CLIMATE CHANGE IMPACT ON THE SOUTHEASTERN EUROPE SECURITY ENVIRONMENT AND THE INCREASING ROLE OF THE BULGARIAN ARMY AS THE WORLD WARMS

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE
General Studies

by

KUMAN GEROVSKI, CAPTAIN, BULGARIAN ARMY
M.Eng., National Military University, Veliko Tarnovo, Bulgaria, 2003

Fort Leavenworth, Kansas
2016

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
10-06-2016	Master's Thesis	AUG 2015 – JUN 2016

4. TITLE AND SUBTITLE

Climate Change Impact on the Southeastern Europe Security Environment and Increasing Role of the Bulgarian Army as the World Warms

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

CPT Kuman Gerovski

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Command and General Staff College
ATTN: ATZL-SWD-GD
Fort Leavenworth, KS 66027-2301

8. PERFORMING ORG REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution is Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Climate change impacts on the security environment are real and have the potential to create unprecedented levels of risk through activating dormant conflicts or even triggering a new one over transboundary issues in the southeastern European region. Undeniably, the long-term environmental changes and weather extremes, occurring not only on the territory of southeastern Europe, but also in its neighboring regions, will have a great effect over all of the domains of the socio-economic system and will generate certain risk to the security environment in Bulgaria. Given the fact that the southeastern European region borders some of the areas most vulnerable to climate change, political turmoil, environmental degradation, resources scarcity, and population growth, there is no doubt that projected migratory pressure, economic challenges, and transboundary issues in the region together with political instability will make the Bulgarian security system more susceptible and vulnerable than ever before. Although, direct armed conflict between Bulgaria and its neighbors, based on climate change impacts, is unlikely to occur, climate change impacts might increase the rivalry between the neighbors in southeastern European region over human migration flows, transboundary diseases, and shared resources. Furthermore, the internal security impacts posed by the climate variability over the territory of Bulgaria have the potential to greatly affect the food and water security, public health, and disaster response.

15. SUBJECT TERMS
Climate Change, Security Environment, Impacts, Southeastern Europe

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. PHONE NUMBER** *(include area code)*
(U)	(U)	(U)	(U)	106	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: CPT Kuman Gerovski

Thesis Title: Climate Change Impact on the Southeastern Europe Security Environment and Increasing Role of the Bulgarian Army as the World Warms

Approved by:

_____, Thesis Committee Chair
Wendell C. King, Ph.D., P.E.

_____, Member
James R. Cricks, M.A.

_____, Member
LTC Typhanie Y. Dial, M.S.

Accepted this 10th day of June 2016 by:

_____, Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

CLIMATE CHANGE IMPACT ON THE SOUTHEASTERN EUROPE SECURITY ENVIRONMENT AND THE INCREASING ROLE OF THE BULGARIAN ARMY AS THE WORLD WARMS, by CPT Kuman Gerovski, 106 pages.

Climate change impacts on the security environment are real and have the potential to create unprecedented levels of risk through activating dormant conflicts or even triggering a new one over transboundary issues in the southeastern European region.

Undeniably, the long-term environmental changes and weather extremes, occurring not only on the territory of southeastern Europe, but also in its neighboring regions, will have a great effect over all of the domains of the socio-economic system and will generate certain risk to the security environment in Bulgaria. Given the fact that the southeastern European region borders some of the areas most vulnerable to climate change, political turmoil, environmental degradation, resources scarcity, and population growth, there is no doubt that projected migratory pressure, economic challenges, and transboundary issues in the region together with political instability will make the Bulgarian security system more susceptible and vulnerable than ever before.

Although, direct armed conflict between Bulgaria and its neighbors, based on climate change impacts, is unlikely to occur, climate change impacts might increase the rivalry between the neighbors in southeastern European region over human migration flows, transboundary diseases, and shared resources. Furthermore, the internal security impacts posed by the climate variability over the territory of Bulgaria have the potential to greatly affect the food and water security, public health, and disaster response.

TABLE OF CONTENTS

Page

ACRONYMS

AR5	Fifth Assessment Report, IPCC
CO2	Carbon Dioxide
EU	European Union
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
NATO	North Atlantic Treaty Organization
RCP	Representative Concentration Pathways
SPM	Summary for Policymakers
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
WGBU	German Advisory Council on Global Change
WGII	Working Group II, IPCC

ILLUSTRATIONS

Page

TABLES

Page

CHAPTER 1

INTRODUCTION

A new threat to peace is rising in southeastern Europe. Climate change impacts on the security environment have the potential to create unprecedented levels of risk in the region associated with environmental degradation, economic disturbance, and social disruptions. The United Nations[1] has determined that a part of the problem solving process would be adaptation and mitigation of the impacts posed by climate change. The ability to manage and lower the risk imposed by climate change requires clear and sound adaptation and mitigation decisions with implications for the future generations, economies, and environments.[2] In its fifth assessment report (AR5) the Intergovernmental Panel on Climate Change (IPCC) considered adaptation as a measured process of adjustment to the expected climate change and its negative and positive effects. Although throughout the centuries the biosphere has certainly adjusted itself to changing climate and environment, today scientists are looking for broader and higher degrees of success in adaptation. There is high confidence among the scientists that adaptation to the new environment can prevent most of the projected damage on the human and natural environment, if done in conjunction with strong mitigation to greatly

[1] Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)," accessed 3 February 2016, http://ipcc.ch/.

[2] Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers," in *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. C. B. Field et al. (Cambridge: Cambridge University Press, 2014), 25.

reduce the amount Greenhouse Gases (GHGs) released in the future. Since adaptation has less human involvement, the mitigation is considered as a human deliberate intervention for reduction the sources or enhancing the sinks of GHGs, which present the single most significant climate change driver.[3] Not surprisingly, both adaptation and mitigation concepts contribute to the objective expressed in Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) from 1992.

> The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.[4]

The key regional risks posed by climate change and the potential for reducing these risks through adaptation and mitigation require thorough examination of the climate change drivers. Given the geographic specifics of the southeastern Europe region the following climate-related drivers: warming trend, extreme temperature, drying trend, extreme precipitation, precipitation, sea level rise, and ocean acidification would have the most significant impact on the environment. Some of the key impacts are increases of disease, stress on water resources, loss of arable lands, reduced food production,

---

[3] Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers," in *Climate Change 2014: Mitigation of Climate Change, Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. O. Edenhofer et al. (Cambridge: Cambridge University Press, 2014), 3-6.

[4] United Nations Framework Convention on Climate Change (UNFCCC), Article 2 (New York: United Nations, 1992).

increased in ocean salinity, economic loss, and livelihoods at risk.[5] Having clearly defined this as the problem, it can be summarized that the growing potential of increasing the number of natural disasters interrelated to climate-induced events and their social implications requires deeper and broader assessment on the security environment in southeastern Europe. A rigorous analysis of the expected risks posed by climate change will reshape the Bulgarian Army structure and capabilities if the Army is to develop the proficiency to face this imminent threat.

Background

Merriam-Webster's definition of "climate" defines the term as the usual weather conditions in a particular place or region. By mentioning "usual weather condition" the dictionary portrays a balanced system with detailed weather conditions where people, the economy, government, and the physical environment exist in relatively natural harmony with the long prevailing specific conditions in that particular place or region. However, these conditions are changing and the changes are predicted to become more drastic, therefore every change in the system makes it different, unfamiliar, and what is more important, more unbalanced. The different modifications to the climate can disturb the natural harmony and make the system unbalanced by causing different, by type and intensity, weather effects.

[5] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part B: Regional Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. V. R. Barros et al. (Cambridge: Cambridge University Press, 2014), 1300-1306.

Today, climate change is a universally acknowledged fact and almost nobody argues that it is not caused by human activities and constitutes a tremendous threat to global security.[6] According to the European Commission, some of the global threats driven by climate change and related in one way or another to security issues are conflicts over diminished resources, economic damage and risk to coastal cities and critical infrastructure, loss of territory and border disputes, environmentally-induced migration, situations of fragility and radicalization, tension over energy supplies, and pressure on international governance. The southeastern Europe region which is the focus for this work does not constitute an exception.

[6] United Nations Framework Convention on Climate Change (UNFCCC), 1992; Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

Figure 1. Southern Europe

Source: English Online, “Mediterranean Sea,” accessed 3 February 2016, http://www.english-online.at/geography/mediterranean-sea/geography-of-mediterranean-sea.htm.

Since the area borders some of the regions most vulnerable to climate change, e.g. North Africa and the Middle East, migratory pressure at the southeastern countries together with political instability and conflicts could considerably decrease the security environment in the region in the near future. The still fragile economy and security environment in the Balkans is at greater risk than before and could easily be affected by the dangers posed by environmental changes and/or severe weather events. Therefore, having the growing anticipation of increasing numbers of changes in the environment, it

is extremely important to clearly identify the nature and intensity of the new threat posed by climate change, which will help create a need for a new doctrinal model to combat these threats by mitigation and/or adaptation. As Albert Arnold "Al" Gore, Jr. alludes in his *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*, climate change is like a global war and requires local, regional, and strategic/global levels of defense planning in order to achieve a success over the threat. There is no doubt that in such a concept the military will have a significant role in order to combat the new challenges and missions. Moreover, having the ever-decreasing circle of ongoing budget cuts and force reductions, together with the uncertain global security environment requires effective force development planning, and an even more efficient force integration process, in order to provide the military with the right resources to do the right job within an unknown and completely unpredictable operational environment.

The Republic of Bulgaria is a small country situated in the southeastern part of Europe on the Balkan Peninsula. Bordering Romania to the north, Turkey and Greece to the south, the Black Sea to the east, and Serbia and Macedonia to the west. As an EU and NATO member, Bulgaria becomes a strategic logistics hub between Asia, the Middle East and Western Europe. With no international disputes the only external threat for the country remains the refugees and internally displaced persons. On the other hand, any severe impact on the national security would have a corresponding impact on the economic stability of the country. For instance, almost 35 percent of Bulgaria's GDP comes from both the agriculture and industry sectors and close to 50 percent of the Bulgarian territory is agricultural land which defines its interdependency on the climate and water resources, and their impact on the economic sector.

Figure 2. Republic of Bulgaria

Source: Ezilon Maps, "Bulgaria Map-Physical Map of Bulgaria," accessed 3 February 2016, http://www.ezilon.com/maps/europe/bulgaria-physical-maps.html.

Primary Research Question

How will the most probable impacts of climate change affect the southeastern Europe security environment and what new challenges will it pose for the Bulgarian Army?

Secondary Research Questions

While answering the primary research question, multiple secondary research questions require attention, and specifically:

1. What effect will climate change have in the southeastern Europe region?

2. What is the cause and effect relationship between climate change and the security environment?

3. Which variables in the security environment in the region will be affected by the climate change?

4. What are the threats for the Bulgarian National Security posed by climate change?

Assumptions

During the analytical research I will focus mainly on the national security environment in Bulgaria and its bordering countries. Moreover, I assume that the negative effects and scenarios projected by the IPCC of the climate change in North Africa and the Middle East will create migratory pressure within the southeastern European region which will worsen the national security environment in Bulgaria.

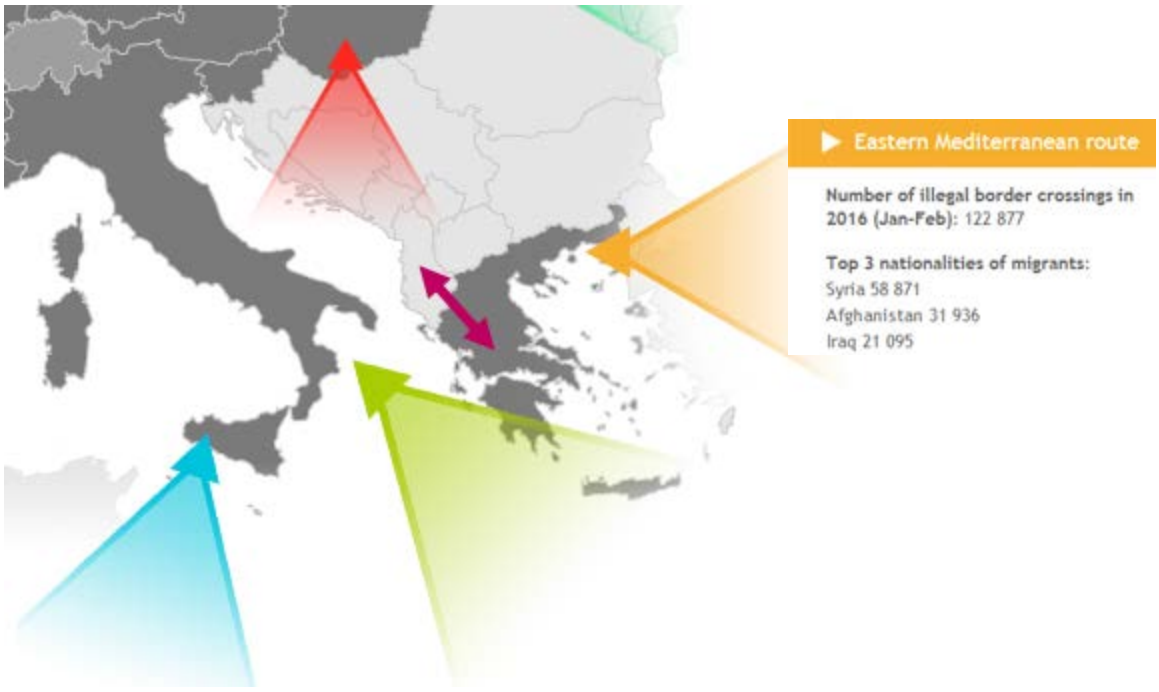

Figure 3. Migratory pressure

Source: FRONTEX, "Migratory Routes Map," accessed 1 April 2016, http://frontex.europa.eu/trends-and-routes/migratory-routes-map.

> In 2015, some 885,000 migrants arrived in the EU via the Eastern Mediterranean route–17 times the number in in 2014, which was itself a record year. The vast majority of them arrived on several Greek islands, most on Lesbos. The numbers increased gradually from January to March, but began to climb in April, peaking at 216,000 in October. The numbers eased slightly in November and December with the onset of winter, but were still well above the figures from the same months of 2014.[7]

Secondly, in order to highlight the new role and missions for the Bulgarian Armed Forces, during the analysis I will consider the 3-stage model used by IPCC. It illustrates the core concepts of the WGII AR5 where the risk of climate-related impacts results from

[7] FRONTEX, "Eastern Mediterranean Route," accessed 1 April 2016, http://frontex.europa.eu/trends-and-routes/eastern-mediterranean-route.

the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems.[8]

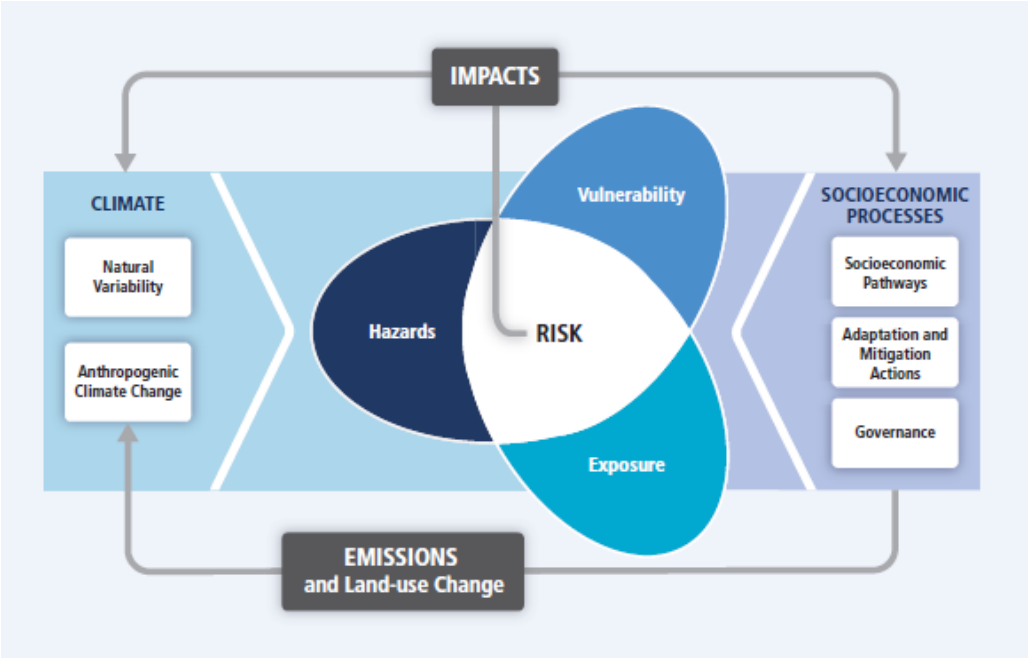

Figure 4. 3-stage IPCC model

Source: Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)," accessed 3 February 2016, http://ipcc.ch/.

Finally, I assume the climate change will follow the patterns predicted in the IPCC AR5 report.[9]

[8] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A: Global and Sectoral Aspects, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. C. B. Field et al. (Cambridge: Cambridge University Press, 2014), 1046-1050.

[9] Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

Significance of the Study

Despite the fact that the German Advisory Council on Global Change (WGBU) assessment highlighted that climate-induced inter-state wars are unlikely to occur, the global security environment is still at great risk because of climate change. There are a plethora of works and analysis which attest to the fact of a link between environmental degradation, scarcities of vital natural resources, economic disturbance, and violent conflicts.[10]

Climate change is real and severe.[11] It is here to stay and every country has to take it into consideration. It could easily activate dormant conflicts or even trigger a new one. Therefore, the military will have an increasing role as the world warms; however, whether they will be prepared and equipped for the new missions depends on the capabilities and competencies their respective governments have developed for them.

Most of the work in analyzing climate change impacts have been at the regional or larger scale. This work appears to be insufficient for the needs of Bulgaria because it lacks the resolution needed for Bulgaria to truly understand the risks posed by climate changes. This paper intends to add clarity to the analysis to fill this gap.

---

[10] Colin H. Kahl, *States, Scarcity, and Civil Strife in the Developing World* (Princeton, NJ: Princeton University Press, 2006); Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

[11] United States President, *U.S. National Security Strategy* (Washington, DC: The White House, 2014).

