THE ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF CLIMATE CHANGE IN RURAL AREAS: THE CASE OF KONYA

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

BUSEN ÖZGÜR

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
CITY PLANNING IN CITY AND REGIONAL PLANNING

JUNE 2019

Approval of the thesis:

THE ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF CLIMATE CHANGE IN RURAL AREAS: THE CASE OF KONYA

submitted by **BUSEN ÖZGÜR** in partial fulfillment of the requirements for the degree of **Master of Science in City Planning in City and Regional Planning Department, Middle East Technical University** by,

Prof. Dr. Halil Kalıpçılar
Dean, Graduate School of **Natural and Applied Sciences** __________________

Prof. Dr. Hüseyin Çağatay Keskinok
Head of Department, **City and Regional Planning** __________________

Assoc. Prof. Dr. Osman Balaban
Supervisor, **City and Regional Planning, METU** __________________

Examining Committee Members:

Prof. Dr. Hüseyin Çağatay Keskinok
City and Regional Planning, METU __________________

Assoc. Prof. Dr. Osman Balaban
City and Regional Planning, METU __________________

Prof. Dr. Emine Yetişkul Şenbil
City and Regional Planning, METU __________________

Assoc. Prof. Dr. Mehmet Çağlar Meşhur
City and Regional Planning, Konya Technical University __________________

Assist. Prof. Dr. Bilge Çakır
City and Regional Planning, Hatay Mustafa Kemal University __________________

Date: 12.06.2019

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Surname: Busen Özgür

Signature:

ABSTRACT

THE ASSESSMENT OF SOCIO-ECONOMIC IMPACTS OF CLIMATE CHANGE IN RURAL AREAS: THE CASE OF KONYA

Özgür, Busen
Master of Science, City Planning in City and Regional Planning
Supervisor: Assoc. Prof. Dr. Osman Balaban

June 2019, 259 pages

Climate change and its related events have made significant impacts on rural areas in socio-economic as well as environmental terms. Even though agriculture sector is a cause of climate change, agricultural production itself has also been adversely affected by the climate problem. Climate change also affects rural development and conservation policies in terms of the problem it causes such as natural disasters, migration, poverty, diseases, and food security. Moreover, the rural and agricultural impacts of climate change also affect urban areas through food security, food shortage and increased urban demand for food production. Thus, both experts and farmers develop various practices and solutions in order to adapt to the impacts of climate change. In general, farmers tend to focus on short term solutions, while experts emphasize long term actions and policies. If the short term solutions are integrated into long term problem solving actions, adaptation strategies can be directly related to the climate problem. For this reason, this study focuses on farmers' and expert' perceptions, experiences and estimations on climate change in a rural context. The case study analysis indicates that in terms of risk perception, both experts and farmers underline water depletion, water shortage and desertification. From a planning perspective, both farmers and experts state that agricultural production would increase if necessary mitigation actions are taken. In regards to future estimations, farmers generally stress the necessary of product pattern plans in short term; besides, experts are concerned about water crisis among sectors in the long term. There are also similarities and differences between farmers' and experts' perceptions and experiences depend on observed effects, risks, the outcomes of mitigation action, methods, and estimated consequences in the future in five zones. These focal points are targeted to contribute to adaptation and mitigation strategies for agricultural sector and rural areas in Turkey.

Keywords: Climate Change, Agriculture, Perception, Planning, Konya

ÖZ

İKLİM DEĞİŞİKLİĞİNİN KIRSAL ALANLAR ÜZERİNDEKİ SOSYO-EKONOMİK ETKİLERİNİN DEĞERLENDİRİLMESİ: KONYA ÖRNEĞİ

Özgür, Busen
Yüksek Lisans, Şehir Planlama
Tez Danışmanı: Doç. Dr. Osman Balaban

Haziran 2019, 259 sayfa

İklim değişikliği ve buna bağlı olaylar, çevresel koşulların yanı sıra sosyo-ekonomik açıdan da kırsal alanlarda önemli etkiler yapmaktadır. Tarım sektörü iklim değişikliğine neden olan bir sektör olmasına rağmen, iklim sorunu tarımsal üretimi de olumsuz etkilemektedir. İklim değişikliği; yol açtığı doğal afetler, göçler, yoksulluk, hastalıklar ve gıda güvenliği gibi problemler nedeniyle kırsal kalkınma ve koruma politikalarını da etkilemektedir. Kırsal alanlar üzerindeki iklim değişikliği, gıda güvenliği, gıda kıtlığı ve kentsel alanlardaki gıda talebindeki artış açısından kentsel alanları da etkilemektedir. Dolayısıyla, hem uzmanlar hem de çiftçiler, iklim değişikliğine uyum sağlayabilmek için çeşitli çözümler ve uygulamalar geliştirmektedirler. Genel olarak, çiftçiler kısa erimli çözümlere odaklanırken, uzmanlar uzun erimli eylemler ve politikalara vurgu yaparlar. Kısa erimli çözümler uzun erimli problemlerin çözümleri ile birleştirilirse, uyum stratejilerinin iklim sorunu ile ilişkilendirilmesi mümkün olur. Bu araştırma, kırsal alanlarda yaşayan çiftçilerin ve uzmanların iklim değişikliği üzerindeki algıları, deneyimleri ve tahminleri üzerine odaklanmaktadır. Saha çalışması sonuçlarına göre, risk algıları açısından hem uzmanlar hem de çiftçiler su azalması, su kıtlığı ve çölleşmeyi vurgulamaktadır. Planlama açısından, hem uzmanlar hem de çiftçiler gerekli önlem alınması durumunda üretimin artacağını ifade etmektedirler. Gelecek tahminlerinde, çiftçiler genellikle kısa erimde ürün deseni planlanmasının gerekliliğini ifade ederken, uzmanlar ise uzun erimde sektörler arasındaki su krizinden endişelenmektedirler. Çiftçilerin ve uzmanların algıları ve deneyimleri, gözlemledikleri etkiler, riskler, azaltım eylemlerinin sonuçları, methodlar ve gelecekteki tahmini sonuçları açısından beş bölgede farklılıklar ve benzerlikler göstermektedir. Bu tespitlerin, Türkiye'deki kırsal alanlarda ve tarım sektöründe uyum ve azaltım stratejilerinin belirlenmesinde katkı sağlanması hedeflenmektedir.

Anahtar Kelimeler: İklim Değişikliği, Tarım, Algı, Planlama, Konya

To my beloved family; Sabriye, Hasan Hüseyin and Umut Özgür

ACKNOWLEDGEMENTS

The explorative and instructive experience would not be realized without the contributions, supports and existence of many people. Firstly, I would like to express sincere gratitude to my supervisor Assoc. Prof. Dr. Osman Balaban for his endless support and positive guidance. Additionally, I would like to thank for all his contributions, profound knowledge, incredible patience, and advise throughout the research.

I would like to thank the examining committee member, Prof. Dr. Hüseyin Çağatay Keskinok, Prof. Dr. Emine Yetişkul Şenbil, Assoc. Prof. Dr. Mehmet Çağlar Meşhur and Assist. Prof. Dr. Bilge Çakır for their valuable critics and suggestions. I must also offer a special gratitude to all of farmers and experts who participate this study in Konya and I am very grateful for their patience and endless supports during the research.

Besides, I would like to offer my special thanks to my beloved friends. I would like to thank to Cennet Arıkan, Aysel İrem Ataç and Yakup Yetişir for their supports. I am also thankful to Dilara Ünalan, Didem Duman, Gizem Açıl and Yağmur Çakıroğlu. I would also like to express the deepest appreciation to my friends, Elif Bilge, Hazal Ertem and Begüm Sakar for their endless support.

Above all, I owe the most special thankful to Ayşe Esen, Hüseyin Esen, Nihayet Tümen, Celal Tümen, Huriye Okay and Mehmet Okay for continuous encouragement thoughout my academic career. I would like to express my deepest gratitude to my family, my mother Sabriye Özgür, my father Hasan Hüseyin Özgür, and my brother Umut Özgür for their endless encouragement, tolerance and supports during all my life. This accomplishment would not have been possible without them. Thanks for everything.

TABLE OF CONTENTS

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

LIST OF ABBREVIATIONS

ASC	Agriculture Specialization Commission (Tarım Özel İhtisas Komisyonu)
CEM	Directorate General for Combating Desertification and Erosion
ÇATAK	Çevre Amaçlı Tarım Arazilerini Koruma Programı
DSİ	General Directorate of State Hydraulic Works
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse gas
IFOAM	International Federation of Organic Agriculture Movements
IPCC	Intergovernmental Panel on Climate Change
KMM	Konya Metropolitan Municipality
KOP	Konya Plains Project
KOP BKI	Konya Ovası Projesi Bölge Kalkınma İdaresi Başkanlığı
MEVKA	Mevlana Development Agency
MGM	Turkish State Meteorological Service
MoAF	Republic of Turkey Ministry of Agriculture and Forestry
MoD	Republic of Turkey Ministry of Development
MoEF	Republic of Turkey Ministry of Environmental and Forestry
MoEU	Republic of Turkey Ministry of Environment and Urbanization
MoFAL	Republic of Turkey Ministry of Food, Agriculture and Livestock

MoFWA	Republic of Turkey Ministry of Forestry and Water Affairs
NGO	Non-governmental Organization
OGM	General Directorate of Forestry
SPSS	Statistical Package for the Social Sciences
SYGM	Directorate General for Water Management
TEMA	The Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats
TÜGEM	General Directorate for Agricultural Production and Development
TUIK	Turkish Statistical Institute
UHI	Urban Heat Island
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
U.S. EPA	U.S. Environmental Protection Agency
WMO	World Meteorological Organization
WWF	World Wildlife Fund

LIST OF SYMBOLS

°C	Degree Celsius
CFC	Chlorofluorocarbons
CO_2	Carbon dioxide
CH_4	Methane
N_2O	Nitrous oxide

CHAPTER 1

INTRODUCTION

1.1. Context and Problem Definitions

Climate change rapidly has affected both urban areas and rural areas since industrial revolution. While climate change affects agricultural lands, agricultural areas contribute to climate change due to increase GHG (greenhouse gas) emissions such as methane. Therefore, it is estimated that climate change cause significant outcomes in terms of environmental and socio-economic perspectives. The relationship between environmental and socio-economic conditions cannot be considered separately. Hence, many studies based on literature focus on farmers' perceptions on the impacts of climate change. In this context, farmers' and experts' perceptions, experiences, and estimations were assessed in terms of climate change on agricultural lands. Climate change and food security are directly connected with each other. This research includes in two main concepts: climate change and food security on agriculture.

First of all, climate change is fundamental principle in the scope of this research. WMO (World Meteorological Organization) "Proceeding of the World Climate Conference" (1979) stated that *"climate change defines the difference between long-term mean values of a climatic parameter or statistic, where the mean is taken over a specified interval of time, usually a number of decades*" (p.752). As seen in Figure 1.1., average surface temperature increases from 2081 to 2100, and the average precipitation rate increases from 2081 to 2100. Due to the changes in climatic conditions, various risks will occur in different regions in worldwide. Thus, these changes will affect food systems in the future.

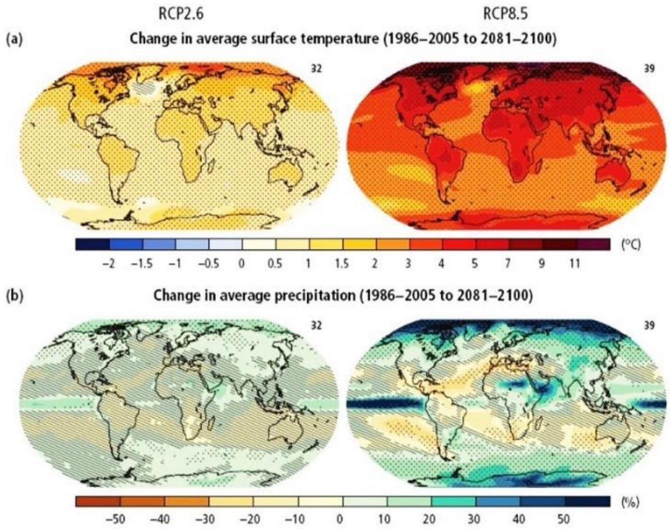


Figure 1.1. Change in average surface temperature(a) and precipitation(b) (IPCC, 2014, p.12)

Secondly, food security is directly related to the change in weather conditions and climate change. As FAO (Food and Agriculture Organization of the United Nations) (2017), "*understanding the vulnerability of people's food security to climate change is essential to identifying appropriate adaptation measures and so reduce both vulnerabilities and impacts*." (p.13). As seen in Figure 1.2, the decrease in yield will increase from 2010 to 2109 (IPCC, 2014, p.15); thus, there is a strong connection between food security and climate change (FAO, 2006, p.1). Especially, farmers fell compelled to sustain socio-economic conditions in agricultural sector. Food security is also related to the availability, accessibility, utilization and stability in agricultural areas.

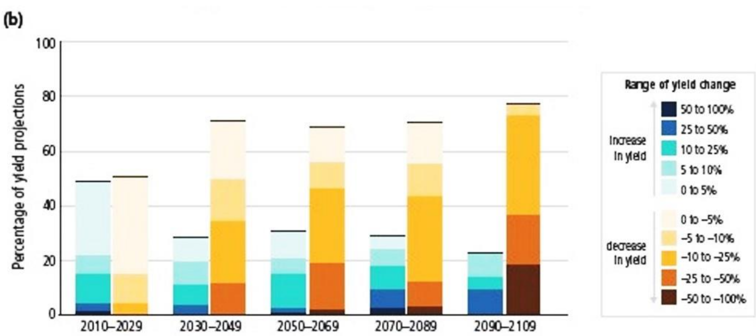


Figure 1.2. Risks of food production (IPCC, 2014, p.15)

A significant increase in GHG emissions in the period following industrialization causes serious problems both in urban areas and in rural areas. While urban heat islands occur in urban areas; rural areas, which are the center food production, have serious effects on food security by decreasing crop yields and qualities, the changes in product pattern, and these areas are directly affected by weather conditions such as unexpected change, an increase temperature and precipitation, and a decrease in temperature and precipitation. Thus, changes in weather conditions affect crop yields and qualities, and farmers also face socio-economic problems such as migration, unemployment and poverty. For this reason, in recent years, these studies of climate change on agriculture have increased in different regions in worldwide. These studies help to form mitigation and adaptation plan strategies.

As a result of drought after 2007, food efficiency and wetlands are affected in Konya. Although the change in crop pattern and irrigation systems have increased, water depletion and desertification are still serious problems. Thus, farmers are obliged to do these practices due to lack of information. On the other hand, the increase in agricultural activities on wetlands, which have dried up in recent years, also triggers environmental issues such as water depletion, water shortage and pothole formation, and socio-economic issues such as diseases, poverty, migration and income reduction. The main problem is socio-economic threat on rural areas, and farmers face serious economic threats related to their short term production and reproduction necessities. Thus, climate change triggers these threats as well as insufficient knowledge and awareness. It is necessary to understand differences between farmers' and experts' perception. Their perceptions and experiences are directly related to the education level and awareness. Therefore, the increase in natural disasters, the decrease in crop productivity are negative outcomes of climate change. In addition, the collaboration among institutions can be a fundamental solution in order to deal with negative impacts of climate change. This study focuses on a dilemma between short term and long term actions in terms of climate change on agriculture. Even though farmers and experts perceive climate change, agricultural practices are limited against climate change. However, this problem is not a matter that farmers can solve alone. Therefore, the impacts of climate change on agriculture is the subject of planning discipline due to social network and collaboration with all stakeholders.

The problem definition of the research is there are similarities and differences between farmers' and experts' perceptions, experiences and estimations on climate change. Farmers focus on short-term solutions based on autonomous adaptation, while experts emphasize long term actions based on planned adaptation. That is, short term solutions can be integrated to long term strategies in order to solve climate change problems. Therefore, this study analyzed the differences between farmers' and expert' perception, experiences and estimations on climate change on a micro-meso scale and macro scale. In this study, these differentiations are examined in terms of observed effects, risks, the outcomes of mitigation action, methods, and estimated consequences in rural areas.

1.2. Aim of the Research and Problem Questions

Climate change brings about negative effects on land, soil and water resources in terms of environmental perspectives; moreover, it threatens socio-economic problems such as migration, poverty and diseases. These socio-economic conditions are associated with perception and experiences, technology and education. The socio-economic impacts gradually increase as well as environmental impacts of climate change. This study aims to determine participants' observations based on their experiences on local farming as regards impacts of climate change in rural areas and agricultural sector in Konya Provinces. Furthermore, it purposes to examine how climatic risks, the outcomes of mitigation actions, methods and estimated consequences are varied in terms of farmers' and experts' perceptions and experiences. According to the effects of climate policy, the stakeholders' perceptions should be similar. Thus, this study aims to fill the gap by appearing experts' and farmers' perceptions, experiences and estimations based on impacts of climate change. The research provides various views in terms of observed effects, risks, the outcomes of mitigation actions, methods, and estimated consequences in different rural areas.

Both farmers and experts perceive the change in weather conditions. In particular, crops based on agricultural sector are affected by the change in weather conditions, and farmers are directly related to agricultural sector. Thus, climate change can trigger socio-economic problems in rural areas. On the other hand, institutional collaboration also draw attention in terms of agricultural policies.

The study has three hypotheses.

The **first hypothesis** of the research is that the agricultural sector is faced with socio-economic risks as well as environmental risks based on climate change on a micro and macro scale.

The **second hypothesis** of the research is that the farmers will suffer from negative impacts of climate change in terms of socio-economic conditions in the future. If the social network and collaboration with all stakeholders are strengthened, the negative impacts of climate change can be decreased in rural areas on a macro scale.

The **third hypothesis** of the research is that although farmers focus on autonomous adaptation on a micro scale, experts emphasize planned adaptation on a macro scale. The dilemma between micro and macro scale can been reduced via planning discipline.

Within the scope of this research, the problem questions can be formulated as follows:

- What are socio-economic risks based on climate change on a micro-meso and macro scale?
- How do social network and collaboration all stakeholders affect on a macro scale?
- What is the role of planning on a micro-meso and macro scale?

Within the scope of this research, the problem sub-questions can be formulated as follows:

- How do the participants' perceptions vary in Konya?
- How do the participants' experiences vary in Konya?
- Which risks farmers face in rural areas in Konya?
- What are the outcomes if mitigation actions are applied in Konya?
- Which methods enables farmers to cope with climate change in Konya?
- What are the estimated consequences in Konya?

Within the scope of this research, the problem sub-questions can be formulated as follows:

- How do the participants' perceptions vary in different zones?
- How do the participants' experiences vary in different zones?
- Which risks farmers face in rural areas in different zones?
- What are the outcomes if mitigation actions are applied in different zones?
- Which methods enables farmers to cope with climate change in different zones?
- What are the estimated consequences in different zones?

1.3. Methodology of the Research

This study aims to determine the impacts of climate change on rural areas, to appear risks, the outcomes of mitigation actions, methods and estimated consequences compared with farmers' and experts' perceptions and experiences. The comparative table among the draft version of Konya Closed Basin, Büyük Menderes Basin, Meriç Ergene Basin and Susurluk Basin was prepared in terms of agricultural consumption. As a result, Konya Closed Basin was selected due to over-consume water on agricultural sectors. Konya Province was selected as case study due to the largest surface area and its leading position in agricultural sector in Konya Closed Basin. Indeed, Konya Province, which has a strong agricultural sector, was selected, and it was assessed as a whole. In addition to the existing important agricultural areas in Konya, it faces various threatens such as water depletion, pothole formations, and drought. Climate change also will trigger these risks. Thus, case study method was used to find more information and to gather empirical evidences. Data were obtained two stages. While primary data was collected by structure questionnaires and semi-structure questionnaires, secondary data was collected by international and national reports. First of all, secondary data were obtained from institutions and e-resources of international or national reports. Especially, these reports were reached from official websites of FAO and United Nations (UN). In national resources were obtained from institutions such as Republic of Turkey Ministry of Forestry and Water Affairs (MoFWA), Turkish State Meteorological Service (MGM), Republic of Turkey Ministry of Environment and Urbanization (MoEU), Republic of Turkey Ministry of Food, Agriculture and Livestock (MoFAL) and Turkish Statistical Institute (TUIK). Tables, graphs, statistical data and mapping were used for the resulting data for documentation. According to these reports, the changes in climatic variables are examined regarding extreme or unexpected weather conditions. Secondly, secondary data was used in order to analyze these conditions. Data selection was prepared based on data, "*Residential Locations in the Rural Areas of Konya*", which was obtained by Konya Metropolitan Municipality (KMM). These data were obtained from the website: konya-e-desen.com/kriterDetay (updated e-desen.konya.bel.tr/) on May 2018. All these maps were prepared by using '*ArcMap-10'* software regarding these data in 771 villages and 31 districts. The selection criteria were established in order to determine case study areas, where were carried out these questionnaires. The selection criteria included eight variables: land consolidation, whether farming is carried out by second generation or not, good agricultural practices, the rate of ensuring the livelihood of production, the amount of wetland, the average of individual land, cooperatives and certified organic agriculture.

The criteria for selection was evaluated for each village in Konya. The density of the settlements, which had a score of 4 and above, was rated. These points for each district were recreated within themselves.

According to the selection criteria,

- Rural areas where had above and 50% of land consolidation
- Rural areas where had above and 2 points of the wetland
- Rural areas where had above and 2 points of the individual land average
- Rural areas where had above and 75% of cooperatives
- Rural areas where had 26-50% of good agricultural practices areas
- Rural areas where had 50% and above of the second generation suggestion
- Rural areas where had 26-50% of certified organic agriculture
- Rural areas where had above and 3 points of the rate of ensuring the livelihood of production

According to eight criteria, the selection map was prepared in order to conduct the questionnaires. The fundamental regions were determined as the north, west, south and south-east of Konya. As a result, eight districts, which are Akşehir, Çumra, Ereğli, Karapınar, Doğanhisar, Hüyük, Çeltik, and Yunak were selected. These provinces are grouped as five zones based on geographical similarity, the proximity of sites and zones' size. The study investigates whether participants' perceptions and experiences on adaptation strategies were heterogeneous or not by using primary data. Thus, five main zones were determined as the north, west, south and south-east of Konya. While qualitative semi-structured questionnaires were conducted from July to September 2018 for experts' perceptions, experiences and estimations, structured questionnaires were conducted for farmers at the same time (Figure 1.3.).

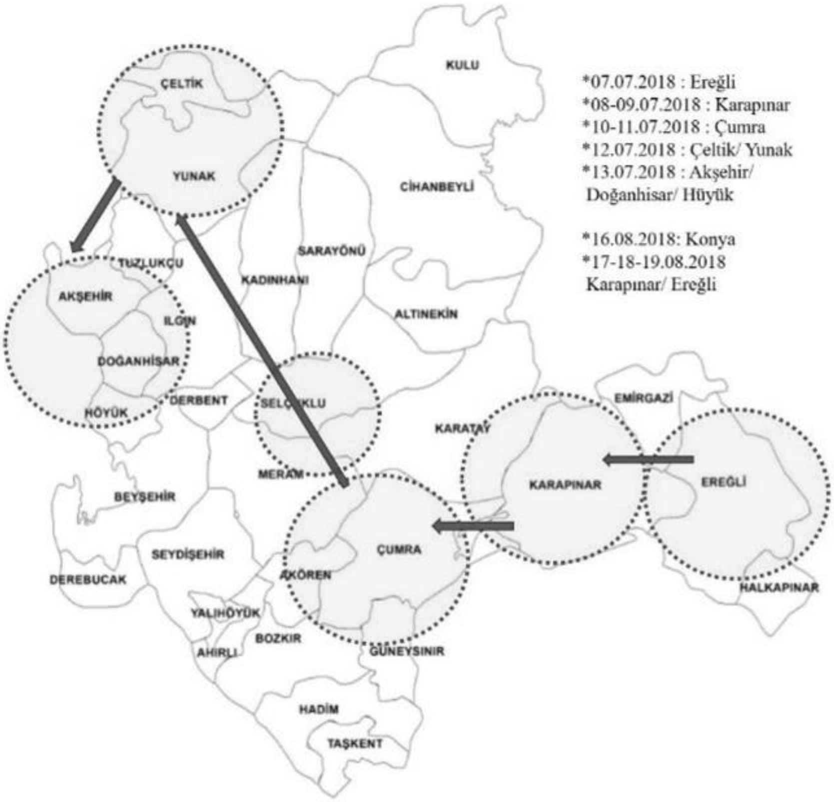


Figure 1.3. The map of case study

For this purpose, the structured and semi-structured questionnaires were prepared, and they consist of three parts: demographic information of the participants, general information about climate change of the participants and the relationship between climate change and planning. This study was conducted using data from a random sample of 72 farmers and 28 experts. 72 structured questionnaires were applied to farmers from eight districts in first step (Appendix A-B). In the second phase, the study was conducted by asking semi-structured questions to 28 experts in nine districts (Appendix C-D). These experts have worked with public institutions and organizations, local governments, NGOs and villages as headman in terms of agricultural facilities. All questionnaires were carried out via face-to-face communication. The research was carried out in five zones (96 participants) in Konya. Besides, the questionnaires were implemented by four experts in center of Konya. As seen in Table 1.1., the number of participants in zones can be explained as follow:

Table 1.1. *The number of the questionnaires of farmers, experts and participants*

Zones	Districts	Number of Farmers	Number of Experts	Total
ZONE 1	Akşehir	8	4	24
	Doğanhisar	4	2	
	Hüyük	4	2	
ZONE 2	Çeltik	8	3	17
	Yunak	4	2	
ZONE 3	Ereğli	18	2	20
ZONE 4	Karapınar	9	3	12
ZONE 5	Çumra	17	6	23

The questionnaires include a variety of features such as multiple choice, the standard 3 point Likert type scale and open-ended questions. The collected data were recorded on SPSS (Statistical Package for Social Science) software package (IBM SPSS Statistics 24.0) in October and November 2018, and '*analyze/descriptive statistics*' were used to describe the data. All the findings were visualized via Microsoft Excel Worksheet 2016.

1.4. Structure of the Research

This research consists of six chapters including the introductory and concluding parts. The **first chapter**, introductory part, discusses the background of this argument, problem definition, the main objectives, problem questions and sub-questions, and the methodology of this research. This chapter briefly summarizes the framework of the research (Figure 1.4).

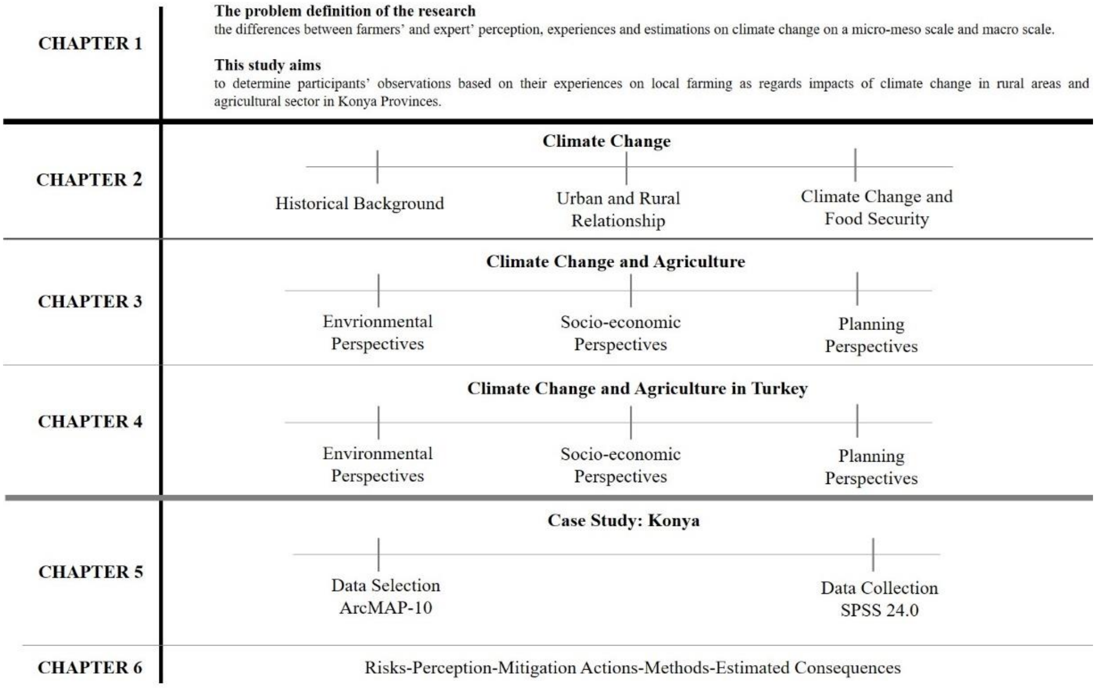


Figure 1.4. Framework of the research

In the second chapter, the historical background of climate change, the relationship between urban and rural areas, and food security are analyzed via the literature review. The historical background of climate change focuses on environmental breaking points based on international reports; moreover, the relationship between urban and rural areas are associated with urban heat island and impacts on its surrounding. Thus, impacts of climate change are stated not only urban areas but also rural areas. The theoretical framework of food security is analyzed from various perspectives. The fundamental principles of climate change on agriculture are discussed in detail in terms of environmental, socio-economic and planning perspectives in the following chapter.

