama (the President of the world's largest economy and second-largest carbon emitter) announced measures to reduce carbon pollution and to protect people from climate change. He announced his new climate change policy on June 25, 2013, at Georgetown University. In that speech, he emphasised a low-carbon and clean energy economy as an engine of growth for decades to come, based on using less dirty energy, transitioning to cleaner sources of energy, and wasting less energy. He also outlined some concrete steps, such as the following: doubling energy from wind and sun to power more than 6 million homes by 2020; installing 3 gigawatts of renewable power on the bases of the Department of Defence—the biggest energy consumer in America, which generates about the same amount of electricity each year as would be generated by burning 3 million tons of coal; calling upon Congress to end tax breaks for big oil companies; investing in clean-energy companies; wasting less energy in cars, homes, and businesses, via manufacturing and installing smarter lights and windows and sensors and appliances; setting new energy standards for appliances, and providing 20 percent of the federal government's electricity supply from renewable resources within seven years. It should be noted that while in 2012, American emissions of CO_2 from fossil fuels fell by 200 million tonnes (Mt) to levels last seen in the mid-1990s (due to the transition from coal power to natural gas and renewable energy), in the same year global carbon pollution rose to a record high (by 1.4 percent) to 31.6 billion tonnes (gigatonnes [Gt]). This is the second smallest annual increase since 2003 after 2009 (which was due to the global recession) (IEA, 2012). President Obama's speech created an expectation for further steps, taken globally at the 19th Conference on Climate Change.

In this book, global climate change (a critical issue in world politics), will be discussed based on an approach which stresses the interdependence between environment and energy. The issue of the global commons requires an interdisciplinary and multidisciplinary approach. The book identifies the challenges and policy recommendations required to overcome these challenges. This makes the book unique.

In the first chapter, issues of global climate, environment and energy are discussed by the authors with respect to global challenges and

opportunities for global stability, in three articles with a primary focus on the security aspect of global climate change. In the article entitled "Analysis of Global Climate Change Impacts on Security" by Filiz Katman, global climate change is presented as a contemporary threat to security, and its impacts on security in general terms are analysed. In the article entitled "Paradigm Shift in Millennium Development Goals Management through Global Climate" by Aylin Met and Taner Altunok, the circumstances surrounding the Millennium Development Goals and climate change are explained and the necessity and the applicability of paradigm change are discussed.

The article entitled "Seeking Security in Changing Climate" by Argiro Vasilaki takes the findings of the official documents of the European Union and the United Nations as its starting point, and analyses the social and human consequences of global climate change, with particular attention to the risks of instability and social unrest.

Chapter Two is dedicated to a discussion of the impacts of Global Climate Change on the Environment, with six articles by scholars, with a multidisciplinary approach. The article entitled "A New Ethical Approach to Environmental Protection: Ecocentrism" by Kıvılcım Akkoyunlu Ertan and Birol Ertan aims to explore the role of ecocentrism (the new ethical approach that has to be a guide for decision-makers and citizens in environmental protection) in preventing environmental problems, and its effects in the process of energy production and consumption.

In the article entitled "Voluntary Carbon Trade: A New Livelihood Model for Low Income Families" by İlker Met and Taner Altunok, practices of carbon market for low income families and a resulting model for Turkey are presented. A way of saving low income families (the most vulnerable to the effects of climate change) is recommended, as well as an important step towards mitigating the negative effects of climate change, by helping the carbon market to liberate itself from the monopoly of large projects and making it available to the community.

The article entitled "Analysis of Turkish Environmental Energy Policies in a Regional Framework", by Çiğdem Üstün, demonstrates the main issues that Turkey focuses on in its (foreign and domestic) environmental policies and in the security of energy supplies, using the findings of in-depth interviews conducted in Turkey and the regional countries, i.e. Greece, Moldova, Bulgaria, Ukraine, Georgia, and Azerbaijan.

The article entitled "European Union Environmental Directives and a Practice on Business" by Meral Erol Fidan presents the existing situation in Turkey, and measures the level of businesses' knowledge about environment and waste management in the adaptation process to the EU.

The article entitled "Wind Speed and Energy Characteristics based on Statistical Analyses" by Zafer Aslan and Z. Nevin Çağlar covers some statistical analyses of wind speed data, recorded in the Northwestern part of Turkey, Şile (Istanbul); monthly, seasonal and annual wind speeds are analysed statistically.