CHAPTER 2

THE REVIEW OF LITERATURE

Literature used in this paper represent numerous sources from UN convention, EU's directives, national security strategies, and reports, briefings, and periodicals interrelated with the climate change phenomenon, consequences, and security implications.

The initial sources comprise some of the recent studies on the impacts of climate change. This group of sources includes mainly reports from the IPCC, the European Environment Agency, the European Commission Reports, UN convention, articles and deliverables of different research projects. The main purpose of the primary group of the sources is to assess and manage the risk of climate change by compiling and analyzing statistical data which is already available. The reader would comprehend the causal relationships between climate-related drivers such as: warming trends, extreme temperatures, drying trends, extreme precipitation, precipitation, snow cover, damaging cyclones, sea level rise, ocean acidification, and carbon dioxide concentrations on the one side and the key impacts on socio-economic and environmental systems such as: increase of disease, stress on water resources, losses of arable lands, reduced food production, increase in ocean salinity, economic losses, and livelihoods on the other side. Having this information the reader would be able to perceive and rank the risk and potential threats posed by complex climate change effects. Furthermore, the literature used in that group of sources will facilitate the comprehensive risk assessment across extensive social and economic impacts and vulnerabilities.

What is the significance of the IPCC reports? The IPCC is the leading intergovernmental scientific body for studying climate change. It works under the approval of the UN and currently 195 countries are members of the IPCC. The IPCC reviews and assesses the most current information pertinent to the climate-related phenomenon. It does not conduct either research or monitoring, yet it does analyze scientific, technical and socio-economic information delivered, mostly on a voluntary basis, by hundreds of leading scientists from all over the world. The chief part of IPCC's activities includes providing a clear and up to date assessment of the scientific, technical and socio-economic facts on climate change. The IPCC "working" body is comprised of three Working Groups with designated area of responsibility. Working Group I deals with "The Physical Science Basis of Climate Change," Working Group II with "Climate Change Impacts, Adaptation and Vulnerability" and Working Group III with "Mitigation of Climate Change."[12] Each Working Group prepares its respective report which contributes to the overall Assessment Report. Since IPCC initiation in 1988 the intergovernmental body has prepared five multi-volume assessment reports. The last Fifth Assessment Report (AR5), released between September 2013 and November 2014, represents the most comprehensive, thorough and wide-spectrum report. It comprises near 5,000 pages and required great effort in the volumes of literature reviewed and data summarized during its development. The success of the IPCC process in bringing the nations of the world together to address this world scale problem represents the single most positive outcome from the climate change debate.

[12] Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

Summarizing all the information related to AR5, it confirms that there is no doubt about a strong cause-effect connection between human activities and climate change. The IPCC concludes that human influence on the climate change is clear and it impacts all the elements of social-economic domain all over the world.

> Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.[13]

Moreover, the IPCC reports firmly connects economic and population growth with the observed climate change.

> Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.[14]

All these facts and analysis indicate that climate change is a universally acknowledged fact associated with the socio-economic system and its associated impacts will continue for centuries

> Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.[15]

---

[13] Intergovernmental Panel on Climate Change (IPCC), "Synthesis Report," in *Climate Change 2014, Contribution of Working Group I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. R. K. Pachauri et al. (Cambridge: Cambridge University Press, 2014), 40.

[14] Ibid., 44.

[15] Ibid., 58.

> Many aspects of climate change and its associated impacts will continue for centuries, even if anthropogenic emissions of greenhouse gases are stopped. The risks of abrupt or irreversible changes increase as the magnitude of the warming increases.[16]

Having the projection of ever-increased global population and diminished natural resources it can be deduced that climate change impacts have the potential to create unprecedented levels of risk not only in regions associated with environmental degradation, economic disturbance, and social disruptions, but also among the developing and developed countries all over the world.[17]

Climate-Related Drivers

Social interference with the climate on the planet is inevitable as well as the risks for the human and natural systems posed by the climate change. WGII AR5 illustrates climate-related drivers of diverse impacts as result of the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems.[18] Since the IPCC Fourth Assessment Report (AR4) has been published the number of indications of climate-related drivers of impacts have grown significantly. The drivers occur on all continents and across the oceans and some of the most distinguishable could be those associated with the following severe weather events: temperature warming, extreme

[16] Intergovernmental Panel on Climate Change (IPCC), "Synthesis Report," in *Climate Change 2014, Contribution of Working Group I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 73.

[17] United Nations Framework Convention on Climate Change (UNFCCC); Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

[18] Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

temperature, drying trend, extreme precipitation, snow and ice cover, damaging cyclones, sea level rise.[19] IPCC WGI Summary for policymakers (SPM) condenses some scientific projections of climate change based on direct measurements and remote sensing from satellites and other platforms which helps the reader to comprehend the relationship of the climate-related drivers to the impacts on the human and natural systems. The projections are made based on Representative Concentration Pathways (RCPs) scenarios: RCP2.6, RCP4.5, RCP6.0, and RCP8.5 extending up to 2100. These scenarios represent the range of most likely emissions and concentrations across the full suite of GHG, aerosols, chemical active gases, and land use scenarios. Each RCP provides only one of many possible scenarios that would lead to the specific radiative forcing characteristics projected throughout the coming years.[20] In common language the range goes from an optimistic mitigation scenario (RCP2.6), to moderate at RCP 4.5 and 6.0, to most dire in impacts at RCP8.5. RCP8.5 represents continuing the emission rates as of AR5 report date. Based on multiple lines of evidence global warming will continue through the entire 21st century, and as result the global surface temperature is likely to exceed 1.5°C relative to 1850 to 1900 for all RCP scenarios except RCP2.6. It is projected to exceed 2°C for RCP6.0 and RCP8.5, and more likely than not to exceed 2°C for RCP4.5. As

[19] Dr. W. C. King, with Neil Morisette, Joseph Singh, and Members of the Global Military Advisory Council on Climate Change, "Strategic Defense Impacts of Climate Change" (Paper), 6.

[20] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. T. F. Stocker et al. (Cambridge: Cambridge University Press, 2013), 1461.

global mean temperature increases it is expected to have more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales.

In response to the global warming, changes in the global water cycle will create significant contrast in precipitation between wet and dry regions and between wet and dry seasons. Mean precipitation is likely to increase in wet regions and decrease in the dry regions by the end of the century. Furthermore, correspondingly to the global mean temperature increase, the global ocean will also continue to warm during the 21st century. Heat will penetrate from the surface to the deeper ocean and affect ocean circulation. At the beginning of the 21st century it is very likely that the Arctic sea ice cover will continue to shrink and thin and that Northern Hemisphere spring snow cover will decrease during the century as global mean surface temperature rises. Global glacier volume will further decrease. Moreover, a projection of RCP8.5 scenario estimates that it is likely the Arctic might become nearly ice-free in September in the 21st century. It is most likely the area of Northern Hemisphere spring snow cover will decrease by 7 percent for RCP2.6 and by 25 percent in RCP8.5 by the end of the 21st century. Therefore, due to increased ocean warming and increased loss of mass from glaciers and ice sheets and significant confidence in the projection of the global sea level shows that the sea level will continue to rise during the 21st century. The rate of the global mean sea level rise for 2081–2100 relative to 1986–2005 will likely be in the ranges of 0.26 to 0.55 m for RCP2.6, 0.32 to 0.63 m for RCP4.5, 0.33 to 0.63 m for RCP6.0, and 0.45 to 0.82 m for RCP8.5. With high confidence the report reveals that climate change will affect carbon cycle processes in a way that will exacerbate the increase of CO_2 in the atmosphere. Ocean uptake of anthropogenic CO_2 will continue under all four RCPs

through to 2100, with higher uptake for higher concentration pathways which would increase global ocean acidification.[21]

Key Impacts (Risks)

Given the climate-related drivers of impacts on the human and natural systems it can be deduced that some of the major risks to human security are associated with the climate-related impacts on the security environment. Moreover, some of the environmental changes driven by the warming climate represent indirect risk to the human security through deprivation of immediate basic needs.

Chapter 19 of IPCC AR5 Working Group II (WGII) focuses on analysis and assessment of the newly published literature pertinent to the distribution of risk over geographic regions, economic sectors, time periods, and socio-economic domain. In this assessment the climate-related risk is simply represented as interaction of climate change impacts and the level of exposure and vulnerability in every given sector or domain. The IPCC identifies a variety of emergent risks that were not analyzed in the previous assessment reports. Moreover, the IPCC AR5 identifies some key impacts to human and the natural system caused by climate-related drivers that yield potentially severe adverse consequences for humans and the socio-ecological system.

Although, the impacts and related risks differ considerably throughout sectors, regions, and time periods they can be roughly summarized as risks upon human health

[21] Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers," in *Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. T. F. Stocker et al. (Cambridge: Cambridge University Press, 2013), 19-29.

and existence, food security and water access, damage to livelihoods and infrastructure. As a result, in global perspective climate related risks to the human and natural systems are depicted as reduced access to some of the basic needs such as food, clean water, and housing, or risks to the people's health, infrastructure damages, and losses in livelihood. The analysis shows that all of the human and natural domains are highly dependent and vulnerable to any climate variations and its related effect. Furthermore, more often than not a single climate-related driver would have a severe impact on several aspects of the human and natural systems. The following paragraph intend to show the causal connection between the drivers and impacts.

The projected temperature warming (with high confidence) will create significant reductions in water availability and food production, increase incidence of diseases and ill-health, degrade coral reefs and increase ocean salinity, reduce arable lands, stocks and livelihoods. Concurrently, extreme temperature events are expected to significantly increase death, injury, and ill-health, food insecurity, stress water resources, and decrease agricultural productivity. The drying trend would create a significant risk of food insecurity and water supply. Extreme precipitation, through inland flooding, will create conditions for epidemic disease, losses of life and livelihoods, damages to the infrastructure, stress on food and water supply, and increased economic losses. Further, changes in precipitation patterns will increase losses of arable land, food productivity, biodiversity, and ecosystem goods. Losses of snow and ice cover have direct impacts on water resources, create conditions for flooding and droughts, and increase the rates of the warming. Damaging cyclones will increase the losses of life and property damage, economic losses, ecosystems and biodiversity, and post-disaster diseases. Projected sea

level rise will create losses of coastal infrastructure, livelihoods and settlements, marine ecosystems and biodiversity, economic losses and food production.[22]

In addition, chapter 12 of IPCC AR5 WGII is the contribution of Working Group II to the whole IPCC AR5 which directly communicates the human security threats and risks. It offers robust evidence and high agreement among the scientists demonstrating the cause-effect relationship between climate change and human security.

> Human security will be progressively threatened as the climate changes. Human insecurity almost never has single causes, but instead emerges from the interaction of multiple factors. Climate change is an important factor threatening human security through (1) undermining livelihoods; (2) compromising culture and identity; (3) increasing migration that people would rather have avoided; and (4) challenging the ability of states to provide the conditions necessary for human security.[23]

The cultural aspects of human security focuses on identity, community, and economic activities. The IPCC AR5 suggests that any changes in the access to natural resources would directly affect the indigenous cultures. Considering the probability of the climate change scenarios and their impact on the vital natural resources it be concluded that climate change would have its great impact on cultural dimensions as pastoralism, herding, farming, fishing, hunting, and other local customs.

---

[22] Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers," in *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,* eds. C. B. Field, et al. (Cambridge: Cambridge University Press, 2014), 11-28; King et al., "Strategic Defense Impacts of Climate Change," 6.

[23] Intergovernmental Panel on Climate Change (IPCC), "Summary for Policymakers," in *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A,* 758.

Another profound impact on the human security would be increasing migration. A significant number of sources suggest the connection between the climate related extreme weather events and both temporary and permanent migration and resettlement.[24] In either scenario it would create social instability and a vulnerable environment to both migrants and hosts, which contributes to the holistic security environment.

Despite the fact that IPCC AR5 does not focus specifically on the security issues driven by the climate change impact, the report provides an abundance of data, information, and knowledge which attests to the fact of changing security environment and emerging new threats that must be taken into account.

> Climate change will amplify existing risks and create new risks for natural and human systems. Risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development. Increasing magnitudes of warming increase the likelihood of severe, pervasive and irreversible impacts for people, species and ecosystems. Continued high emissions would lead to mostly negative impacts for biodiversity, ecosystem services and economic development and amplify risks for livelihoods and for food and human security.[25]

In *States, Scarcity, and Civil Strife in the Developing World*, Colin H. Kahl examines the connection between the large-scale, sustained, and organized violent conflicts within the countries on the one side and rapid population growth, environmental degradation, inequality, and emerging scarcities of vital natural resources on the other side. The plethora of sources he used in his book unquestionably show the climate-related impacts on the security environment. Despite the fact that climate change could increase

---

[24] Kahl, *States, Scarcity, and Civil Strife in the Developing World*.

[25] Intergovernmental Panel on Climate Change (IPCC), "Synthesis Report," in *Climate Change 2014, Contribution of Working Group I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 64.

the potential of violent conflict or impact the factors related to civil war, it would be a big challenge to find enough evidence to directly connect climate change and war.

> In summary, there is justifiable common concern that climate change or changes in climate variability increase the risk of armed conflict in certain circumstances, even if the strength of the effect is uncertain. This concern is justified given robust knowledge of the factors that increase the risk of civil wars, and medium evidence that some of these factors are sensitive to climate change.[26]

Given all these facts and projections there is no doubt that climate change phenomena will lead to new threats to the human security and will shape the future security environment.

Climate-Related Drivers in Europe

Chapter 23 of IPCC AR5 Working Group II (WGII) focuses particularly on the climate changes and its impacts in Europe.

Despite the fact that climate change projections shows a high confidence in increased temperature and droughts all around the European region, it should be noted that there are significant differences in the projected precipitation levels within the northern and southern sub-regions. However, high-temperature extremes, heavy precipitation events, and sea level rise with variation across Europe are expected to have great impact on economic activities, infrastructure, tourism, and agriculture. Additional threats to the socio-economic domain would be imposed by sub-factors as droughts, floods, wildfires, coastal erosion, and cereal yields.

> Climate change will have adverse impacts in nearly all sectors and across all sub-regions. A key finding is that all sub-regions are vulnerable to some

[26] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A,* 773.

impacts from climate change but these impacts differ significantly in type between the sub-regions.[27]

For a better understanding and clearer analysis of the climate change phenomena in Europe, the region has been divided by the IPCC into five sub-regions representing specific geographical and ecological zones: Atlantic, Alpine, Southern, Northern, and Continental.

[27] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part B,* 1300.

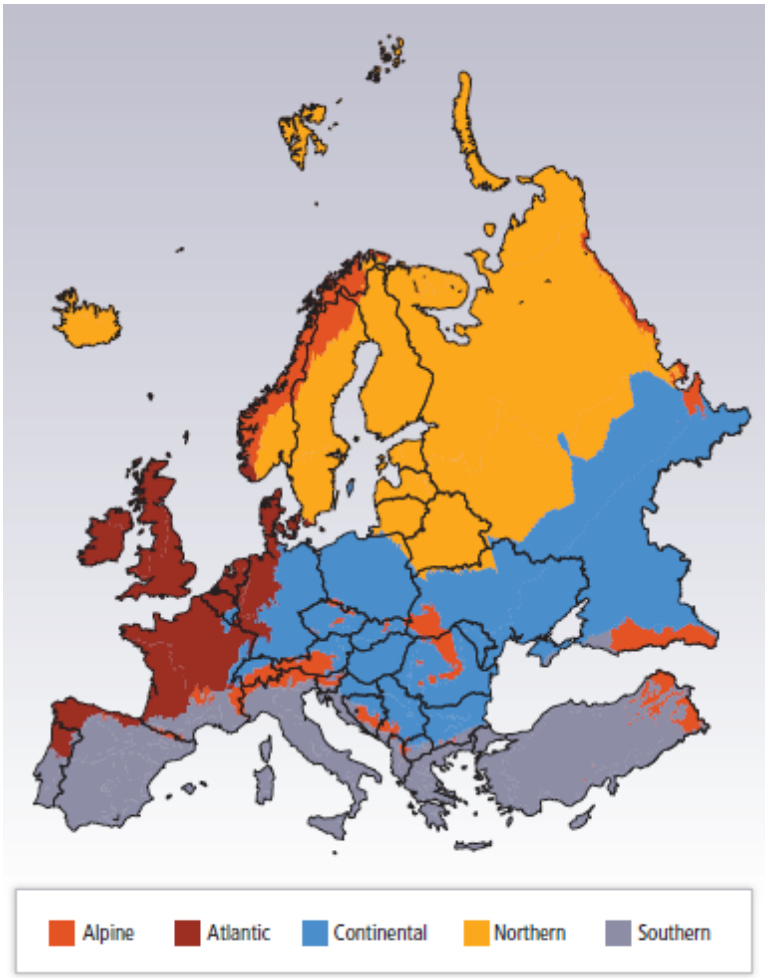

Figure 5. Europe – IPCC sub-regions

Source: Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)," accessed 3 February 2016, http://ipcc.ch/.

As globally observed, with some expected regional and seasonal distinctions, the average temperature in Europe has also continued to increase. With greatest rates in high latitudes in Northern Europe the decadal average temperature over land area for 2002–2011 was 1.3°± 0.11°C above the 1850–1899 average. Moreover, since 1950 the hot days, tropical nights, and heat waves in Europe have more frequently defined the high

temperature trend. Since 1500 the hottest summer was registered in 2010 in Eastern Europe and Western Russia.

No trend changes are anticipated in the future. All climate models show a significant agreement on the projected warming all over Europe. The highest magnitude and rate of warming is anticipated in Southern Europe in summer, and in Northern Europe in winter.

Another climate-related driver with significant regional impact in Europe is precipitation. Since 1950, annual precipitation in Northern Europe has increased up to +70 mm per decade, and considerably decreased in parts of Southern Europe. Besides the fact that there is not sufficient information about past and future changes in hail occurrence in Europe, the precipitation trends are much clearer. Precipitation is projected to decrease in Southern Europe and increase in Northern Europe; however, the mean snowpack in Northern Europe is projected to decrease with more in mountainous regions.

The observed climate change analysis shows increased mean sea level with regional variations all around the continent. Although, the significant confidence in projected global mean sea level rises, there is a low confidence on projected regional changes. However, the sea level rise trend is expected to increase with the increase of the temperature.

There is a general high confidence in projected climate change extremes.