The third chapter focuses on the concept of climate change on agriculture, and this part given in detail about environmental, socio-economic and planning perspectives. Whereas environmental impacts have ecosystem-water resources, natural disaster, and agricultural practices, socio-economic perspectives consist of farmers' perception and experiences, migration, poverty, health, technology, education and micro-macro economy. An alternative research models and questionnaires-interviews are examined by qualitative and quantitative methods. The main principles are investigated by various examples in different regions.

In the fourth chapter, the impacts of climate change in Turkey is evaluated based on environmental, socio-economic and planning perspectives as the previous chapter. Especially, planning perspectives are assessed based on various national plans such as national plans on climate change and agriculture, and national plans on drought and watershed management in Turkey. Thus, by comparing with four river basins, Konya Closed Basin are selected as case study area due to over usage of water in agriculture sector. Water depletion and agriculture are two main focal points in Konya Closed Basin.

The fifth chapter is the case study chapter. The research was conducted in Akşehir, Doğanhisar, Hüyük, Yunak, Çeltik, Çumra, Karapınar, Ereğli and center of Konya. This chapter consists of general information about case study and methodology in Konya. The first step focuses on the change in drought index and agricultural pattern. The second step includes three parts: data selection, data collection and data analysis. The findings are obtained by face-to-face interviews. The findings are assessed for farmers and experts in Konya and in different zones in Konya.

Finally, **the last chapter**, conclusion, discusses all research findings evaluate from a critical perspective. The similarities and differences of farmers' and experts' perceptions, experiences and estimations are discussed by comparing with each other. The concluding remarks also lead to the further researches that can be carried out on natural disasters, risk management plans and rural development.

CHAPTER 2

THE FRAMEWORK OF CLIMATE CHANGE

2.1. Introduction of Climate Change

Climate change affects ecosystems, water resources, and livelihood resources in worldwide. As well as climate change, an increase in weather variability have threatened the agricultural sectors. Thus, the impacts on agriculture bring about not only environmental shifts but also socio-economic shifts. Based on the existing literature, climate change triggers vital challenges on ecological and socio-economic systems. Therefore, in many countries, the impacts of climate change are investigated in terms of several aspects such as natural disaster, poverty, and food security both in urban areas and in rural areas.

IPCC (2014) claimed,

> "*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"* (p.2).

In this part, it is identified the impacts of climate change in worldwide. Firstly, global warming and climate change can use as similar definitions; however, they have different characteristics. According to NASA (2018a), global warming is associated with long-term warming of the planet. An increase in global temperature has been observed since the 1970s. Climate change, which is wider-perspectives, consists of not only global warming but also sea level rise, glacial melting, flower/planting blooming times, and human activities bring about an increase in using fossil fuel and heat-trapping gases in air. As seen in Figure 2.1, it is evaluated that although there are similar changes in Earth's surface temperature from 1000 to 1900, the increase in temperature rose in 1950 and 2000. In addition to these, it is estimated that surface temperature dramatically will increase the projections based on 2000 and 2100 (IPCC, 2001, p.34). Global warming effects have been increasing since the 1950s, so the atmosphere and ocean warmed, sea level rose and ice and snow amount decreased (IPCC, 2014, p. 40).

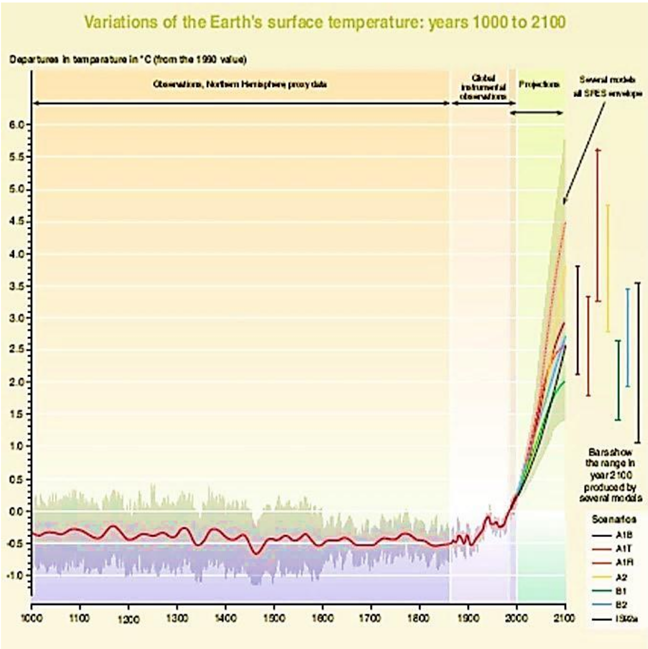


Figure 2.1. Earth’s surface temperature from 1000 to 2100 year (IPCC, 2001, p.34)

Greenhouse gas concentrations consist of water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and chlorofluorocarbons (CFCs). As displayed in Figure 2.2, globally averaged CO_2, CH_4, N_2O have increased from year to year (IPCC, 2014, p.3) Water vapor increases as the atmosphere heats up, and it causes cloud or rainfall. Water vapor has a feedback mechanism for the climate. An important component of the atmosphere is CO_2 (carbon dioxide), which is released by respiration, volcano eruption, human activities such as deforestation, land use, fossil fuels. Indeed, CO_2 concentration has increased by more than 30% since Industrial Revolution. On the other hand, methane consists of not only natural resources but also human activities, ruminant digestion and manure of livestock. Although methane is more effective than CO_2, there are less amount of methane in the atmosphere. An another gas is nitrous oxide which are released by soil cultivation practices such as fertilizers, fossil fuel, biomass, and nitric acid production. Even if chlorofluorocarbons (CFCs) is regulated by international agreements, this gas, having synthetic components, are used in industrial areas (NASA, 2018b).

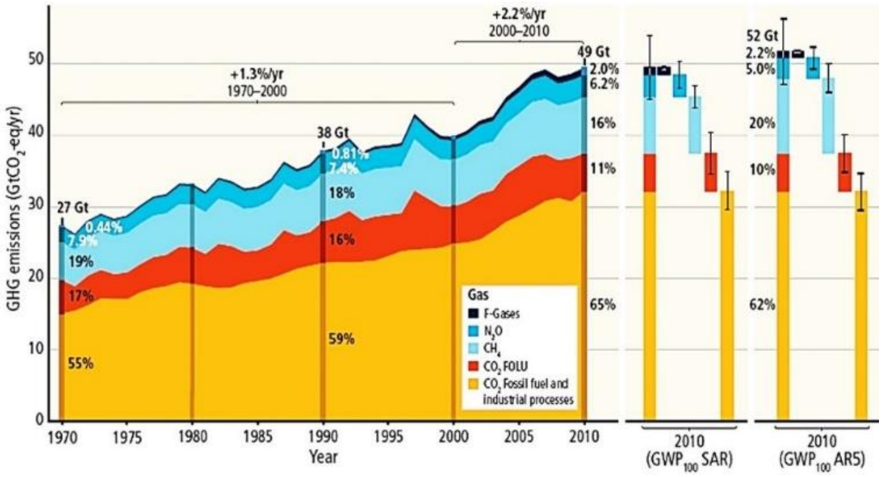


Figure 2.2. The annual anthropogenic GHG emissions by different gases 1970-2010 (IPCC, 2014, p.46)

GHG emission can pass through the short wave solar radiation atmosphere and the long wave terrestrial radiation, which emitted by the earth’s warm surface, partially cools and is re-emitted by gases, so it is one of the important factors (IPCC, 1992, p.65). GHG emission are generated by human impact due to economic and population growth, and the warming is quite high since the mid-20th century because the carbon dioxide, methane and nitrous oxide have risen (IPCC, 2014, p. 4). As seen in Figure 2.3, these gases related economic sectors consist of two emission types such as direct GHG emissions and indirect CO_2 emissions. AFOLU (Agriculture, forestry and other land use) has 24% of greenhouse gas emissions, and 21% of GHG emissions is industry (IPCC, 2014, p.47).

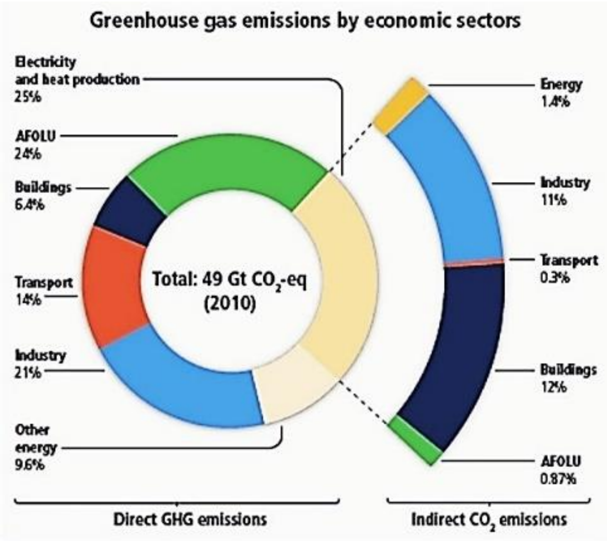


Figure 2.3. Greenhouse gas emissions by economic sectors (IPCC, 2014, p. 47)

Climate change will have implications for the change in temperature and precipitation, growth season and efficiency process on agriculture, and the increase in CO_2 will alter productivity of certain crops. In addition to these, changes in floods, droughts, storms, evapotranspiration, sowing and harvesting will affect agriculture, so different impacts will be encountered in different regions of the world (Atay, 2015, p.23). Increased displacement of people has been observed due to climate change. Low-income developing counties are more affected by extreme weather conditions, so climate change may increase indirectly risks based on poverty and economic reasons (IPCC, 2014, p.16). As seen demonstrated in Figure 2.4, human system and earth system are related to each other in terms of vulnerability and socio-economic conditions. Climatic impacts on the earth have caused various natural disasters such as flood and drought since early times. However, greenhouse gases dramatically increase owing to human impacts in recent years.

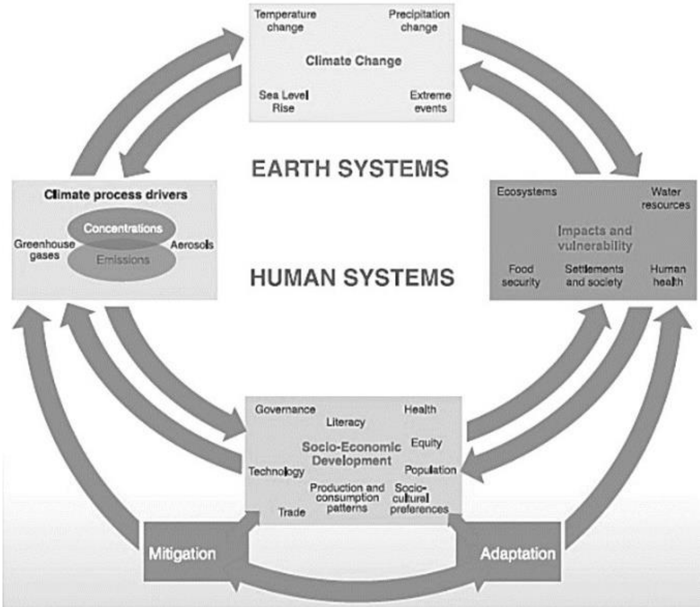


Figure 2.4. Framework of climate change based on human effect (IPCC, 2007, p.26)

2.2. Historical Background of Climate Change

Throughout history, all species faced with climate-related events. However, recently, risks dramatically increased based on climate change related events. These risks are associated with both environmental conditions and socio-economic conditions. Therefore, these risks threat to livelihoods several aspects such as poverty, food security and migration. In this part, the environmental and socio-economic impacts of climate change was evaluated based on national reports (Figure 2.5).

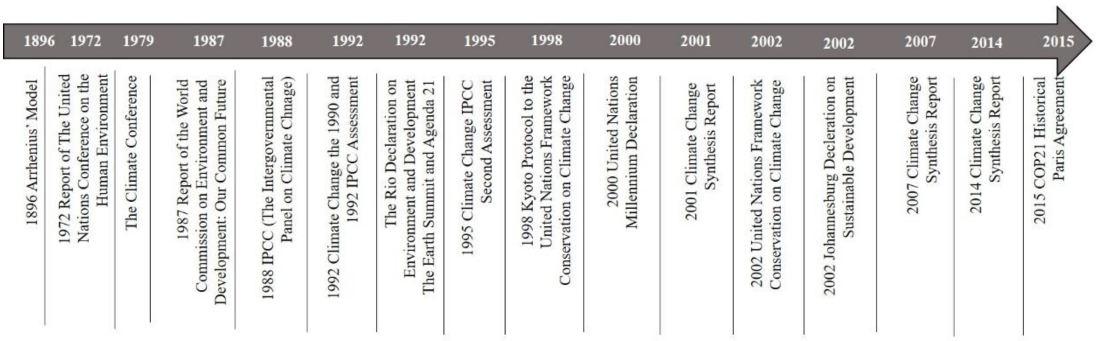


Figure 2.5. Fundamental milestones of climate change in historical process

At the beginning of 1896, Svante Arrhenius published two articles regarding the impacts of CO_2 (carbonic acid) on surface temperature. According to the article in the Philosophical Magazine, climate variations occurred from CO_2 variations, and these variations caused climate change in geological times such as Ice Ages. On the other hand, it was a new and interesting model. It is first approach, which described the impacts of CO_2 on climate change (as cited in Crawford, 1997, pp.6-10).

According to '*Report of the United Nations Conference on the Human Environment'* (1972), as per principle 2, the natural resources (air, soil, water, flora and fauna) and ecosystem must protect via planning or management for future generation. Principle 15 stated planning was necessary in order to enable to environmental, socio-economic benefits as a whole. As seen in Figure 2.6, the framework of plans consists of three main activities: global environmental activities, management activities and supporting measures both national and international (pp.4-6). According to United Nation (1972), in the development and environment section, it was summarized that short and long term plans were related to environmental problems in regional, sub-regional and sectoral levels and unique problems such as coastlines, lakes, rivers in the least developed countries; moreover, it was emphasized that poverty, malnutrition, illiteracy and misery were terrific problems in developing countries (p.25,46). For this reason, planning and environmental problems are related to each other.

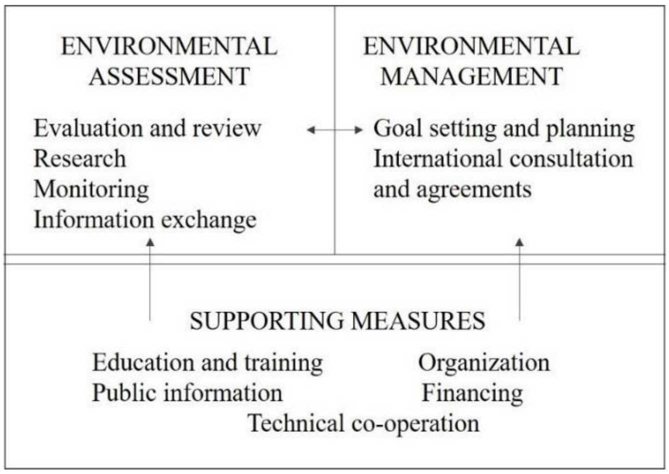


Figure 2.6. The framework of the action plan (United Nations, 1972, p.6)

The climate conference was organized by World Meteorological Organization (WMO) in February 12-13, 1979 in Geneva. The issues of conferences consist of four parts: climate and public policy, global climate system, human effects on climate system, and the impacts of climate on human (WMO,1979).

According to "*World Commission on Environment and Development: Our Common Future"* (1987), it was referred that new economic approach was associated with environmental resources, and this could reduce poverty in the developing counties. Disaster was also one of the important problem. There was a connection among each other regarding environmental issues. Deforestation brought about soil erosion and negative effects on rivers and lakes. These areas and forests were affected by air pollution and acidification. Therefore, it was emphasized that different issues should be considered at the same time. Also, environmental and economic development can balance because the relationship between economic and ecology must be equal. The other issue was a relationship between environmental and social conditions. Women's social status, rapid population growth and cultural differences were related to environmental and social conditions. Lastly, people might be faced with important problems such as water and air pollution not only on an international scale but also on a national scale. As a result, this report highlights sustainable development, environmental, economic and social-policies balance.

IPCC (The Intergovernmental Panel on Climate Change) was founded by WMO and United Nations Environment Programme (UNEP) in order to assess the impacts, risks, adaptation and mitigation of climate change in 1988 (IPCC,2013). Then, IPCC published assessment reports about climate change in 1990/2, 1995, 2001, 2007, and 2014.

The IPCC First Assessment Report was completed in 1990 after the 1992 IPCC Supplement was declared in 1992. IPCC (1992) emphasized the report included scientific assessment, climate change effects, and strategies about climate change. In the section, *'potential impacts on agriculture'*, it was stated that there were significant uncertainties in specific regions even though climate change significantly affected agriculture and livestock in different studies. The impacts of increase and decrease in global agricultural potential were not determined precisely. Whether changes, diseases, pests and weeds, which associated with technology and agricultural practices, could be influenced by climate change, negatively. Because of the prolong growth season, crop productivity could increase at high and middle latitudes and limit in the Northern Hemisphere. In addition, food production might relate to not only climate change but also rapid population growth and cost. Moreover, human impacts brought about changes on climate, so serious problems occurred in terms of social, economic and natural conditions in worldwide. Also, human health, well-being and agricultural production could be influenced by climate impacts (p.93,113).

"The Rio Declaration on Environment and Development" were declared by The United Nations Conference on Environment and Development (UNCED) in order to develop new cooperation among states, sectors, society and people in 1992 in Rio de Janeiro (UNCED, 1992a, p.1). As per article 5 and 7, all states and people might cooperate with each other in order to eradicate poverty and protect and restore the nature ecosystem (UNCED, 1992a, p.2). In the second part in same report, "*The Earth Summit and Agenda 21*", focused on various issues: poverty, land sustainability, drought and desertification, biodiversity, management of water resources, empowering the farmers and indigenous people, education, training, and awareness (1992b, pp.1-14). These variabilities are directly related to the impacts of climate change on agricultural lands.

"Climate Change 1995: IPCC Second Assessment Report" was published in 1995. This report consisted of three parts: science and analyses, adaptation and mitigation, and socio-economic conditions of climate change. Especially, adaptation involved several issues such as hydrology and water management, agriculture and forest, health, technology and policy action based on climate change related events. Economic and social methods were very important. Furthermore, climate change would affect crop yield and productivity, and it would cause regional differentiations. Thus, productivity patterns would change in tropical and subtropical areas. Global agriculture would

preserve under twice the equivalent CO_2 equilibrium. Despite the beneficial effects of CO_2 fertilization, it might not affect pests and climatic variability. Even if global agriculture was focused, it might differ from local and regional aspects. Therefore, the risk of hunger might rise in some regions, and negative results for consumption might occurred (p.7).

United Nation (1998) declared *'Kyoto Protocol to the United Nations Framework Convention on Climate Change'* in 1998. This report focused on implementations and policies: the increase in energy efficiency, the improved in sustainable forest management and agriculture, the develop in renewable energy, waste management, the decrease in GHG emissions of transportation and other sectors. Moreover, United Nations aimed to decrease at least 5% the level of 1990 in 2008-2012 period (pp.2-3).

United Nation (2000) claimed that collective responsibility is necessary in order to empower human dignity, and equality; moreover, it focused on major values: freedom, equality, solidarity, tolerance, respect for nature and shared responsibility (pp.1-2).

"Climate change 2001: Synthesis report: Summary of Policymakers" (2001) was assessed three parts: new projections based on the change in temperature and precipitation, sea level, and extreme climate events, socio-economic and biophysical effects regarding climate change, and adaptation or mitigation actions. Environmental problems affected sustainable development on a local, regional and global scale, and increased benefits, reduced costs and human needs provided a collaborative opportunity for sustainable development (p.29). As seen in Figure 2.7, it can be considered that there is a fundamental cycle among climate change, impacts on human and natural system, socio-economic conditions, and emission and concentrations. Adaptation and mitigation actions affect this cycle in term of environmental, and socio-economic conditions.

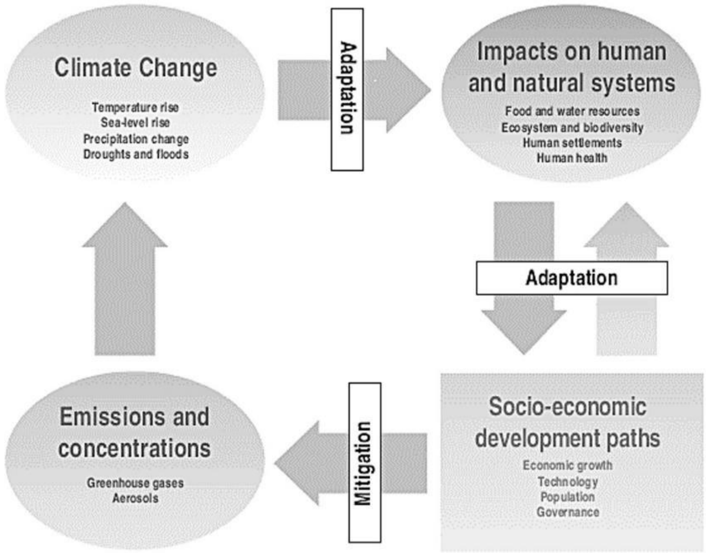


Figure 2.7. The integrated cycle of climate change (IPCC, 2001, p.3)

United Nations (2002a) aimed to stop the human impacts and GHG emissions on climatic system, and it aimed adapt to ecosystem, and to eradicate damages on food productivity, and to sustain economic development. Also, economic, social and environmental policies related climate change would reduce the adverse impacts on economy, public health and environmental quality; moreover, the technological, scientific and socio-economic systems would be developed with cooperation (pp.6-8). Furthermore, '*UN Johannesburg Declaration on Sustainable Development*' highlighted human dignity, basic requirements, financial resources, modern technology, and education. Food security, energy, water, and protecting biodiversity were associated with basic requirements (2002b, p.3).

According to IPCC (2007), human activities brought about GHGs emissions such as CO_2, methane (CH_4), nitrous oxide (N_2O) and halocarbons (p.37). This report focused on adaptation, which could reduce negative impacts, and mitigation actions, which aimed to reduce GHG emissions (pp.56-58). The report explained that unexpected climate change would cause drought, flood, wildfires, acidification of oceans, land use change, pollution, natural system change, over-usage of resources as regard models.

If global temperature exceeds 1.5°C and 2.5°C, approximately 20-30% of plants and animals will be danger. In the events of the increase of 1.5°C– 2.5°C, ecological areas can be change, and biodiversity, water and food sources will be affected by these events. Also, it was estimated that if the temperature increased 1°C-3°C, crop productivity could be affected both negatively and positively. At lower attitudes, when the local temperature increased 1°C-2°C, the hunger risks would increase in dry and tropical areas. Globally, while food production might increase in 1°C-3°C, it might decrease above these temperature (p.48). As seen in Figure 2.8., GHG emissions occur energy supply (25.9%), industry (19.4%), forestry (17.4%), and agriculture (13.5%) in terms of total anthropogenic GHG emissions in different sectors.

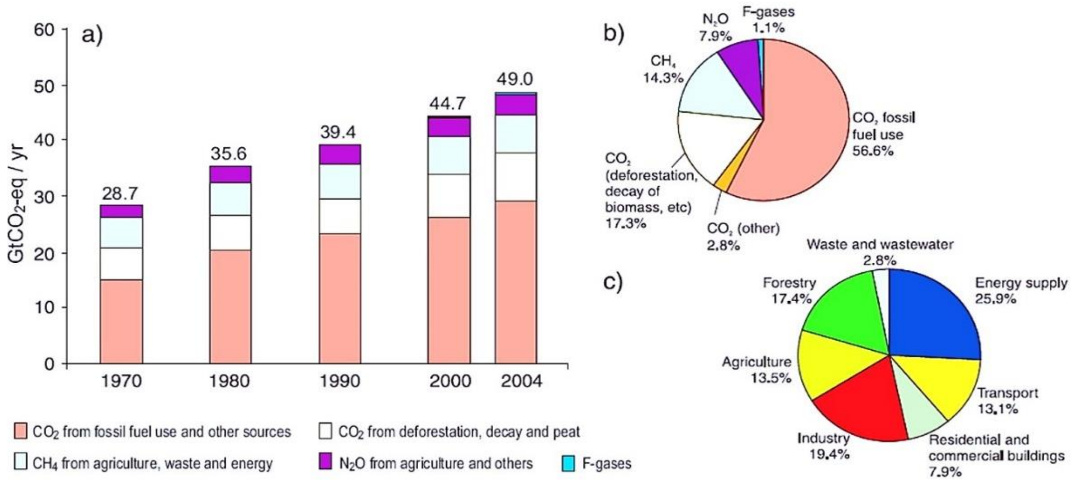


Figure 2.8. Global anthropogenic GHG emissions (IPCC, 2007, p.36)

According to '*IPCC Climate Change 2014: Synthesis Report' (2014),* there were four main topics: observed changes and causes, risks and impacts for future, future pathways, and adaptation and mitigation. Climatic events increased as regards human effects such as increased extreme temperature, high seal level and increased heavy precipitation. Social and natural system will face with the risks of climate change.

This report stated that,

"Adaptation can reduce the risks of climate change impacts, but there are limits to its effectiveness, especially with greater magnitudes and rates of climate change. Taking a longer term perspective, in the context of sustainable

development, increases the likelihood that more immediate adaptation actions will also enhance future options and preparedness" (p.19).

United Nations (2015), "*Paris Agreement",* stated that an increase in temperature would limit below 1.5°C above the pre-industrial levels, and aimed to increase climate resilience in order to not affect food production, negatively. Also, the financial flows improved in order to decrease GHG emissions (p.3).

In brief, climate change is an integrated issue in terms of on a local, regional and global scale. The impact on ecosystem and food system are directly related to rural areas. Climate change has experienced with various disasters since the world existing; however, nowadays, these impacts increased due to human impacts, and it is estimated that natural disaster will rise in the future. The livelihood in rural areas is depended on agriculture and food, so food will be affected socio-economic relations, seriously. The impacts in increased GHG emissions will alter not only the urban areas but also the rural areas. Adaptation to climate change in rural areas is linked to crop yield. According to international policies, climate change is evaluated in terms of environmental, economic and social aspects. Although climatic events have been observed from past to present, human impact are dramatically rise on climate change, recently. These practices depend on human impacts can alter both the spatial and socio-economic perspectives.

2.3. Urban and Rural Relations of Climate Change

Climate anomalies bring about significant impacts on rural and urban livelihoods in terms of land use patterns and food security. To understand the influence of climate change, climate related events in urban and rural areas are evaluated in this part. There is a strong connection among land use decision, agricultural policies and climatic variabilities. While climate change in rural context is related to land use and water conservation strategies, climate change in urban areas is associated with urban heat island and urban canopy (Sanderson, 2018; Gedikli, 2018).

Firstly, in urban context, there is significant relationship between urban climatology and planning. Urban canopy referred to air between urban elements such as street canyons (Gedikli, 2018, p.92). As well as urban canopy, urban heat island defined in terms of various aspects. As Oke (1979) stated that urban heat island was one of the fundamental points in terms of differences in rural-urban areas and warmth pre-urban in urban climatology (p.36). According to Wamsler (2014), heat island effect included high amount of weather and radiation-heat storage in built environment in terms of traffic, industry, and heating (p.82).