Chapter Three discusses the impacts of global climate change on energy. The article entitled "Sustainable Development and Turkey's Biomass Energy Potential" by Coşkun Karaca and M. Mustafa Erdoğdu focuses on the level of Turkey's biomass energy potential, and discusses ways of making sufficient use of this potential. It seeks answers to two questions in particular: (1) to what extent can the quality of the environment be improved by the use of biomass energy? (2) What changes occur in economic variables such as foreign trade, employment, and balance of payments when the consumption of fossil fuel is reduced by the use of biomass energy?

The article entitled "Energy and Climate Change Policies of Russia and China" by Çağla Gül Yesevi and Ceren Uysal Oğuz aims to analyse the meaning and dimensions of global climate change, energy and the environmental policies of Russia and China. The article entitled "The Relationship between Natural Resources and Security (with an Emphasis on Energy Security)" by Hakan Korhan addresses the place of energy security in national security definitions, the concept of energy security in terms of different purpose typologies of foreign policy, and the question of what kinds of foreign policy outputs such components might create.

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CHAPTER ONE:

GLOBAL CLIMATE CHANGE, ENVIRONMENT AND ENERGY: GLOBAL CHALLENGES AND OPPORTUNITIES TO GLOBAL STABILITY

ANALYSIS OF GLOBAL CLIMATE CHANGE IMPACTS ON SECURITY

FILIZ KATMAN[1]

1. Introduction

The needs of human beings change over time, but security has always been part of the most fundamental level of the hierarchy of needs. Security is a subjective feeling, determined by threat perception. If something normal is perceived as an existential threat—it might be presented as such a threat, even it is not a real one—then this process is called securitization. In desecuritization, a perceived threat is transformed into a normal issue. Whilst the means of providing and sustaining security are developing, threats to security are in the process of being transformed. September 11 proved that we live in an insecure world and that the source, time and place of a threat cannot be known before it is realized, so that the means of providing our security might not be appropriate. In such an interconnected world, a problem in one part of the world can affect a distant country: the problem becomes global. From this perspective, it can be argued that destabilising regions, concepts and insecurity (especially in strategic and important regions) are the objects of the process of securitisation, of desecuritization and, ultimately, of transformation (Buzan et al., 1998). Global climate change is the latest object of securitisation.

2. Global Climate Change: Crisis of the Earth

It was in 1826 that Joseph Fourier determined the role of the atmosphere on average world temperature; then, in 1896, Svante Arrhenius noted that coal used as an energy resource by a rapidly growing industry produced carbon gas (Denhez, 2007: 8). Global climate change is both an

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environmental and sustainable development issue. The word 'climate', meaning angle, is referred to as *klimatis* in Latin and as *klima* in Greek (Denhez, 2007: 11). Global climate change impacts are projected over the next 20-30 years, mainly due to greenhouse gases. In order to determine climate conditions, average values of air condition are observed over long periods of time. If the scale of the changes in climate is global, and impacts are significant and local, this means that climate change has occurred. On the other hand, global climate change reflects both natural climate change and also climate change due to the (direct or indirect) damage caused by the human impact on global atmosphere components, observed over a comparable time period.

At present, CO_2 emissions play a critical role. If internationally binding agreements are not reached on limiting CO_2 emissions, as well as on other greenhouse gas emissions, the upper limit of a 2-degree temperature rise will be exceeded. It is projected that the average global temperature will rise by 3.6 degrees Celsius by 2035 (IEA, 2012) with a domino effect, and in the long run, by 5.3 degrees Celsius; this is considered destructive for the world.

There are several indicators of global climate change, such as CO_2 increase per year, average global earth temperature increase, increase in sea level, and global warming. Since 1850, concentrations have increased by approximately 35% (Houghton, 2007: 319). The timing of this increase is coincident with the rising carbon emissions resulting from fossil fuel combustion and land-use change. Research shows the CO_2 increase per year has developed as follows:

- 1850 (approximately the start of the industrial revolution-2005: 0.65 ppm
- 1995-2005: 1.90 ppm (more than double)

The average global earth temperature increase was 0.74°C in 1906-2005, according to the Intergovernmental Panel on Climate Change-IPCC (2007). 1998 was the hottest year, with a 0.58°C anomaly. 2005 was the second hottest year, with a 0.49°C anomaly. After the 1990s, fluctuations occurred in the amount of rainfall. Another indicator is the increase in sea level. In the 20th century, the increase was 17 cm; the average yearly increase was as follows:

- 1961-2003: 1.8 mm (1.3-2.3 mm)
- 1993-2003: 3.1 mm (2.4 mm-3.8 mm)

Global warming is around 0.74°C. IPCC-Projections on temperature for 2000-2100 have two scenarios, optimistic and pessimistic:

- Optimistic scenario: 1.8 °C increase, CO_2: 600 ppm
- Pessimistic scenario: 4.0 °C increase, CO_2: 1550 ppm

Sea level increase in 2000-2100 is expected to be:

- Optimistic scenario: 0.18-0.38 m increase
- Pessimistic scenario: 0.26-0.59 m increase

The IPCC (2007) prepared scenarios on global climate change with no decrease in greenhouse gas emissions. According to scenario A1, the world population will be 7 billion with a rapid economic growth in 2100. In scenario A2, the world population will be 15 billion. In scenario B1, population growth is the same as in scenario A1. Economic structures, service, and the knowledge economy will diminish, due to a decrease in the financial economy, as will the use of clean energy and energy saving technologies. In scenario B2, despite diminishing growth, world population will be around 10 billion but with a lower rate of population growth than in scenario A2. The search for local solutions and economic development will be slower than in the A1 and B1 scenarios.

Based on such data, in order to prevent emissions reaching twice the level reached in the period prior to the industrial age, and notwithstanding countries' aspirations for economic development, emission in 2100 should diminish to half the 1990 levels. In order to keep the level to 550 ppm in 2100, an individual footprint should be 500 kg, which means 25% of a French footprint and 8% of an American footprint in 2005. If 550 ppm is realised, the average temperature increase in the atmosphere could remain at a level of 2-4.5 °C. If not, ppm levels will rise to 1000-1200 ppm, meaning that the average temperature increase will be 3.7-9.4 °C. Scenarios for 2100 show that under the most optimistic scenario, the increase will be 1.5-2.8 °C, 2.3-4.1 °C in the medium scenario, and 3.5-5.8 °C in the most pessimistic scenario.

3. Impacts of Global Climate Change on Security

Global climate change is detected by means of the previously mentioned indicators. Such changes have impacts which can be categorised as either direct or indirect. Direct impacts reflect the consequences of global

climate change on human beings and the world. In contrast, indirect impacts reflect the secondary consequences of global climate change due to deteriorating conditions and the situations that arise as a result.

In 1896, Arrhenius projected that the average increase in global earth temperature would be 5-6 °C, due to a doubling in the amount of carbon gases in the atmosphere. However, according to IPCC (2007), the increase will be 1.5-1.8°C. As a result of this increase, water cycles will accelerate, ocean drifts and air cycles will change, and great biogeographical regions will be disrupted. Such changes in biogeography maps will challenge geopolitical conditions, and may lead to millions of 'climate migrants' facing hunger, drought, and distorted living conditions. Climate determines air, environment, activities, feelings and mood.

The Global Warming Atlas (Denhez, 2007) reviews the impacts of such changes on the environment, and provides a case of chain reaction. The ecologic environment is defined by temperature, amount of rain, duration of the seasons, and flora and nutrition conditions strictly defined for each species. In case of changes to any of these, a species will adapt, given physiological capacity and time. If not, the search for a new environment begins and, if none is found, the species disappears. The environment vacated by the species is then open to adaptive species. On the other hand, everything in nature is connected, so when one species changes its environment, this has an impact upon reproductive chains and hunting ranges. As a result, other species are also affected. This is called the domino effect. Researchers have observed that there has been a general move in species from the south to the north, due to global climate change.

The parameters of global climate change are listed as temperature, humidity, pressure, speed, etc. Changes in such parameters have a range of impacts, including the following: a decreasing frequency and increasing density of storms towards the north; an increase in floods, due to the increasingly unstable atmosphere; changes to the shores and continents, and the environment and types of plants and animals; changes to human beings in general. It is argued that the increasing levels of gases causing the greenhouse effect will lead to rain and warming, and that regional weather patterns will be distorted. There will be more rain, but less rain in some dry regions. It is expected that rain volume will increase 2-7%, due to rapid vaporisation-condensation cycles, leading to heavy and intermittent rainfall (Denhez, 2007).

As a chain reaction, sea levels will also increase, but it is argued that this will not be due to the melting of ice. The result of the increase in average world temperature will be expansion and increase in water levels. While expansion will occur in the long run, through changes in the deep