In winter, small increases in extreme wind speed are projected for Central and Northern Europe, while a small decreasing trend in Southern Europe is anticipated. On

the other hand, Southern Europe shows trends toward more intense and longer droughts, while in all other sub-regions the trend is not statistically significant.[28]

Key Impacts in Europe

As the rate and magnitude of the climate-related drivers of impacts increase they also increase the risks and the magnitude of the key impacts on the human and natural systems. Unsurprisingly, with some regional and seasonal deviations in magnitude and severity, each climate-related driver in Europe has several areas of impact on human and natural systems.

For instance, the risk of extreme sea level rise continues to be a key challenge for several European cities and coastal infrastructure. It would create a coastal flood damage to the infrastructure, economic losses, damage livelihoods, stress water and food supply systems, and produce coastal erosion affecting cultural heritage and landscapes

The observed drying trend will reduce water availability, food production, livelihoods, and economic losses. It also will have a great impact on health and well-being, labor productivity, crop production, and would increase the risk of wildfires in southern Europe.

Extreme temperature will have a significant social impact such as increase mortality, create more health issues, stress water resources, impact food security and critical infrastructure, livestock production and agriculture, damage road and rail

[28] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part B,* 1275-1279.

transport systems, reduce / interrupt operation of nuclear power plants, and increase outdoor pollution.

Extreme precipitation through inland flooding, will create conditions for epidemic infection, losses of life and livelihoods, damage to the infrastructure, stress on food and water supply, and increased economic losses. Precipitation on other hand would directly impact agriculture, food productivity, economic losses, and water quality degradation.[29]

Climate-Related Drivers in Bulgaria

The geographic location of the country, diverse relief, and position of the mountains explain the climate specifics in Bulgaria. Geographically, the country is located in Southeastern Europe on the Balkan Peninsula and according to the IPCC classification the country falls in both continental and southern sub-regions.

With a territory of 110,994 m2 Bulgaria has diverse relief, which includes 31 percent lowlands (0–200 m), 41 percent hills (200–600 m2), 25 percent highlands (600–1,600 m2), and 3 percent mountains (>1,600 m2).[30]

The Balkan Mountains, which splits the country into northern and southern Bulgaria, represents a natural barrier for the movement of the atmospheric air masses and has the greatest impact on the climate and its characteristics.

All these conditions determine the predominantly temperate continental climate in Bulgaria with certain Mediterranean influences in the southern part of the country.

---

[29] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part B,* 1279-1295.

[30] Climate Change Post, "Climate Change Bulgaria," accessed 20 December 2015, http://www.climateadaptation.eu/bulgaria/climate-change.

Bulgaria has four very distinct seasons with damp and cold winters and hot and dry summers. The continental influence, which is stronger during the winter, generates the cold and wet weather, while the Mediterranean influence, stronger during the summer, generates the hot and dry weather. The annual average temperature depends on the latitude and varies in the northern and southern part of the country. Usually the northern part is cooler and receives more rainfall than the southern part. Daytime temperature ranges from 0-5°C in the winter and 25-30°C in summer months. Annual average rainfall is about 600 mm. Winter is the driest season, while in summer, showers and thunderstorms are common, especially in the mountains.

For the purpose of this paper and better understanding the variability of the climate within the different regions of Bulgaria, figuratively the country will be split into six distinguishable major areas: Sofia, Plovdiv, Varna, Burgas, Pleven, and Sandanski.

Sofia, the capital of Bulgaria, is located in the central western part of the country. Although diverse all over the country, the climate in Sofia is closest to the average climate in the country. Sofia has hot and dry summers which usually start in June and finish at the end of August. The average high temperature in summer reaches about 30°C. In summer Sofia can become unpleasantly hot and very dusty due to the lack of rain and lack of humidity. Winter comes usually in mid-December and lasts until the end of February. The average low temperature in winter drops to -4°C. From September to November is the fall for Sofia. At that time the temperature drop rapidly from the warm

summer highs towards the cold winter lows. Similarly the spring in Sofia sees a rapid temperature increase from the cold of winter to the warmth of the summer.[31]

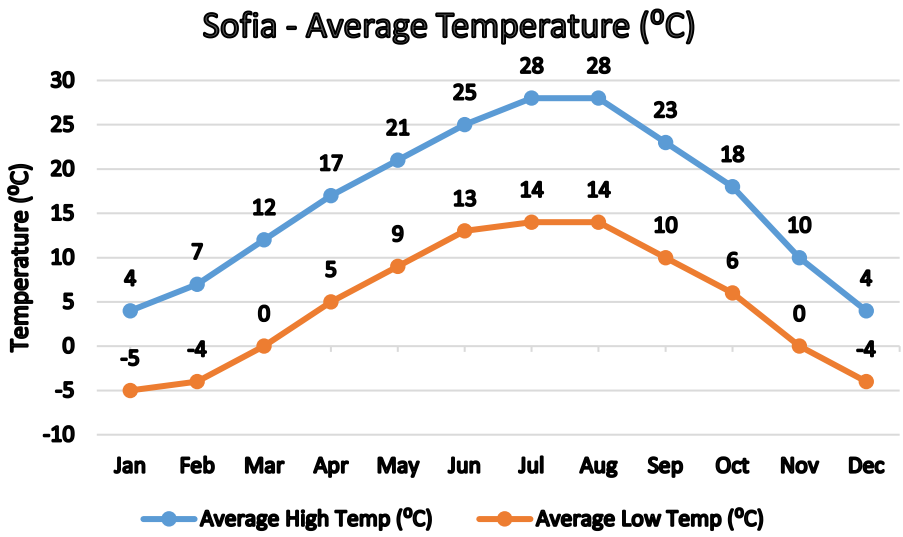

Figure 6. Annual mean temperature in Sofia

Source: Created by author. Data from ClimaTemps, "Sofia," accessed 10 January 2016, http://www.sofia.climatemps.com.

[31] World Weather Online, "Sofia Weather, Bulgaria," accessed 10 January 2016, http://www.worldweatheronline.com/sofia-weather-averages/grad-sofiya/bg.aspx.

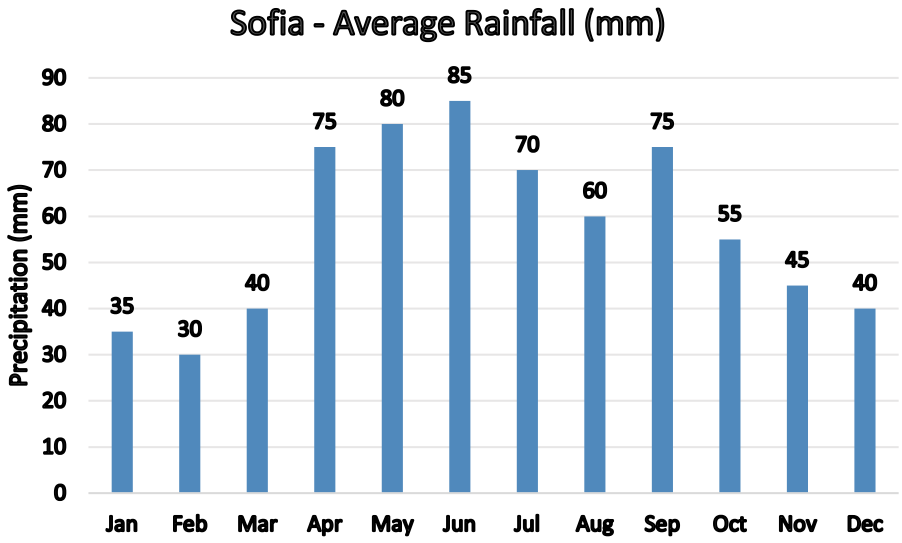

Figure 7. Annual mean rainfall in Sofia

Source: Created by author. Data from ClimaTemps, "Sofia," accessed 10 January 2016, http://www.sofia.climatemps.com.

Plovdiv is located in the central southern part of the country. It has predominantly a humid subtropical climate with considerable continental influence. The summers are hot and moderately dry and usually start in mid-May and continue to late September. The average high temperature in summer reaches above 31°C. Winters are mild with precipitation from mid-latitude cyclones. The average low temperature in winter is around -1°C. Similarly to the other part of Bulgaria, spring and fall are the transition seasons between the hot summers and cold winters.[32]

[32] World Weather Online, "Plovdiv Weather, Bulgaria," accessed 10 January 2016, http://www.worldweatheronline.com/plovdiv-weather/plovdiv/bg.aspx.

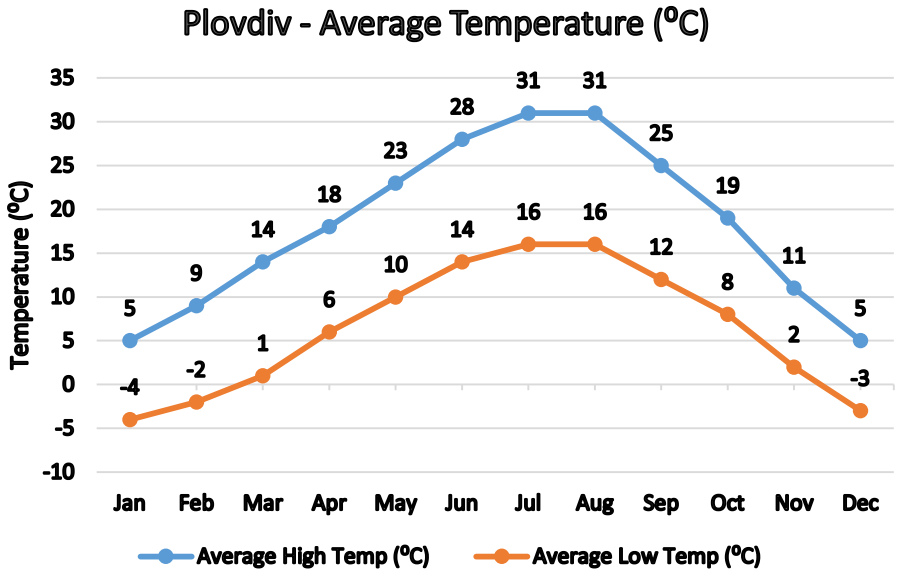

Figure 8. Annual mean temperature in Plovdiv

Source: Created by author. Data from ClimaTemps, "Plovdiv," accessed 10 January 2016, http://www.plovdiv.climatemps.com.

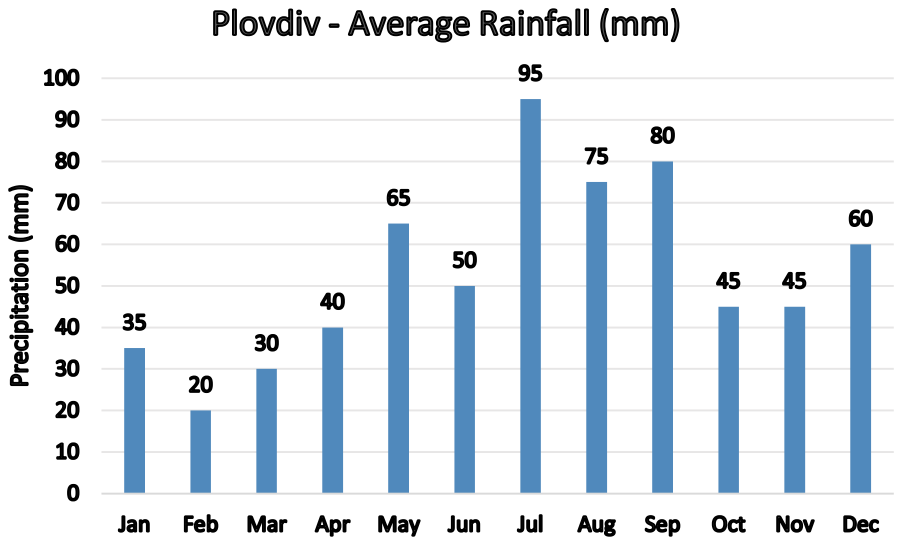

Figure 9. Annual mean rainfall in Plovdiv

Source: Created by author. Data from ClimaTemps, "Plovdiv," accessed 10 January 2016, http://www.plovdiv.climatemps.com.

Varna is located in the northeastern part of Bulgaria on Black Sea coast. It has humid subtropical climate with considerable maritime influence. The summer begins in early May and lasts till early October. The average high temperature in summer is around 26°C. In winter the average low temperature is 0°C. Snow falls occasionally.[33]

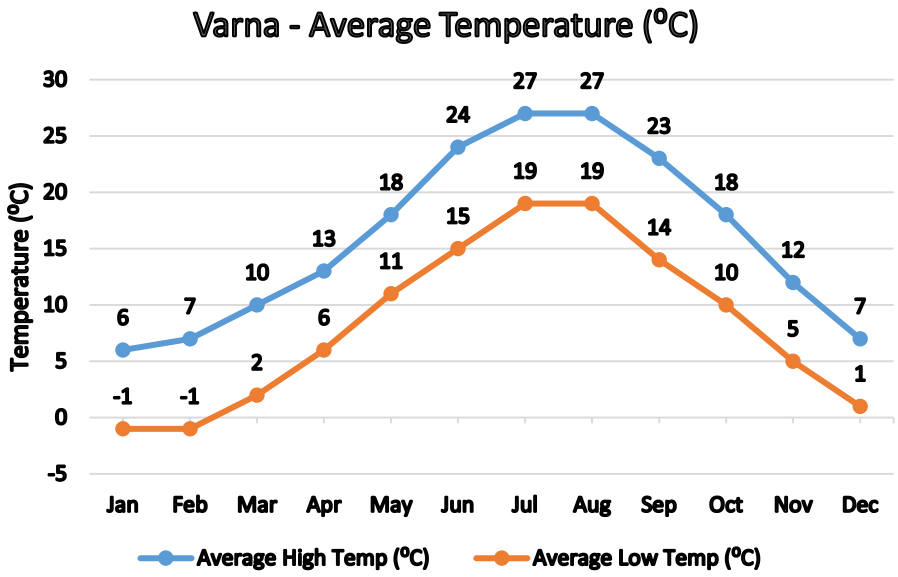

Figure 10. Annual mean temperature in Varna

Source: Created by author. Data from ClimaTemps, "Varna," accessed 10 January 2016, http://www.varna.climatemps.com.

[33] World Weather Online, "Varna Weather, Bulgaria," accessed 10 January 2016, http://www.worldweatheronline.com/varna-weather/varna/bg.aspx.

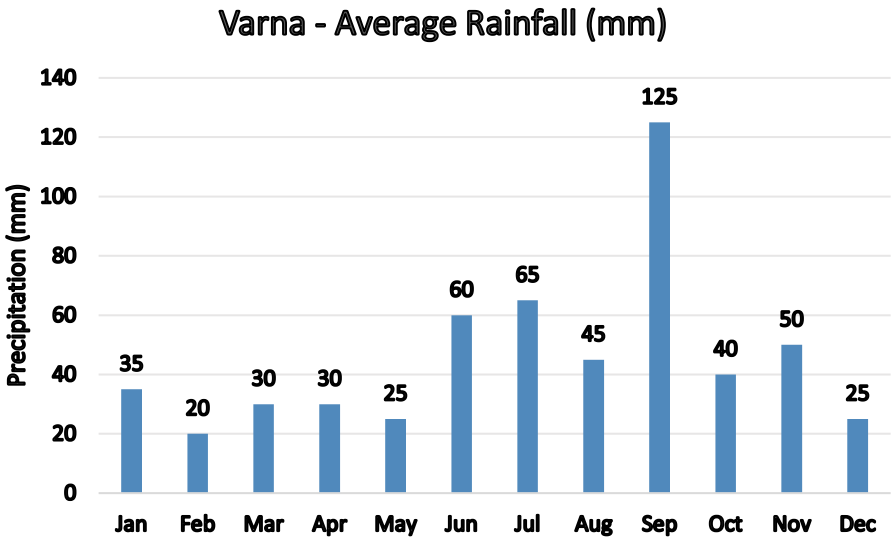

Figure 11. Annual mean rainfall in Varna

Source: Created by author. Data from ClimaTemps, "Varna," accessed 10 January 2016, http://www.varna.climatemps.com.

Burgas is the other major city in Bulgaria which also is located on the Black Sea coast. The difference with Varna is that Burgas is located in southeastern part of the country. It has the same subtropical climate and considerable maritime influence as Varna. However, the average high temperature in summer is higher and reaches around 28°C. In winter the average low temperature is 0°C. Snow falls occasionally.[34]

[34] World Weather Online, "Burgas Weather, Bulgaria," accessed 10 January 2016, http://www.worldweatheronline.com/burgas-weather/burgas/bg.aspx.

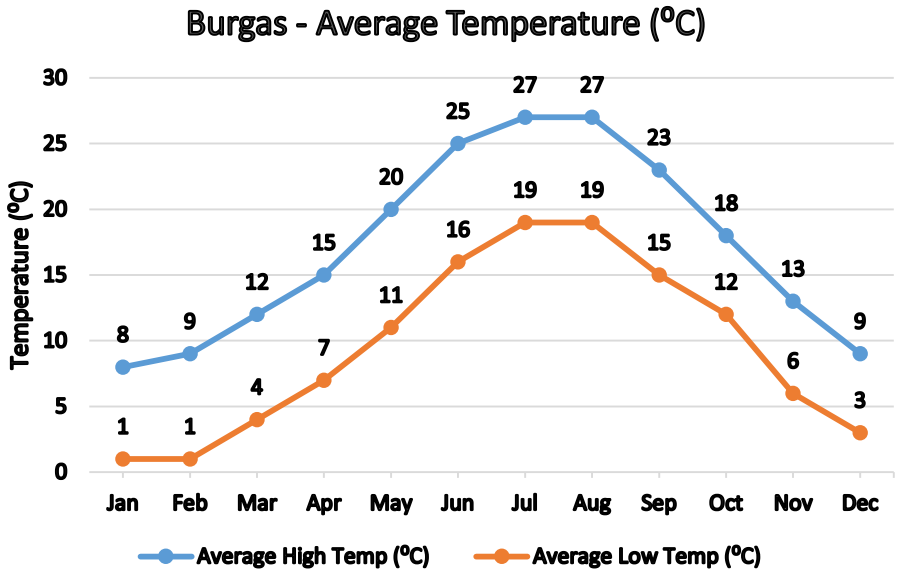

Figure 12. Annual mean temperature in Burgas

Source: Created by author. Data from ClimaTemps, "Burgas," accessed 10 January 2016, http://www.burgas.climatemps.com.