As Yang et al., (2016) stated,

"The increase of land surface temperature caused by UHI effect will definitely influence material flow and energy flow in urban ecological systems, as well as alter their structure and functions, exerting a series of ecological and environmental effects on urban climates, urban hydrologic situations, soil properties, atmospheric environment, biological habits, material cycles, energy metabolism and residents' health" (p.11).

U.S. EPA (2008) claimed that open areas related cooler surface temperature (parks, vegetated areas) support cooler air temperature; however, built environmental areas bring about warmer air temperatures (p.4). As seen in Figure 2.9, surface and atmospheric temperatures changed in different areas such as rural, suburban, and urban areas. As a result, the weather conditions varied from urban areas to rural areas. Especially, agricultural lands are directly related to weather conditions in terms of food systems.

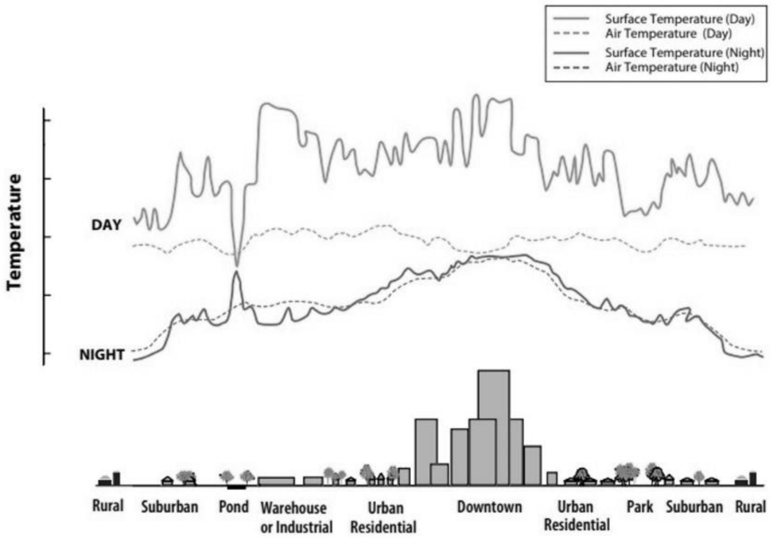


Figure 2.9. The compared with surface and air temperature in day and night (Modified from Voogt, 2000 as cited in EPA, 2008 p.4)

As displayed in Figure 2.10, UHI (urban heat island) effect will rise with urbanization, and the temperature in rivers and lakes is lower due to evaporation and ventilated corridor. To mitigate and eliminate the impacts of UHI, rivers and lakes are significant parts in urban areas in order to in order to decrease thermal radiation and thermal field circulation. This could create fresh air due to accelerate heat transporting process and balance weather condition such as temperature in river and lake system (Yang et al., 2016, pp.12-17).

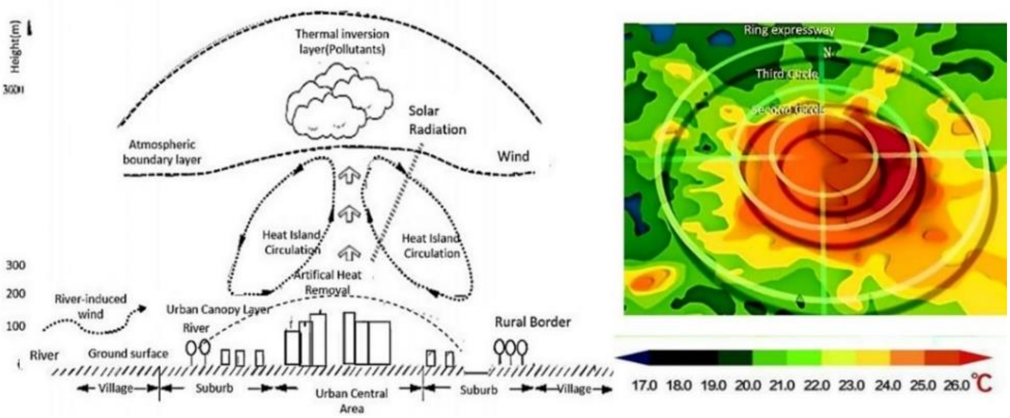


Figure 2.10. The diagram (a) and simulation (b) of UHI effect (Yang et al., 2016, p.12)

With regard to urban planning, the impacts of climate change bring about various problems in terms of environmental and socio-economic conditions. Climatic concerns affect the settlements patterns; thus, new solutions are necessary for deal with various climatic risks.

As Balaban (2012) stated,

> *"Among main impacts of climate change on urban areas are (a) rise in sea levels and storm surges, (b) extreme weather events and flooding, (c) heat waves and higher temperatures, (d) air pollution and reduced air quality, (e) water shortage and water pollution"* (p.23).

The impacts on climate change are explained differently in the planning process. According to Gedikli (2018), whereas 1/100.000 and 1/50.000 upper scale plans focused on nature conservation sites, and renewable energy plants, 1/5.000, and 1/1.000 lower scale plans related to thermal comfort, principles for solar and wind energy, fresh corridor, which are not determined in documents and regulations (p.103). In addition to planning process, Wamsler (2014) referred that the relationship between urban and rural was related to people, money, goods, infrastructure, information and water-waste system. For example, money was related to financial payment due to move or communicate from urban to rural areas. Also, infrastructure is necessary for sharing roads, information related to prices and opportunities, reaching products to urban markets. Waste and water are also linked to shared river system and dispose urban waste (p.93).

Secondly, in rural context, climate change is related to agricultural practices, land and water conservation strategies. Adaptation and mitigation actions are directly connected with the role of farmers in rural areas; therefore, farmers' perceptions and experiences provide a priority approaches in order to reduce of climate change effects. Agriculture is a very vulnerable economic sector due to impacts of climate change. This sector directly uses weather conditions such as temperature, precipitation in production process. For this reason, the weather conditions, which are associated with climate change, lead to the agricultural productivity. As a result, income, population, productivity-related investments of private sector are necessary for food security policies (Nelson et al., 2014, p.85-86). Livelihoods and survival are related to agriculture and other rural sectors, and the growth of the agricultural sector is also strongly linked to other sectoral relations (Davies et al., 2009, p.11). However, there are vicious cycle between climate change and agriculture. As seen in Figure 2.11, whereas climate change affects agriculture, the impacts on agricultural sector increase in terms of GHG emissions, the change of land cover, and food system (Tripathi & Mishra, 2017, p.196).

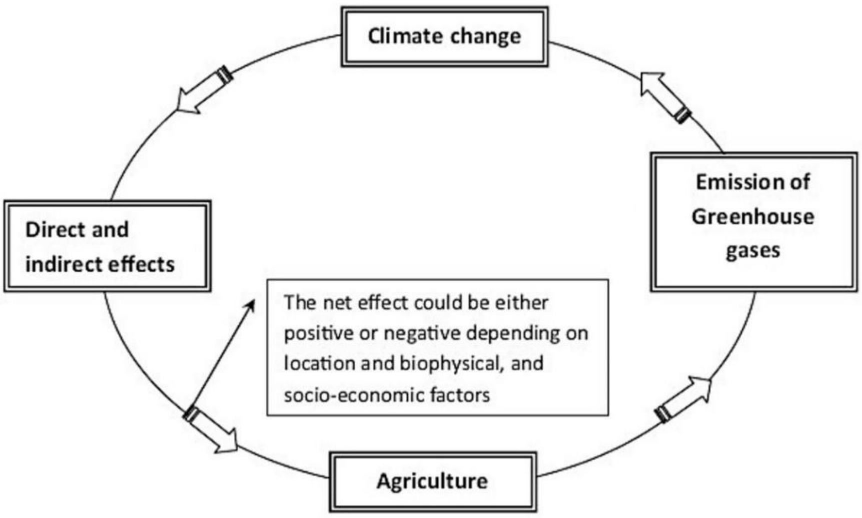


Figure 2.11. The relationship between agriculture and climate change (Tripathi &Mishra, 2017, p.197)

Like urban planning, climate change is a very important factor in rural planning. In rural areas, even though the conservation of soil, agricultural lands, water resources are related to climate change effects in terms of environmental perspectives, climate change causes various risks: poverty, migration, the decrease in crop yields, and unemployment. The impacts of climate change on agricultural lands are assessed in terms of environmental, socio-economic and planning perspectives as detail in Chapter 3.

2.4. Climate Change and Food Security

Food productivity is affected by climate related events such as drought, floods, storms, and hail. The natural disaster may lead to both environmental problems such as water depletion and land degradation, and socio-economic problems such as reduced in farmers' income, poverty, increased unemployment and migration. Sustainable Development Goals are related to food systems such as end poverty, zero hunger, sustainable consumption and production, and combat climate change.

According to FAO and the 17 Sustainable Development Goals (n.d.),

> *"There is more than enough food produced today to feed everyone in the world, yet close to 800 million are chronically hungry. As the affordability of food largely relates to income, ensuring access to food remains one of the key pillars of food security and the wider anti-poverty agenda."* (p.2).

The World Bank (2013) stated that global demand increases in the future, and crop production system will be affected, even if crop yield is influenced at 0.8 ℃. Even if the projections are different and uncertain, it is observed risks of crops as regard the decreased in temperature, and risks on crop yields in observed warming (0. 8 ℃), mostly. In addition to these, protein levels of grain crops can be decreased due to the higher level of CO_2. If temperature increases 1.5 ℃ and 2 ℃, crop yield and reduce in production can occur in Sub-Saharan Africa, South East Asia and South Asia, and food security, economic growth and poverty may be adversely affected (p.3). Thus, global food system can face tremendous challenges of climate change. The risks are evaluated in terms of environmental and socio-economic perspectives. This part focuses on relationship between climate change and food systems.

As World Food Summit (1996) defined,

> *"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (p.3).*

To begin with, food security has four main components: food availability, food accessibility, food stability, and food utilization. Firstly, food availability referred to reach sufficient and appropriate quality production. Another component is food access. It stated that people can reach sufficient resources for nutritious via legal, political, economic and social arrangements. Thirdly, utilization is related to non-food outcomes such as sufficient diet, clean water, sanitation and health care. Finally, stability defined as access to food at all times. They should not be fragile structure in terms of sudden economic and climatic shocks and seasonal events (FAO, 2006, p.1). As displayed in Figure 2.12, the development priorities have five components: water and sanitation, energy, health, agriculture and biodiversity, and there is inter-sectorial connection between food security and sustainable development priority (Ziervogel & Frayne, 2011, p.13).

Food Security				
water and saintation	**energy**	**health**	**agriculture**	**biodiversity**
rainfall drought irrigation water quality conservation urbanisation	fossil fuels land change transport processing consumption wildlife	chemicals pollution food quality safety diet and disease access	industrial farming; local and alternative models; organics markets	mono crops fisheries biotech genetics ecology extinction

Figure 2.12. Relationship between sustainable development priorities and food security (Ziervogel& Frayne, 2011, p.14)

Secondly, there are directly and indirectly significant connection between climate change and food security. As demonstrated in Figure 2.13, climate change directly affects biophysical systems, agricultural management, socio-political and economic systems. On the other hand, it indirectly affects demographic, socio-politic and economic, cultural, sciences and technology, ecosystem and urbanization. Even if climate change affect in rural areas, urban areas will be affected in terms of food system, food prices and water resources. Although urban agriculture contributes to production systems, urban water resources may also be suffered from climate change.

Thus, food system in urban areas may be affected by climate change in order to access to food in urban areas (Ziervogel & Frayne, 2011, p.11).

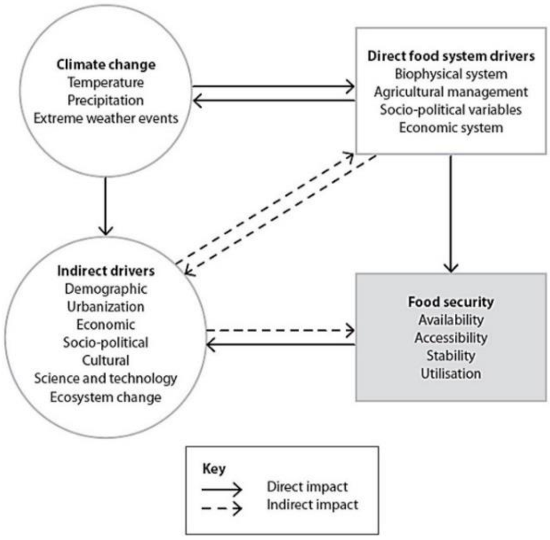


Figure 2.13. Relationship between climate change and food security (Ziervogel & Frayne, 2011, p.11)

Thirdly, resilience is very important concept in order to reduce climate change effects. As FAO (2016) presented, *"resilience can be described as the capacity of systems, communities, households or individuals to prevent, mitigate or cope with risk, and recover from shocks"* (p.35). Adaptation and mitigation actions can be associated with resilience concept in order to avoid negative impacts of climate change. On the other hand, Keller et al. (2018) claimed that there are various challenges as regards food security. The use of resilience concept is difficult in terms of functionalization on a local scale. It is necessary that local knowledge can be adapted. On the other hand, significant time and financial investments are necessary. In addition, different geographic level and decision-making scale can be defined once again (p.11).

In briefly, food security is related to not only agricultural sectors but also different sectors such as energy. To strengthen food system is related to resilience concept; however, there are some challenges in terms of time and economy. On the other hand, climatic variabilities affect crop productivity and qualities. Thus, food access, availability, utilization and stability are affected by the change of climatic conditions.

CHAPTER 3

CLIMATE CHANGE AND AGRICULTURE

3.1. Environmental Perspectives of Climate Change on Agriculture

3.1.1. Land and Water Resources

Climate change is a serious threat on natural resources in many regions. It causes extreme and unexpected weather events such as flood, drought, hail, and storms. These natural disasters can lead to not only environmental but also socio-economic problems. This part focuses on two environmental factors: land and water resources.

First of all, changes in temperature, rainfall, extreme weather events can shift food production potential. Even though intrinsic impacts based on natural resources are linked to climate related events, poor and vulnerable people will face global risks in terms of agriculture (Davies et al., 2009, p.14). Climate change can lead to land degradation; thus, it threatens sustainable agricultural lands, and disrupts the ecosystem. As Webb et al. (2017) stated that climate change can lead to land degradation with regard to soil erosion, increased evapotranspiration, drought, biodiversity, pests and diseases; thus, it affects agro-ecological systems positively or negatively (p.452). As seen in Figure 3.1, land degradation adversely affects the ecosystem. Overgrazing related drought brings about wind erosion and shrub invasion; hence, various interventions such as overgrazing, restoration, and mechanical interventions can be improved in order to reduce the impacts of climate change (Webb et al., 2017, p.451).

Figure 3.1. Ecological differentiations with land degradation (Webb et al., 2017, p.451)

Climate change brings about various outcomes based on different geographical conditions. Thus, this part is assessed as regards different regions. FAO (2013) stated that climate smart practices are necessary for agricultural and land management systems since they bring about increased carbon in soils, biomass, productivity and resilience (p.50). In a study conducted in Pakistan, agriculture is an important sector to reduce poverty and to improve food security. The increase in weather variability and climate change threatens agriculture, and there are obstacles such as an increase in temperature, changes in planting seasons, increased evaporation, the necessary for irrigation and the stress in crops in terms of food security and poverty. To reduce the impacts of this situation, even if short-term crop use and sowing time are regulated, semi-arid and arid regions are just fragile against climate change (Ali & Erenstein, 2017, p.184). On the other hand, pressure on agricultural lands and resources increases due to high population growth rates in rural areas in Sub-Saharan Africa; thus, the reduction poverty is affected, negatively (Calzadilla et al., 2013, p.151). In USA, the locations of corn/maize, soybean and wheat products were changed from 1870 to 1990 (for soybeans until 1930). This study has defined significant changes over past the 100 years. Whereas the maize areas moved westward direction (1870-1900), northward direction (until 1980) and westward direction (1980-1990), wheat areas moved westward direction (1870-1980). Besides, soybean areas shifted northward and westward direction (1930 and 1990) (Reilly et al., 2003, p.47). As seen in Figure 3.2, it can be said that product pattern shifted in 100 years. In particular, the alteration of production locations can be associated with ecological changes based on climatic variabilities.

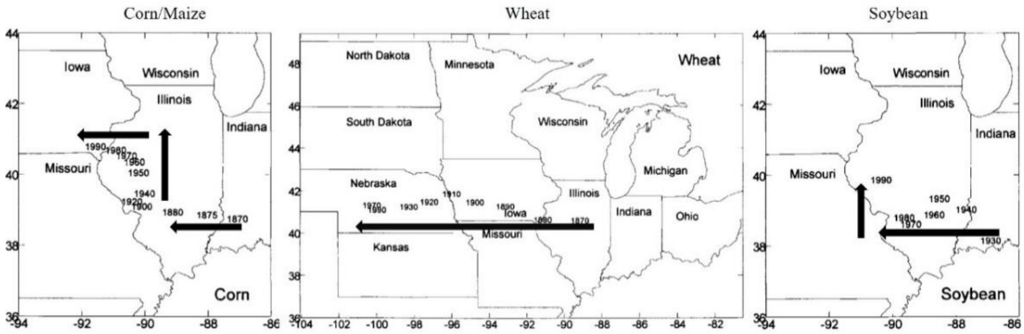


Figure 3.2. The spatial change in U.S. for corn, wheat and soybean areas in years (Adapted from Reilly et al., 2003, p.48)

In the meantime, even if product pattern has shifted, the determination of protected areas is a crucial approach from a planning perspective. Hannah et al. (2017), both farm and off- farm adaptations help to decrease economic difficulties such as cash, subsistence on smallholder farmers. In particular, *'protected areas'* should be developed to reduce losses in the ecosystem and to protect such agricultural areas as the place where unique crops a coffee is grown, so the reinforcement of policies and strategies are associated with new actions (p. 40). As seen in Figure 3.3, protected coffee areas are determined based on alteration of weather conditions such as an increase in 2°C; thus, the protected areas are vital in order to sustain food systems in Uganda.

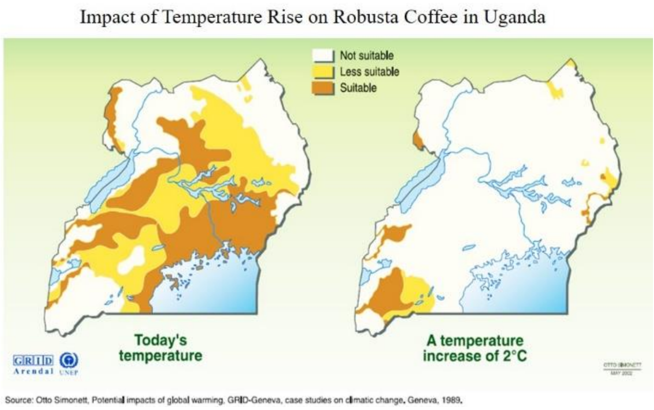


Figure 3.3. The alteration of coffee areas based on weather conditions in Uganda (GRID Arendal& UNEP, 2002)

Webb et al. (2017) stated that the impacts of climate change can be managed rapidly, reorganization of land and increased agricultural production can be considered opportunities. Climate-resilient agriculture consists of four components: the relationship between land degradation and adaptation planning, determination of major vulnerabilities, knowledge transfers between local scale and global scale, and pioneering management depend on land, climate, biodiversity and food security (p.450). Land degradation is also significant problem in relation to these issues. The relationship between land degradation and climate change should be assessed using an integrated approach by correlating with users' adaptation actions. In this process, when land degradation is integrated on agriculture, ecosystem and climate change models, adaptation strategies will be established in developed and developing regions. There may be a priority approach, especially in agro-ecologically vulnerable areas (Webb et al., 2017, p.457). FAO (2013) puts forth various examples in order to shed light on different approaches in different locations. A case study was carried out in Kenya. The findings showed that land degradation is a social problem, and 'transformation process' is associated with personal, relational, collective and systematic approaches. The issue differs for each location; therefore, a whole approach is necessary for social, environmental and economic perspectives. Furthermore, another example was Mt. Kilimanjaro. The major activities are sustainable land management, irrigation system and the conservation of certified organic farming (coffee), and aquaculture related water canals (pp.59-61).

Another issue is water in terms of environmental effects. Climate change affects alteration of crop yield, water demand and irrigation requirements; as a result, it also affects peoples' values as basic nutrients (Adams et al., 1995, p.149). FAO (2013) claims that agricultural productivity is affected by increased temperature. These impacts cause evaporation; thus, depletion of soil moisture will occur. In other words, irrigation and rainfed systems are directly related to the effects of climate change. While mountainous areas suffer from extreme events such as rainfalls, floods and erosion, pastoral areas will face water depletion (pp.86-89). Water is associated with the negative impacts of climate change in all scenarios in terms of estimated temperature and precipitation changes. Although the water flow increases due to heavy rainfall, evaporation also increases based on temperatures, and it brings about the reduction in water flow (Mendelsohn &Williams, 2004, p.325). Therefore, water problems affect not only environmental but also socio-economic conditions. The relationship between irrigation and poverty enables micro scale economy such as conversion of physical, social and human capital as regards higher yields and revenues. Moreover, irrigation enables lower food prices with increased production. In Central America, it is claimed that crop suitability will decrease, and considerable changes will occur on the natural ecosystem in terms of water availability. These changes will seriously affect not only their income, food security, livelihood conditions and national economy but also biodiversity based on the agricultural sector (Hannah et al., 2017, p. 42).

In brief, this part assessed the impacts of climate change on ecosystems in terms of land and water resources in different countries. Although positive impacts occurred in some regions, negative impacts can be observed as pressure on the ecosystem and pressure on resources for sustainability. Thus, an integrated approach is necessary in terms of environmental and socio-economic perspectives. The risks on ecosystem are not only an environmental issue but also a socio-economic issue.

3.1.2. Natural Disaster

Climate change triggers natural disasters in terms of environmental, social and economic perspectives. Climate change is concerned with both the reduction in GHGs emissions, and reduction in risks based on adaptation and mitigation against natural disasters (Bajracharya et al. 2011, p.3). 0’ Brien et al. (2006) represented that climate change is an intricate and long duration hazard, and anthropogenic GHGs emissions cause climate change. Climate change brings about various natural hazards such as drought and flood on a local and global scale (p.68).

This part of the thesis focuses on various natural hazards based on alteration of climatic variabilities in worldwide. Elasha et al., (2006) stressed that climate change caused serious threat in terms of melt icecap on Mount Kilimanjaro (Figure 3.4).

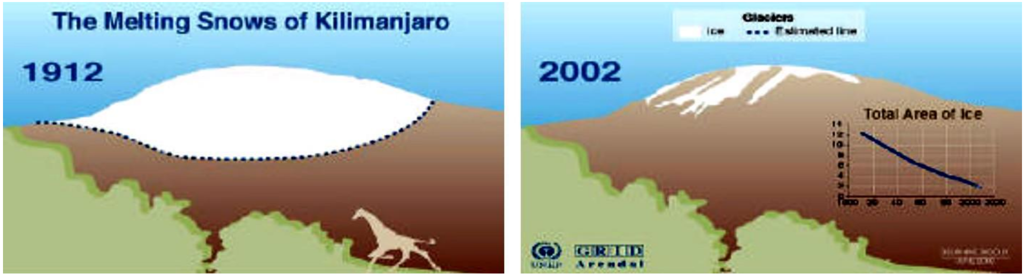


Figure 3.4. Melting snows of Mount Kilimanjaro (GRID Arendal& UNEP, 2002 as cited in Elasha et al., 2006, p.23)

As Elasha et al. (2006) stated (Figure 3.5),

"Impacts of sea level rise include: reduced productivity of coastal fisheries; coral bleaching; mass migration of population from the coast and associated health issues; salt water intrusion; loss of recreational beach facilities and negative impacts on tourism; loss of coastal infrastructure such as ports" (p.30).

Potential impact of sea level rise on the Nile Delta

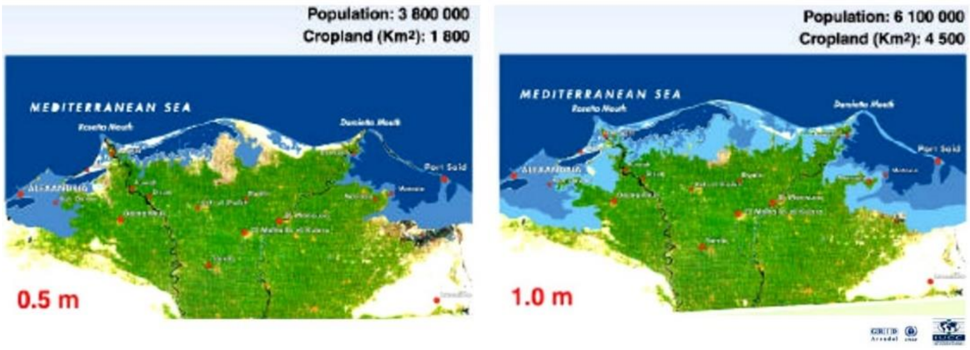


Figure 3.5. Potential impacts of sea level rise on the Nile Delta (Elasha et al., 2006, p.30)

From an agricultural perspective, the natural hazards affect quality and quantity of foods. Thus, climate change indirectly affects food production and accessibility (Keller et al., 2018, p.6). The change in weather has significant impacts on both small-scale and large-scale agricultural farmers. The sudden shocks and stresses such as drought can vary by influencing households and individuals (Davies et al., 2009, p.11). According to the study in Pakistan, floods occurred due to extreme weather events and heavy rainfall; hence, these events brought about great damage on crops. It was estimated that climate change was an effective factor. As agriculture has a significant impact on economic and rural livelihoods, adaptation strategies are important (Ali & Erenstein, 2017, p.185).

As displayed in Figure 3.6, there is a strong relationship among climate change, land use planning and disaster management. While the relationship between climate change and disaster management is planning for natural hazard, the linkage between climate change and land use planning reduces GHGs emission. On the other hand, PPRR concept including prevention, preparedness, response and recovery focuses on linkage between land use planning and disaster management (Bajracharya et al., 2011, p.5).

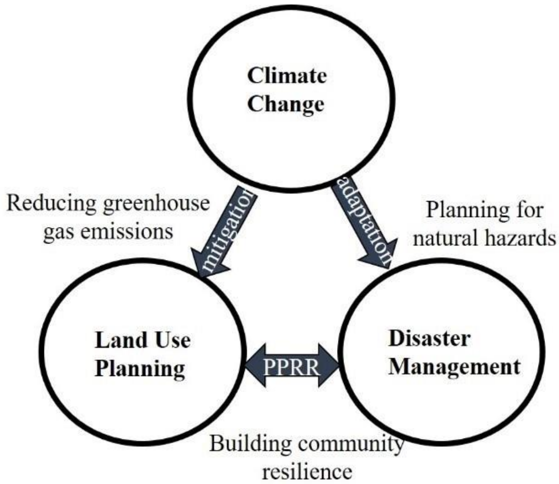


Figure 3.6. The relationship among climate change, land use planning and disaster management (Bajracharya et al. 2011, p.5)

In summary, environmental management can be strengthened by various measures such as protecting ecosystem, preventing environmental risks and degradations, and enforcing regulations (United Nations, 2008, p.9). The alteration in weather events, which are related to climatic change, lead to various risks on agricultural areas. The connection among climate change, land use planning and disaster management is a rather significant in urban areas and rural areas.

3.1.3. Agricultural Practices

Different practices have been developed in different regions in order to reduce the negative impacts of climate change. In the agricultural sector, climate change is related to adaptation and climate-friendly agricultural practices, and these practices are necessary in order to reduce of GHGs emissions, nitrous oxide (associated with fertilizers), methane (linked to livestock), and all negative results (Elum et al., 2017, p.248). With the agricultural practices, it is aimed to reduce the negative impacts on agriculture. The part of this thesis focuses on various agricultural practices in South Africa, Rural Sahel, East Africa, and Sub Saharan Africa. According to a research conducted in South Africa, agricultural practices were determined as regards to climate change and farmers' experiences and perceptions. There were significant changes such as a decrease in average rainfall and an increase in average temperature. The planting of drought-tolerant varieties was frequently applied as farmers' practices. Insurance was insufficient practice due to lack of awareness and economic reasons. Thus, potato and cabbage farmers applied various adaptation methods: seeds based on drought development, market accessibility, irrigation systems and insurance policies via media (Elum et al., 2017, p.255). In another study conducted in Rural Sahel, it is emphasized that the new crop diversity is a very important adaptation strategy. New alternative crops are adopted; however, this situation is not directly related to climatic variabilities without income (Mertz et al., 2009, p.812). In the research of agricultural practices in East Africa, new crop or crop diversity, land preparation or planting data were changed, and reduction of risks are associated with more than maximum benefit because of requiring less economic investment. Whereas the policies in short term are information of planting time, crop diversification, adaptation of crops and resilience of farming systems, the policies in long term are soil, water and land management as well as increased investment in human, social and physical investments (Shikuku et al., 2017, pp.239-242). In Sub-Saharan Africa, water requirement for crops arises because climate change leads to high temperatures. However, water accessibility reduces in some regions; thus, loss of crop yield and adverse impacts on food production can occur at the same time (Calzadilla et al., 2013, p.161).