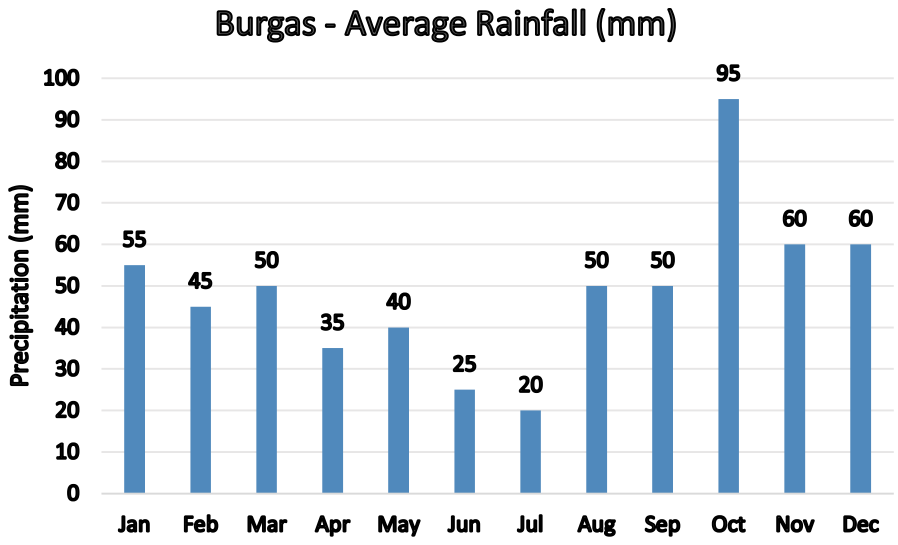

Figure 13. Annual mean rainfall in Burgas

Source: Created by author. Data from ClimaTemps, "Burgas," accessed 10 January 2016, http://www.burgas.climatemps.com.

Pleven is located in the central northern part of Bulgaria. It has temperate continental climate with large temperature differences. Winters are cold with temperatures falling below -20°C and an abundance of snow. Summers are very hot when temperatures can exceed 38–40°C. The average high temperature in summer reaches above 31°C. The average low temperature in winter is around -4°C.[35]

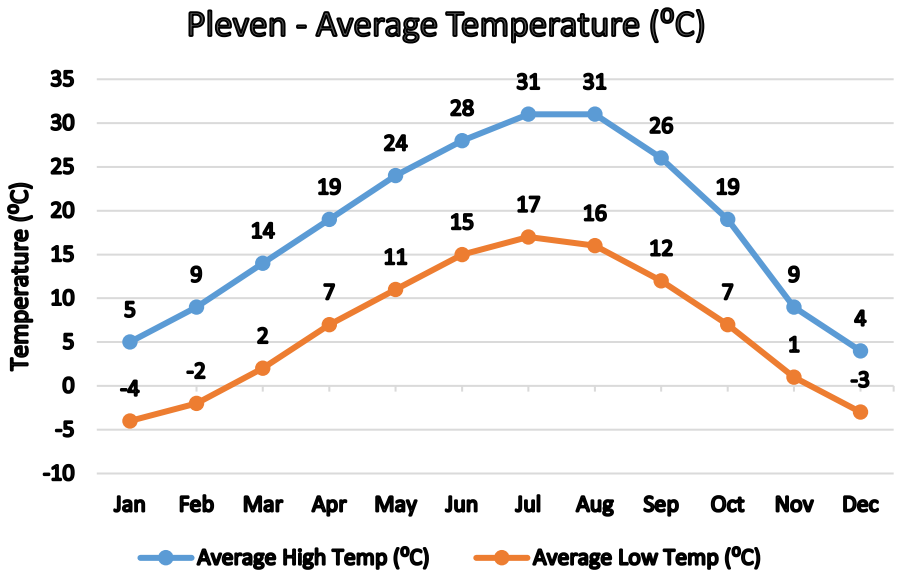

Figure 14. Annual mean temperature in Pleven

Source: Created by author. Data from ClimaTemps, "Pleven," accessed 10 January 2016, http://www.pleven.climatemps.com.

[35] World Weather Online, "Pleven Weather, Bulgaria," accessed 10 January 2016, http://www.worldweatheronline.com/pleven-weather/pleven/bg.aspx.

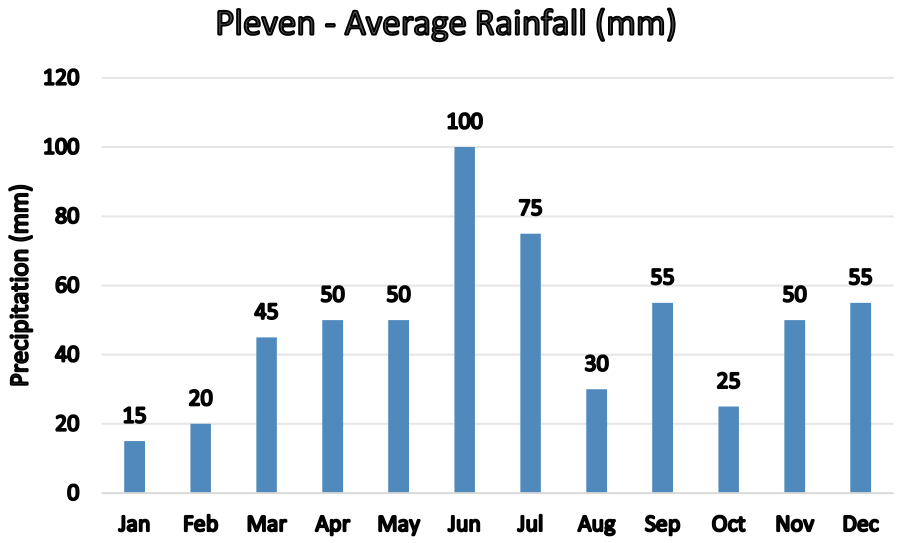

Figure 15. Annual mean rainfall in Pleven

Source: Created by author. Data from ClimaTemps, "Pleven," accessed 10 January 2016, http://www.pleven.climatemps.com.

Sandanski is located in the southwestern part of Bulgaria. It has predominantly Mediterranean climate. Summers are very hot and dry with occasional rainfall, they have the longest summer season in Sandanski, starting from mid-May and lasting until mid-October. The average high temperature in summer is above 33°C, but more often than not the maximum temperature exceeds 40°C. The highest recorded temperature in the city was 45°C. Winters last for about three months. Usually they are damp and relatively mild. It is considered the wettest period in the region.[36]

[36] World Weather Online, "Sandanski Weather, Bulgaria," accessed 10 January 2016, http://www.worldweatheronline.com/sandanski-weather/blagoevgrad/bg.aspx.

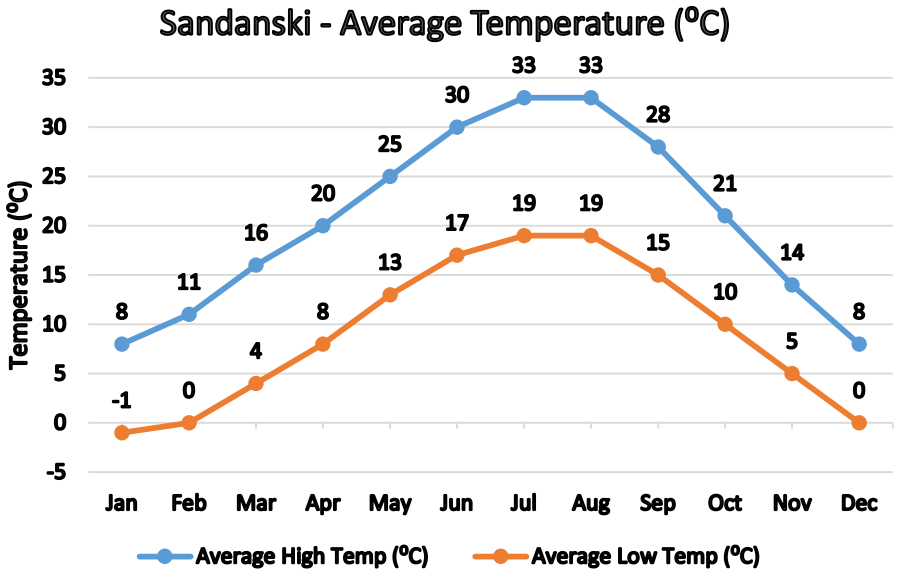

Figure 16. Annual mean temperature in Sandanski

Source: Created by author. Data from ClimaTemps, "Sandanski," accessed 10 January 2016, http://www.sandanski.climatemps.com.

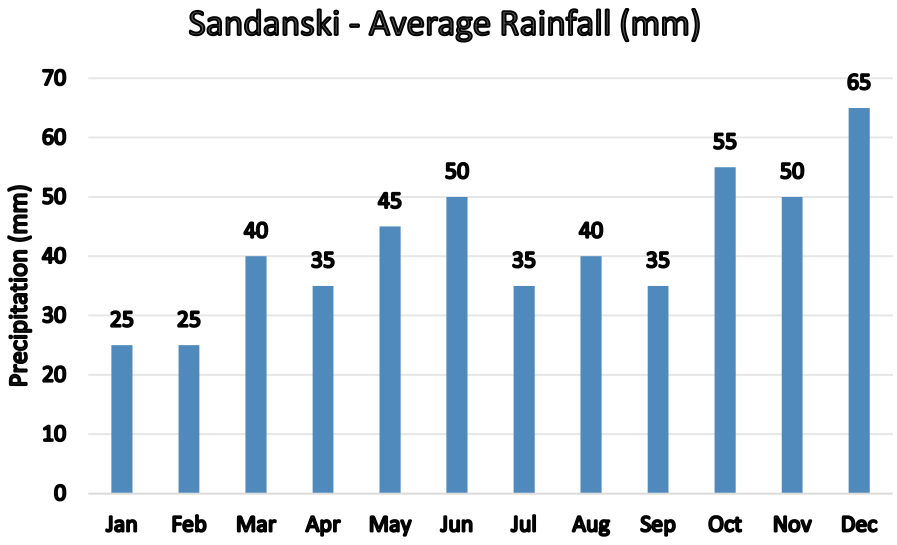

Figure 17. Annual mean rainfall in Sandanski

Source: Created by author. Data from ClimaTemps, "Sandanski," accessed 10 January 2016, http://www.sandanski.climatemps.com.

Summarizing all the information pertinent to the mean annual air temperature in Bulgaria a recent warming is observed. For instance, since 1997 all annual temperature anomalies are positive. Moreover, 1994, 2000, 2002, and 2009 were among the warmest years in record in Bulgaria, while 2007 was the warmest year ever recorded in Bulgaria. In addition, in the southwestern part of the country, with Mediterranean influence, the number of heat waves have increased significantly.[37]

Despite the fact that last decade the precipitation totals have increased in Bulgaria and heavy rains caused severe floods and damaged different socioeconomic sectors, there is no doubt among scientists that climate in Bulgaria has started becoming drier. In addition, a significant reduction in annual mountain precipitation and snow cover during the winter confirms the overall warming in all regions in Bulgaria.

Extreme temperatures are another climate-related driver with significant impact on Bulgarian region. Particularly dangerous for the life and health of people, when they persist over several days, extreme temperature severely damages the transport infrastructure, creates favorable conditions for fires and damage to crops. In temperate latitudes, the extreme high temperature refers to the periods in which at least three consecutive days were measured temperatures above 32°C. A study shows 85 percent of the registered extreme high temperature in Bulgaria occurred in the period 1991-2000. The most commonly affected regions in Bulgaria are the Pleven region in northern Bulgaria and Plovdiv and Sandanski regions in southern part of the country. A 1998

[37] Climate Change Post, "Climate Change Bulgaria," accessed 20 December 2015, http://www.climateadaptation.eu/bulgaria/climate-change/.

heatwave gripped the Balkan Peninsula taking hundreds of lives and causing many others to be hospitalized. This phenomenon has led to similar effects in Bulgaria as early 1987, 1988, 1994, 2000, and also in the last decade.

Drying trend is another climate-related driver of impacts on the human and natural systems. In temperate latitudes a rain-free period of at least 10 days is seen as moderate drought and it can be observed in all seasons. The criterion for the degree of drought is the amount of productive moisture in the root-layer of soil (0-20 cm). At values between 10 and 20 mm it is considered as moderate drought, and at values below 10 mm–severe drought. Reducing the moisture in the top 1-meter layer soil below 60 mm is a sign of extreme drought. In Bulgaria droughts are yearly phenomenon and severe spring or summer droughts occur with a frequency of once every three years. Their average duration is 10-12 days in mountainous areas and up to 16-18 days in the eastern and southeastern parts of the country. The longer droughts often cause dryness of the smaller rivers in southern, eastern, and northeastern regions of the country where the phenomenon continues over 75 days per year. The most severe droughts are often accompanied by so called hydrological drought, where the effect is the reduction of water resources, drying up of rivers, and shortage of water supply to the population in the affected areas.

In last century in Bulgaria there were three major periods with prolonged droughts: 1902-1913; 1942-1953; 1982-1994. In the first period, the dry years were about 20 percent, in the second, an increase to 40 percent, and the third drought reached about 50 percent. The drought that began in 1982 turned into a severe drought with catastrophic consequences for the country in 1993-1994. In this period the river flow fell by up to 41

percent of normal, ordinary fir forests were starting to dry up, a growing number of forest fires, increased morbidity, and the population almost everywhere was under water restrictions. Scientists are unanimous on the key factors causing the increase in the number of droughts. All agreed that it is the reduction or lack of rainfall and rising air temperatures. According to all RCP scenarios of climate change Bulgaria is expected to see higher temperatures and decreasing summer precipitation by the end of this century.[38]

Projected Changes in Bulgaria

Depending on the climate change scenario (RCP 2.6, RCP 4.5, RCP 6, RCP 8.5) the mean annual air temperature in Bulgaria is projected to increase with from 1°C to 7 °C by 2100 compared with those in the baseline period (1961-1990). The biggest change (increase of 5°C to 7°C) would occur at the end of the century, in case of RCP 8.5 scenario, which shows the emissions and concentrations of GHG and aerosols are constantly increasing. In the most optimistic scenario, RCP 2.6, temperature increase by the end of the century will be close to 2°C. In RCP 4.5 and RCP 6 scenarios anticipated temperature increase by 2100 is about 3.0°C - 4.0°C.

Seasonal minimum and maximum temperatures changes will vary in different RCP scenarios and regions in Bulgaria. Expected increase of the average minimum winter temperatures by the end of the century in RCP 2.6 scenario will be to 2.0°C, and

[38] Анализ и оценка на риска и уязвимостта на секторите в българската икономика от климатичните промени, Обща част. МОСВ на Република България, [Analysis and assessment of the risk and vulnerability of sectors in the Bulgarian economy from climate change, General, Ministry of Environment and Water of Bulgaria, Sofia, Bulgaria], 115-140.

up to 4°C - 5°C for RCP 8.5. The summer rise in minimum temperatures is expected to be in the range of 5°C - 7°C by the end of the century for RCP 8.5 scenario. RCP 4.5 and RCP 6 scenarios increases toward the end of the century are projected to be between 3°C and 4°C. For the RCP 2.6 scenario by 2100 the increase is expected to be in the range of 1.5°C to 2.0°C.

Expected increase of the average maximum winter temperatures by the end of the century for RCP 8.5 scenario will be up to 5°C - 7°C in the Pleven region and 4°C to 5°C for the rest of the country. For RCP 6 scenario the projected increase by 2100 is 3.0°C - 4.0°C. RCP 4.5 scenario on the expected increase in the average maximum winter temperatures at the end of the century is 2.0°C - 3.0°C, and 1.5°C - 2.0°C for RCP 2.6.

Projected increase in summer average maximum temperatures at the end of this century for RCP 8.5 scenario will be 5.0°C - 7.0°C along the Black Sea coast and 7.0°C - 9.0°C inland. In the case of RCP 6 scenario the expected increases in average summer maximum temperatures is 5.0°C - 7.0°C in Pleven region and 4.0°C to 5.0°C for the rest of the country. For RCP 4.5 scenario temperatures increase between 3.0°C to 4.0°C and the Black Sea and the rest of a 4.0°C to 5.0°C; and the increase is 1.5°C - 2.0°C for RCP 2.6.

The transitional seasons (spring and fall) are also expected to see increases in the average minimum and average maximum temperatures. In fall this increase is larger compared to the spring. The increase in average minimum temperatures in the spring by the end of the century in case of RCP 2.6 scenario will be 1.5°C - 2.0°C, but for RCP 8.5 scenario will be 5.0°C - 7.0°C. Expected increase in average maximum temperatures in

fall will be greatest at the end of the century. For RCP 8.5 – from 4.0°C to 5.0°C on the Black Sea coast and Southeastern Bulgaria, and from 5.0°C to 7.0°C inside the rest of the country.[39]

Table 1. Projected changes in average annual and seasonal temperatures in 2100 compared to the reference climatic period (1961-1990**)** according to the RCP scenarios of IPCC AR 5

ΔT (^{0}C) 2100									
	Annual Mean ΔT (Jan-Dec)	**Winter (Dec-Feb)**		**Spring (Mar-May)**		**Summer (Jun-Aug)**		**Fall (Sep-Nov)**	
		ΔT min	**ΔT max**	**ΔT min**	**ΔT max**	**ΔT min**	**ΔT max**	**ΔT min**	**ΔT max**
RCP2.6	+1.5/ +2.0	+1.5/ +2.0	+1.5/ +2.0	+1.5/ +2.0	+1.5/ +2.0	+2.0/ +3.0	+2.0/ +3.0	+1.5/ +2.0	+2.0/ +3.0 +1.5/ +2.0
RCP4.5	+3.0/ +4.0 +2.0/ +3.0	+2.0/ +3.0	+2.0/ +3.0	+2.0/ +3.0	+2.0/ +3.0	+3.0/ +4.0	+3.0/ +4.0 +4.0/ +5.0	+3.0/ +4.0	+3.0/ +4.0 +2.0/ +3.0
RCP6	+3.0/ +4.0	+3.0/ +4.0 +2.0/ +3.0	+3.0/ +4.0	+2.0/ +3.0	+3.0/ +4.0	+3.0/ +4.0	+4.0/ +5.0 +5.0/ +7.0	+3.0/ +4.0	+3.0/ +4.0 +4.0/ +5.0
RCP8.5	+4.0/ +5.0	+4.0/ +5.0	+5.0/ +7.0 +4.0/ +5.0	+4.0/ +5.0	+5.0/ +7.0 +4.0/ +5.0	+5.0/ +7.0	+5.0/ +7.0 + 7.0/+9.0	+5.0/ +7.0 +4.0/ +5.0	+5.0/ +7.0
RANGE	+1.5/ +2.0 +4.0/ +5.0	+1.5/ +2.0 +4.0/ +5.0	+1.5/ +2.0 +5.0/ +7.0	+1.5/ +2.0 +4.0/ +5.0	+1.5/ +2.0 +4.0/ +5.0	+2.0/ +3.0 +5.0/ +7.0	+2.0/ +3.0 +7.0/ +9.0	+1.5/ +2.0 +5.0/ +7.0	+2.0/ +3.0 +5.0/ +7.0

Source: Created by author. Data from Analysis and assessment of the risk and vulnerability of sectors in the Bulgarian economy from climate change, General Report, Ministry of Environment and Water of Bulgaria, Sofia, Bulgaria.

In summary, the analysis predicts a continual, gradual and relatively strong warming of the area. With significant summer warming, the number of the summer days is projected to increase, the extremely high temperatures will become the norm, and the

[39] Анализ и оценка на риска и уязвимостта на секторите в българската икономика от климатичните промени, Обща част. МОСВ на Република България, 43-97.

number of hot days will grow. Winters will be milder in the next decades and the number of ice days will decrease. Daytime maximum temperatures appear to increase most rapidly in the northern part of the region.

Unlike the mean annual temperature in Bulgaria, where the general trend is upwards, projected changes in precipitation are diverse depending on the given RCP scenario, future period, and region. For instance, in case of RCP 2.6 scenario, increases by about 10 percent of annual rainfall are projected for most of the country by the end of the century, while the same percentage decrease is projected in the southern parts of Western and Central Bulgaria (Plovdiv and Sandanski regions). Overall, for this scenario is not expected to change the value of the annual precipitation in Bulgaria. However, in case of RCP 8.5 scenario by the end of the century the annual precipitation in Bulgaria is projected to decrease between 10 and 20 percent. For the other two scenarios (RCP 4.5 and RCP 6) the annual mean precipitation will decrease by up to 10 percent. The most drastic reduction is summer rainfall by 20-30 percent across the country and even by 30-40 percent in Southeast Bulgaria is expected for RCP 8.5 scenario at the end of the century.[40]

[40] Анализ и оценка на риска и уязвимостта на секторите в българската икономика от климатичните промени, Обща част. МОСВ на Република България, 115-140.

Table 2. Expected changes in average annual, winter and summer precipitation in 2100 compared to the reference climatic period (1961-1990) according to the RCP scenarios of IPCC AR 5

ΔP (mm) 2100									
	Annual Mean ΔP (Jan-Dec)			**Winter (Dec-Feb)**			**Summer (Jun-Aug)**		
	mm/day	**%**	**trend**	**mm/day**	**%**	**trend**	**mm/day**	**%**	**trend**
RCP2.6	0-0.1	0-10	↓↑	0-0.1	0-10	↓↑	0-0.1	0-10	↓
RCP4.5	0-0.1	0-10	↓	0-0.1	0-10	↓↑	0.1-0.2	0-10 10-20	↓
RCP6	0-0.1 0.1-0.2	0-10	↓	0-0.1	0-10	↓	0.2-0.5	10-20	↓
RCP8.5	0.1-0.2 0.2-0.5	10-20	↓	0-0.1 0.2-0.5	0-10	↓	0.2-0.5	20-30 30-40	↓
RANGE	0-0.1 0.2-0.5	0-10 10-20	↓↑	0-0.1 0.2-0.5	0-10	↓↑	0-0.1, 0.2-0.5	0-10 30-40	↓

Source: Created by author. Data from Analysis and assessment of the risk and vulnerability of sectors in the Bulgarian economy from climate change, General Report, Ministry of Environment and Water of Bulgaria, Sofia, Bulgaria.

In summary, the analysis reveals a continuation of the declining trend in the annual mean precipitation in Bulgaria. A decline of 5–30 percent of annual precipitation by 2100 relative to the reference period 1961–1990 is projected. The number of the rainy days will decrease; however, the intensity of precipitation (maximum amount of rain per day) is expected to increase over the region causing floods and damage.

All these facts related to the Bulgarian climate specifics determine and affect the socio-economic domain in the region. It defines the levels of distress to local culture and customs, economic and tourism, and biodiversity and agriculture.

Key Impacts in Bulgaria

Likewise in Europe, as the rate and magnitude of the climate-related drivers of impacts increase it also increases the risks of the key impacts on the human and natural systems in Bulgaria. Naturally, each climate-related driver may cause impacts on several areas, systems, and domains. For instance, the risk of extreme temperature all together with the warming trends, droughts, extreme precipitations, and lack of snow cover will continue to be a key challenge for both social and economic domains in Bulgaria. With regard to social sphere, climate-related drivers would have a great impact on human life, health, food and water security by increasing the diseases and infections, stress on water resources and food production, quality of life, and mortality. Regarding the economic sphere, climate-related drivers would impact almost each of the economic sections. Agriculture is damaged by direct effect on yields, product quality, agricultural pests, diseases, weeds, and livestock. Forestry suffers direct and indirect effects on biodiversity, wildfires, pests and pathogens. Water management impacts include– water quality, amount of surface water, irrigation, fisheries, hydropower plants, floods, manufacturing industry, and water transport. Tourism, ecology, and construction will also be affected by the climate change impact.[41]

The second group of research sources deal with the consequences of climate change. The major sources of that category are joint multinational reports and analysis. The main goal of these sources is to determine the most likely consequences of climate

[41] Анализ и оценка на риска и уязвимостта на секторите в българската икономика от климатичните промени, Обща част. МОСВ на Република България, 161-168.

change. By analyzing the cause the reader can link the effects and consequences of the new emerging threats. This approach will create a model associated with the environmental degradation, economic disturbance, and social disruptions, and most importantly, it will refer to the national security and peace within affected regions. These group of sources reveal current and projected damages to the human and environmental systems. The intent is to connect each of the climate-related drivers of impacts to the key risks and consequences to the vulnerable socio-economic system. With thorough analysis of the sources it is possible to demonstrate the linkages between presented earlier climate-related drivers over any specific region and accumulative effects on each of the key risks.

For the purpose of this paper the key risks will be presented as potentially severe impacts relevant to Article 2 of the UN Framework Convention on Climate Change, which refers to "dangerous anthropogenic interference with the climate system."[42] Risks are considered key due to the importance of their impact on socio-economic domain.

Given specific criteria: large magnitude, high probability, or irreversibility of impacts; timing of impacts; persistent vulnerability or exposure contributing to risks; or limited potential to reduce risks through adaptation or mitigation an expert decision was used to identify the key risks. Despite the fact that climate change risks vary significantly across regions, sectors, and time periods the experts identified and consolidated the key risks in the following list.

[42] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A*, 59-84.

Risk of death, injury, ill-health, or disrupted livelihoods in low-lying coastal zones and small island developing states and other small islands, due to storm surges, coastal flooding, and sea level rise. Risk of severe ill-health and disrupted livelihoods for large urban populations due to inland flooding in some regions. Systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services. Risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable urban populations and those working outdoors in urban or rural areas. Risk of food insecurity and the breakdown of food systems linked to warming, drought, flooding, and precipitation variability and extremes, particularly for poorer populations in urban and rural settings. Risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity, particularly for farmers and pastoralists with minimal capital in semi-arid regions. Risk of loss of marine and coastal ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for coastal livelihoods, especially for fishing communities in the tropics and the Arctic. Risk of loss of terrestrial and inland water ecosystems, biodiversity, and the ecosystem goods, functions, and services they provide for livelihoods.[43]

The third and last group of sources used to form this paper deals with the security implications of climate change. These include EU's directives, U.S. National Security reports, and research projects. The German Advisory Council on Global Change (WGBU) and European Commission work together regarding security implications of

[43] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A*, 1044.

climate change and helped assess the risks for social, economic and environmental systems. The primary objective of that group of sources is to identify all the threats driven by climate change. Identifying the risks and threats posed by the climate change is part of the problem solving process and helps find mitigation pathways and new tasks for the security forces on the ground.

> Security concerns associated with climate change include the potential for conflict over natural resources, population displacement and migration as the result of sea-level rise or other large-scale biophysical, ecological or social disruptions, and the prospect of increasingly frequent humanitarian disasters as the result of extreme climate events.[44]

Increasing human security in the 21st century is not about struggling to avoid a war and its prerequisites, it is more often about facing climate change and the consequences of its impact. Therefore, the ever-increasing number of acknowledgments for more disasters linked to floods, droughts, wildfires and other climate driven events in the 21st century, together with the increasing concern over the social implications of climate variability and change, require a much deeper and broader assessment of the connections between disaster risk reduction, climate change adaptation and human security.[45]

> Climate change is an urgent and growing threat to our national security, contributing to increased natural disasters, refugee flows, and conflicts over basic resources like food and water. The present day effects of climate change are being felt from the Arctic to the Midwest. Increased sea levels and storm surges threaten

[44] Climate Change Post, "Security and Crisis Management Norway," accessed 20 December 2015, http://www.climateadaptation.eu/norway/security-and-crisis-management.

[45] Ibid.

> coastal regions, infrastructure, and property. In turn, the global economy suffers, compounding the growing costs of preparing and restoring infrastructure.[46]

Sociological and Economic Factors in Bulgaria

After the end of World War II, Bulgaria was under the political and economic influence of the former Soviet Union. In 1946 Bulgaria was proclaimed as People's Republic. The Communist party came to power and a new communist constitution was adopted. The political parties outside the Fatherland Front were banned, the economy and banks were nationalized, and the arable land was organized into cooperatives. 1989 marked the beginning of the democratic changes in Bulgaria. A new democratic constitution was adopted, the country chose the way of democratic development and market economy, and the land was returned to the people. In 2004 Bulgaria became a member of NATO and three years later the country joined EU. These intergovernmental relationship predetermined the socio-economic position of Bulgaria, and framed the relationships and responsibilities between the country and its neighbors.

With close to 7 million population, 77 percent of the population in Bulgaria declare themselves as ethnic Bulgarians, other 8 percent Turkish, 5 percent Roma, and others, which determine the new ethnic diversity in the country. As related to the rate of urbanization, 74 percent of the population are considered as living in urban area. However, the majority of the Turkish ethnos live in the southeastern and northeastern parts of the country, mostly in rural areas and find themselves working predominantly in the agricultural sector of the Bulgarian economy. While the main agricultural products

[46] United States President, *U.S. National Security Strategy* (Washington, DC: The White House, 2014), 12.

consist of vegetables, fruits, tobacco, wine, wheat, barley, sunflowers, sugar beets, and livestock, the agriculture sector contributes with 5.2 percent to the GDP. Another 27.4 percent GDP contribution from the industry, and 67.4 percent from services, to make $47.17 billion (2015 est.) GDP official exchange rate and $18,400 (2015 est.) GDP per capita. [47]

The relatively high rate of unemployment among the young population reveals the interdependency of the youth on their older relatives, and determine some regional socio-economic reliance on agricultural sector.

Besides the fact of a low GDP growth rate, one of the biggest social problems in Bulgaria remains the negative population growth rate. With -0.58% (2015 est.) Bulgaria is ranked as the 225th country in world population growth and can face real demographic collapse by the end of the century.[48]

[47] Central Intelligence Agency, "The World Factbook - Bulgaria," accessed 20 December 2015, https://www.cia.gov/library/publications/the-world-factbook/geos/bu.html.

[48] Ibid.

CHAPTER 3

RESEARCH METHODOLOGY

Chapter 2 of this paper provides a historical and theoretical framing of the depth and breadth of the study. It offers a broad spectrum of studies, theories, and opinions which provided a solid baseline for developing the answer of the primary research question. This paper derives a credibility from such a background and helps readers better understand the complexity and significance of the study. Chapter 3, on the other hand explains the methodology applied while answering the primary research question specified in the introductory section of this paper: How will the most probable impacts of climate change affect the southeastern Europe security environment and what new challenges will it pose for the Bulgarian Army?

The answer of the research question proposes a logical, objective, and systematic analysis of numerical description of scientifically proven data. The prime objective is to systematize the well-known facts, discover new facts, analyze the process and identify the cause and effect relationships, and to develop a new concept and theory to understand and solve the problems occurring in a particular environment.

The methodology process will provide a systematic way to conduct a complex and detailed analysis. For the purpose of this paper a mix of quantitative and qualitative analysis will be used. The quantitative analysis of the facts will comprise numerical and non-descriptive methods for classification and evaluation of the existing data. The conclusive nature of this approach will help to present the information and results in tables and charts. The qualitative analysis is non-numerical, descriptive exploratory

process which intend to investigate the cause and effect relationship among the given facts.

The main purpose of this research is going to be a detailed analysis of the processes in order to identify the sources of instability and their effect on the security environment, which could provide another perspective of the future risk posed by climate change impact in the southeastern Europe region. This mix of quantitative and qualitative analysis will help better comprehend the links between the nodes within the process.

The methodology process of this paper will consist roughly of collection information pertinent to the topic, analysis on the consequences, and the impact on the security environment. The collection of information process will be focused on gathering data related to some of the climate-related drivers of impacts. It will start from globally acknowledged climate changes facts and will continue to the specific region of Bulgaria. Then, focus will switch on the key impacts on human and natural environment in global and regional aspects. Lastly, discovery of the security implications and threats driven by climate change will conclude this paper. The primary focus will be on human risks, diminished resources and economic damages, risks to coastal cities and critical infrastructure, losses of territory and border disputes, environmentally-induced migration, and tensions over energy supplies. The analysis of that information will aim to determine some of the risks and vulnerabilities on social, economic, and environmental domains. Finally, having the regional risks of climate change and its effect on the security environment in the southeastern European region the focus will switch to the increasing role of the military while preparing for the new threat. It would be discussed concepts

associated with the readiness, disaster response missions at home, competition for resources, and greater likelihood for civil strife.

CHAPTER 4

ANALYSIS

> Climate change is one of many risks to the vital core of material well-being and culturally specific elements of human security that vary depending on location and circumstance. While there is much uncertainty about the future impacts of climate change on human security, on the basis of current evidence about the observed impacts of climate change on environmental conditions, climate change will be an increasingly important driver of human insecurity in the future. Location and circumstance specific factors include poverty, discrimination, and inadequate provision of public services and public health, and opportunities for education. Investments in institutional responses to facilitate adaptation can dampen many of the potential adverse effects of climate change on human security. Conversely, inappropriate climate policy responses may accelerate and amplify human insecurity including conflict.
>
> —Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)"

This paper is intended to inform Department of Defense level analysis on the security implication of climate change impacts. Chapter 2 illustrated the current status of climate-related drivers of impacts and the key risks imposed by the climate change in southeastern Europe. The intent of this chapter is to connect those impacts with the risks to the security environment in Bulgaria. The first part of the analysis will focus on the key climate-related drivers of impacts in the region. The second part of the analysis will emphasize on the internal and external impacts to Bulgarian security environment. The literature review in chapter 2 of this paper, pertinent to climate change impact, clearly demonstrated that climate variability poses internal and external threats to various domains of human security, which differ by region, magnitude, and severity. Undeniably, the long term environmental changes and weather extremes will influence all of the spheres of the human system and will generate certain risk to the security environment. With regard to social sphere, any variabilities would have a great impact on human life,

health, food and water security through increasing diseases and infections, creating stress on water resources and food production, aggravating quality of life, and causing mortality. The economic sphere would experience impact on each of the economic sections. Agriculture will experience a direct effect on yields, product quality, agricultural pests, diseases, weeds, and livestock. Forestry will see direct and indirect effects on biodiversity, wildfires, pests and pathogens. Impacts in water management will be seen in– water quality, surface water supplies, irrigation, fisheries, hydropower , floods, manufacturing industry, and water transport. Tourism, ecology, and construction will also be severely affected by the climate change impact.

Scientists are almost unanimous in understanding that climate variability will increase the frequency and magnitude of many types of the extreme events, including floods, droughts, and wildfires, but also will change the nature of many threats such as landslides, heat waves, and disease outbreaks.[49] Therefore, the complexity of the emerging threat requires thorough analysis on the causal relation in order to initiate problem solving processes that will focus on the adaptation and mitigation of the negative impacts posed by climate change. Further, the ability to manage and lower the risk imposed by climate variability requires clearer and purposeful assessment on the multifaceted approach to risk management. This approach will allow deeper qualitative risk analysis not only in a specific region, but also in broader and more complex area, because the emergent risks also arise from indirect, trans-boundary, and distant impacts

[49] Intergovernmental Panel on Climate Change (IPCC), "Fifth Assessment Report (AR5)."

of climate change.[50] For instance, with its 354 km Black Sea coastline the sea level rise would have relatively small impact on Bulgaria, however it would have a much greater impact on Bulgaria's neighbor Greece with its 13, 676 km or Turkey with 7,200 km coastlines. Moreover, 80-million-population-Turkey with its 1.26 percent population growth rate would have greater demand of fresh water and resources in next decades in comparison to 7-million-Bulgaria with its negative population growth rate.[51] All these data attest to the fact of not only internal impacts of the climate change, but the trans-boundary and long-distance impacts of climate change, which would indirectly affect the entire security environment.

The IPCC in its AR5 defines human security as a "condition that exists when the vital core of human lives is protected, and when people have the freedom and capacity to live with dignity"[52]. Going deeper into the climate change and security relation analysis it can be summarized that security environment will gradually worsen as the climate changes; moreover, chapter 12 of IPCC AR5 WGII directly connect climate change and human security, and emphasizes the threat multiplier effect on the peace and security.

The table below visualizes the causal connection between the established and projected key human and natural impacts and the security implications of climate change on the territory of Bulgaria.

---

[50] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A,* 1042.

[51] Central Intelligence Agency, "The World Factbook," accessed 20 December 2015, https://www.cia.gov/library/publications/the-world-factbook.

[52] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2014: Impacts, Adaptation, and Vulnerability, Part A,* 759.