In brief, this part investigates various agricultural practices in different countries. The changes in weather conditions bring about new approaches. The agricultural practices differ from various aspects such as geographical features, income, and farmers' perceptions and experiences. These practices contribute to both environmental and socio-economic solutions. The fundamental issues are new crops and crop diversity, awareness, market accessibility, irrigation systems, insurance policies, planting time in short term, while water, soil and land managements are important approaches in long term.

3.2. Socio-economic Perspectives of Climate Change on Agriculture

3.2.1. Perceptions and Experiences

The relationship between climate change and perceptions and experiences is fundamental issue in order to determine adaptation and mitigation strategies. Some researches on perceptions and experiences of farmers, who directly are affected by climate change, are carried out in different regions. This part focuses on various examples to understand theirs' perceptions and experiences in different regions.

To begin with, in a study with farmers in Bangladesh, less than 1% of farmers stated that there were no weather conditions. 98% and 97.9% of farmers observed increase in the annual summer temperature, while 95.2 % and 94.9% of farmers observed decrease in annual summer perception. Moreover, insufficient irrigation facilities, lack of information about the adaptation process, potential climate change and drought-resistant crops (rice), credit and fund limitations negatively affect adaptation process (Alauddin & Sarker, 2014, p.207). Another study is carried out in South Africa. The findings displayed that farmers learned information about climate change from different media, and they observed alteration of weather conditions. Therefore, they perceived higher temperature, drought and lower crop yield (Elum et al., 2017, p.253). Bryan et al. (2009) claimed that climate conditions and extreme events bring about adverse impacts for farmers in South Africa. Moreover, even though farmers desire for adaptation process against extreme weather events in future, it has been observed that farmers' attitudes are more suitable for the short-term adaptation process than long-term adaptation process (pp.420-422). In Kenya, the farmers' perception in agricultural sector is important influence in terms of determining appropriate policies in the adaptation and decision-making process against climate change. Multiple stakeholders, which have farmers, policymakers, NGOs (non-governmental organization), researchers, communities, agents and private sectors, are necessary to adapt to climate change (Bryan et al., 2013, p.27). Another study was carried out in Western Himalayas. Shukla, et al. (2019) claimed that the farmer' perceptions about climate change were varied due to different components: income, food self-sufficiency, crop quality, water resources and social relations. This study emphasized three factors: farmers' heterogeneity, diversity of perceptions, and knowledge transferring from farmers to decision-makers (p.116). Although these researchers are related to farmers' perceptions, a research was carried out on farmers' and expert' perceptions against climate change in Columbia. Eitzinger et al. (2018) underlined that climatic risks should be determined for farmers in terms of their livelihood risks. Adaptation strategies against climatic risks are improved from experts to farmers. The dynamics in their' livelihoods should be appeared in order to deal with climate change (p.521).

In summary, although farmers often observe the impacts of climate change, they have insufficient information. These impacts are likely to cause socio-economic problems in the future. Even if individual solutions are applied by farmers, the collective network is very important issue against climate change.

3.2.2. Migration, Poverty and Diseases

Climate change can bring about not only environmental problems but also socio-economic problems. The impacts of climate change vary on different regions positively or negatively. There are fundamental socio-economic impacts of climate change: migration, poverty and disasters.

First of all, migration can occur due to the negative impacts of climate change. FAO (n.d.a) stressed that climate change triggers conflicts, violence and natural disasters, which related migrate of agricultural populations (p.7). According to Falco et al. (2018), there is a scientific connection between migration and weather conditions such as temperature and precipitation (p.20).

McLeman et al. (2006) stated that

> "*The climate-migration model comes out of the more general conceptualization of vulnerability being a function of exposure and adaptive capacity, and migration being one potential adaptive outcome. This case provides evidence of migration as a type of adaptive response to climate-related exposures.*" (p.46).

It is estimated that extreme weather events, average temperature-precipitation and sea level changes will affect population distribution and movement, but there are uncertainties about the effects on population (Tacoli, 2009, p.513). Massey et al. (2010) claimed that *'environmental refugees'* referred to a linkage between environmental deterioration and out-migration. On the other hand, environmental refugee can be considered as regard climate change, so socio-economic impacts of climate change are vital problems for the whole world. As displayed in Figure 3.7, there is a significant linkage among migration, agriculture and climate change.

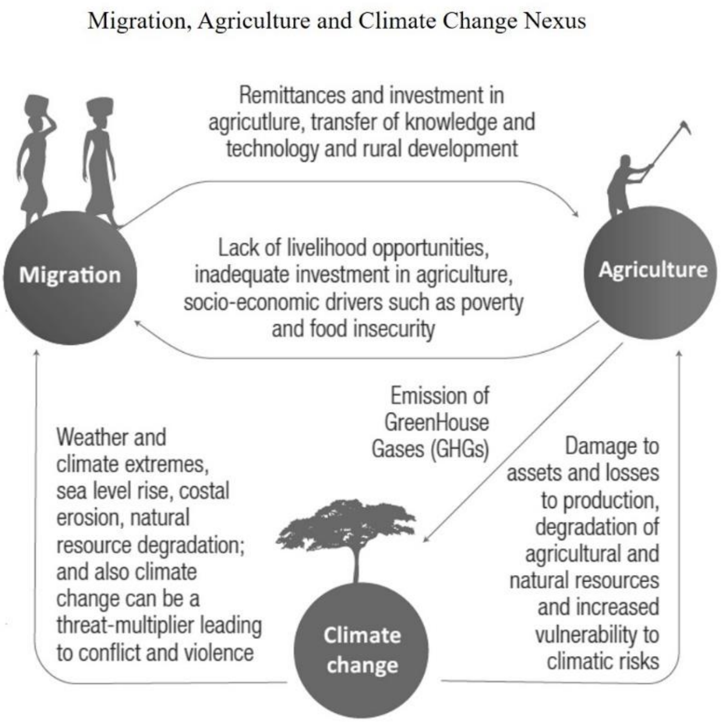


Figure 3.7. Migration, agriculture and climate change nexus (FAO, n.d.a, p.9)

Secondly, the relationship between climate change and poverty is very important issue. Hertel (2010) stated that household consumption, income, indirect market factor, non-priced goods are influenced by the impacts of climate change on poverty. Moreover, majority of the poor are affected by poverty due to prices; therefore, adverse climatic shocks rise labor demand (pp.15-20). For example, in India, farmers' adaptation consists of collective action, social network and learning for adaptation of climate change. One of the adaptation strategies is supported networks and communication among farmers in India (Tripathi & Mishra, 2017, pp.205-206).

> *"Strengthening local governance systems is critical to strengthening the resilience of communities. Local organizations interact with higher-level governance systems in various ways, and there are multiple ways for strengthening civil society and governmental structures so they can help absorb shocks and implement locally relevant practices and policies to build resilience"* (Keller et al., 2018, p.11).

As seen in Figure 3.8, adaptive social protection consists of social protection, adaptation and disaster risk reduction. This concept can associate with reduction poverty based on climate change.

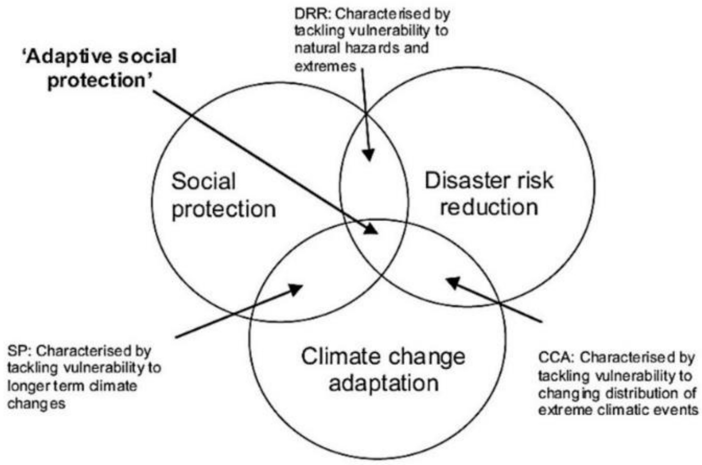


Figure 3.8. Relationship among social protection, disaster and adaptation (Davies et al., 2009, p.26)

Thirdly, disease is one of the fundamental problems in terms of climate change. Ebi et al. (2008) highlighted that "*climate change is challenging the mission of public health to promote physical and mental health, and prevent disease, injury, and disability*" (p.501). Extreme rainfall and flood negatively affect water resources due to carrying sediments and farm-pollution; thus, diseases based on water may increase, food digestion, labor and income capacities may decrease, so food system can be adversely affected (Keller et al., 2018, p.10).

In brief, these impacts of climate change are likely to bring about negative outcomes in terms of socio-economic conditions. Migration, poverty and diseases are social impacts rather than individual impacts. Thus, three factors can be linked closely based on climatic variabilities.

3.2.3. Technology and Education

Technology and education are obligatory factors for adaptation process. Farmers' perceptions and experiences are affected by these features. This part of the thesis focuses on various examples in different counties. To begin with, in Bangladesh, it is stated that adaptation to climate change is consisted of not only scientific findings and supports services for farmers but also accessibility to information and strengthened community based on farming practices with agronomic and cultural practices (Alauddin & Sarker, 2014, p.212). In India, lack of education and awareness of farmers stem from insufficient extension services, which affect farmers' perception and adaptation to climate change. As a result of the study, it is observed that the media has a significant effect on the farmers' perception. However, since farmers' level of education is low, the use of mobile phone may be an effective option instead of written media such as newspaper (Tripathi & Mishra, 2017, pp.201-206). Adaptation on technologies contributes to agricultural adaptation in the decision-making process of farmers. Wealth is associated with technology; therefore, while climate change adaptation is higher in mobile phone and vehicle users in South Africa, adaptation process is higher in radio, agricultural tool and equipment in Ethiopia (Bryan et al., 2009, pp.416-423). For this reason, technological system and educational level differ among countries. Thus, there are various adaptation strategies for each country, and technological systems are related to economic development. In summary, technology and education systems should be developed to reduce adverse climate change effects in rural areas.

3.2.4. Micro-Macro Economy

Climate change affects both macro-economy and micro-economy. In this part, while macro economy focuses on international and national impacts of climate change, micro-economy focuses on small scale farmers' income.

Firstly, global climate change affects all crops at the same time, and the impacts on market vary due to change in yields and substitution of crops in international trade. Whereas growing longer season can increase in Poleward regions, drought and extreme temperature can rise in mid and lower latitudes. The economic effects of climate change on farmers may not be accurate in partial equilibrium analysis; thus, the impacts depend on change in prices and global coverage. Although the existence of climate change is known, the effects on agriculture are not estimated, so the impact of weather and climate on crop yield is a fundamental step in order to predict food supply and market (Blanc & Reilly, 2017, p.255). According to a regional model in Central America, crop suitability and yield changes, and water resources will decrease, so coffee and maize regions will reduce. For this reason, great economic results will occur and both ecosystem-species and tourism revenues will decrease due to these impacts (Hannah et al., 2017, p.39). At the global and regional level, institutions and organizations can support both crop diversity and technological development in national adaptation plans. Also, national organizations can support regional trade policies, food and aid; moreover, global climate change policies can be developed with these organizations (Calzadilla et al., 2013, p.152). Increased temperatures will cause negative consequences due to the increase in damages and cooling expenditures in the energy sector (Mendelsohn & Williams, 2004, p.324).

Secondly, the micro-economic perspective focuses on the economic level of the farmers. Even though the climate change is a national and an international economic effect, farmers are developing practices to increase their socio-economic efficiency in their production areas. This process may vary according to production areas or farmers. Farmers aim to increase their incomes via various agricultural practices.

> According to results of research in India,
>
> *"Despite perceiving climate change, farmers are not responding to it. But they are changing their agricultural and farming practices to deal with socioeconomic changes, and some of these changes—such as changing sowing and harvesting timing, cultivation of crops of short-duration, inter-cropping, changing cropping pattern, investment in irrigation, agroforestry—help in adapting agriculture to climate change."* (Tripathi & Mishra, 2017, p. 206).

In East Africa, wealthy households, which can meet the costs, labors and mulching, can adapt to the process easily (Shikuku et al., 2017, p.241). In South Africa, small scale agricultural products commercialized in order to generate a source of cash, so this income meets household necessities (Thomas et al., 2007, p.319). Negative impacts of climate change will affect poor farmers who live in marginal areas; moreover, not only market areas such as timber, energy, water and coastal but also non-market areas such as ecosystems, health and aesthetics are estimated to be affected adversely (Mendelsohn & Dinar, 1999, p.290). To conclude, climate change brings about the negative outcomes both on a national scale and on a local scale. Thus, the impacts of climate change should analyze as a whole in terms of environmental and socio-economic perspectives.

3.3. Planning Perspectives of Climate Change on Agriculture

3.3.1. Adaptation and Mitigation

Climate change threatens agricultural lands in terms of several aspects such as biodiversity, crop yields, and farmers' incomes. Adaptation and mitigation actions are noteworthy approaches to cope with negative impacts of climate change, and these actions are still discussed in various regions. This section of the thesis focuses on adaptation and mitigation actions in different regions.

First of all, adaptation aims to reduce the negative impacts of climate change, and adaptation methods are related to perceptions and experiences on climate change in different regions. Moreover, different methods, which are unique for each region, are applied in different regions. As Tripathi & Mishra (2017) stated that adaptation is adjustment and alteration of systems in order to reduce the negative impacts and increase the positive impacts of climate change. Moreover, adaptation is related to perceived risks, then it is connected with reduce the negative impacts. Also, correct perception is associated with accessibility of information, education and experiences (p.196). In addition, adaptation also aims to decrease the risks on human' lives and economy based on climate change (Davies et al., 2009, p.13). Adaptation consists of diversity of farming based practices, which are accessed with technology and practices, and it consists of timing of sowing, crop diversity and gathering of crops (Mendelsohn & Dinar, 1999, p.281). According to Smit & Skinner, (2002), agricultural adaptation consists of four main components: the adaptation strategies based on technological development, government programs and insurance, farming production practices and farming economic management (p.95). According to Mumtaz et al. (2019), there are two adaptation actions: autonomous and planned adaptation. While autonomous adaptation focuses on changing planting dates, changing crop diversity, alteration of fertilization systems and planting shade trees based on experiences, agricultural production and knowledge sharing, planned adaptation underlines coordination among departments, collaboration with academics and financial resources (p.1).

These strategies varied in different geographical regions with various characteristics. For example, in South Africa, adaptation strategies have four parts: the alteration of farming practices, the usage of various landscape as spatial and time-related, marketing system and network (Thomas et al., 2007, p. 314). Another example is Pakistan. The adaptation strategies are related to awareness and knowledge on a local scale, and to rise affordability capacities against climate risks. Education, agricultural extension services and policies help to increase the financial resources in poor households (Ali & Erenstein, 2017, p.192). On the other hand, the adaptation level is low in some regions. In Central Chile, majority of farmers did not adapt to climate change. Meteorological information can be used a basic adaptation approach; thus, accessibility of weather information should associate with education level of farmers. Furthermore, social network can be a fundamental policy against climate change (Roco et al., 2014, p. 94). In South Africa, from an adaptation perspective, accessibility of drought tolerant seeds, marketing systems and the usage of micro-irrigation systems can be improved, and insurance and supporting programs can be strengthened. Thus, an integrated approach occurs regarding indigenous knowledge and experience (Elum et al., 2017, pp.247-248). As a result, based on the literature, adaptation process is related to knowledge, education, experience, awareness, and agricultural practices. In fact, these components refer to an integrated process; therefore, increasing the awareness, strengthening the knowledge and education, powering of the agricultural practices can be evaluated as an integrated adaptation approach.

Secondly, mitigation is associated with reducing GHGs emissions and increasing carbon sinks in order to limit global warming. Even though adaptation is a responsive approach, which aims to protect the ecosystem and society against adverse effects of climate change, mitigation is a forward-looking approach that purposes to stop global warming with GHGs emission reduction (Elum et al., 2017, p.249). In another study, mitigation focuses on reducing GHGs emissions and estimating future effects. Mitigation approaches involve in developed environmental standards, energy and water efficiency, empowering building and regulated urban forms, and it aims to decrease motor vehicle uses with land use planning (Bajracharya et al. 2011, p.3). In Sub-Saharan Africa, while adaptation is collective action based on infrastructure such as rainwater collection, irrigation and flood protection on a local scale, it has developing agricultural policies, markets and inter-institutional relations on a national scale. Also, public policies can play an active role for establishing of local seed banks, storage, warning systems and weather forecast (Calzadilla et al., 2013, p.152).

In summary, adaptation and mitigation actions play a vital role in order to cope with the adverse impacts of climate change. The objectives of these strategies in rural areas are to increase in crop productivity and to strengthening of their economic incomes. Especially, these countries based on agricultural sector seek to mitigate the adverse impacts of climate change. Thus, these countries develop various practices in short and long term.

3.3.2. Research Methods of Climate Change and Agriculture

The alteration of climatic trends affects both environmental and socio-economic conditions since climatic characteristics vary for each region. The impacts of climate change on vulnerable people are associated with various outcomes such as their income, quality of life, and food security. Within the scope of this study, it will be investigated how the research methods vary in terms of not only climatic models but also questionnaires and interviews in different regions.

3.3.2.1. Models

Regional Modelling

Regional modelling focuses on relationship among climate change, agriculture and ecological sectors, and it determines the impacts on food safety, biodiversity conservation, agriculture and climate change on a local and national scale. This model is associated with crop, species distribution, ecosystem, hydrological and climate models. However, these methods on local scale is expensive; hence, economies of scale are used (Hannah et al., 2017, p.30).

Agro-ecological zone analysis

This analysis was carried out in different agro-ecological zones. According to Roco et al. (2014), in Central Chile, four areas, which are agro-ecological variety, were selected. 3% of the total registered population were carried out (274 farmers). New technology, price and policy approaches were investigated. Water-soil conservation, changes in crops, developing irrigation systems were investigated. In the Hurdle model, logit model (adaptation) and zero truncated regression (intensity) were used. Socio-economic variables were investigated in terms of age, education, experiences in years, membership in council, weather information by internet and technology. As a result, farmers developed basic and low-cost water conservation techniques and irrigation systems. Thus, to strengthening of agricultural social groups are important for farmers (pp.88-94).

Agro-economic Analysis

Agro-economic analysis uses crop models and livestock simulation models in order to climate change adaptation. Crop simulation models are related to genetic structure, simulations, which associated with CO_2, water and food variables, are evaluated with planting dates, fertilization data and water use. Hence, these crop models are integrated with consumption, trade and economy. Moreover, this method is likely connection between the agricultural and economic factors (Blanc & Reilly, 2017, p. 248).

Ricardian Model

Ricardian or cross sectional analysis is a statistical method that evaluates both cross-sectional climate data and agricultural productivity such as land value and income (Blanc & Reilly, 2017, p.248). The Ricardian model is a disadvantage that farms cannot be controlled due to a variety of variables, so basic variables such as soil quality, market access, solar radiation are used (Mendelsohn & Dinar, 1999, p.283). Ricardian Model consists of the linkage between agricultural land value and climatic data, and it estimates changing land value, timing change and places holding constant of local qualities (Timmins, 2006, p.120). The Ricardian model estimated changes as regards production function and climatic data such as temperature, precipitation and carbon-dioxide level, and it is observed that crop yield generally decreases due to global warming (Mendelson et al., 1994, p.753).

The ASM (Agricultural Sector Model)

> *"The model solution contains a number of measures of economic activity, including total social welfare (consumers' and producers' surplus), regional crop acreage, regional resource use (water, labor, land), exports, and other items. As with any modeling exercise, the focus is on how the economic model solution changes as the model is altered to reflect differing climate assumptions"* (Adams et al., 1995, p.155).

Rasch model

This model is used for attitude measurement, and focuses on two approaches: rank adaptation strategies from easy to difficult, and definition of preferences and attitudes for each groups. In East Africa, climate risks threaten food security, and it is difficult to determine adaptation strategies locally. Accordingly, it is important to measure farmers' attitude towards agricultural practices, and to assess the adaptation of livelihood and climatic risks. Rasch model is used simultaneous measurements, and evaluate farmers' attitudes on crop management practices (Shikuku et al., 2017, pp.237-242).

IMPACT and GTAP-W Models

The IMPACT Model, which includes global impacts such as climate change, consists of CO_2 fertilization, temperature change and crop yield in order to improve the analysis and adaptation on food systems. The changes in water demand use climate, soil and land surface; hence, these changes affect to spatial distribution parameters. On the other hand, the GTAP-W model is related to economic feedbacks, and determines the new production structure in the pastureland, irrigated and rainfed land (Calzadilla et al., 2013, pp.152-153).

The Structured Mental Model Approach (SMMA)

As seen in Figure 3.9, *"Structured mental model approach (SMMA), for analyzing diverging system perspectives between experts and farmers regarding the perception of farmers' livelihood, related risks and potential utility of interventions in the rural areas of developing countries."* (Binder & Schöll, 2010, p.18).

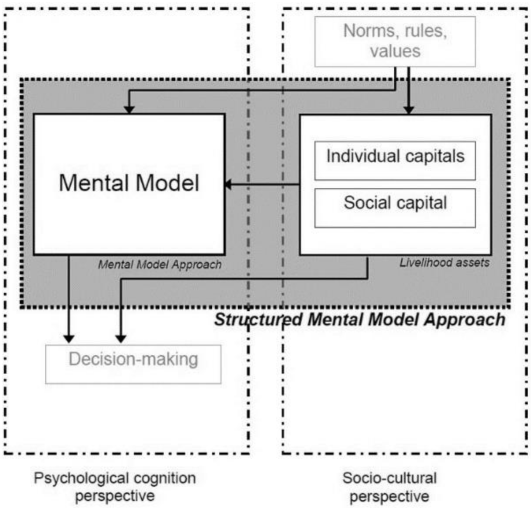


Figure 3.9. System of structured mental model approach (Binder & Schöll,2010, p.5)

3.3.2.2. Questionnaires and Interviews

While models are associated with technical information and simulations, questionnaires and interviews emphasize socio-economic conditions such as perception, awareness, age, and gender. This part focuses on methodology of different researches.

According to Ali & Erenstein (2017), surveys were conducted to determine perception of farmers in Pakistan. The structured-questionnaire system was used, and the main parameters were determined as sowing time, use of drought, tolerant varieties and shifting to new crops. A total of 950 farmers was surveyed in four provinces, 119 sub-districts and 275 villages. Socio-economic data such as farm households, farmers' experiences, income, and crop yield were investigated by probit model. As a result, awareness of climate change and rising affordability of climate risk were focused, and an increase in knowledge, education and awareness, affordability of climate risk, and supporting households were highlighted (pp.186-192).

According to Elum et al. (2017), the survey was carried out on three different areas, and analyzed perception of climate change and challenges of process in South Africa. The farmers were selected for both 75 cabbage and 75 potato farmers by randomly in Department of Agriculture and/or Rural Development. Socio-economic characteristics (age, education, farming years, cultivated farm size, irrigated farm size, number of labors, net revenue and gender) were evaluated for two groups. The constraints in production were gender, inadequate water and farm size, absence of extension services and lack of assess to market. These findings displayed that there was relationship between socio-economic characteristics and farmers' perceptions (pp. 250-254).

According to Alauddin &Sarker (2014), in Bangladesh, rice production is affected by climate and natural disasters because water shortage is fundamental problem. The research is conducted by 1800 observation in three different zones, and the survey are applied to farmers. Socio-economic characteristics, institutional factors, social capital and farm characteristics, farmers' perception, and infrastructure are investigated (pp.205-206).

According to Bryan et al. (2013), the relationship between household and agricultural adaptation are investigated in Kenya. The research was carried out in various agro-ecological zones, and mixed methodology was used for each agro-ecological zone. Firstly, household questionnaires were used for determining socio-economic features such as demographic, social capital, management, and food consumption. Then, focus group was carried out participatory rural appraisals. As a result, the findings underlined drought management, the integration of rural development and practices, and the association of natural disaster risks such as floods and erosion. Planning with household and institutional participation is highlighted (pp.27-34).

In India, this research was carried out in three villages. Farmers, who are 40-60 years old, have at least 20 years of experience. Focus group was formed in order to understand of farmers' perception and thinking. Each group consists of nine people. The study was examined farmers' perception, adaptation against climate change such as crop diversity, planting timing and irrigation systems and other adaptation strategies (collective action and learning). As a result, the focus group may not be generalized due to the lack of control and small sample, and it is used for exploratory purposes (Tripathi & Mishra, 2017, pp. 199-205).

Bryan et al. (2009), in summary, in Ethiopia and South Africa, comparative study was conducted in terms of farmers' perceptions, adaptation measures and decision-making process. While South Africa dataset had 800 participants, Ethiopia dataset had 1000 participants. The survey consists of socio-economic characteristics such as household expenditures, shocks, land tenure, production, perception on climate change, adaptations and limitations. The open ended questions were used. According to finding, different income groups choose different options. This study highlighted institutional relationship, crop water management, increasing farmers' resilience, and knowledge related decision-making process. These parameters contribute to determine benefits and risks in the long and short term (pp.416-425).

According to Eitzinger et al. (2018), in summary, in Colombia, the research was carried out in order to understand differentiations between experts' and farmers' perceptions on climate change. Open interviews with 13 experts and semi-structured interviews with 58 farmers was carried out, and this research focused on concerns, risks, barriers. The results indicated that the understanding of experts' and farmers' perceptions differentiations was essential in order to prevent maladaptation and enable to strong connection (p.511-521)

As a result, even though there are mostly quantitative studies in the literature, qualitative studies have increased on climate change on agriculture in recent years. Especially, qualitative studies focus on farmer' perception, experiences, risks about climate change, and their' methodology frequently consists of focus group, surveys and interview techniques.

3.4. Concluding Remarks

Climate change will have positive or negative impacts on agricultural lands. The chapter in the thesis focuses on negative impacts of climate change in terms of environmental, socio-economic and planning perspectives (Figure 3.10).

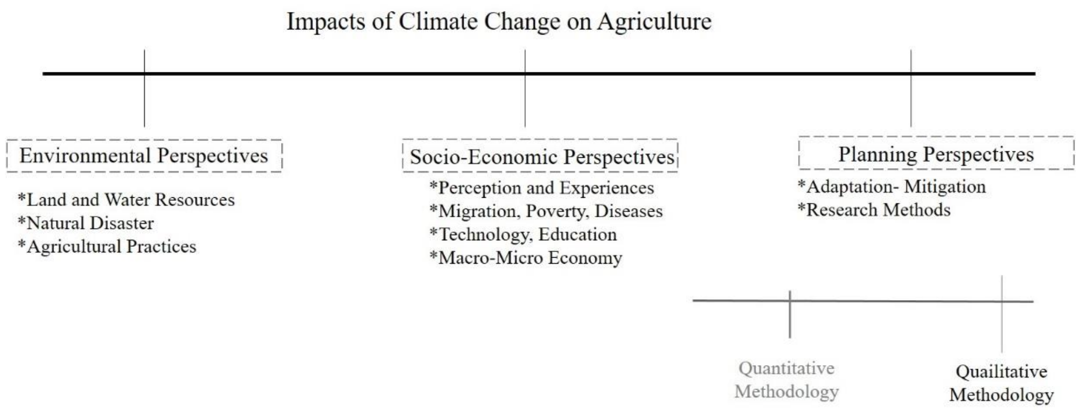


Figure 3.10. Conclusion of impacts of climate change on agriculture

Environmental perspectives consist of impacts on land and water resources. Environmental problems of climate change threaten food systems in different regions. Moreover, climate change causes land degradation and the alteration of agricultural lands. Thus, natural disasters will increase based on climatic impacts. Land, water and soil management are associated with natural risks. Climate change impacts affect to the vulnerable families. Thus, the extreme weather events lead to natural disasters such as soil erosion, land degradation and drought. From a socio-economic perspective, farmers' perceptions and experiences are fundamental parameters in order to cope with the impacts of climate change. All these approach are strengthened with technology and education. Lack of education is a fundamental problem, so the farmers are inclined to short term solutions such as change of sowing time and crop diversity. The macro-economy is related to energy, tourism and food system, while the micro-economy is associated with small holder farmers' livelihoods and income. In planning perspective, even if adaptation and mitigation actions vary for each different region, social network and collective action are necessary issues to deal with negative impacts. As well as adaptation and mitigation actions, quantitative and qualitative methods was used to understand impacts of climate change, farmers' perception and experiences. In this following Table 3.1 and Table 3.2, the studies are classified in terms of methods and impacts on agriculture.