Table 3. Key impacts of climate change in Bulgaria

Climate-Related Drivers	*Human and Natural Impacts*	*Security Implications*
Drying trend: **Increase summer season**	A great impact on human life, health, food and water security Stress on water resources and food production. Decrease quality of life. Reduced food production. Wildfires. Loss of arable lands. Effect on winter tourism	Significant prerequisite for human migration flows. Increased the number of Muslim migrants to the region. Significant negative social outcomes in resource-dependent systems. Restrictions on the movement of goods could also be a source of economic and political turmoil with great security implication.
Extreme precipitation: Increase by 2100	A great impact on the economic sphere and human life. Loss of arable lands. Impact on water quality, manufacturing industry, and water transport. Floods. Damages to the existing infrastructure and property. Loss of life, livelihood Breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services.	Temporary or permanent displaced people, refugees, relocated communities, and migration. Increased risk of newly emerging pathogen or disease situation. Risks of tension over access to energy supply.
Temperature warming: **7.0-9.0°C in 2100**	A great impact on human life, health, food and water security. Increase the diseases, infections, and mortality. Stress on water resources and food production. Decrease quality of life. Droughts.	Certain human insecurities associated with a lack of basic needs such as food, water, and shelter, limit capabilities and freedoms. Social insecurity based on increased mortality and negative population growth rate in the country.

Extreme Temperature: **More extremely hot days**	Stress on water resources and reduced food production. Direct and Indirect effect on biodiversity, wildfires, pests and pathogens.	Social insecurity based on increased mortality and diseases.
Precipitation: **Decrease 20-30 percent in 2100**	A great impact on the economic sphere. Direct negative effect on yields, product quality, agricultural pests, diseases, and weeds, and livestock. Affect the amount of surface water, irrigation, fishers, hydropower plants	Potential to increase rivalry between regions over shared resources.
Snowfall: **Decrease snow cover** **Increase extreme snowfall**	Mostly economic impact, but also negative impact on human life. Floods. Droughts. Damages to the infrastructure.	Risk of economic damages following failed tourist seasons.

Source: Created by author.

The table below visualizes the variation of the key impacts of climate change in Bulgaria by regions and the connection of these impacts and the security implications of climate change in Bulgaria.

Table 4. Variation of the key impacts of climate change in Bulgaria by regions

	Climate-Related Drivers	*Human and Natural Impacts*	*Security Implications*
SOFIA	**Temperature warming:** 7.0-9.0°C in 2100	A great impact on human life, health, food and water security. Increase the diseases, infections, and mortality. Decrease quality of life.	Social insecurity based on increased mortality and negative population growth rate in the country.
	Drying trend: Increase summer season	A great impact on human life, health, food and water security Stress on water resources and food production. Decrease quality of life.	Significant prerequisite for human migration flows. Increased the number of Muslim migrants to the region. Significant negative social outcomes in resource-dependent systems.
	Extreme precipitation: Increase	As economic, cultural and social center of Bulgaria, each extreme precipitation will have great impact on the economic sphere and human life. Impact on water quality, manufacturing industry, and water transport. Flood damages to the existing infrastructure and property. Loss of life, livelihood Breakdown of infrastructure networks and critical services such as electricity, water supply, and health and emergency services.	Temporary or permanent displaced people, refugees, relocated communities, and migration. Increased risk of newly emerging pathogen or disease situation. Risks of tension over access to energy supply. Potential to increase rivalry between regions over shared resources.
PLOVDIV	**Temperature warming:** 7.0-9.0°C in 2100	As major agricultural region all impacts on the food production and agriculture will have severe effects in the area. Insect and plant pests may survive or even reproduce more often each year if cold winters no longer keep them in check. New pests may also invade each region as temperature and humidity conditions change.	For general security implication see Table 3.
	Extreme Temperature highest changes	Reduced food production.	For general security implication see Table 3.
	Drying trend: Increase summer season	The productivity of crops and livestock, including milk yields, may decline because of drought-related stress.	For general security implication see Table 3.

		Depending on rain-fed agriculture the region may require irrigation, bringing higher costs and conflict over access to water. Prime growing temperatures may shift to higher latitudes, where soil and nutrients may not be as suitable for producing crops, leaving lower-latitude areas less productive.	
VARNA	**Extreme precipitation** increase all over the region	Major summer tourist destination. All impacts on infrastructure, water and food security will have severe impacts for the region. Landslides Municipal sewer systems may overflow during extreme rainfall events, gushing untreated sewage into drinking water supplies.	For general security implication see Table 3.
	Extreme snowfall	Damages to the existing infrastructure	For general security implication see Table 3.
BURGAS	Extreme precipitation increase all over the region	Major summer tourist destination. All impacts on infrastructure, water and food security will have severe impacts for the region. Impact on water quality, manufacturing industry, and water transport. Flood damages to the existing infrastructure and property. Loss of life, livelihood	Increased the number of Muslim migrants to the region. For general security implication see Table 3.
PLEVEN	**Temperature warming:** 7.0-9.0°C in 2100	Higher temperatures may mean that water is too warm to cool "Kozloduy" nuclear power plant, leading to power brownouts. As another major agricultural region all impacts on the food production and agriculture will have severe effects in the area.	Turmoil caused by insufficient resources, food production, and water insecurity.
	Extreme snowfall	Damages to the existing infrastructure Loss of life, livelihood	For general security implication see Table 3.
SANDANSKI	**Extreme Temperature** highest changes	Stress on water resources and food production. Direct and Indirect effect on biodiversity, wildfires, pests and pathogens. Reduced food production.	For general security implication see Table 3.
	Precipitation decrease: 30-40 percent	Direct negative effect on yields, product quality, agricultural pests, diseases, and weeds, and livestock. Affect the amount of surface water and irrigation.	For general security implication see Table 3.

Source: Created by author.

The analysis of the data shown in the previous two tables display some variability of the magnitude and severity on the climate-related drivers of impacts over the different regions in Bulgaria. However, the climate-related drivers on the southeastern European region appear to be more critical than others.

Drying Trend

According to all RCP scenarios of climate change, increases in the mean temperature and decreasing summer precipitation are projected by the end of the century for the region of Bulgaria. The scientists are unanimous on a key factor being an increase in the number of droughts. All agree that it is the reduction or lack of rainfall combined with rising air temperatures.

Unquestionably the drying trend and related to this phenomenon of droughts represent the chief climate-related driver of impacts in the southeastern European region. The observed phenomenon in Bulgaria indicates that the present day moderate droughts will probably go into severe droughts with catastrophic consequences by the end of the century. Having greater impact in the southern region of the country and respectively to the southern Bulgarian neighboring countries, the drying trend together with the warming temperature and decreasing precipitation will have significant effect on water resources. A large number of river basins will be severely affected by the drying trend in the region. By doing so, it will pose a significant water stress in the region, resulting in great negative impact on human life, health, food production, and water security.[53]

[53] Climate Change Post, "Droughts Bulgaria," accessed 20 December 2015, http://www.climateadaptation.eu/bulgaria/droughts/.

Additionally, having a severe impact on the quality and quantity of the water, the drying trend will certainly decrease the quality of life and affect people's financial security, family life, health and safety.

The longer droughts often cause reduction of water resources, drying up of rivers, and shortage of water supply to the population in the affected areas; however, it will also cause a certain loss of arable lands. The main crop desired growing temperatures will shift to higher latitudes making lower-latitudes areas less productive. Increased requirements for irrigation will bring higher costs of the food production and greatly increase the possibility of conflicts over access to water. Moreover, crop yields and livestock production may significantly decline because of drought-related insecurity. Additional stress to e agriculture would be created by the survivability of the insect and plant pests because of the friendly dryer and warmer environment.[54]

Drying trend, followed by droughts and heat waves will significantly influence the Bulgarian forestry through increasing the risk of uncontrolled widespread wildfires, which will have major impact on the economic, biodiversity, and ecology.

> The GDP contribution of the sector is 2.5%. Approximately 150,000 people are directly employed in the sector, primarily in rural areas and there are thousands of local timber based manufacturers and small scaled industries, and a few big and international oriented pulp, paper and board producers. The forests give wide range of essential public products and services; such as water production, protection functions, erosion control, fire prevention, social timber supply, etc.[55]

---

[54] Union of Concerned Scientists, "Climate Hot Map," accessed 20 December 2015, http://www.climatehotmap.org/global-warming-effects/food.html.

[55] Climate Change Post, "Forestry and Peatlands Bulgaria," accessed 20 December 2015, http://www.climateadaptation.eu/bulgaria/forestry-and-peatlands.

Statistics describing the wildfire phenomenon show that the longer drying trend the higher the risk of wildfire leading to more economic and environmental losses. For instance, in last 5 years in Bulgaria more than 500,000 ha of forests have been severely damaged by wildfires and about 80 percent are not yet restored.[56]

Last in sequence but not least in importance is the drying trend impact on the tourism sector in Bulgaria. Having a significant percentage of the GDP contribution the sector will experience a great negative impact based on the drying trend and warming temperature. The loss of mountain snowpack and shorter winter season will increase competition for resources, decrease quality of life within the affected regions, and eventually create social and economic instability.

In summary, resulting increased competition for resources, drying trend will directly distress the human safety and security not only in Bulgaria, but also within the entire region.

Extreme Precipitation

The extreme precipitation and related to this phenomenon floods and landslides represent the second major climate-related driver of impacts in Bulgaria. Despite the fact that all analysis reveal a continuation of the declining trend in the annual mean precipitation in Bulgaria, reaching 30 percent reduction by 2100 relative to the reference period 1961–1990, the intensity of precipitation (maximum amount of rain per day) is expected to increase all over the region of Bulgaria causing floods and costs to the socio-economic system.

[56] Climate Change Post, "Forestry and Peatlands Bulgaria."

> From the aforementioned model and observational evidence, there is high confidence that the intensity of extreme precipitation events will increase with warming, at a rate well exceeding that of the mean precipitation. There is medium confidence that the increase is roughly 5 to 10% $°C^{-1}$ warming but may vary with time scale, location and season.[57]

Undeniably, the warmer climate leads to more intense precipitations, which will lead to much greater weather extremes by the end of the century. The greatest impact of the extreme precipitation will be on the socio-economic sphere. By generating extreme river floods and inducing heavy landslides the extreme precipitation will directly affect millions of people all over the country of Bulgaria. Furthermore, bordering Turkey and Greece to the south and sharing some of the biggest rivers basins with both countries, extreme precipitations and related river floods would create significant transboundary tensions. The main consequences of extreme precipitation are expected to impact human system by directly threatening human life, livelihood, and health. In addition to the losses of life and livelihood, extreme precipitations will increase the risk of newly emerging pathogen or epidemic disease. Furthermore, it would create a masses of temporary or even permanent displaced people and relocated communities, which would eventually increase rivalry between regions over shared resources. As regard to the economic domain, extreme precipitation and related floods will create severe damages to the existing infrastructure and property. Having damage to infrastructure networks it will breakdown critical services such as electricity, water supply, and health and emergency services, which indirectly affect the human domain by creating internal tensions over

[57] Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2013: The Physical Science Basis, Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. T. F. Stocker, et al. (Cambridge: Cambridge University Press, 2013), 627.

access to essential services. Finally, increased floods and landslides will have impact on water quality, manufacturing industry, and water transport.

> At the end of January 2015, parts of Bulgaria also suffered from heavy rainfall, snow, floods and landslides. As a result, considerable damage was caused to public infrastructure, businesses, private homes and assets, and the agricultural sector was harmed. The South-East region of Bulgaria was the hardest hit by the events. In the city of Burgas alone, over 300 buildings were flooded. Landslides destroyed important infrastructure; dykes broke, many rivers burst their banks and flooded agricultural land and forests. Gusty winds destroyed pine forests, caused power failures that disrupted the communication networks, and roads were blocked by fallen trees.[58]

Since the data collection started in 1900, a significant increase in heavy floods with severe consequences has been registered. The statistics show that 86 percent of the heavy floods, which caused severe social and economic consequences on the Bulgarian territory, have occurred just in last 10 years. In 2014 the torrential rains all over southeastern European region caused severe flash floods in Bulgaria. The results were dozens killed, numerous regions without essential services, and significant property damage. Floods in Bulgaria have become the major threat to the National Security and socio-economic system. The Bulgarian Government clearly recognizes that the extreme precipitation and following floods and landslides are real threats to the Bulgarian socio-economic system and transboundary relationships. Billions of dollars losses and dozens

[58] Floodlist, "€16.2 Million in EU Aid for Floods in Greece and Bulgaria," accessed 20 December 2015, http://floodlist.com/europe/16-million-eu-aid-floods-greece-bulgaria.

of dead without counting the transboundary relationships is just the rough estimate on the impact of the extreme precipitation.[59]

Temperature Warming

The warming trend is a third major climate-related driver of impacts, but it has a direct relation and interconnection with the other key drivers. Based on information pertinent to the mean annual air temperature in Bulgaria it could be deduced that the warming trend on the territory of the country is real and persistent. According to the worst case IPCC scenario - RCP8.5, it is projected that the mean annual temperature on the territory of the country will rise between 7.0^0 and $9.0\ ^0$C by the end of the century. For instance, since 1997 all annual temperature anomalies has been positive. Moreover, 1994, 2000, 2002, and 2009 were among the warmest years, while 2007 was the warmest ever recorded year in Bulgaria. In addition to the temperature warming, in the southwestern part of the country, with predominantly Mediterranean influence, the number of heat waves have increased significantly. There are strong evidences that rising the air temperature causes heat waves, accentuates spreading of diseases, forces changes of the plant and animal habitat, and brings extreme weather events, such as droughts and blizzards.[60]

---

[59] Kosta Delev, "Climate Change and Poor Water Resource Management will Have Serious Security Implications in the Balkan Peninsula" (Master's thesis, U.S. Army Command and General Staff College, 2015), 32.

[60] Union of Concerned Scientists, "Climate Hot Map," accessed 20 December 2015, http://www.climatehotmap.org/global-warming-effects/air-temperature.html.

Having greater impact in the southern part of Bulgaria and in the mountainous regions, the warming trend will affect human life, health, food production, and water security. As result of the temperature warming the increase of diseases, infections, and mortality are projected to create certain social insecurity. Combined with the negative population growth rate in the country, the warming trend in the region will threaten the national security system in Bulgaria posing a severe risk to the socio-economic sphere.

Additional threats are anticipated over the water resources and food production, which eventually will decrease quality of life. Interrelated droughts, stress on water resources, losses of arable land, and reduction in food production will lead to lack of basic needs such as food, water, and shelter and will increase competition for resources, decrease quality of life within the affected regions, and create social and economic instability. The projected negative impact of the temperature warming is supposed to spread over the continent but with much greater influence over the southern countries. For instance, as result of the warming trend and following negative impacts, 12 of the 28 European Union Member States declared themselves as affected by land degradation under the United Nation Convention on Combating Desertification: in the Mediterranean - Cyprus, Greece, Italy, Malta, Portugal, Slovenia and Spain and in central and eastern Europe - Hungary, Latvia, Slovak Republic, Bulgaria and Romania.[61]

[61] Climate Change Post, "Desertification Bulgaria," accessed 20 December 2015, http://www.climateadaptation.eu/bulgaria/desertification/.

Extreme Temperature

Extreme temperature is one of the climate-related drivers of effect, which does not have a great impact on the changes in mean annual temperature; however, because of its short period of abnormal high or low temperatures it has an extremely devastating effect over the socio-economic system. The major risk posed by the nonlinear temperatures comes from the limited time for adaptation on each of the socio-economic elements. The extreme high temperature is considered as the most common in the southeastern European region. The scientists are unanimous on the negative impacts from the extreme temperature. It will bring significant harmful impact on the crop growth and final yield by stressing water resources and plant habitat.

Moreover, based on increased mortality and diseases it will create a certain social insecurity in the region.

A study describes heat- and cold-related mortality in 12 urban populations' centers including Sofia, the capital of Bulgaria.

> Most cities showed a U-shaped temperature-mortality relationship, with clear evidence of increasing death rates at colder temperatures in all cities except Ljubljana, Salvador and Delhi and with increasing heat in all cities except Chiang Mai and Cape Town. Estimates of the temperature threshold below which cold-related mortality began to increase ranged from 15°C to 29°C; the threshold for heat-related deaths ranged from 16°C to 31°C. Heat thresholds were generally higher in cities with warmer climates, while cold thresholds were unrelated to climate.[62]

Another negative impact to the economic domain would be damage to property and existing infrastructure. People's homes, roads, bridges, railroad tracks, airport

[62] Oxford Journals, "International Study of Temperature, Heat and Urban Mortality: The 'ISOTHURM' project," accessed 28 December 2015, http://ije.oxfordjournals.org/content/37/5/1121.short.

runways and power lines are also vulnerable to the negative impact of the extreme temperature.

In conclusion, extreme temperature has a direct and indirect impacts over human life, biodiversity, agriculture, and infrastructure.

Precipitation

By 2100 the precipitation in Bulgaria is projected to decrease by 20-30 percent. The main direct effect of the decreasing precipitation is expected to be a negative impact on the economic domain. Having direct linkage with the amount of surface and groundwater, decreased precipitation will pose its damaging effect on crops, yields, product quality, and water and food security. In addition, an increase in agricultural pests, diseases, and weeds is anticipated. Lack of adequate precipitation will bring increased requirements for irrigation which will create cascade effects to the costs of food production and certain conflicts over access to water. The dryer and warmer environment will create supplementary stress over the agriculture sector because of the newer pattern in survivability of the insect and plant pests. Moreover, the productivity of yields and livestock may significantly decline because of drought-related insecurity. Another great impact on the economic sphere will be the effect over hydropower plants. Unquestionably, lack of precipitation leads to less water in the reservoirs and rivers, which represents a significant obstacles for hydropower and nuclear industry in Bulgaria.

Last, but not least in importance is the decreased snow precipitation, which will affect the tourism sector in Bulgaria. Lack of snowpack will have devastating impact over the winter season in Bulgaria, which has its significant percentage of the GDP contribution. So, all these factors and considerations related to decreasing precipitation

would create significant social and economic insecurity and will create conditions for increasing rivalry between the regions over shared resources and create general deterioration in quality of life.