Table 3.1. *Assessment of quantitative methodology and models in previous studies*

Author(s)	**Methodology**	**Impacts of Climate Change on Agriculture**
Hannah et al., (2017)	*Regional Modelling* ▪ relationship among climate change, agriculture and ecological sectors ▪ national and local impacts on food safety, biodiversity conservation, agriculture and climate issues ▪ Crop, distribution, ecosystem, hydrological and climate models	➢ protected areas ➢ reinforcing of policies and strategies are associated with new actions ➢ income, food security- livelihood strategies of smallholder farmers, biodiversity ➢ both ecosystem-species and tourism revenues will decrease
Blanc & Reilly, (2017)	*Agro-economic Analysis* ▪ crop models and livestock simulation models ▪ integrated with consumption, trade and economy *Ricardian Model* ▪ both cross-sectional climate data and agricultural productivity	➢ the impact of weather and climate on crop yield
Shikuku et al., (2017)	*Rasch model* ▪ 140 household in four sites	➢ new crop diversity, land preparation and planting data, risk reduction ➢ Soil fertility and reducing soil loss ➢ short- term investment are preferred owing to labor, time and cost for poor farm households
Roco et al. (2014)	*Agro-ecological zone analysis* ▪ Four areas, which are agro-ecological variety ▪ In the Hurdle model, logit model (adaptation) and zero truncated regression(intensity) ▪ Socio-economic variables age, education, experiences in years, membership in council, weather information by internet and technology	➢ accessibility of weather information ➢ New technology, price and policy approaches ➢ Water-soil conservation, changes in crops, developing irrigation systems

Calzadilla et al., (2013)	*IMPACT model* ▪ CO_2 fertilization, temperature change and crop yield in order to improve the analysis and adaptation on food systems ▪ The changes in water demand *The GTAP-W Model* ▪ the new production structure in the pastureland, irrigated and rainfed land	➢ agricultural production ➢ water requirement for crops arises ➢ yield loss and adverse effects on food production ➢ national organizations can support regional trade policies, food and aid ➢ public policies can play an active pole for establishing of local seed banks, storage, warning systems and weather forecast
Binder& Schöll, (2010)	*Structured Mental Model Approach (SMMA),* ▪ analyzing perspectives between experts and farmers ▪ related risks and interventions	➢ development of sound intervention strategies ➢ comparing perceptions ➢ analysis of potential sources
Mendelsohn & Dinar, (1999)	*Ricardian model* soil quality, market access, solar radiation	➢ market areas; timber, energy, water and coastal ➢ non-market areas; ecosystems, health, aesthetics ➢ technology, timing of sowing, crop diversity
Adams et al., (1995)	*Agricultural Sector Model* ▪ total social welfare ▪ regional crop acreage and resource use ▪ exports	➢ crop yield ➢ water demand ➢ irrigation requirements

Table 3.2. *Assessment of qualitative methodology and questionnaires and interviews in previous studies*

Author(s)	Methodology	Impacts of Climate Change on Agriculture
Eitzinger et al. (2018)	*A qualitative semi-structured interview method* ▪ 13 experts and 58 farmers ▪ concerns, risks, barriers in order to take actions	➢ the understanding of experts' and farmers' perceptions differentiations
Elum et al. (2017)	*The Questionnaires* ▪ different products on three different areas ▪ 75 cabbage and 75 potato farmers ▪ Limitation: gender, inadequate water, farm size, absence of extension services, lack of assess to market	➢ The drought-tolerant crops ➢ Lack of awareness ➢ Micro-irrigation system ➢ Linkage local knowledge and experience
Ali & Erenstein (2017)	*The structured-questionnaire system* ▪ sowing time, use of drought, tolerant varieties and shifting to new crops ▪ 950 farmers	➢ awareness of climate change ➢ increasing knowledge, education and awareness, affordability of climate risk
Tripathi & Mishra, (2017)	*The Focus Group* ▪ the participants, who has different farm size	➢ collective action, social network and learning for adaptation of climate change ➢ lack of education ➢ use of mobile phone ➢ changing crop pattern, irrigation
Alauddin& Sarker (2014)	*The Surveys* ▪ *1800 surveys* in three climatic zones	➢ household and socio-economic characteristics ➢ institutional factors ➢ social capital and farm characteristics ➢ farmers' perception, infrastructure
Bryan et al. (2013)	*The mixed method in agro-ecological zone* ▪ household questionnaires ▪ Focus group	➢ the integration of rural development and practices, natural disaster risks ➢ social network
Bryan et al. (2009)	*The open ended questions* ▪ Socio-economic factors	➢ farmers' attitudes are more suitable for the short-term adaptation process than long-term adaptation process ➢ different income groups choose different options. ➢ institutional relationship, crop water management, increasing farmers' resilience

CHAPTER 4

CLIMATE CHANGE AND AGRICULTURE IN TURKEY

4.1. Environmental Perspectives of Climate Change on Agriculture in Turkey

Agriculture is among the most fundamental sectors in order to sustain food systems on a national and local scale in Turkey. The sector is rather sensitive to climatic variabilities such as extreme temperature, and unexpected weather change. The impacts of climate change can offer opportunities and threats on agricultural lands. Thus, not only environmental conditions but also socio-economic conditions are affected by these impacts. This section identifies environmental impacts of climate change on agricultural lands in Turkey. The environmental perspectives are divided into three main categories: land and water resources, natural disaster and agricultural practices in Turkey.

4.1.1. Land and Water Resources

Agriculture directly deals with the risks on ecosystem in terms of the impacts of climate change. The risks are the most critical issues in order to understand the importance of climate change. Before the impacts of climate change on ecosystems, the part focuses on the change of climatic variabilities by projections in Turkey.

According to "How does the global climate change affect the climate of Turkey?" (n.d.), although the average global temperature generally increases regularly from 1970 to 2010, the rate of average temperature fluctuated between 1920 and 2010 in Turkey. According to Turkish State Meteorological Service& MoFWA (2015), HadGEM2-ES temperature and precipitation projections based on RCP4.5 scenario focuses on three periods: 2016-2040, 2041-2070 and 2071-2099 periods (Figure 4.1a). It is predicted that in 2016-2040 period, the temperature will be generally 2°C in Turkey, and this temperature will be 2-3°C in Marmara and West Black Sea Regions in summer; moreover, the precipitation rate of will decrease about 20% in most regions excluding in Aegean coasts and the east of East Anatolia in spring. In 2041 and 2070 period, it is estimated that the temperature will increase 4°C in summer, and the precipitation rate will decrease 20% in East and Southeastern Anatolia and Central and East Mediterranean Regions in winter. Furthermore, it is forecasted that the temperature will increase 4°C in Aegean coasts and Southeastern Anatolia in summer, and the precipitation rate will decrease about 40% in all regions excluding Aegean coasts, Marmara coasts and Black Sea coasts in summer in 2071 and 2099 (p.67).

According to Turkish State Meteorological Service& MoFWA (2015), HadGEM2-ES temperature and precipitation projections based on RCP8.5 scenario focuses on three periods: 2016-2040, 2041-2070 and 2071-2099 periods (Figure 4.1b). It is predicted that in 2016-2040 period, the temperature will be generally about 3°C in Turkey in spring and summer, and the precipitation rate of will increase about 40% in all coast region excluding West Mediterranean in summer. In 2041 and 2070 period, it is estimated that the temperature will increase 5°C in summer, the precipitation rate will decrease 20% in all regions excluding Aegean coasts and North East Anatolia in spring. Furthermore, it is forecasted that the temperature will increase 6°C in summer, and the precipitation rate will decrease 20% in all regions excluding Aegean coasts, the west of Middle Black Sea Region and East Black sea Region in spring in 2071 and 2099 (p.70).

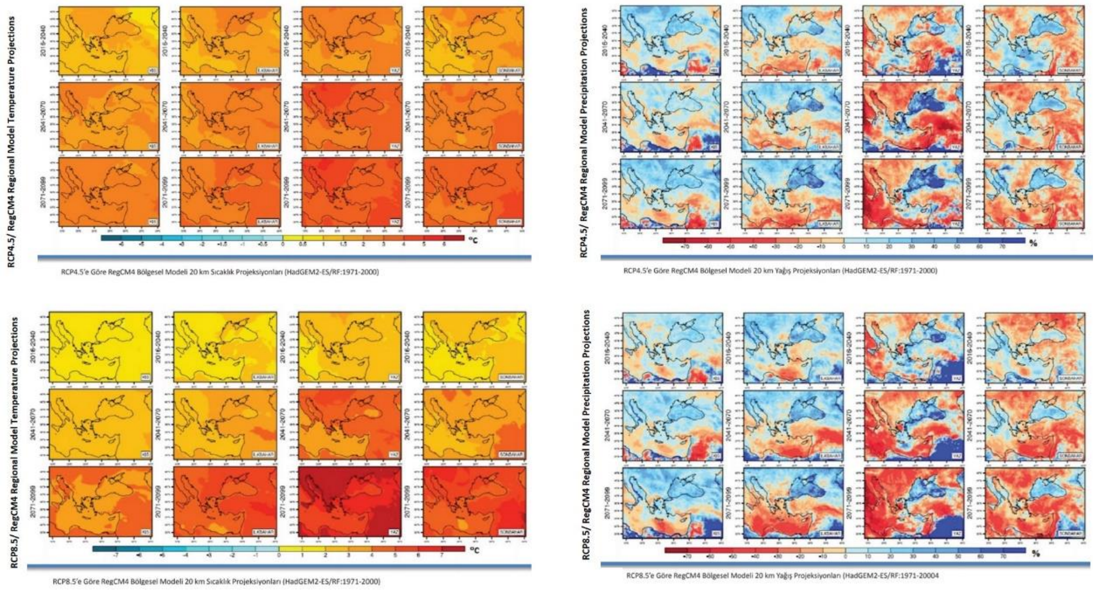


Figure 4.1. The changed of temperature and precipitation based on RCP 4.5(a) and RCP 8.5(b) in 2016 and 2099 (Turkish State Meteorological Service & MoFWA, 2015, pp.65-69)

This part focuses on conservation of wetlands, pasture lands and soil areas, and the pressure of urbanization. From an environmental perspective, the conservation of wetlands is one of the most fundamental factors in order to deal with the negative impacts of climate change. Climate change can affect the health and productivity of forests, diversity of same trees on geographical areas as well as fisheries and water products; therefore, it is estimated that it may cause coastal erosion due to increase in the impacts of climate change on coastal and marine ecosystems (MoEU, 2012a, p.7). These impacts are associated with the sustainability of water resources. Water resources, which are one of the most significant elements in ecosystem, can be affected by climate change negatively. Water depletion is a serious risk to ecosystem. The usage of wetlands as agricultural lands, water flows directed toward dam and irrigation projects, over-usage of underground water, and flood risks to vulnerable habitats caused by dams bring about serious damage to meadows and wetlands (MoEU, 2012a, p.33). The crop yields and irrigation requirements change in Turkey for 2010-2035, 2035-2060 and 2060-2099 periods. As seen in Figure 4.2, Dudu (2013) claimed that crop productivity will increase and necessity of water will decrease in the west of Turkey in the first period. The change of irrigation systems is higher than the change in yield in the central regions. In addition, while irrigation requirements can increase, the change in yield can decrease in the east of Turkey (p.18).

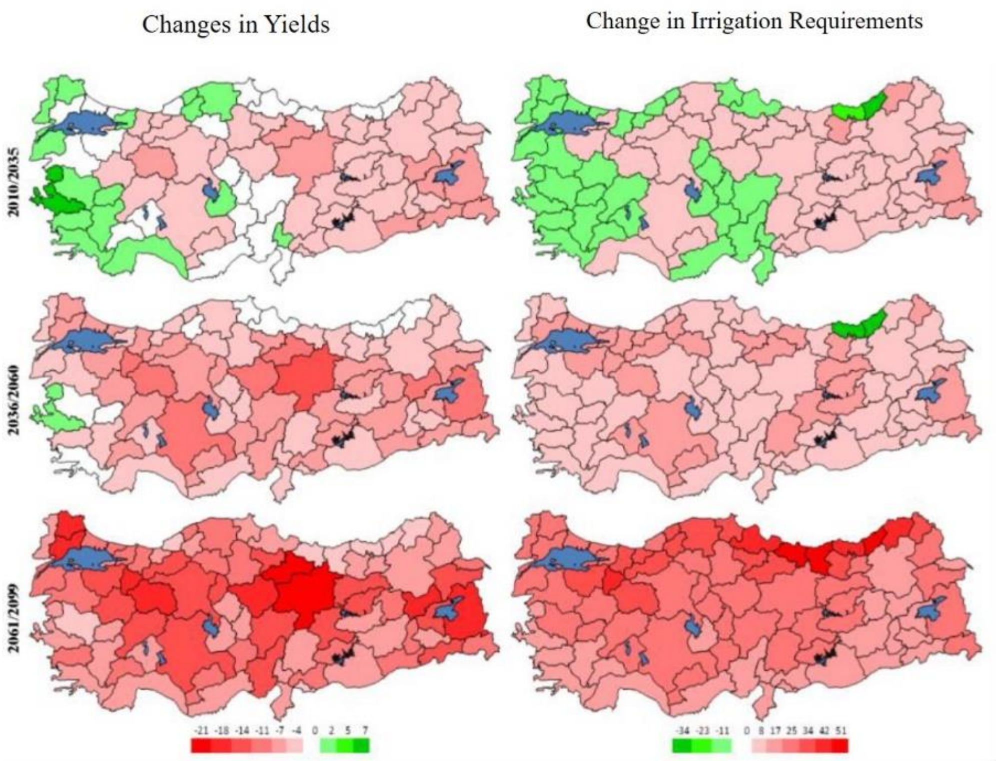


Figure 4.2. Spatial effects of climate change (Dudu, 2013, p.19)

In addition, the pasture areas and usage of water resources can be correlated with each other. Usage of pasture areas can be connected to users' awareness level. The incompatible behaviors among farmers and ineffectiveness of the managers have negative effects in terms of control and accessibility in pasture areas (Aşıcı, 2017, p.76). Thus, the relationship between planning and the sustainability of natural equilibrium is unavoidable issue. Like the conservation of wetlands, the conservation of pasture lands is one of the priorities of ecological sustainability. Republic of Turkey Ministry of Development (MoD) & Agriculture Specialization Commission (ASC) (2014) state that there are several strategic aims: the development of agricultural activities together with environmental protection methods, conservation of pasture areas with natural or regional richness, and development of product/crop pattern planning with regard to local ecological system. For this purpose, integrated agricultural basins, organic agricultural methods, good agricultural methods, environmental friendly productions, observation of environmental pollutions, the development of agricultural and pasture lands, and the precautions against natural disaster will be supported (p.45). Another impact of climate change on ecosystem is soil or agricultural lands. Soil management is a type of approach needed to reduce the adverse effects of climate change on agriculture. In this scope, classification of agricultural lands, formation of agricultural basins, determinations of product design patterns are carried out by decision-makers. Depending on the development of these studies, an integrated approach of planning and development is fundamental for sustainability. The soil management includes five factors: making of soil analysis, controlling of mineral fertilizer application, increasing of carbon sinks capacity via composting, using of high carbon waste on soil areas and increasing agricultural practices without soil treatment (Ağaçayak & Öztürk, 2017, p.12). Moreover, land management is a compulsory issue in terms of environmental policies. Land management can directly strengthen with farmers' participation. Aşıcı (2017) stated that traditional land use patterns have been changed by rapid industrialization and urbanization. While the land available for agriculture decrease, the food demands rapidly increase. It is anticipated that climate resistance will increase with a holistic approach in soil use and recovery of eroded land (p.14). In addition to these, as seen in *'Republic of Turkey Climate Change Action Plan 2011-2023'* (2012b), the activation of land management focuses on upgrading land maps, preparing erosion hazard maps, coastal erosion risk map and determining of soil pollution- terrain disruptions (p.82). The conservation of pasture areas, water resources and soil areas are crucial issues in terms of climate change. Yet another impact is pressure of urbanization on agricultural lands. MoD &ASC (2014) claimed that as well as the decrease in agricultural lands, environmental pollution arising from unplanned urbanization and industrialization affects the water resources and the sustainability of agricultural land negatively (p.1). According to MoEU (n.d.), the report aims to several strategies in long term such as preparing of land classification maps, the conservation of wetlands, developing of adaptation and mitigation strategies in settlements, determining strategies in order to prevent of UHI, and preparing an integrated coast planning, increasing urban forest areas and green areas in urban areas and take precaution to reduce the adverse impacts of urbanization on rural and natural areas (p.29). Thus, various planning approaches have been carried out based on environmental perspectives. These issues are assessed in terms of planning perspectives as detail (see Chapter 4.3.). Although the conservation of pasture areas, water resources and soil areas are directly associated with the impacts of climate change on ecosystem, the socio-economic impacts of climate change can pose serious threats such as poverty, epidemic diseases, and unemployment. However, all of these impacts are related to each other. Consequently, all of these impacts of climate change should be considered as a whole.

4.1.2. Natural Disaster

Climate change can affect environmental patterns within a broader context. Natural disaster is a serious risk both in environmental and socio-economic terms. It is considered that these risks make middle and low income families vulnerable to some negative consequences. According to Republic of Turkish Ministry of Environment and Forestry (MoEF) (2007), the increase in temperature, the decrease in precipitation and wetlands, and the loss of cultivable lands will occur according to the climatic scenario in Turkey (p.205). As seen in Figure 4.3, 598 meteorological natural disasters were reported in 2017 in Turkey, and the number of disasters in 2017 is at its third highest value from 1940 to 2017 (Erkan et al., 2018, p.59).

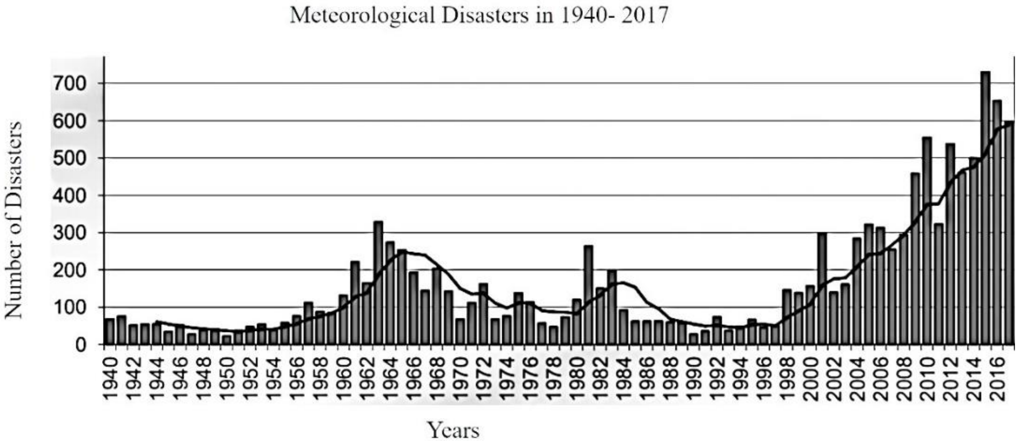


Figure 4.3. Meteorological disasters between in 1940- 2017 (Erkan et al., 2018, p.59)

As displayed in Figure 4.4, the meteorological disasters occurred highly in Marmara, Aegean coasts, Mediterranean Regions and center and north of Turkey in 2017. Moreover, the number of disasters is higher in Kahramanmaraş, Antalya, İstanbul and Balıkesir. Aksaray, Konya, Kayseri and İzmir are followed by these cities in terms of the frequency of natural disasters (Erkan et al., 2018, p.60). These disasters occur in the form of drought, extreme rainfall, snowfall, and hail.

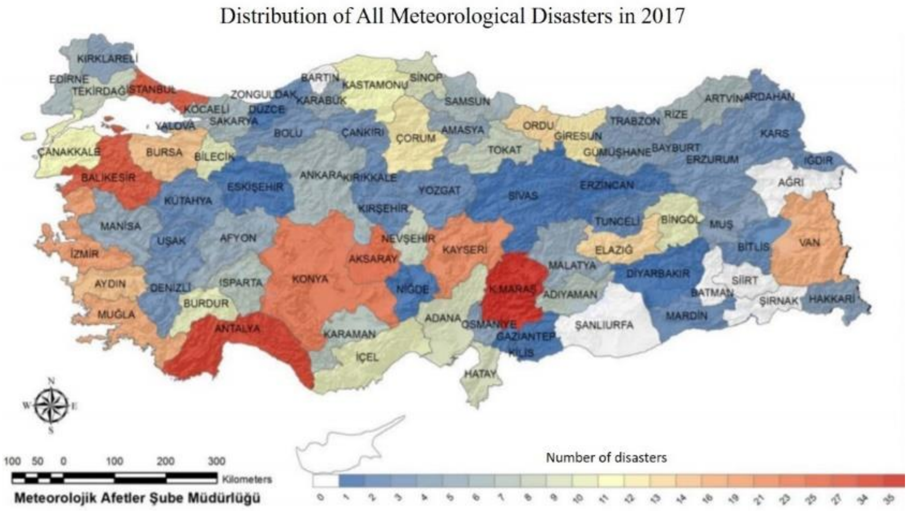


Figure 4.4. Distribution of all meteorological disasters in 2017 (Erkan et al., 2018, p.61)

Firstly, Central Anatolia and Mediterranean Regions are mostly affected by drought. Drought affects some agricultural crop yields such as barley, wheat, maize and pulses, and it leads to deterioration in market balances. It also causes the decrease of farm and garden areas. (Kadıoğlu et al., 2017, p.63). In addition, desertification is one of the serious natural disasters in Turkey. It is defined as the land degradation because of climate change and human effects on dry, semi-dry and semi-humid areas. The situation affects the ecosystem adversely, and poses serious risks such as poverty and migration. In Turkey, various studies are carried out in these issues. As MoAF&CEM, (n.d.), the project of '*Desertification Model of Turkey and Risk Maps'* is a very important project regarding desertification. Desertification Risk Map consists of 7 criteria and 48 parameters. This desertification model shows main criteria such as climate variabilities, water, soil, land cover-land use, topography-geo-morphology, socio-economy and administrative perspectives. As displayed in Figure 4.5, 19% of the lands in Turkey is higher risk. Moreover, while the highest risk areas are Konya-Karapınar, Iğdır-Aralık and Urfa-Ceylanpınar, medium and high risk areas are Salt Lake, Ereğli-Karaman, Urfa-Ceylanpınar-Mardin-Batman corridor and the area around Eskişehir.

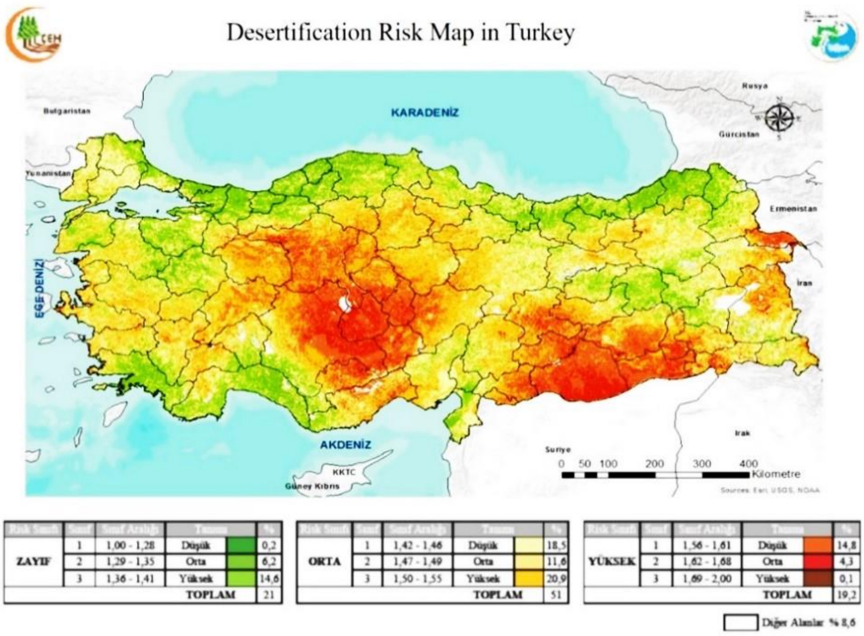


Figure 4.5. Desertification risk map in Turkey (MoAF & CEM, n.d)

Like desertification, rainfall and flood disaster, storms and heavy winds, heavy snowfall and hail are other critical disasters in Turkey (Figure 4.6). As Erkan et al. (2018) presented the heavy rainfall and flood disaster occurred highly in Marmara, Mediterranean, Aegean and Black Sea Regions in 2017. In the same year, the heavy rainfall and flood occurred in İstanbul (10 disasters) and Antalya (10 disasters) at the same time. Moreover, 217 storms and heavy wind disasters were observed in 2017. The highest number of disasters could be seen in Kahramanmaraş (33), Kayseri (20), Antalya (14), Giresun (9) and Balıkesir and Elazığ (8). The disasters are observed in many other provinces of Turkey. Another disaster, which is heavy snowfall, are observed in Central Anatolia, Black Sea, Marmara, Aegean, Mediterranean and East Anatolia Regions. Especially, the stronger snowfall disaster happened in İstanbul and Aksaray in 2017. Hail is another fundamental disaster in Turkey. It brings about serious damages on agricultural lands. In Turkey, hail was highly observed in Konya. Konya is followed by Antalya, İstanbul, Amasya, Tokat, Balıkesir and İzmir as the cities where hail occurs frequently (p.62,75,110,80). In this study, these disasters are associated with unexpected and seasonal changes.

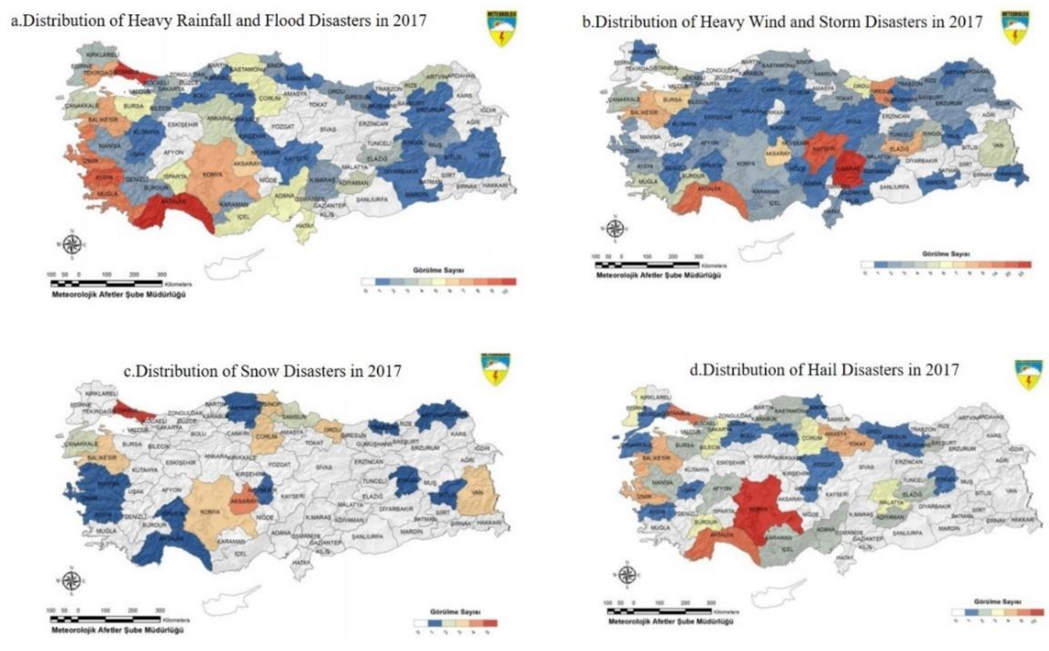


Figure 4.6. Distribution of heavy rainfall and flood disaster (a), wind and storm disaster (b), snow disaster (c), and hail disaster (d) in 2017 (Erkan et al, 2018, p.62,74,110,80)

Climate change seriously affects not only urban areas and rural areas. According to Turkish Exporters Assembly (2016), climate change brings about environmental and socio-economic problems on agricultural lands. To begin with, the increase of drought and high temperature duration bring about salinization and erosion via drought and desertification. Moreover, the climate belts will shift the north of Turkey, so extreme high temperature and arid climate conditions will occur in Turkey. Another risk is water. As well as the existing water problems, potable water and water consumption will face with a big trouble. In addition, the potential of agricultural productivity can vary positively or negatively. Terrestrial ecosystem and agricultural production systems can suffer from pests and diseases. The increase in temperature will have negative effects on human and animal health due to the increase of disease and death rates. Another risk is referred to high sea level in this report. While the settlements, which have agricultural and tourism sectors, will be submerged because of increase of sea level, avalanches and floods will increase on the settlements, which have seasonal snow and ice cover areas. Finally, marine ecosystem will change due to change of sea ecosystems (p.51). On the other hand, as demonstrated in Figure 4.7, Dellal et al. (2011) stated that wheat area decreased in the Mediterranean and Central Anatolia regions; however, barley areas increased in the Mediterranean, Central and Southeastern Anatolia. On the other hand, corn/maize areas increased in Black Sea, Marmara, Central and Southeastern Anatolia while sunflower areas decreased in Black Sea and Central Anatolia (pp. 379-380).

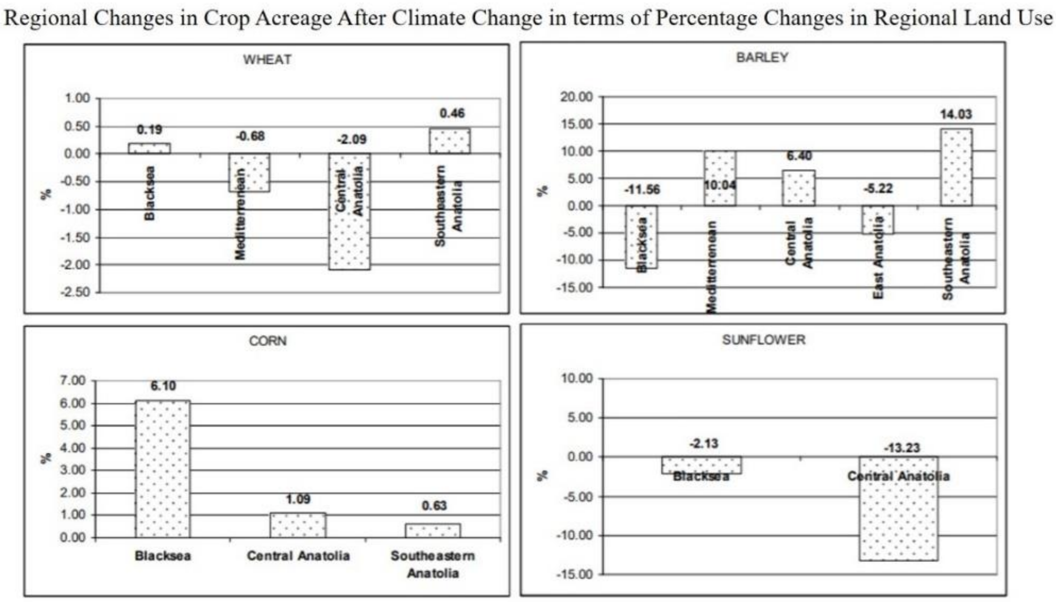


Figure 4.7. Crop percentage changes in regional land use (Dellal et al., 2011, 380)

Natural disasters are directly or indirectly risen on agricultural lands, and these disasters affected both spatial and socio-economic conditions. For example, news in Çankırı and Konya indicated as serious porthole formation. In Çankırı, a village moved other place due to increase pothole formation risks. The pothole formation increases in Karapınar, and the agricultural lands are faced with serious risks (NTV, 2017; Hürriyet, 2019). The risks threaten not only food systems on agricultural lands but also people' lives on rural and urban areas. The pothole formation is vital natural risks. All disasters are associated with socio-economic conditions such as food productivity, income, migration and unemployment. It can be said that climate change is one of the impacts on natural disaster. As highlighted in MoEU (2012a), it is estimated that the severity and spatial distributions of natural disasters are associated with water cycle based on climate change, and they will rise in Turkey. When drought coupled with climate change, it will be necessary to develop irrigation activities on a national, regional and basin scale, and effective methods of water irrigation, product patterns planning, seed species resistant to drought and disaster management policies for agricultural drought should be improved. Especially, the vulnerable people will face with serious threats in terms of food, housing and health rights. Local people, farmers and women will feel the negative impacts of climate change. Thus, the vulnerable areas, affected by agricultural drought, economic, social and environmental impacts should be defined rapidly, and vulnerable farmers should determine and take precautions on a basin and regional scale (p.7,24,28).

4.1.3. Agricultural Practices

Agricultural practices aim to reduce adverse effects on agricultural lands. These practices can be autonomous and planned. While some agricultural practices are applied by decision-makers such as land consolidation, other practices are applied by farmers based on their experiences. As seen in Chapter 3, the existing literature focuses on several issues such as water irrigation infrastructure, crop switching, planting dates, and crop varieties (Bryan et al, 2013; Alauddin & Sarker, 2014). These practices are applied in order to increase the crop productivity on agricultural lands. Although there are many agricultural practices, this part focuses on common practices. This part focuses on land consolidation, organic agriculture, good agriculture practices, product pattern planning, community supported agriculture and regenerative agriculture.

Land Consolidation Practices

Land consolidation is one of the important agricultural practices. According to MoEU (2012a), agricultural productivity is increased by land consolidation for adapt to climate change effects. Land consolidation is used in order to increase agricultural fertility, protect soil quality, prevent to overuse energy and loss of water, so it support to sustainability development. This method, which is used as land management in order to integrated disorder parcels, is an integrated rural development tool and will be effective method to solve environmental problems (p.34). To solve the priority water problems on wide plains is vital role for agriculture and resilience against climate change. Renewable energy, irrigation projects and infrastructures, and land consolidation are necessary for adapt to climate change (Kadıoğlu et al.,2017, p.8). In addition, land consolidation is priority action in order to improve the rural environment and ensure the sustainability of natural resources (MoFAL, 2015 p.9).

Organic Agriculture Practices

By regulation on certified organic agriculture, which the original Turkish name is *Organik Tarımın Esasları ve Uygulamasına Dair Yönetmelik*, was published in the Official Gazette in August 18, 2010. As per article 1, this regulation determines principles and procedures as regards conservation of ecological balance, development of organic agricultural activities, regulated of productions and marketing (Organik Tarımın Esasları ve Uygulamasına Dair Yönetmelik, 2010). In the direction of organic agriculture protocol, the protocol aims to prevent soil and water pollutions based on agricultural productions and spread organic agriculture practices on basins regarding potable water (MoEU, 2012a, p.23). Accordingly, organic agriculture is aimed to rehabilitate of rural areas and sustain of natural resources (MoFAL, 2015, p.9). Fertilizer-pesticide production, their consumption and emissions will reduce by organic agricultural practices (Ağaçayak & Öztürk, 2017, p.11). Furthermore, organic agriculture certification may help farmers to create networks for sharing tools and information, and their network can be lead to new practices (Aşıcı, 2017, p.76).

Good Agriculture Practices

Good agriculture practices cooperation protocol is signed between 'General Directorate for Agricultural Production and Development, which the original Turkish name is *Tarımsal Üretim ve Geliştirme Genel Müdürlüğü,* and 'General Directorate of Cultural and Natural Heritage, which the original Turkish name is *Tabiat Varlıklarını Koruma Genel Müdürlüğü*, in order to protected environmental areas, to sustain food security, and to produce healthy crops (MoEU, 2012a, p.23). The regulation on good agricultural practices, which Turkish original name is *İyi Tarım Uygulamaları Hakkında Yönetmelik,* was published on the Official Gazette on December 07, 2010. As per article 1, the regulations aim to make agricultural production that does not harm environmental, human and animal health, to protect natural resources, to ensure traceability, sustainability, and reliability of agriculture (İyi Tarım Uygulamaları Hakkında Yönetmelik, 2010).

Product/ Crop Pattern Planning

The reduced of water availability in agriculture, deterioration of water quality, destruction of biodiversity and ecosystem bring about degradation of agricultural ecosystem, the change of sustainable agricultural product/crop patterns, the deterioration in pasture areas and animal husbandry, and the lack of capabilities of farmers; therefore, these impacts of climate change threaten food security (MoEU, 2012a, p.6). For this reason, product pattern planning is fundamental issue for impacts of climate change on agriculture.

Community Supported Agriculture

According to the International Federation of Organic Agriculture Movements (IFOAM), community supported agriculture is a partnership between farms and consumers, and it directly links to between food production and consumption. Therefore, this aims to eliminate the risks for farmers and to access healthy and affordable food for consumers (Aşıcı, 2017, p.67).

Regenerative Agriculture

Regenerative agriculture is one of the symbiotic tools in order to regenerative of land and adapt to climate change. Another dimension of this method is the socio-economic effect on food production and agriculture based on local economic development. There are fundamental systematic changes such as: seed freedom, biodiversity, food security, petro-chemistry based agriculture sector, and they are fundamental momentums in order to develop of small scale family, to be resistance in local economy cycles, and to be restructure of rural and city (Aşıcı, 2017, p.74).

4.2. Socio-economic Perspectives of Climate Change on Agriculture in Turkey

4.2.1. Perceptions and Experiences

The importance of climate risks is associated with the farmers' perceptions. As the existing literature, farmers' perceptions are shaped by their experience, beliefs, and social relations. Thus, they aim to use appropriate strategies against climate-related events. In this part, farmer' perceptions and experiences are assessed by studies in Turkey. In 2012, the research, which was "*İklim Değişikliğinin Farkında mıyız?*", was carried out in Turkey. MoEU (2012c) stated that it is aimed to determine to the awareness levels of people, adaptation methods against climate change, and the willingness for reduce greenhouse emissions, and it was carried out by 3166 participants in areas with different geography and socio-economic conditions. In summary, most of participants stated that climate change was seasonal change, and they highly highlighted that one of the most significant impacts of climate change was the increase of drought. The findings indicate that even though there are concerns of the participants on issues related climate change, they do not have enough information about mitigation and adaptation methods. In addition, the perception on climate change in rural is lower than urban areas. In rural areas, climate change is highly related to drought and water depletion. Drought and water depletion affects both agriculture and animal husbandry in rural areas; thus, adaptation methods are crucial issues in order to deal with climate change in rural areas. The research emphasized while decision-makers should produce understandable project, people should develop individual their precautions. Moreover, education programs should improve in primary and high schools in order to increase awareness levels (p.7-18). Another research was assessed farmers' perceptions based on good agricultural practices in terms of environmental conditions and climate change in Göksu. In summary, the research was carried out by 261 farmers. The questionnaires included several issues: socio-economic conditions, perception about climate change and environmental conditions, the criteria of good agricultural practices, farmers' visions, incentive and effects of good agricultural practices. The studies were carried out via face-to-face communication, and the questions are assessed via Microsoft Excel and SPSS. As a result, the farmers stated that crop productivity and income would decrease due to the impacts of climate change. Food security would face with serious threats and animals' epidemic diseases would increase, and poverty would increase in the world. In addition, farmers mention that fertilizer system brings about climate change (Polat, 2017). As a result, to understand of farmers' perceptions and methods is necessary for successful strategies against climate change. The interaction between their perceptions and implementations is vital for effective adaptation policies. Thus, this study also focuses on farmers' and experts' perceptions, experiences, methods, actions and estimated consequences.

4.2.2. Migration, Poverty and Diseases

Climate change threatens water resources, crop productivity, and land cover areas as regards increased drought, desertification, hail or extreme rainfall. Thus, people can face with serious problems such as migration, poverty and epidemic diseases. Firstly, migration is very important problem. Ekşi (2016) stated that people leave their habitat and go to other places to live permanently or temporarily due to several natural disasters such as floods, earthquakes, and drought. This migration movement leads to the emergence of new concepts: climate migrants, climate refugees or environmental refugees (p.17). Especially, another significant issue is migration from rural areas to urban areas. The problem is related to several conditions. When the irrigation problems are solved, production will increase on agricultural lands, and fluctuations prevent. Thus, variety of agricultural product will increase, and migration will decrease from rural areas to urban areas (Kadıoğlu et al.,2017, p.63). Another socio-economic risk is poverty in terms of climate change. From an existing literature perspectives, many researches focus on the poor and small holder farmers. According to MoEU (2012a), the poor, which is low-income families, suffer from food, water, shelter and health due to impacts of climate change on agricultural areas; therefore, local people, farmers and women, which are poor and vulnerable, are enormously exposed to these negative impacts. For this reason, it is highlighted that the decision-makers should take their' opinions in vulnerability areas in order to adapt the impacts of climate change (p.28). Finally, epidemic diseases affect both human and animal and plants regarding climate change effects. Diarrheal diseases, malaria and viral diseases, which are the main causes of death all over the world, frequently increases as regards climate change (MoEU, 2013, p.18). According to MoEU (2012a), extreme climatic events affect the weather conditions, so mortality and disasters can increase. Whereas extreme temperature is a problem for elder people and people, who have chronic vascular and respiratory disease, floods with extreme rainfall may cause spatial changes by spreading of infectious diseases. The diseases will increase by migration and tourism due to human movements. Also, there is a possibility that serious infectious diseases will spread by insects (p.7). Water consumption will increase; thus; the increase of temperature and heat waves bring about water stress in warmer periods. These climatic changes lead to deterioration of urban green areas and ecosystems (Balaban, 2012, p.25). Thus, the epidemic disasters can increase regarding air, soil or water pollutions. In brief, the three factors are related to each other. For example, as poverty increases, people can migrate to other place. Then, as migration increases, epidemic disasters can spread other place. Epidemic disasters can bring about poverty, again. Therefore, three factors should be considered as a whole.

4.2.3. Technology and Education

The participants' perceptions are directly related to education and experiences. Education contributes to migration and adaptation actions of climate change via technology. According to MoEU (2012c), as the educational level increases, information in climate change increases. To learn issues on climate change, the participants use several technological devices: programs and news on TV. But there are several differentiations between the urban and rural areas in terms of accessibility of information. While people learn from internet and NGO in urban areas, they learn from teachers, headman villages and religious headman in villages (p.10). Technological devices can use to inform about climate change. The increase in educational programs can contribute to decrease the negative impacts of climate change. Thus, it should be investigated how the participants use their technological devices in order to increase of the usage of technological devices. According to 'Fifth National Declaration on Climate Change' (2013), various education programs on climate change are carried out in Turkey. For example, the education program is associated with the increase of farmers' awareness against climate change risks in Kayseri. The project was carried out 4458 farmers. Another sample is related to milk production in Seyhan Basin, and the project was carried out 80 participants (pp.262-263).

4.2.4. Micro-Macro Economy

Climate change affects not only farmers' incomes but also national economic systems in terms of several perspectives such as food systems, migration, and poverty. Climate change affects regional diversity in terms of production and consumption patterns. Dudu (2013) stated that the spatial distribution of value added both agri-food sector and non-agri-food sectors was investigated (Figure 4.8). The findings indicated that there were small effects for all sectors in the first period. Agricultural production decreased in Southeastern Anatolia, but the production increased in Mediterranean and Aegean Regions. The production of West Central and Southeastern Regions was highly affected in the second period. In the third period, all regions were negatively affected. That's way, the regions depended on irrigation systems will likely face with more adverse effects than other regions (p.37).

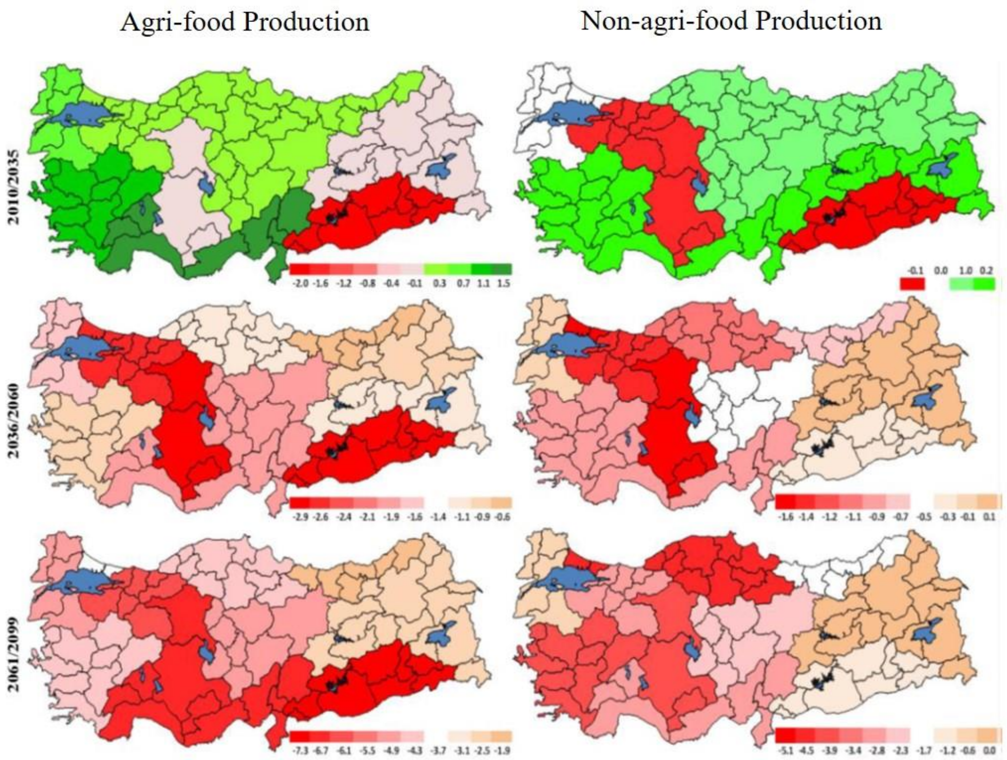


Figure 4.8. Regional production in value added units (Dudu, 2013, p. 38)

According to MoEU, (2012a), extreme climatic events highly bring about socio-economic outcomes. Infrastructure (building, transportation, energy and water supply) is affected by climate change, and it is significant threat for high density areas. High sea level based on climate change affects infrastructure. Then, transportation, regional developments, industry, tourism and energy sectors are affected by climate change; therefore, long-term and strategic planning approaches should be developed on land and sea areas. In addition, tourism sectors are influenced due to the decrease in snow cover, and the increase in extreme temperature in Mediterranean Region (p.1). In the same report, scientific and socio-economic research about agriculture, food systems, environmental and rural developments aim to develop innovative policies in order to contribute to national agriculture adapted climate change and increase farmers' resilience based on climate change (MoEU, 2012a, p.24). The national agricultural lands are divided into thirty agricultural productions basins based on similar ecological structure in terms of dataset in climate variabilities, soil, topography and land classification in 2009 (Kadıoğlu et al.,2017, p. 21).

Another issue is farmers' income based on agricultural sectors. This sector is generally carried out by small scale farmers in villages in Turkey. Small scale farmers, who does not use extra labor force. The study indicates that 70% of women and 30% men work in the agricultural sector, and the rate is % 92.7 for women in rural areas (MoEU, 2012a, p.29). The agricultural sector must adapt to the impacts of climate change on production-oriented policies, it is necessary to revise the national and regional development strategy and action plans should be related to the sectors and prepared adaptation strategies for each sectors (MoEU, 2012a, p.20). In brief, small scale farmers have their' incomes based on agricultural sectors, so they are directly affected from adverse impacts of climate change. The families are faced with socio-economic risks such as migration, and loss of income.

4.3. Planning Perspectives of Climate Change on Agriculture in Turkey

The changed in temperature and rainfall patterns affect both environmental and socio-economic patterns, positively or negatively. Decision-makers focuses on policies and strategies in order to deal with adverse impacts of climate change. However, the policies and strategies vary for each settlement since they have different environmental, political and socio-economic conditions. Thus, the government has developed several national plans. The plans are associated with climate change effects directly or indirectly. This part divided to two groups: national plans on climate change and agriculture, and national plans on drought and watershed management.

4.3.1. National Plans on Climate Change and Agriculture in Turkey

The national plans focus on the impacts of climate change on several sectors, and identifies adaptation or mitigation strategies in Turkey. The planning process is very significant to understand the critical issues on climate change. According to '*İklim Değişikliği İhtisas Heyeti Raporu'* (n.d.), 'The Framework Conservation on Climate Change' was approved by Turkey in May 24, 2004 in order to prevent the negative impacts of greenhouse gas emissions related human and stop at a certain level. Then, Turkey officially became a party to 'Kyoto Protocol' in August 26, 2009 (p.42). 'The Climate Change Coordination Council' was established with Prime Minister Circular No: 2001/2, and was reorganized as 'The Climate Change and Air Management Coordination Council' in 2013 (MoEU, n.d.a).

First National Declaration on Climate Change 2007

First National Declaration on Climate Change was published in January, 2007. The report consists of nine sections: decision-makers' general information, national conditions, greenhouse gases and carbon sinks, mitigation policies, predictions and scenarios, adaptations against climate change, technology and financial resources, observations, and education and public awareness (MoEF, 2007).

Republic of Turkey Climate Change Strategy 2010-2023

The plan consists of various strategic goals such as to mitigate the global greenhouse gas emission, to increase national capacity, and to prepare an integrated information management system (MoEU, n.d., pp.9-12). Besides, the plans focus the strategies on various sector: energy, agriculture, forestry, transportation, industry and waste sectors in short, medium and long terms. From agriculture and forestry perspectives, fertilization, drought resilient crops, certified seed production and organic agriculture, land consolidation, irrigation systems, solutions against forest degradation are very important strategies in short terms. In addition to these, crises management depend on agricultural drought predictions, the conservation and analysis of soils and lands, increasing of carbon sinks, wastewater collection are some strategies in medium terms. Finally, to establish central geographic systems, to protect of water resources, to determine adaptation and mitigation strategies, to prevent UHI, to increase of green areas, and to reduce of urbanization pressure are fundamental strategies in long term (MoEU, n.d., pp.28-29).

Fifth National Declaration on Climate Change 2013

Fifth National Declaration on Climate Change was published in May, 2013 by MoEU. Like First National Declaration on Climate Change report, this report has nine parts. The report stated that agriculture sectors, which were equal to 25.69 Mton CO_2 greenhouse gas emissions, constituted approximately 7% of the total emissions in 2009, and the agricultural emission consists of enteric fermentation of animals (58%), agricultural lands (27%), fertilizer systems (13%), and paddy production and burning of agricultural waste (2%) (p.11). Moreover, there are several agricultural goals in order to control of greenhouse gases and climate change. Some of these goals are soil conservation and land use law, agricultural reform law, the regulation of good agricultural practices and organic agriculture, and ÇATAK. The report emphasized various educational programs in Turkey.

Republic of Turkey Climate Change Action Plan 2011-2023

The plan aims to integrate its climate change policies, to development policies, to increase of energy efficiency, to rise of clean and renewable energy, and to develop low-carbon. From an agricultural sector and food security perspectives, there are various goals such as an integrated approach between climate change and food security, the increase of research & development, an integrated management of water resources, sustainable agricultural practices, soil and pasture areas management, irrigation and infrastructure system. In addition to these, agricultural emissions, energy systems and monitoring of climate change effects are critical goals (MoEU, 2012b).

Turkey's National Climate Change Adaptation Strategy and Action Plan

The plan, which the original Turkish name is *Türkiye'nin İklim Değişikliği Uyum Stratejisi ve Eylem Planı*, focuses on five main issues: water resources management, agriculture and food security, ecosystem, biodiversity and forestry, natural disaster risk management and health. The increase of summer temperature, the decrease of winter rainfall (especially western provinces), loss of ground water, drought, soil degradation, coastal erosion, and flood threatens with water depletion. Besides, agricultural pests will increase depending the change of temperature and precipitation patterns. Climate change will affect animal husbandry and crop production, product design patterns, severity of extreme weather conditions, and agricultural harvest; thus, this is directly related to food security. The frequency of natural disaster will increase with regard to flood or drought. These impacts of climate change are very serious issues for planning (MoEU, 2012a, pp.6-7).

4.3.2. National Plans on Drought and Watershed Management in Turkey

Climate change brings about several natural disasters such as drought and flood. From a planning perspective, this part investigated how actions are taken in terms of drought and extreme rainfall.

National Drought Management Strategy and Action Plan 2017-2023

As Turkish State Meteorological Service stated a study, defined as 'Climate Change and Drought Analysis', widespread droughts have been observed especially in 1928, 1973, 1989,1990,1993,1999, 2000 and 2008. It is estimated that the great drought in 1876 caused the death of some 200 000 citizens by causing famines and disasters. The main principles of this report are an integrated approach based on plans and programs on a basin scale, structural-nonstructural measures to mitigate drought damages, strategies based on water saving, monitoring of the drought in the sub-basins/basins, and institutional coordination for drought' all process (MoFWA, n.d., p.8-10). The plan, which the original Turkish name is *Ulusal Kuraklık Yönetimi Stateji Belgesi ve Eylem Planı 2017-2023*, consists of three periods: Pre-drought, during drought, and after-drought. Firstly, it is aimed to determine drought index and sectoral effects, drought map and management plan, preparation of legislation, educational programs, modern irrigation systems and crop tolerated drought. Secondly, drought has evaluated during drought. In this process, it is aimed that drought emergency action plans and participation and information programs should be prepared. Finally, in after-drought, development plans based on after-drought should be prepared, and the impacts on sectors should be evaluated (MoFWA, n.d., p.17-18). It is important to strengthened disaster analysis for agricultural droughts, because drought, floods, forest fires and storms increased compared to past years and agricultural capacity reduced in many countries. In Turkey, water and soil management must be improved due to loss of farmland areas regarding climate change. Also in Turkey, provincial drought action plans have prepared, and these plans aimed to strengthen the financial, legal and administrative aspects. The drought test center, which established at the International Research Institute, has been carried out since 2008 (MoEU, 2012a, p.27,28,36).

National Watershed Management Strategy 2014-2023

National Watershed Management Strategy, which is the original Turkish name is *Ulusal Havza Yönetim Stratejisi 2014-2023*, prepared by Republic of Turkish Ministry of Forestry and Water Affairs. As seen in Figure 4.9, Turkey is divided into 25 hydrological basins, and their total average annual flows is 186 billion m³ (2014, p.3).

Figure 4.9. Watershed areas in Turkey (DSİ, 2014, p.36)

Due to the usage of overdose chemical fertilizers and drugs in agriculture, pollution of soil and water is gradually increasing in the lower basin, western and southern basins. In contrast, agriculture in the north basins continues as organic farming.

Destruction of forests and pasture areas can disrupt ecosystem. Also, road constructions in non-inclined areas bring about deterioration and erosion. Turkey, where located on the semi-arid places of all world, has rainfall patterns, seasonal change and regional differentiations. In some river basins, water needs have exceeded potential of resources. In addition to the quantitative distribution, there are large differences in water quality in the country. The changes in land use and land degradation increase greenhouse gas emissions, and they affect local climate conditions. Although Turkey's net emission in land use are not large amount, land use changes reduces in carbon level in the above ground and soil. This reduction in organic matter adversely leads to chemical and biological effects such as soil fertility, biodiversity, and ecological functions. Nevertheless, not only negative effects of climate change on the basin but also positive effects of climate change can be assessed in Turkey (MoFWA, 2014, p.3,6,8).