Based on the analysis, over the anticipated risk posed by climate change within the southeastern European region, two major climate-related drivers appear to represent much greater threat to the security environment than the rest, and could be easily determined as crucial climate-related drivers for the region. Both, drying trend and extreme precipitation constitute the newly emerging threat in the region and will define the increasing role of the future military as the world warms.

For better understanding the impacts on the Bulgarian national security they will be split into two major groups. The first major group are the internal impacts which represent the risk posed by phenomena within the borders of the country such as droughts, floods, and economic issues. The second major group of impacts on the Bulgarian national security will be the external impacts, which define the threat and risks coming outside of the country's borders, such as: migration and cross border conflicts.

Internal Impacts to Bulgaria

Some of the largest internal security impacts posed by the climate variability over Bulgaria embrace the groups of interrelated and interdependent factors of human insecurities, economic collapse, and environmental degradation.

The climate change impacts over human security constitutes the largest and most significant threat to the humankind.

> The Commission on Human Security's definition of human security: to protect the vital core of all human lives in ways that enhance human freedoms and human fulfilment. Human security means protecting fundamental freedoms—

> freedoms that are the essence of life. It means protecting people from critical (severe) and pervasive (widespread) threats and situations. It means using processes that build on people's strengths and aspirations. It means creating political, social, environmental, economic, military and cultural systems that together give people the building blocks of survival, livelihood and dignity.[63]

As the UN definition on human security suggests, human insecurity is mostly associated with limited access to or complete lack of basic human needs such as water, food and shelter, limited capabilities and freedoms.

Undeniably, the analysis of the climate change impact on the security environment in Bulgaria indicates a significant stress on water resources. Projected drying trends and interconnected with this phenomenon decreased precipitation, extreme temperature and precipitation will have devastating and unescapable consequence on water resources. Drying up of rivers, changing the patterns of groundwater, and water pollution will create a significant shortage of water supply to the population within the region, which not only will decrease the quality of life, but also will create conditions for potential increase rivalry among segments of the population over shared water resources.

Food production is another aspect of human security, which will be dramatically affected by the climate change impacts. The major climate-related drivers with the greatest impact on the territory of Bulgaria will have substantial influence over food security. Anticipated drying trend, extreme precipitation, warming temperature, decreased precipitation, and extreme temperatures will have shocking effects over food production. Many of the crops will not survive some of the devastating effects of the climate change. Some will shift their natural habitat to different geographic latitudes,

---

[63] United Nations, Commission on Human Security, *Human Security Now* (New York: United Nations, 2003), 4.

while others will completely vanish from the region. However, whatever scenario happens this dramatic change will decrease the food production, will bring higher costs, and will limited the access to basic food and required nutrition. This condition will drastically decrease the quality of life and increase tensions and rivalry among the population and require greatly increased medical, humanitarian and logistics support.

Shelter is the third basic element to the human security system. Despite the fact that drying trend, decreased precipitation, and warming temperature have a limited and mostly indirect influence to the shelter and protection, other climate-related drivers such as extreme precipitation and following floods and landslides will have extremely negative impact on the human security in Bulgaria as regard as access to adequate shelter and protection. The home and its protection function have a special place in the Bulgarian psychology from ancient times. It is considered as the fortress which provides the family protection and security. According to the Directorate-General of the European Commission–Eurostat, which provides statistical information to the institutions of the European Union, Bulgaria has one of the highest percentage of homeowners (around 85 percent) in Europe, which means highest percentage of personal losses and dramatic consequences in case of natural climate-related disaster such as floods and landslides. All this data attests to the fact of the devastating effect on the human security in Bulgaria in case of property and shelter insecurity. This will bring enormous wave of internally displaced people, relocated communities, and significant negative social outcomes.

Having impacted the basic human needs such as water, food and shelter it inevitably will affect the capabilities and freedoms of people to choose and manage their way of life. The widespread consequences and effects of the drying trend, extreme

precipitations, warming temperature, decreased precipitation, and extreme temperature will rigorously impact also the other elements which complement the human security. The projected security deviations will certainly breakdown the education system and the capability of people to make their own choices. It will stress the healthcare system and social security in the country by limiting people's access to adequate medical services. No doubt it will affect law-enforcement system and the perception of people for stable and capable government in Bulgaria. And lastly, but not least in importance the democratic foundation and institutionalism in Bulgaria will be under risk and imminent threat.

The second largest internal threat to the Bulgarian national security posed by climate change impacts is the risks to the economic system.

> As developing countries weigh how best to revitalize their economies and craft a sustainable development path to boost living standards, they will have to factor in the reality that the global annual average temperature is expected to be 2º C above pre-industrial levels by 2050. A 2º warmer world will experience more intense rainfall and more frequent and more intense droughts, floods, heat waves, and other extreme weather events. As a result, it will have dramatic implications for how countries manage their economies, care for their people and design their development paths. Countries will need to adopt measures to adapt to climate change. These measures offer a way to make the effects of climate change less disruptive and spare the poor and the vulnerable from shouldering an unduly high burden.[64]

The main challenges in front of Bulgaria during its way of managing country's economy within climate-related environmental variations are related to the risks over some of the key elements of the economic system. No need to be an expert of economics to acknowledge the fact that each threat to labor, land, infrastructure, natural resources,

[64] The World Bank, *Economics of Adaptation to Climate Change: Synthesis Report* (Washington DC: The World Bank, 2010), xi.

and manufacturing and distribution process have the potential to collapse even the strongest economic system in the world. Therefore, the challenges are much greater when a country with still fragile economic discipline and minuscular growth has to manage its economic sphere in unsecure and unstable environment.

Unquestionably, the drying trend, extreme precipitation, warming temperature, decreased precipitation, and extreme temperatures as well as the related natural phenomena such as droughts, floods, and landslides will have significant influence over all of the key elements of the economy in Bulgaria. Decreased quality of life and certain unemployment will cause a substantial obstacles for the economic system. Losses of arable land and desertification will bring considerable food insecurity and eventually economic losses. Damages to the existing infrastructure will impede the manufacturing and distribution processes within the economic cycle, which will cause higher prices and limited access to the final products. The limited access to national resources will be the major reason for widespread inequality and rivalry among the population of Bulgaria. These are only part of the major consequences which the country should be ready to face in order to overcome the pending economic collapse. All this will bring necessity for large-scale humanitarian and logistic support in the country with potential security disturbance.

The third largest threat to the Bulgarian national security posed by climate change impacts is the risk of environmental degradation.

> Environmental degradation is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems

> and the extinction of wildlife. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable.[65]

The main climate-related drivers of impacts in the region of Bulgaria clearly cause some of the key types of environmental degradation, which eventually will root significant security instability in the country. Pollution, deforestation, and soil erosion are only the key implications of environmental degradation in Bulgaria.

Air and water pollution based on climate-related extreme events will create significant negative impacts over the quality of life, food production, and access to natural products. A certain restriction over usage of natural resources will bring higher cost to the final products and inequality among the population within the affected regions. This will create a substantial risk of tension, rivalry, and social turmoil.

Thirty-seven percent of the territory of Bulgaria is covered by forests. With 2.5 percent of GDP contribution from forestry it has its substantial impact not only over the economic system in Bulgaria, but also over the population in rural areas, where approximately 150,000 people are directly employed in the sector. Ironically, despite the fact that the ecological function of the forests is the reduction of climate change through carbon absorption, the climate variation and following phenomena such as warming trend, extreme precipitation, and decreased precipitation and related wildfires, floods, and landslides have extremely negative influence over the Bulgarian forest causing widespread deforestation. This phenomenon will bring additional soil erosion and water imbalance throughout the country. In addition, deforestation will have terrific socio-

[65] D. L. Johnson et al., "Meanings of Environmental Terms," *Journal of Environmental Quality* 26, no. 3 (1997): 581-589.

economic impact over the population in the rural areas of Bulgaria, which use forests as biomass for energy production.[66]

Having a substantial impact over the Bulgarian forest a large number of essential public products and services will be indirectly impacted by the climate-related drivers of impacts. Stress on water production, wind protection, soil erosion, and social timber supply will create significant social negative outcomes and required humanitarian, logistics, and medical support.

Soil erosion is another element of the environmental degradation which will have impact on the social insecurity. All of the forms of soil erosion will eventually lead to water and food insecurity and cause cascade failure to the system.

Therefore, all mitigation and adaptation strategies should be thoroughly considered to prevent the stress on the national security system from the internal impact on the environmental changes.

External Impacts to Bulgaria

The external impacts on the security environment in the country of Bulgaria represent risks to the national security evolving from out of the country factors and reasons.

Some of the largest and most distinguished external security impacts posed by the climate variability over Bulgaria are interrelated migratory pressure, transboundary issues, and conflicts over shared resources.

[66] Climate Change Post, "Forestry and Peatlands Bulgaria."

International Organization for Migration describes the human migration as movement of person or group of people from one place to another with the intention of settling in the new location.[67] It includes any kind of movement no matter the length, composition, or purpose. Though, the most often kind of human migration is moving to the purpose of taking up permanent or temporary residence, usually across the political boundaries, because of imminent threat to the people's life, health, or freedoms. Besides the political, economic, and cultural push factors, the environmental is seen as the next major factor which influences people to move. Many scientists argue on the term "environmental refugee"; however, it seems the best way to describe this group of people who try to escape from current extreme weather conditions or natural disasters.

Geographically, southeastern European region borders some of the world most vulnerable areas to climate change and political turmoil, which can indirectly have detrimental effect on the security environment on the continent. For instance, the conflict in Syria triggered a wave of refugees toward Europe, which creates great socio-economic problems all over the continent.

> IOM estimates that 55,528 migrants and refugees crossed the Mediterranean to enter Europe during the first 28 days of 2016 – a rate of nearly 2,000 per day. The daily average is nearly equivalent to the total numbers for the month of January as recently as two years ago.[68]

Migratory pressure at the southeastern European countries together with political instability and a couple of lingering conflicts could considerably decrease the security

[67] International Organization for Migration, "Mediterranean Update," accessed 28 December 2015, http://www.iom.int.

[68] Ibid.

environment in the region in the near future. The still fragile economy and security environment in the Balkans is at greater risk than before and could easily be affected by the danger posed by environmental changes and/or severe weather events, which may trigger additional migratory flows and increase the tensions among the neighboring countries.

While being a NATO and EU member, Bulgaria borders both other members of the Alliance and the Union, and non-members of either of the organizations. This fact can create additional tension in the problem solving process between the southeastern European neighbors which follows varied organization's agreements, treaties, and bi-lateral contracts related to the transboundary movement and migration of people.

On the one side we have EU, its members, and the Union regulations. A significant part of the Treaties of the European Union regulate the free movement of people, services, and capital, as well as justice and security. From this perspective Bulgaria shares borders with two EU members: Greece to the south and Romania to the north. However, on the other side we have non-EU members, which do not follow the same regulations. Therefore any transboundary issues, conflicts, and disagreements can be a significant threat multiplier in the region by not having clearly identified working mechanism for climate-related problem solving process. From this standpoint Bulgaria is bordering Turkey to the south (non-EU member, but NATO member), Serbia and Macedonia to the west.

Climate-related transboundary disputes represent a specific part of the challenges among the neighboring countries. Despite the fact that by definition the neighboring countries more often than not are challenged by similar climate-related drivers of impact,

there is a very high probability for one climate-related threat or consequence happening in one country to spill over into another and to bring certain environmental issues and conflicts. For instance, unquestionably there are no political boundaries for the air and water pollution, pests and diseases, plants, animals, and micro-organisms, which can affect neighboring ecosystems while transferring the negative impacts and consequences over the political borders. All these affected elements of the environment, which are highly vulnerable to the climate change impacts, may be reasons for triggering international conflict within a given uncertain environment. In addition, there is no doubt that most of the countries in the region lack sufficient capacity, political will, and regulatory mechanisms to manage the risks and threats posed by climate variation over the region. Therefore, the southeastern European security environment will remain uncertain and extremely vulnerable to every significant negative socio-economic effect driven by climate change and its impacts.

Being part of southeastern Europe, Bulgarian security environment might be at imminent risk as the world warms and some of neighboring countries start experiencing various climate-related challenges and impacts. Consequentially, all these issues will necessitate large-scale regional agreements on the climate-related threats, and adequate planning of possible humanitarian and logistic support for populations within the impacted regions.

The transboundary conflicts over shared resources are another potential reason for deteriorating the security environment in Bulgaria.

With more than 70 percent of the Earth covered by water, there is no surprise that water is the most shared resource on the planet. As regard to shared water resources in

the southeastern European region some security implication issues can be initiated between countries for the sake of shared international water, the contiguous zone, or the exclusive economic zone establishment. However, the shared river basins and lakes have the potential to affect greater numbers of people and create much larger scale conflicts and arguments among the neighbors in the region.

> Close to 50 percent of the Earth's land surface area is comprised of shared river and lake basins. Some 276 river basins cross the political boundaries of two or more countries, and about 40 per cent of the world's population lives in river and lake basins that cross international borders. Globally, about 2 billion people depend on groundwater, which includes well over 300 transboundary aquifer systems. These facts represent the basic premise of the transboundary water management challenge facing the international community. Therefore, developing approaches that balance interdependencies of transboundary waters is a matter of high importance.[69]

All these data attest to the fact of the socio-economic interdependencies between countries sharing transboundary water bodies. With that said it can be a vital economic, environmental, and political driver for developing partnership and cooperation between countries and societies within any given region; however, climate variabilities can be also a significant threat multiplier facing the region. Facing ever-decreasing water supply, increasing demands, and growing population in some of Bulgaria's neighbors, climate change impacts over transboundary water and other shared resources could easily contribute to any international conflicts and disputes.

[69] Water Governance Facility, "Transboundary Water Management–Why it is Important and Why It Needs to be Developed," accessed 28 December 2015, http://watergovernance.org/resources/transboundary-water-management-why-it-is-important-and-why-it-needs-to-be-developed/.

Summary

The analysis in chapter 4 clearly demonstrated that climate change poses internal and external threats to various domains of human security, which differ by region, magnitude, and severity. Based on the examination of the anticipated risk posed by climate change within the southeastern European region, two major climate-related drivers of impact appear to represent much greater threat to the security environment in Bulgaria than the rest of the drivers. Both drying trend and extreme precipitation could be easily determined as crucial climate-related drivers for the region based on their cause-effect connection with the newly emerging threat posed by climate variability. Moreover, the drying trend and extreme precipitation will create some of the largest internal security impacts posed by the climate variability over Bulgaria. Undeniably, both crucial climate-related drivers of impact will cause a significant stress on water resources, food security, and shelter as basic elements to the human security system. As regards to the risks to the economic system and environmental degradation, both the drying trend and extreme precipitation will create significant negative impacts over the quality of life and access to natural products. Regarding the external security impacts posed by climate change over Bulgaria, it seems that the same two major climate-related drivers appear to represent much greater threat to the security environment in the region than the rest of the drivers. Unquestionably, the most significant climate change threats posed by the drying trend and extreme precipitation in the region will create certain migratory pressure on Bulgarian socio-economic domain, transboundary issues between the neighboring countries, and predictable inter-state conflicts over shared resources.

In conclusion, despite the fact of variability of the internal and external threats over the security environment in Bulgaria, the analysis clearly demonstrated that the drying trend and extreme precipitation will define the increasing role of the future military as the world warms.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Framing the depth and breadth of this study, chapter 2 provided the current status of climate-related drivers of impacts and the key risks imposed by the climate change in southeastern Europe. The review of the existing literature pertinent to climate change impact clearly demonstrated that climate variability poses internal and external threats to various domains of human security, which differ by region, magnitude, and severity. Chapter 3, on the other hand explained the methodology applied while answering the primary research question specified at the beginning of this work: How will the most probable impacts of climate change affect the southeastern Europe security environment and what new challenges will it pose for the Bulgarian Army? The methodology process defined by the mix of quantitative and qualitative analysis provided a systematic way to conduct a complex and detailed examination of the problem. The quantitative part of the analysis of the facts helped better organize and evaluate the existing data, while the qualitative component supported the investigation of the cause and effect relationship among the given facts. Chapter 4 analyzed the causal relationship between the key impacts of the climate change and security implications. The first part of the analysis focused on the key climate-related drivers of impacts in the region, while the second part of the analysis emphasized on the internal and external impacts to Bulgarian security environment. The intent of this chapter is to highlight possible outcomes while looking at the future and recommend adaptation and mitigation decisions with a goal to manage and lower the external and internal risks imposed by climate change.

External Risks and Vulnerabilities

Having the analysis in chapter 4 it could be easily determined that the risk posed by climate change is real and can easily activate dormant conflicts in the region or even trigger a new one as result of transboundary issues. Undeniably, the long-term environmental changes and weather extremes, occurring not only on the territory of southeastern Europe, but also in its neighboring regions, will have a great effect over all of the domains of the socio-economic system and will generate certain risks to the security environment in Bulgaria. Given the fact that southeastern European region borders some of the areas most vulnerable to climate change, political turmoil, environmental degradation, resources scarcity, and population growth, there is no doubt that projected migratory pressure, economic challenges, and transboundary issues in the region together with political instability will make the Bulgarian security system more vulnerable than ever before.

Analyzing the causal connection, visualized in chapter 4, table 3, between the established and projected key human and natural impacts and the security implications of climate change on the territory of Bulgaria, it can be concluded that a direct armed conflict between Bulgaria and its neighbors based on climate change impacts is unlikely to occur. However, climate change impacts have the potential to increase the rivalry between the neighbors in southeastern European region over certain transboundary issues such as: human migration flows, transboundary diseases, and shared resources. Moreover, it appears that mass migration scenario, epidemic diseases, and water management conflicts have the biggest potential for triggering possible future unarmed

conflicts between Bulgaria and its neighbors, conflicts where the Bulgarian Army most probably will have a significant role.

Bulgarian Armed Forces – mission and tasks

Bulgarian Armed Forces consists of Bulgarian Army and other agencies under the Ministry of Defense authority. Bulgarian Army represent the military forces in Bulgaria and involves Joint Forces Command, Land Forces, Air Force, and Navy.

The Joint Forces Command is a formation of the Bulgarian Army directly subordinated to the Chief of Defense. It is a structure tasked to plan and conduct operations within and outside the territory of the country. Some of the main tasks include: Planning and managing operations within the territory of the country, and responsibility for exercising national control over the Armed Forces when they participate in operations outside the territory of the country, and planning, organizing and coordinating the logistic provision and the communication-information support of the additional formations of the Armed Forces participating in the full spectrum of operations.