National watershed/basin management plans are also related to socio-economic impacts. Western region and south basins in Turkey, residential areas, demand of water and energy increased due to high urban population and industries; thus, environmental pollution, conurbation, unplanned industrialization rapidly threaten fertile soils, water resources, forest and pasture areas (MoFWA, 2014, p.3). Despite the increase in water demand due to rapid population growth, the availability of resources is low and water resources excessively use both industrial and agricultural areas. For this reason, water resources management in basin is very important in order to deal with usage of underground water resources and pollution problems (MoFWA, 2014, p.6). Water potential of a basin should be primarily evaluated within the basin. However, the amount of rainfall and time in Turkey vary from region to region. While the Eastern Black Sea Region has a 2500 mm rainfall per year, Central Anatolia Region, especially around Konya has a rainfall of 320 mm per year. The low level of precipitation and drought affect all sectoral areas. It decreases regional growth, farmers' income, basic food needs, and it cause serious losses in industries, where agricultural production is directly linked, and unemployment owing to reduce production. Before implement the decision, which water transfer from other basins, are need to assess to reduce water demand, to recycle the waste water, and to evaluate alternative to local water supply. Watershed management is globally regarded as a value added approach to climate change in all circumstances. Watershed management will link potential climate change impacts on the hydrological regime with the various uses of resources to help planners and decision-makers determining investments that will enduring potential climate effects (MoFWA, 2014 p.7,8).

Draft version of River Basin Management Plans

While climate change can damage sustainability of wetlands and agricultural lands, it likely has positive impacts on agricultural lands. Thus, national plans lead to a priority action in terms of environmental and socio-economic aspects. Basin Protection Action Plans were completed for 25 basins. Four basin plans were transformed into 'River Basin Management Plans-RIBAMAP under the technical assistance for converting watershed conservation action plans (Draft version of the Büyük Menderes Basin Management Plan, 2018, p.1). Konya, Susurluk, Büyük Menderes and Meriç- Ergene river watershed/basin management plan has been prepared. While Basin Protection Action Plans, watershed management plans, watershed master plans are related to directly management of watershed and their resources, environmental plan, land use plans, protected area plans are important plan for management and preventing land misuse in the watersheds (MoFWA, 2014, p.8).

River Basin Management Plans are very significant factors in order to determine of differentiations on a local scale. Therefore, according to draft version of the Büyük Menderes, Konya, Susurluk and Meriç Ergene Basins Management Plans were evaluated in terms of water consumption and sectoral distributions. As displayed in Table 4.1, the highest water consumption is Konya Basin, and water consumption based on agriculture in Konya Basin is higher than other basins. Moreover, Konya Basin has agriculture sector. Thus, Konya Closed Basin was selected as case study. In the following part, Konya Closed Basin will evaluate.

Table 4.1. *Consumption water as the river basins (This table was adapted from Büyük Menderes, Meriç Ergene, Susurluk and Konya Closed Basin River Basin Management Plan Draft, 2018)*

2012 Data	Büyük Menderes Basin	Meriç-Ergene Basin	Susurluk Basin	Konya Closed Basin
Agriculture	1051 hm^3	471 hm^3	657 hm^3	**2719 hm^3**
Animal husbandry	16 hm^3	11 hm^3	17 hm^3	29 hm^3
Industry	55 hm^3	141 hm^3	211 hm^3	60 hm^3
Domestic-water use	109 hm^3	67 hm^3	123 hm^3	116 hm^3
Water consumption	1231 hm^3	696 hm^3	1008 hm^3	**2923 hm^3**

*Note: It is formed by four river basin management plan drafts, Büyük Menderes, Meriç-Ergene, Susurluk, Konya Closed Basin

4.3.3. Evaluation of Selected Basin

Konya Closed Basin has wide agricultural areas; however, it has rather high water consumption on agriculture compared with Susurluk, Meriç-Ergene and Büyük Menderes Basins. Konya Closed Basin was analyzed to understand the influence of climate change on livelihoods. This basin was evaluated in terms of drought based on climatic data, and water resources related to agriculture. Konya, Karaman, Aksaray, and Niğde provinces are widely located in Konya Closed Basin, and this area accounts for 3.5% of the labor force and 2.7% of gross value added (the original Turkish name is *brüt katma değer*) in Turkey. Compared with Turkey's production structure, 22 % the gross value added and 34% of the labor force of agricultural sector have relatively high percentage in Konya Basin, that's way this area is important. In 2012, water consumption (net water use) was 2923 hm^3. The distribution of usage of water reflects the socio-economic profile of the basin. The most important use in the basin is in agriculture (2719 hm^3), animal husbandry (29 hm^3), industries (60 hm^3) and domestic water use (116 hm^3) (Draft version of the Konya Basin Management Plan, 2018, p.12).

The total areas of agricultural land of the basin are 3.66 million hectares, and Konya Plain covers 72.5% of this basin. Although the agricultural lands of Konya Closed

Basin constitute 14% agricultural lands of Turkey, potential available water resources of this basin has only 3% of the available water resources of Turkey. Moreover, even though 74% of water resources are used for agriculture in Turkey, 88% of water resources is used for agriculture in this basin, and 61% of the water resources come for ground-water resources (WWF-Türkiye and Eti Burçak, 2010, p.15).

According to WWF-Türkiye and Eti Burçak, (2010), it is estimated that while the increase in temperature will be limited until the end of 2030s, the increase in temperature will rapidly increase after 2030 in Konya Closed Basin (Figure 4.10). Therefore, it is predicted that crop production will be affected, and crop patterns will change due to the increase in temperature and the decrease in rainfall (p.21). Thus, global climate change will affect the basin since temperature increases and precipitation decreases. As a result, water budget of this basin will change. Even if pressure irrigation techniques are applied in all of this basin, they will not be enough, and drought-resistant crops, and alternative crop patterns (low water use) should be improved in order to meet the demand of water (WWF-Türkiye and Eti Burçak, 2010, p.27).

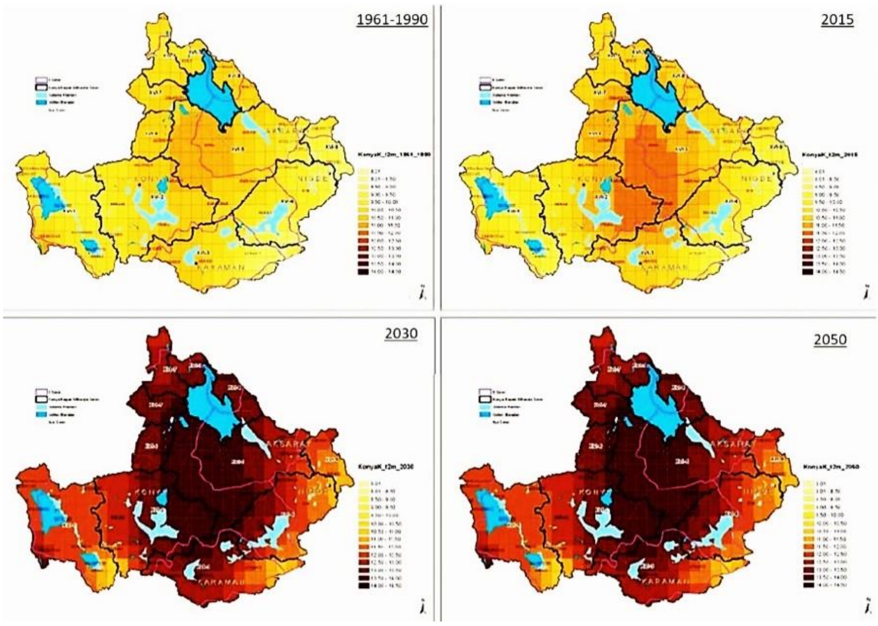


Figure 4.10. Average temperature change in Konya Closed Basin 2015-2030-2050 based on 1961-1990 data (Berke et al., 2014, p.12)

There will be significant decrease in precipitation values based on seasonal features, and it is estimated that the significant impacts on crop patterns will occur in Konya Closed Basin due to fall in precipitation, which starts from 20-30% of rate. Many sectors, especially agricultural sector, will be adversely affected due to rainfall amount decrease (WWF-Türkiye and Eti Burçak, 2010, pp.21-23). As seen in Figure 4.11, in the boundaries of DSI IV. Regional Directorate, which these areas have 93948 total wells consisting of 66808 unlicensed wells, and most of which (70%) are in Konya Basin. Thus, the groundwater resources in basin face with serious threats (WWF-Türkiye and Eti Burçak, 2010, p.13). Land subsidence and pothole formations are observed due to decrease in groundwater levels. In recent years, new pothole formations have increased in the south of basin, where population density is higher, and they bring about serious concerns as regards their lives and property securities (Berke et al., 2014, p.37).

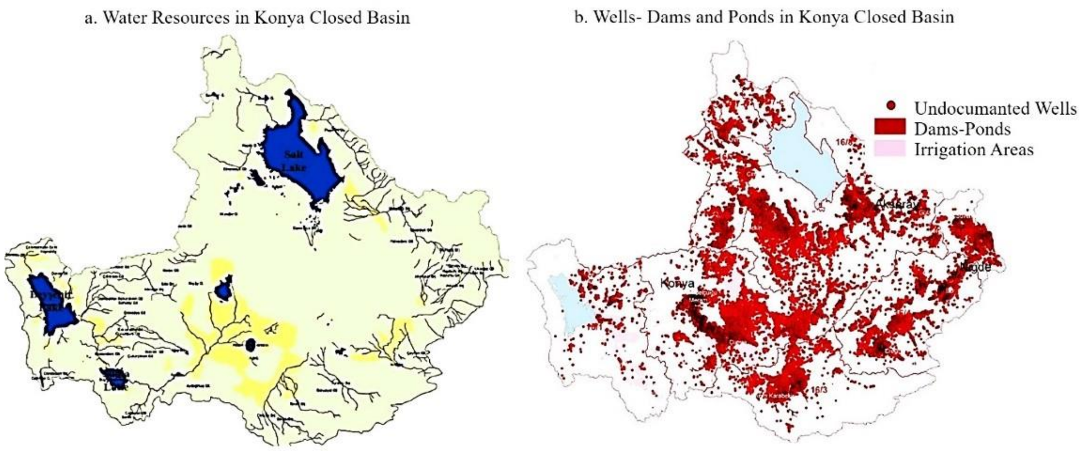


Figure 4.11. Water resources and wells-dams and ponds based on Konya DSİ in Konya Closed Basin (WWF-Türkiye and Eti Burçak, 2010, p.19,13)

4.4. Concluding Remarks

This part consists of three main perspectives: environmental, socio-economic and planning. From an environmental perspective, the future projections are evaluated. In other words, the increase in temperature and the decrease in rainfall are very important predictions in terms of climate change' effects. Environmental perspective also focuses on conservation of wetlands, pasture lands, and soils in order to preserve the natural equilibrium. Soil and water managements are critical strategies in order to reduce climate change effects on agricultural lands. Another point is urbanization. There is a strong network between urban and rural areas in terms of productivity and the demand of agricultural products. Even though agricultural practices aim to decrease negative impacts of climate change, these changes bring about natural disasters such as drought and floods. In socio-economic perspectives, although the farmers perceive the impacts of climate change, they lack necessary information. While macro-economy is related to plan of supply and demand on national scale, micro-economy is associated with small-scale families with an income coming from agriculture. Therefore, there is a close link among migration, poverty and health, and climate related events might occur as regards socio-economic conditions in the future years. As per the classification in this part, planning perspectives were emphasized in terms of national plans of climate change and national plans based on drought and basin/watersheds.

The increase in temperature and the decrease in rainfall amount will lead to adverse outcomes based on climatic events such as lack of water and drought. The agricultural sector is directly related to these climatic components. That's way, as the more adverse impacts of climate change are observed, the worse productivity and quality of crops will be seen. These risks can threaten food security. As seen in Figure 4.12, there are critical threats in Central Anatolia Region: the decrease of crop yields and the increase of crop price, the change of seasons, the increase of wetlands drying, erosion and land degradation, and migration based on decreased agricultural productivity (TEMA&WWF-Türkiye, 2015, p.11).

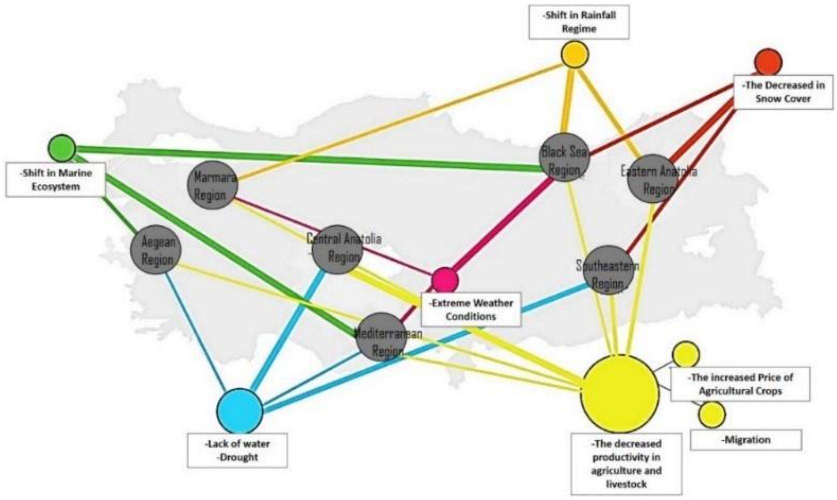


Figure 4.12. The relationship between perceptions and estimated consequences based on climate change (TEMA&WWF-Türkiye, 2015, p.9, translated from Turkish)

The decrease in usage of underground water and effective irrigation systems are fundamental strategies in order to deal with drought. Along with the debate on planning, environmental and socio-economic perspectives were argued according to climate change impacts and consequences in each districts, as mitigation and adaptation actions are varied in each district. Especially, agriculture, which is the fundamental sector compared with other sectors, should be planned under climate change conditions in terms of food security and socio-economic risks. Otherwise, as the impacts of climate change increase, the risks based on climate change will be likely to increase in the future (Figure 4.13).

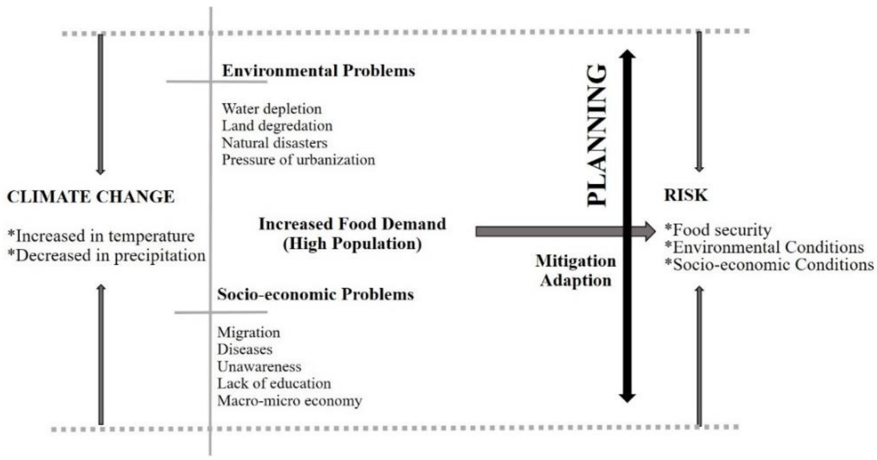


Figure 4.13. The relationship between climate change on agriculture in Turkey

CHAPTER 5

CASE STUDY: KONYA

5.1. Introduction to Case Study

5.1.1. General Information on Konya

Climate change and agriculture are interrelated in terms of many aspects such as crop productivity, food security, and water availability. While climate change affects agriculture, agriculture is affected by climate change regarding agricultural emissions.

Vermeulen et al. (2012) claimed,

> *"Food systems contribute 19%–29% of global anthropogenic greenhouse gas (GHG) emissions, releasing 9,800–16,900 megatonnes of carbon dioxide equivalent (MtCO2e) in 2008. Agricultural production, including indirect emissions associated with land-cover change, contributes 80%–86% of total food system emissions, with significant regional variation. The impacts of global climate change on food systems are expected to be widespread, complex, geographically and temporally variable, and profoundly influenced by socioeconomic conditions"* (p.195).

The impacts of climate change on agriculture could be positive or negative. Although agricultural lands are likely to have positive outcomes thanks to the impacts of climate change, some regions suffer from negative impacts of climate change such as extreme temperature, unexpected rainfall etc. Agriculture is a fundamental sector in Konya Closed Basin in Turkey; thus, climate change can affect both environmental and socio-economic systems, negatively. Konya Closed Basin is one of the most important of 25 basins in Turkey. It is located 49.786 km² area, and makes up approximately 6.4% of Turkey's surface areas (Draft version of the Konya Basin Management Plan, 2018, p.1). According to Berke et al. (2014), this basin, which has the lowest rainfall amount, has a semi-arid climate, and rainfall in this area decreased 10-25 mm per year during last 30 years period. Moreover, it is estimated that the increase in temperature will be 7°C, and the rainfall will decrease 20-30% depending on the impacts of global climate change (p.9). As a result, it can be considered that the agricultural lands in Konya are under serious threat due to the negative impacts of global climate change. Especially, water depletion is associated with these negative impacts on agricultural lands. In other words, climate change threatens not only environmental perspectives (desertification, pothole formation, decrease in fertile soil areas, water depletion) but also socio-economic perspectives (decrease in crop productivity on food systems, decrease in income, unemployment and migration). Thus, if precaution is not taken via adaptation or mitigation actions against climate change, food systems can face with socio-economic threats both on a local and national scale in the future in Konya. In addition to these, Konya Closed Basin includes wide agricultural lands, and it has a unique position to provide food security in Turkey. This study was conducted in Konya Closed Basin, and Konya province was chosen due to having wide agricultural lands. As indicated in Figure 5.1, all of Konya province is not located on Konya Closed Basin. However, Konya was evaluated as a whole in this study.

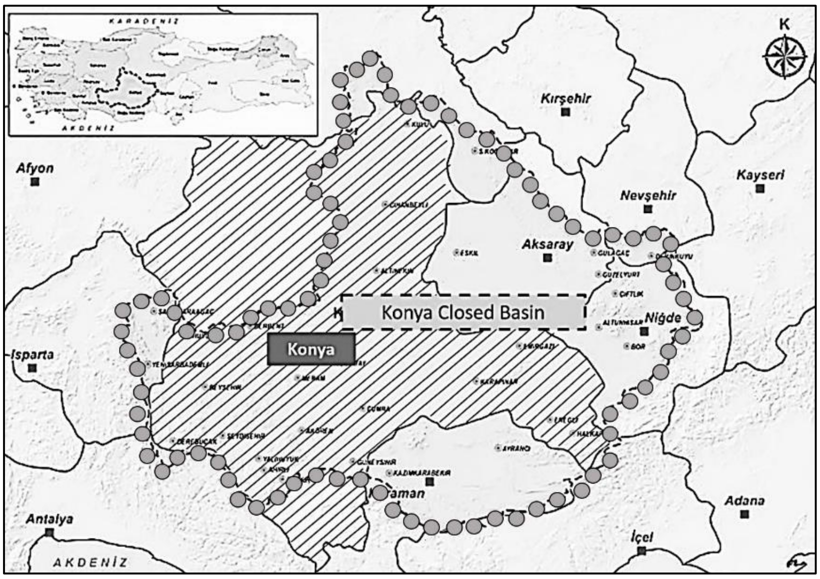
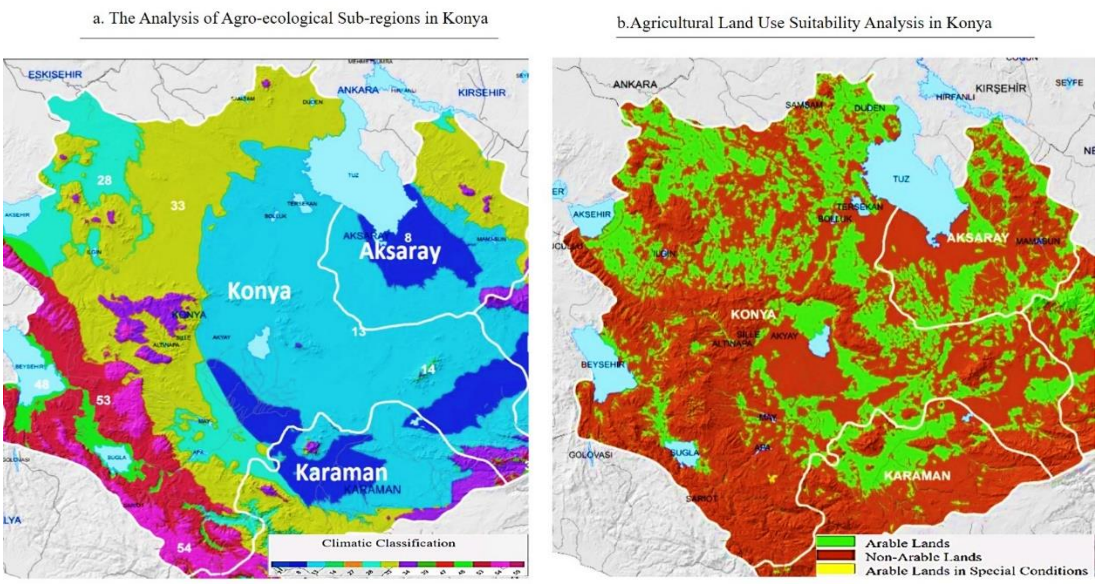


Figure 5.1. The relationship between Konya Province and Konya Closed Basin (Adapted from Berke et al., 2014, p.11)

Konya is located between 36º22’-39º08’ north latitudes and 31º14’-34º27’east longitudes. The average height of the district from sea level is 1027 meters, and it has the widest lands in Turkey. It is located to the west of Niğde, Aksaray, the north of Antalya, Karaman and Mersin, the south of Ankara and Eskişehir, and the east of Afyon and Isparta. Konya has three central districts, Meram, Selçuklu and Karatay, and 28 districts, Akşehir, Beyşehir, Seydişehir, Karapınar, Kulu, Cihanbeyli, Bozkır, Hadim, Ilgın, Kadınhanı, Doğanhisar, Ereğli, Çumra, Yunak, Sarayönü, Hüyük, Emirgazi, Tuzlukçu, Yalıhüyük, Derbent, Çeltik, Halkapınar, Ahırlı, Altınekin, Güneysınır, Akören, Derebucak and Taşkent. The south of Konya consists of wide grain areas with approximately 4000 km^2, and the largest river is Göksu. Other rivers are Çarşamba, İvriz, Tekke, Uluçay, Argıthanı and Adıyan. Besides, it has Salt Lake, Akşehir, Beyşehir, Suğla, Ilgın-Çavuşcu lakes. Besides, Konya is surrounded by Central and Central West Anatolian plateaus, and Taurus Mountains. Even though Konya has different types of landforms, the plains cover most of the area in Konya, then mountainous and plateaus cover the rest (IPED, 2012, p.19). According to Yıldırım et al. (2017), the agricultural lands in Konya is 26.48 million decare (65% of its surface area). The total value of agricultural production in Konya is 4.9% of Turkey, the value of plant production in Konya is 5.6% of Turkey (p.3). In addition, the law the act number 6360 was published on the Official Gazette on 12.11.2012, and the administrative status of villages in metropolitan cities was changed into neighborhoods (On Dört İlde Büyükşehir Belediyesi ve Yirmi Yedi İlçe Kurulması ile Bazı Kanun ve Kanun Hükmünde Kararnamelerde Değişikli Yapılmasına Dair Kanun, 2012). However, in this study small rural settlements are stated as villages which reflect the existing situation of the settlements accurately in the following sections.

Agro-ecological sub-regions and agricultural land use suitability analyses are utilized to guide planning perspectives regarding climate change. These maps emphasize different aspects in each districts in Konya. First of all, the analysis of agro-ecological sub-regions consist of maps at scale of 1/25000, which display soil and elevation patterns, temperature and rainfall patterns dataset, climatic characteristics of crop productions for many years, and land use/cover maps are prepared by TUİK and Landsat satellite images. Moreover, slope, elevation, agricultural land use suitability, land use/cover analyses were prepared in districts (KOP BKİ, 2017, p.66). Afterwards, these maps were overlapped, and the agro-ecological sub-regions were made up in Konya (Figure 5.2a). In this study, the agro-ecological analysis was used in order to determine case study areas. Another analysis is agricultural land use suitability (Figure 5.2b). The analysis was categorized with arable lands, non-arable lands and arable lands in special conditions (KOP BKİ, 2017, p.34). From a planning perspectives, the analysis can guide rural development plan-making in terms of agricultural patterns. On the other hand, the analysis should be prepared with climatic predictions in the future. Thus, the agricultural lands, which will continue to be fertile in the future, can be easily identified. The analysis can contribute to planning perspectives. A similar map was prepared in order to deal with the impacts of climate change in Uganda (see detail Chapter 3)



*Note: These maps are obtain from «Kırsal Dezavantajlı Alanlarda Tarımsal- Kırsal Kalkınmaya Yönelik Model Geliştirilmesi ve Elma, Kiraz, Üzüm ve Çilek Meyvelerinde Değer Zinciri Analizi Araştırma Etüt Projesi Sonuç Raporu, 2017»

Figure 5.2. The analysis of agro-ecological sub-regions in Konya (a) and Agricultural land use suitability analysis in Konya(b) (KOP BKİ, 2017, p.67,34, translated from Turkish)

Even though Konya Closed Basin is the largest agricultural land, it faces various problems: water depletion, drought, lack of irrigation infrastructure, and unawareness.

The rate of rainfall is low(mm); thus, the agricultural yields decreased on dryland farming areas. As a result, the acquisition of agricultural value is reduced in Konya Closed Basin (WWF-Türkiye and Eti Burçak, 2010, p.16). The agro-ecological and agricultural land use suitability analyses are very significant tools that help connecting the relationship between climatic and agricultural variabilities to urban-rural planning perspectives. In addition, these analysis, which include environmental/physical perspectives, are associated with socio-economic conditions such as national food system, farmers' income, migration. The following part focuses on the change of drought and agricultural patterns in Konya.

5.1.2. The Change of Drought and Agricultural Patterns in Konya

Climate change is expected to negatively affect agricultural patterns due to increased drought risk. Although WWF International declared that Konya Closed Basin is one of the 200 ecological regions in the world in terms of biodiversity, water resources are limited in this area, and the demand of usage of water gradually increases in different sectors (WWF-Türkiye and Eti Burçak, 2010, p.8). Water depletion is directly associated with agricultural production in terms of fertile soil areas and irrigation on rural areas. If water resources decrease, risks would increase such as drought, desertification and pothole formation in the villages. This part examined how the drought and agricultural patterns changed from year to year. The change of drought was assessed inTR52 Region: Konya and Karaman from 1981 to 2011, and the change of agricultural patterns was assessed in Konya from 2013 to 2018.

Firstly, drought patterns are very important in terms of climate change. Drought is categorized three main aspects: agricultural, hydrological and meteorological drought. Agricultural drought has been described as a period of significant reduced agricultural production as regards lack of moisture in the soil. Hydrological drought refers to the loss of surface and ground water levels. Another drought is meteorological drought, which is observed below the average rainfall within a period. According to three definitions, drought is related to the reduced in rainfall. Agricultural production significantly decreases during dry times, and serious problems occur in the lives of the farmers due to insufficient rainfall patterns in short term periods (IPED, 2012). According to Berke et al. (2014), along with drought, on a serious level, soil degradation has occurred because of the usage of surface and groundwater for agriculture and the increased crops, which consume a lot of water. Soil degradation is referred to the decrease of soil quality by salinization, desertification and concretion, and it is frequently observed due to these problems on plain soils, where they have highly agricultural productions. Turkey's most influential wind erosion damage occurred in Karapınar in 1950, and it was exposed to destroy land cover by overgrazing, burning demands, and failure in agricultural methods. Even though the interventions have continued in the 1960s in Karapınar, this problem still continues in the region between Ereğli and Karapınar. Especially, the wind erosion has occurred due to decrease of water resources in Ereğli reeds. Another impact is salinization. Salinization soils bring about extinction of agricultural production in these areas. The average slope of the lands is 3 per thousand in Konya Plain; therefore, salinity on plains cause serious problems due to insufficient surface drainage regarding low slope, high groundwater level and unawareness in irrigation. According to the CORINE 1. Level classification, approximately 2.7 million hectares of agricultural land in the Konya Closed Basin consist of approximately 1.2 million hectares of dryland agriculture, 0.8 million hecteras of irrigated farming. The remaining 0.7 million hectares is garden, vineyard, pasture and mixed agricultural areas (p.38,13). Thus, drought patterns are very significant in order to increase agricultural productivity. The crop diversity or product pattern plans can be occurred based on these analyses. According to Köksoy (2012), '*Erinç method'*, which aims to reveal the relationship between rainfall and loss of water amount (p.14), was used to describe drought patterns in Konya. As seen in Figure 5.3, the annual drought index was determined between 1981 and 2011 years. Drought has increased in some districts since 1981. For example, whereas Ilgın and Kulu, which had semi-dry climate in 1985, had dry climate in 2011, Akşehir and Beyşehir, which had sub-humid climate in 1981, had semi-dry climate in 2011. The districts with a longest period of drought were Ereğli, Karapınar, Çumra and Cihanbeyli (Köksoy, 2012, p.30).