The Land Forces represent the backbone of the Bulgarian Army. It basic tasks involve: Readiness of the troops to participate in the collective defense of the territory of the country, and participation in joint operations related to struggle against terrorism, support for international peace and security, and maintaining forces and means, which have the ability to support state and local authorities in assisting the population to overcome crises of non-military nature in peacetime.

The primary mission of the Air Force is to guarantee the air sovereignty and security of the country, with the other services, to protect its territorial integrity. It also conducts: air defense of strategic sites on the territory of the country; participate of the struggle against terrorism, organized crime and human trafficking, as well as trafficking of arms and drugs; participation in search-and-rescue operations; support and protection of the population at times of natural disasters, industrial breakdowns, and catastrophes; contribution to the activities of other state bodies and agencies; participation in the preservation of natural environment.

The Navy protects the sovereignty and the territory of the Republic of Bulgaria in her maritime spaces. Besides the military operations The Bulgarian Navy is capable also of conducting operations in response to crises of a military or non-military nature.

Figure 18. Bulgarian Armed Forces–Mission and Tasks

Source: Republic of Bulgaria, Ministry of Defense, "Bulgarian Army," accessed 20 February 2016, www.mod.bg.

Given the primary mission and tasks of the Bulgarian Army, it is very likely for the Bulgarian Army to be involved in border and humanitarian issues, when the primary internal security departments and agencies exceed their capacity in shaping and supporting Bulgarian security environment. Furthermore, reshaping Bulgarian Army capability might be required in order to create capable and competent balanced forces, with organization, equipment, and combat training allowing not only adequate participation within the full spectrum of NATO operations, but also providing adequate support to the national and local authorities while dealing with certain non-military threats and crisis response operations within the territory of the country.

Undeniably, the Bulgarian Government comprehensive approach to problem solving within projected complex, deteriorated environment defined by natural disaster or climate induced threats would involve Bulgarian Army and its components, assets, and capabilities in support of the population of Bulgaria. The Bulgarian Army participation would include indirect and direct contribution to the national security environment together or separate from the internal security defense departments and agencies. The indirect approach would involve advising, training and planning of disaster response missions, while the direct approach would involve straight contribution and participation of the Bulgarian Army into missions of support to the national security. The most adequate contribution of the Bulgarian Army to the national security environment while dealing with climate-related impacts would involve timely, well-organized, and coordinated efforts while providing emergency logistics support, transportation, humanitarian assistance, or certain short-term reconstruction and engineering projects.

Examining the data represented in the previous chapters some variability of the magnitude and severity on the climate-related drivers of impacts over the different regions in Bulgaria can be observed. Some of the regions in the country appear to be more critically affected than others. For instance, having the specific geographic location, relief, hydrological characteristics, and economic development of Burgas region, this area appears to be the most vulnerable and the most severely affected region in the country by the external impacts of the climate change. Reaching the Bulgarian-Turkish international border the region would be the main frontline within every mass migration, epidemic disease, and water management conflict scenario in the case of possible future unarmed conflict between both countries.

Internal Risks and Vulnerabilities

The analysis in chapter 4 of the internal climate-related impacts on the security environment in Bulgaria helped to isolate certain upcoming risks and vulnerabilities to the national security evolving from internal to the country factors, reasons, and consequences. It seems that some of the largest internal security impacts posed by the climate variability over the territory of Bulgaria include risks and vulnerabilities related to food and water security, public health, and disaster response.

Having the probability of the greatest impact on the basic socio-economic elements such as: water and food security, and public health, together with the ever-increasing probability of climate-related natural disasters. These are clear strategic indications for potential risks with widespread negative consequences and effects over the Bulgarian security environment. Therefore, all mitigation and adaptation strategies should be thoroughly considered to prevent the stress on the national security system

from the internal impact on the environmental changes. Unquestionably, facing such a multidimensional and multifaceted threat, the Bulgarian Army will have an increasing role while conducting its "Contribution to the national security in peacetime" mission. Moreover, the Bulgarian Army will certainly be required to increase its ability to support the Government to overcome crises of non-military nature while preserving the democratic foundation and institutionalism within the country.

A certain new challenge for the Bulgarian Army posed by climate-related impacts on the security environment would be its ability to supplement the Bulgarian internal security departments and agencies when reaching their capacity in providing disaster response to crises of non-military nature. A joint interagency interorganizational effort will be required to predict and prevent any security environment degradation in order to preserve the socio-economic system. The fundamental challenge would be an effective integration and synchronization of assets toward achievement of the political and strategic objectives of the country. It might be required certain law initiatives to ensure legal support of the concept. Unquestionably, some of the doctrine and training programs will require some changes to adapt the philosophy of the training and preparation concept to the newly emerged security environment threat and support the implementation of the updated defense policy. A significant step toward better communication, information sharing, and intelligence should be taken to support liaison and cooperation between the departments and agencies within Bulgarian administration. Most probably, a joint interagency, interorganizational doctrine should be adopted in order to provide shared working environment and set common language for achieving effectiveness in dealing with the security threats posed by climate change impacts on the territory of Bulgaria.

Analyzing the data represented in this paper it can easily be deduced that the magnitude and severity of the threat to the security environment posed by the climate-related drivers of impact will vary significantly on the territory of Bulgaria. However, some of the regions appear to be more severely affected than others. Having the internal risks and vulnerabilities throughout the regions in Bulgaria, not surprisingly the southern part of the country seems more susceptible and sensitive to any variation in food and water security, public health, and disaster response.

The drying trend, extreme precipitation, warming temperature, decreased precipitation, and extreme temperatures as well as the related natural phenomena such as droughts, floods, and landslides will have more significant influence over the southern part of the country than to the northern. Losses of arable land and desertification will bring considerable food insecurity and eventually economic losses. Given the biggest part of the Bulgarian forest in the southern part of Bulgaria, any kind of deforestation, soil erosion, and related environmental degradation will create significant security instability in the region. Expected decreases in the quality of life, certain unemployment, and pertinent health issues will cause a substantial obstacles for the economic system on south.

Therefore, the southern part of the country will present a certain new challenge for the Bulgarian Army as result of the risks and vulnerabilities posed by climate-related impacts on the security environment.

This analysis summarizes the human interference with the climate variability, risks for the socio-economic system, and the new challenges for the Bulgarian Army when conducting its mission of “Contribution to the national security in peacetime”.

Having tasks such as: protection and support to the population in case of natural disasters, industrial accidents, ecological crises and epidemics; unexploded ordnance disposal; providing humanitarian relief; support to migration control; search and rescue activities; support when necessary to other government organizations and local authorities to prevent and overcome the consequences of terrorist attacks, the Bulgarian Army must be prepared to respond in a timely and professional manner in case of need.

Recommendations

Aiming for an affordable, easily adaptable, and balanced forces capable to implement modern defense policy within newly developed security environment requires certain changes in the given organization, equipment, and training. Corresponding with the constitutional responsibilities, the Bulgarian Army will be tasked to develop and sustain certain capabilities in order to face newly emerged threat to the security environment in the southeastern European region.

Similar to the total war concept, the main approach to problem solving requires local and regional levels of defense planning in order to achieve a total success over the impending threat. Having a growing anticipation of increasing numbers of changes in the environment, it is extremely important to develop needed capabilities and take proper and adequate preventive actions for mitigation and adaptation. Unquestionably, within the described future security environment and required holistic approach of combating the new risks and vulnerabilities, the Bulgarian Army will have a significant role. However, whether the military forces will be well prepared and properly equipped for the new missions depends on the capabilities and competencies Bulgarian Government have developed for them.

In order to combat against the external threat posed by climate-related drivers of impact over the security environment in southeastern European region it is highly recommended for the Bulgarian Army to develop and sustain capabilities of providing emergency logistics support, transportation, humanitarian assistance, or certain short-term engineering projects within the Burgas region, which is projected to be most susceptible and severely affected region by the external impacts of climate change over the security environment in Bulgaria. Moreover, reshaping the Bulgarian Army organization toward providing certain capabilities within the given region would decrease the time for reaction and coordination and increase the effectiveness in case of emergency situation threatening national security environment.

In terms of internal risks and vulnerabilities posed by the climate-related drivers of impact over the security environment in Bulgaria, it is recommended more effort and energy to be spent on the effective integration and synchronization of assets toward achievement of the political and strategic objectives of the country. Developing a joint interagency interorganizational doctrine would increase the coordination and cooperation among the Bulgarian Army and the internal security governmental departments and agencies. Combined trainings and practical exercises would create a capable and responsive Bulgarian Army when facing the internal threats posed by the climate variability.

Equally important to the internal and external risks and vulnerabilities on the security environment in the region and more specifically in Bulgaria would be reshaping the capabilities of the Bulgarian reserve forces. With adequate legal initiatives,

organization, training, and execution the Bulgarian reserve force would be the primary respondent of the climate-related threats on the territory of Bulgaria.

Future Research

This paper suggested the most probable impacts of climate change affect the southeastern Europe security environment and the projected challenges in front the Bulgarian Army. It analyzed the causal relationship between the key impacts of the climate change and security implications. Furthermore, possible adaptation and mitigation decisions were highlighted while aiming to manage and lower the external and internal risks imposed by climate change over the security environment in southeastern European region.

In terms of external risks and vulnerabilities, a possible development of the topic would be analyzing the mechanisms and capacity for future regionally cooperation. Using developed NATO and EU relationships in the region certain projects could be initiated for better cooperation and coordination in the area of human migration flows, transboundary diseases, and shared resources.

Concerning the internal risks and vulnerabilities to the security environment in Bulgaria pertinent to the climate-related impacts over the region a possible development of the topic would be interagency cooperation for unity of effort when dealing with food and water security, public health, and disaster response as result of the internal security impacts posed by the climate variability over the territory of Bulgaria.

BIBLIOGRAPHY

Alexandrov, V. *Vulnerability and Adaptation of Agronomic Systems in Bulgaria. Climate Research.* Sofia, Bulgaria: 1999.

Alexandrov, V., and G. Hoogenboom. *The Impact of Climate Variability and Change on Crop Yield in Bulgaria. Agricultural and Forest Meteorology*. Sofia, Bulgaria: 2000.

Barros, V. R., C. B. Field, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, and L. L. White, eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 2014.

Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel, and J. C. Minx, eds. *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 2014.

Field, C. B., V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, and L. L. White, eds. *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, 2014.

Johnson, D. L., S. H. Ambrose, T. J. Bassett, M. L. Bowen, D. E. Crummey, J. S. Isaacson, D. N. Johnson, P. Lamb, M. Saul, and A. E. Winter-Nelson. “Meanings of Environmental Terms.” *Journal of Environmental Quality* 26, no. 3 (1997): 581-589.

Pachauri, R. K., and L. A. Meyer, eds. *Climate Change 2014: Synthesis Report*. *Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: 2014.

Stocker, T. F., D. Qin, G. K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P. M. Midgley, eds. *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, 2013.

United Nations Framework Convention on Climate Change (UNFCCC), New York, 1992.

United Nations. Commission on Human Security. *Human Security Now*. New York: United Nations, 2003.

Books

Kahl, Colin H. *States, Scarcity, and Civil Strife in the Developing World*. Princeton, NJ: Princeton University Press, 2006.

Government Documents

Central Intelligence Agency. “The World Factbook–Bulgaria.” Accessed 20 December 2015. https://www.cia.gov/library/publications/the-world-factbook/geos/bu.html.

Republic of Bulgaria, Ministry of Defense. “Bulgarian Army.” Accessed 20 February 2016. www.mod.bg.

Republic of Bulgaria, Ministry of Environment and Water. *Third National Action Plan on Climate Change, for the Period 2013-2020.* Sofia, Bulgaria: Republic of Bulgaria, May 2012. Accessed 17 December 2015. http://www3.moew.government.bg/files/file/Climate/Climate_Change_Policy_Directorate/THIRD_NATIONAL_ACTION_PLAN.pdf.

Republic of Bulgaria, Ministry of Environment and Water. *National Program for the Necessary Measures in the Conditions of Draught Trend*. Sofia, Bulgaria: Ministry of Environment and Water, 2001.

United States President. *U.S. National Security Strategy.* Washington, DC: The White House, 2014.

проф. д-р Антон Попов, АНАЛИЗ И ОЦЕНКА НА РИСКА И УЯЗВИМОСТТА НА СЕКТОРИТЕ В БЪЛГАРСКАТА ИКОНОМИКА ОТ КЛИМАТИЧНИТЕ ПРОМЕНИ; ОПЕРАТИВНА ПРОГРАМА ОКОЛНА СРЕДА 2007-2013 [Popov, Anton, Ph.D. Analyze the Risk and Vulnerability of Bulgarian Economy from the Climate Change; Operational Program Environment 2007-2013. Sofia, Bulgaria: Republic of Bulgaria, 2007. Accessed 28 December 2015. http://www.moew.government.bg/files/file/Press/Konsultacii/2014/Obshta_chast.pdf].

Other Sources

Carbon Brief. “Clear on Climate.” Accessed 29 December 2015. http://www.carbonbrief.org/category/science/ipcc.

Centre for Climate Adaptation. “Europe in a Changing Climate.” Accessed 15 December 2015. http://www.climateadaptation.eu/bulgaria/climate-change/.

ClimaTemps. “Bulgaria.” Accessed 10 January 2016. http://www.bulgaria.climatemps.com/.

———. “Burgas.” Accessed 10 January 2016. http://www.burgas.climatemps.com.

———. “Pleven.” Accessed 10 January 2016. http://www.pleven.climatemps.com.

———. “Plovdiv.” Accessed 10 January 2016. http://www.plovdiv.climatemps.com.

———. “Sandanski.” Accessed 10 January 2016. http://www.sandanski.climatemps.com.

———. “Sofia.” Accessed 10 January 2016. http://www.sofia.climatemps.com.

———. “Varna” Accessed 10 January 2016. http://www.varna.climatemps.com.

Climate Change Post. “Climate Change Bulgaria.” Accessed 20 December 2015. http://www.climateadaptation.eu/bulgaria/climate-change.

———. “Droughts Bulgaria.” Accessed 20 December 2015. http://www.climateadaptation.eu/bulgaria/droughts/.

———. “Desertification Bulgaria.” Accessed 20 December 2015. http://www.climateadaptation.eu/bulgaria/desertification/.

———. “Forestry and Peatlands Bulgaria.” Accessed 20 December 2015. http://www.climateadaptation.eu/bulgaria/forestry-and-peatlands.

———. “Security and Crisis Management Norway.” Accessed 20 December 2015. http://www.climateadaptation.eu/norway/security-and-crisis-management.

Delev, Kosta. “Climate Change and Poor Water Resource Management will Have Serious Security Implications in the Balkan Peninsula.” Master’s thesis, U.S. Army Command and General Staff College, 2015.

English Online. “Mediterranean Sea.” Accessed 3 February 2016. http://www.english-online.at/geography/mediterranean-sea/geography-of-mediterranean-sea.htm.

Ezilon Maps. “Bulgaria Map-Physical Map of Bulgaria.” Accessed 3 February 2016. http://www.ezilon.com/maps/europe/bulgaria-physical-maps.html.

Floodlist. “€16.2 Million in EU Aid for Floods in Greece and Bulgaria.” Accessed 20 December 2015. http://floodlist.com/europe/16-million-eu-aid-floods-greece-bulgaria.

FRONTEX. “Eastern Mediterranean Route.” Accessed 1 April 2016. http://frontex.europa.eu/trends-and-routes/eastern-mediterranean-route.

———. “Migratory Routes Map.” Accessed 1 April 2016. http://frontex.europa.eu/trends-and-routes/migratory-routes-map.

Gore Jr., Albert Arnold “Al”. *An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It*. 2006. Microfilm.

Intergovernmental Panel on Climate Change. “Fifth Assessment Report (AR5).” Accessed 3 February 2016. http://www.ipcc.ch/.

International Organization for Migration. “Mediterranean Update.” Accessed 28 December 2015. http://www.iom.int.

King, Wendell C., Ph.D, with Neil Morisette, Joseph Singh, and Members of the Global Military Advisory Council on Climate Change. “Strategic Defense Impacts of Climate Change.” Executive Summary, 2015.

Ministry of Defense of the Republic of Bulgaria. “Bulgarian Armed Forces.” Accessed 20 February 2016. www.mod.bg.

Oxford Journals. “International Study of Temperature, Heat and Urban Mortality: The ‘ISOTHURM’ Project.” Accessed 28 December 2015. http://ije.oxfordjournals.org/content/37/5/1121.short.

Republic of Bulgaria, Ministry of Environment and Water. “Climate.” Accessed 17 December 2015. http://www.moew.government.bg/?lang=en.

Union of Concerned Scientists. “Climate Hot Map.” Accessed 20 December 2015. http://www.climatehotmap.org.

Water Governance Facility. “Transboundary Water Management–Why it is Important and Why It Needs to be Developed.” Accessed 28 December 2015. http://watergovernance.org/resources/transboundary-water-management-why-it-is-important-and-why-it-needs-to-be-developed/.

Weather Online. “Bulgaria.” Accessed 31 December 2015. http://www.weatheronline.co.uk/reports/climate/Bulgaria.htm.

The World Bank. *Economics of Adaptation to Climate Change: Synthesis Report*. Washington DC: The World Bank, 2010.

World Weather Online. “Burgas Weather, Bulgaria.” Accessed 10 January 2016. http://www.worldweatheronline.com/burgas-weather/burgas/bg.aspx.

———. “Pleven Weather, Bulgaria.” Accessed 10 January 2016. http://www.worldweatheronline.com/pleven-weather/pleven/bg.aspx.

———. “Plovdiv Weather, Bulgaria.” Accessed 10 January 2016. http://www.worldweatheronline.com/plovdiv-weather/plovdiv/bg.aspx.

———. “Sandanski Weather, Bulgaria.” Accessed 10 January 2016. http://www.worldweatheronline.com/sandanski-weather/blagoevgrad/bg.aspx.

———. “Sofia Weather, Bulgaria.” Accessed 10 January 2016. http://www.worldweatheronline.com/sofia-weather-averages/grad-sofiya/bg.aspx.

———. “Varna Weather, Bulgaria.” Accessed 10 January 2016. http://www.worldweatheronline.com/varna-weather/varna/bg.aspx.