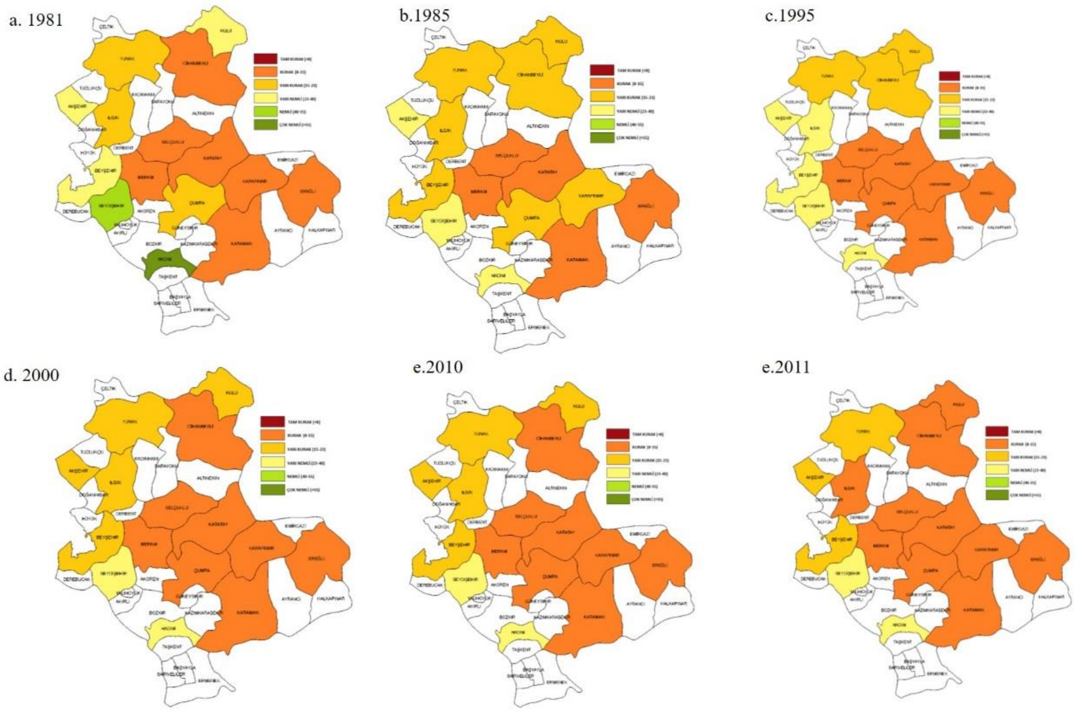


Figure 5.3. Comparison with Erinç Annual Drought Index in Konya and Karaman in 1981-2011 (Köksoy, 2012, p. 24-29)

Secondly, the change of agricultural patterns was one of the main components in order to understand agricultural sustainability. Agricultural sustainability is affected by many risks on agriculture, and climate change is also a very significant factor to continue agricultural sustainability. According to Aras (2014), the cultivated agricultural lands decreased from 1995 to 2013 since not only drought but also migration from rural areas occurred. The agricultural lands in TR52 were seriously decreased rather than other regions. Not only industry, tourism, urbanization, transportation and mining but also drought, the decrease in agricultural income and migration bring about decrease in agricultural lands (p.4). In addition, the total agricultural lands in many districts were decreased excluding Cihanbeyli, Selçuklu, Çumra from 1995 to 2013. However, the highest decrease in agricultural lands occurred in Karapınar. According to grain and other crop product areas, the agricultural lands highly decreased in Hadim, Derebucak and Kulu. Another decreased of observed in agricultural lands that produce fruit, drink and spice areas. The decrease in these agricultural areas occurred in Hadim, Bozkır and Yunak. Especially, the crop that the most decreased is grape regarding drought in 2007-2008. Thirdly, the areas of vegetable crops in Meram, Çumra, Karapınar and Ereğli are very important, and the highest prodution is black carrot (Aras, 2014, pp. 7-12). According to TUIK (2019a), the fallowing part emphasizes the change of agricultural pattern from 2013 to 2018 (Figure 5.4). These maps were prepared according to TUİK dataset in 2019. The part included in four patterns: fruits, drinks and spice plants areas, fallow areas, vegetable areas and grains and other product areas. Firstly, according to the fruits, drinks and spice plants areas, the sizes decreased from 2013 to 2018 in Ahırlı, Altınekin, Beyşehir, Ilgın, Karatay, Taşkent, Yalıhüyük, and Çumra. For example, in Çumra, the size of agricultural lands was 10825 decare in 2013, and also was 6979 decare in 2018. Secondly, the size of fallow areas increased from 2013 to 2018 in Akören, Akşehir, Beyşehir, Derbent, Derebucak, Doğanhisar, Emirgazi, Ereğli, Güneysınır, Hadim, Ilgın, Karatay, Taşkent and Yunak. Thirdly, the size of vegetable areas decreased in Hadim, Hüyük, Ilgın, Kadınhanı, Kulu, Sarayönü, Selçuklu, Yalıhüyük and Yunak (excluding Emirgazi (0 decare)). Finally, the size of grain and other product areas decreased in Akören, Doğanhisar, Emirgazi, Güneysınır, Hadim, Ilgın, Kadınhanı, Sarayönü, Tuzlukçu and Çeltik.

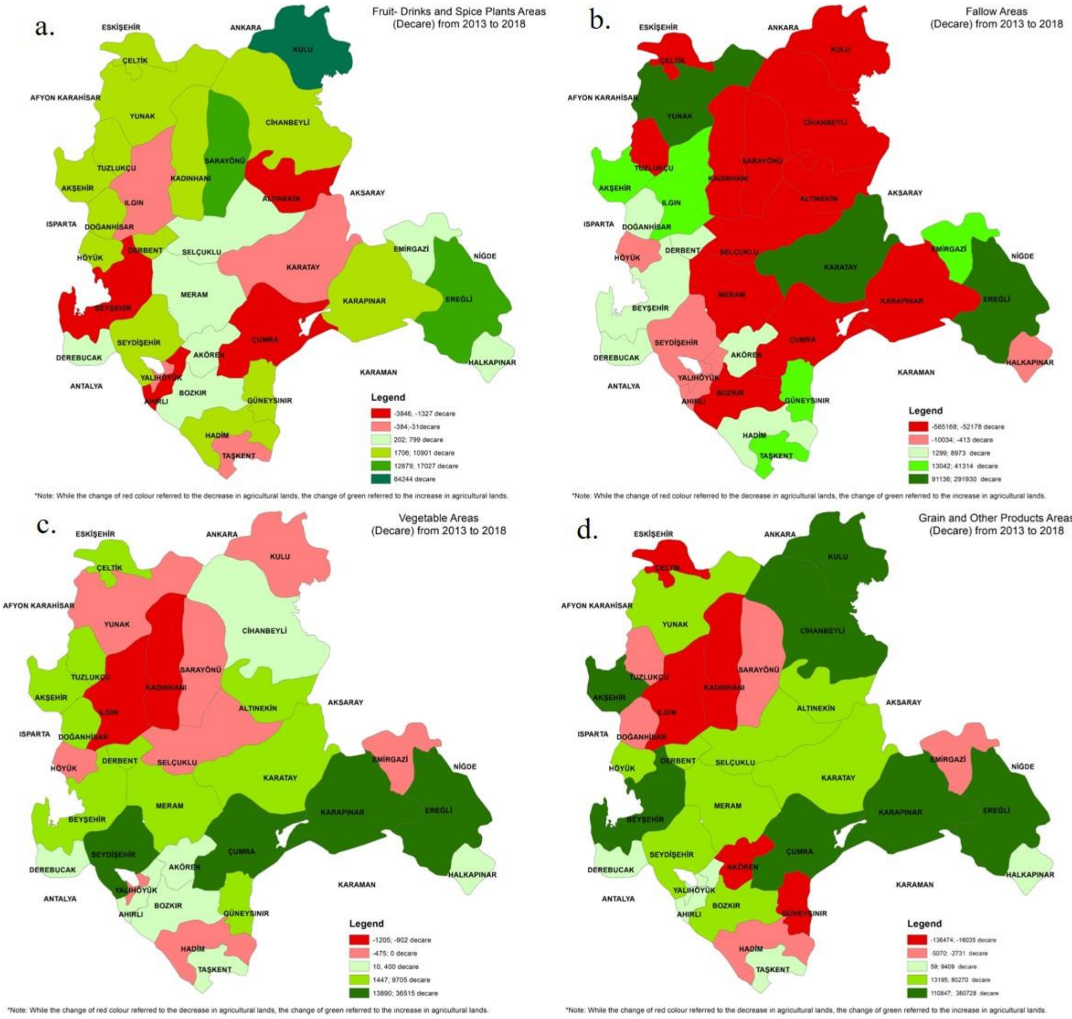


Figure 5.4. The changed in fruit-drinks-spice (a), fallow (b), vegetable(c), and grain and other product(d) agricultural areas from 2013-2018 in Konya (Adapted from TUIK, 2019a)

As literature review, Aras (2014) stated that integrated perspective and agricultural policy are very important in terms of ecological features, agricultural lands and impacts of drought (p.13). All these findings emphasize the necessity of integrated planning. These components are related to the impacts of climate change, directly or indirectly. Natural disasters on agricultural lands can bring about both environmental and socio-economic risks. From a planning perspective, the analyzed of all these impacts is a necessity in terms of various risks management plans. Afterwards, adaptation and mitigation actions can contribute to decrease of environmental and socio-economic risks.

5.2. Methodology of Case Study

5.2.1. Data Selection

The changes in climatic variables are experienced regarding extreme or unexpected weather conditions. The following part focuses on data selection in districts of Konya. The study aims to describe the participants' perceptions, experiences, methods, the outcomes of mitigation actions and estimated consequences on the impacts of climate change. The data selection depended on data, "*Residential Locations in the Rural Areas of Konya*", which was prepared by Konya Metropolitan Municipality (KMM). These data were obtained from the website: konya-e-desen.com/kriterDetay (updated e-desen.konya.bel.tr/) on May 2018. All these maps were prepared by using '*ArcMap-10'* software regarding these data in 771 villages and 31 districts. The selection criteria were established in order to determine case study areas, where were carried out these questionnaires. The selection criteria included eight variables: land consolidation, whether farming is carried out by second generation or not, good agricultural practices, the rate of ensuring the livelihood of production, the amount of wetland, the average of individual land, cooperatives and certified organic agriculture. During the study, Karatay, Meram and Selçuklu districts were excluded from the context in order to focus on rural settlements. As a result, case study areas were determined as regards different criteria. In the following part, the selection criteria were examined in detail.

The Rate of Ensuring the Livelihood of Production

It was classified as 0-25%, 26-50%, 51-75% and 76-100%. This classification was given 1 point for 0-25%, 2 points for 26-50%, 3 points for 51-75% and 4 points for 76-100%. All village scores were collected and a score system was established based on criteria for the districts. According to the results of 'the rate of ensuring the livelihood of production', the number of villages (0-25%) were 123, and it (76-100%) was 194. The villages (309) had the percentage of between 26 and 50. As demonstrated in Figure 5.5, the rate of livelihood based on production was high in the settlements of Çeltik, Altınekin, Çumra, Ereğli and Karapınar. Alternative new crops, purchased products and grown products could be affected both spatially and socio-economically.

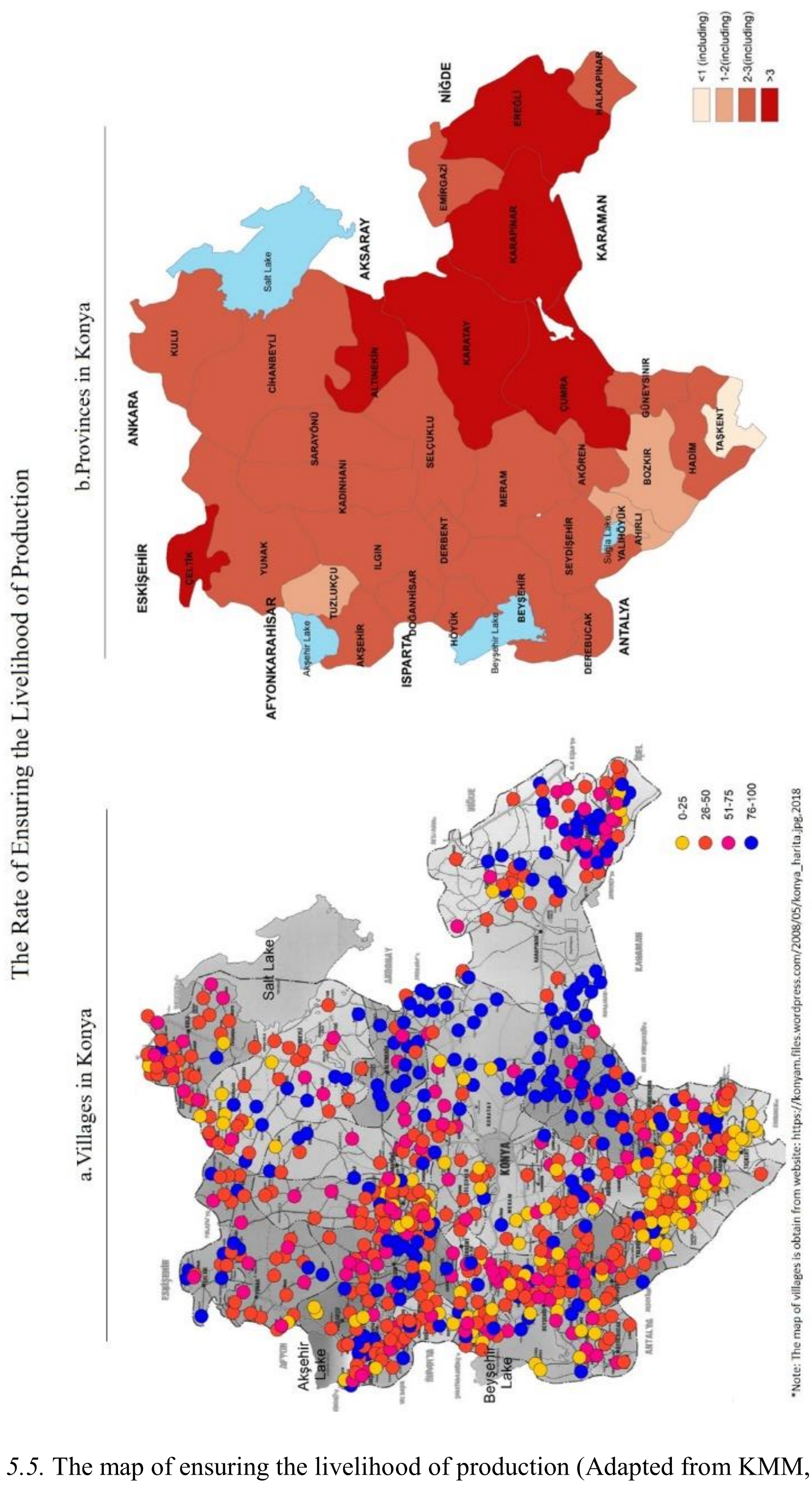


Figure 5.5. The map of ensuring the livelihood of production (Adapted from KMM, 2018)

These findings were associated with crop diversity in Konya. In the following part, according to KMM (2018), the information about the direct production, most grown productions and the alternative new crops explained in Altınekin, Çeltik, Çumra, Karapınar and Ereğli. First of all, various crops such as maize, sugar beet, sunflower, barley, melon, bean, chickpea, apple, pepper, apricot, lentil, pumpkin, vetch and potato were directly produce, and the most grown produce was maize, wheat, pumpkin for its seeds, sugar beet, bean, apple, lentil, chickpea, canola, tomato, barley. Moreover, the alternative new crops vary. There were various crops such as potato, pumpkin, rose, safflower, cumin, maize, bean, canola, quinoa and black cumin in Altınekin.

Secondly, in Çeltik, some crops such as sugar beet, wheat, barley, sunflower, onion, bean, oat, maize, canola, pumpkin, chickpea, lentil, potato was directly produced, and the most prominently produce was varied such as wheat, barley, sunflower, onion, sugar beet, oat, fennel, bean, maize, melon. There are various alternative new crops such as fennel, safflower, bean, canola, black cumin.

Another district was Çumra. Maize, sugar beet, wheat, barley, sunflower, pumpkin, bean, melon, watermelon, grape, strawberry, apple, walnut, plum, apricot, tomato, and cherry are subjected to direct production, and the most prevalent produce are maize, wheat, barley, sugar beet, sunflower, melon, bean, tomato, strawberry, lentil, melon, sesame. The alternative new crops were strawberry, canola, vetch, sunflower, safflower, cumin in Çumra.

Fourthly, in Karapınar, produce such as maize, sugar beet, barley, sunflower, melon, watermelon, nutmeg, clover, tomato, black carrot, chickpea, bean, pepper, carrot, garlic, was directly produced. The most common crops varied as maize, sunflower, wheat, melon, nutmeg, barley, tomato, carrot, sugar beet, potato, pepper, clover. There was a diversity in alternative crops: canola, potato, sunflower, garlic.

Finally, various crops such as maize, sugar beet, wheat, clover, barley, vetch, sunflower, tomato, watermelon, melon, black carrot, cucumber, cherry, apple, walnut, bean, chickpea, almond, apricot, rose, white cherry, rye was cultivated directly, and the most grown produce was maize, wheat, clover, melon, sugar beet, sunflower, rye, black carrot, cherry, chickpea, tomato, apple, grape, canola. The alternative new crops focused on chickpea, vetch, quinoa, sunflower, potato, maize, vetch, averrhoa carambola, pear, black seed, chickpea, bean, sunflower in Ereğli.

Land Consolidation

According to "Residential Locations in the Rural Areas of Konya" (KMM, 2018), a land consolidation map was formed by evaluating yes/no responses. The map was prepared by taking the rate of yes/no responses into consideration in all districts. According to the dataset of KMM (2018), while land consolidation had applied in 146 villages, it had not applied in 625 villages in Konya, yet. On the other hand, the land consolidation is higher in rural settlements in Karapınar and Çumra, and then this land consolidation followed in rural settlements in Ereğli, Akören, Seydişehir, Altınekin and Sarayönü (Figure 5.6).

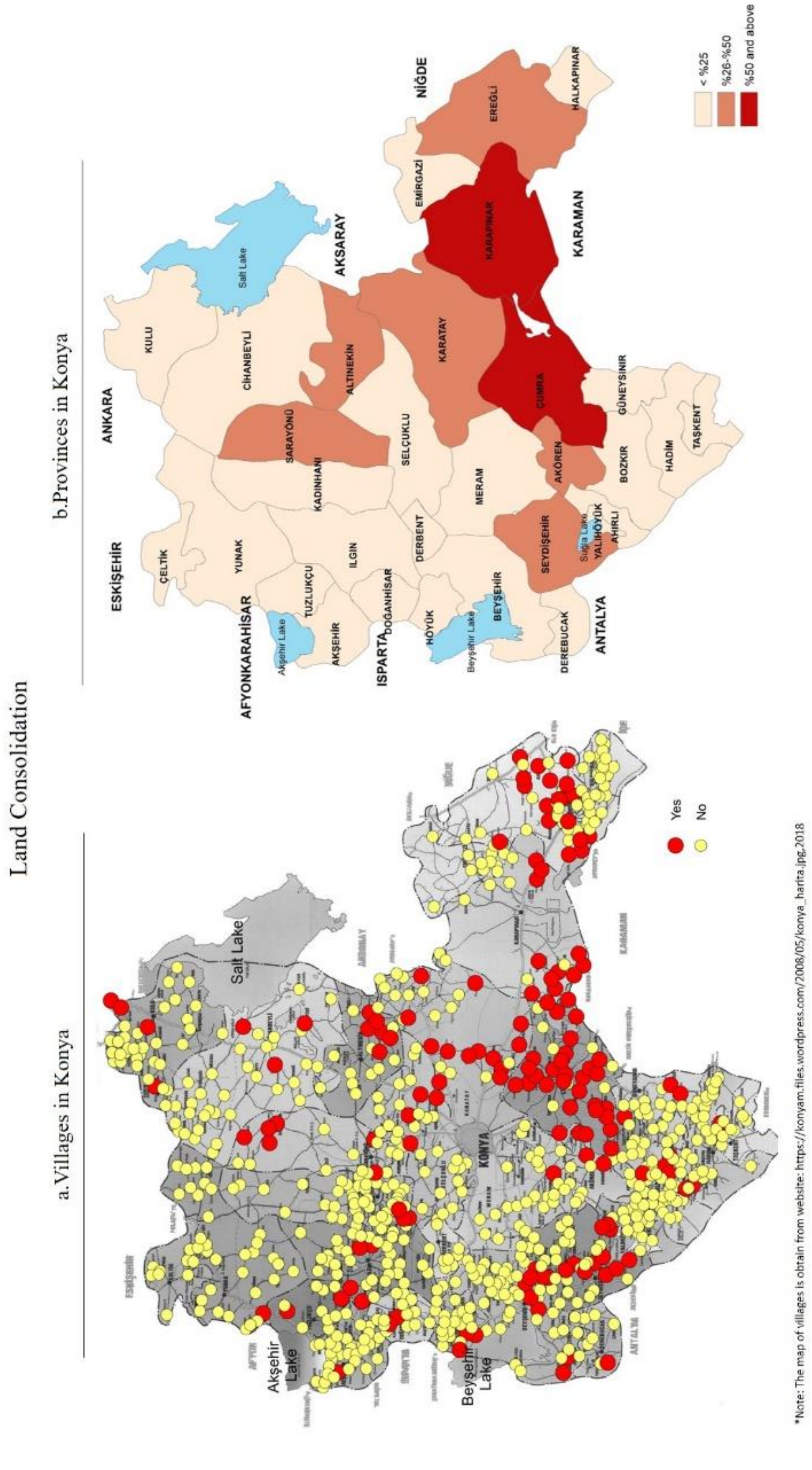


Figure 5.6. The map of land consolidation (Adapted from KMM, 2018)

The Amount of Wetland

"Residential Locations in the Rural Areas of Konya" (2018) referred to the amount of wetland. It was classified as 0-25%, 26-50%, 51-75% and 76-100%. As shown in Figure 5.7a, 372 villages included 0-25% of the amount of wetland, and 213 villages had the percentage of 26-30 in the villages. 79 villages also had 76-100% of these wetlands. The districts' classification aimed to access to villages regarding wetland. This classification was given 1 point for 0-25%, 2 points for 26-50%, 3 points for 51-75% and 4 points for 76-100% (Figure 5.7b). As a result of the map, the villages consisted of wide wetlands in Çeltik, Akşehir, Hüyük, Seydişehir, Çumra, Altınekin, Karapınar and Ereğli. In this context, the amount of wetland was associated with the existing agricultural irrigation resources. Çeltik, Akşehir, Hüyük, Seydişehir (excluding Tepecik, Madenli, Ufacık), Çumra (excluding Afşar), Altınekin (excluding Ayışığı), Karapınar and Ereğli (excluding Kızılgedik) have agricultural irrigation water in all the rural areas (KMM, 2018). In addition to these, drought can be associated with the amount of wetlands and agricultural irrigation systems.

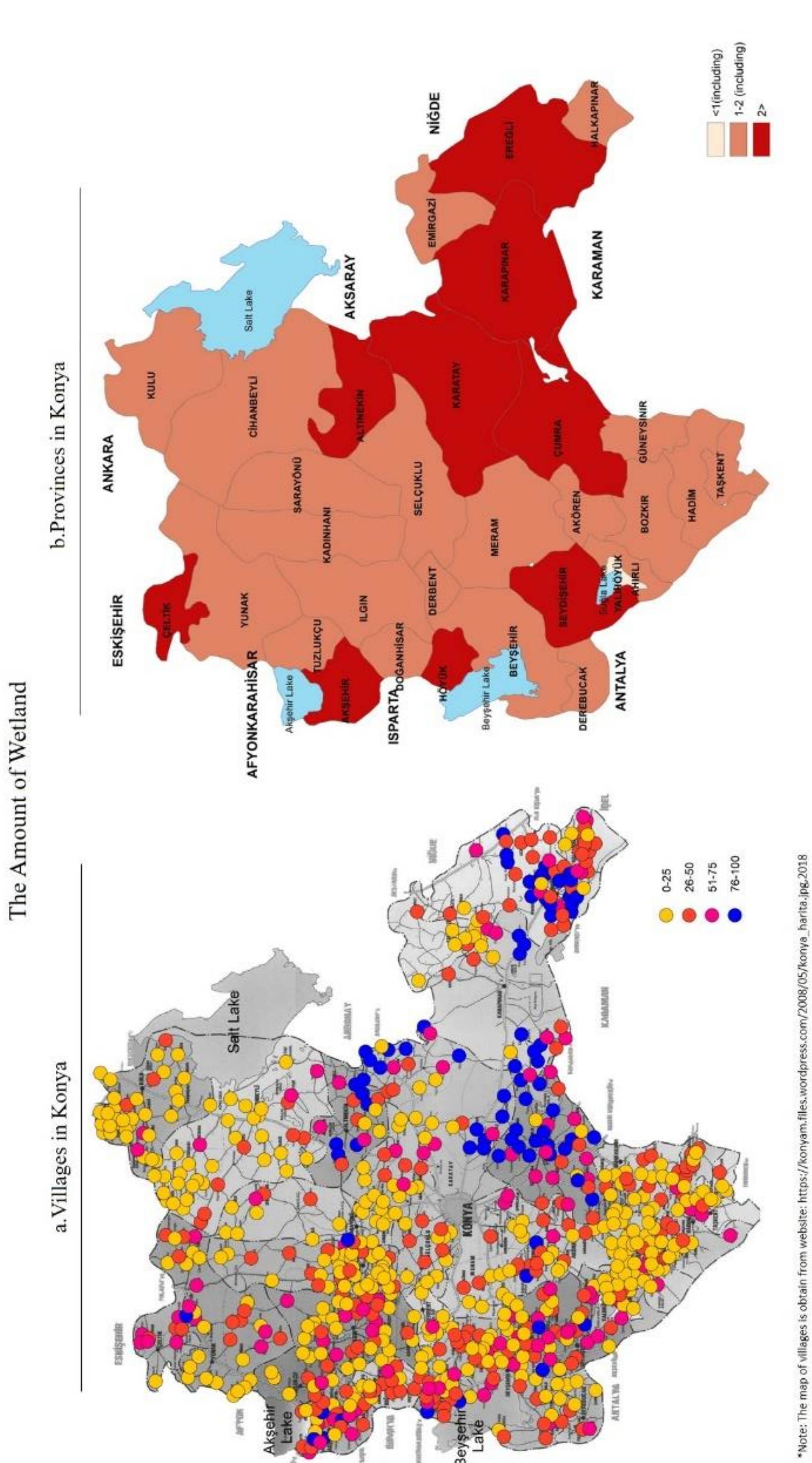


Figure 5.7. The map of amount of wetland (Adapted from KMM, 2018)

Average of Individual Land

The average of individual lands ranged from 1-25 decare to 301-700 decare in Konya. As shown in Figure 5.8, 225 villages included small agricultural lands (1-25 decare), while 65 villages had 201-300 decare (41 villages) and 301-700 decare (24 villages). As a result, most of villages included small and medium agricultural lands. The size of agricultural lands could affect crop diversity. For example, whereas maize was produced in wide areas in Çumra, strawberry areas were produced in small agricultural lands in Doğanhisar. Accordingly, the average of individual land was classified as <1, 1-2, 2> in order to determine districts' agricultural sizes. The classification was given 1 point for 0-50 decare, 2 points for 51-200 decare, 3 points for 201-400 decare and 4 points for 400 and more decare. These points were collected in rural areas and divided into the total villages, so the average individual land was formed for all the districts. As displayed in Figure 5.8, there were larger individual agricultural lands in Yunak, Kulu, Altınekin and Çumra. The selection criteria could relate to geographical characteristics. Especially, the individual areas were small in the south of Konya, where located in mountainous areas.

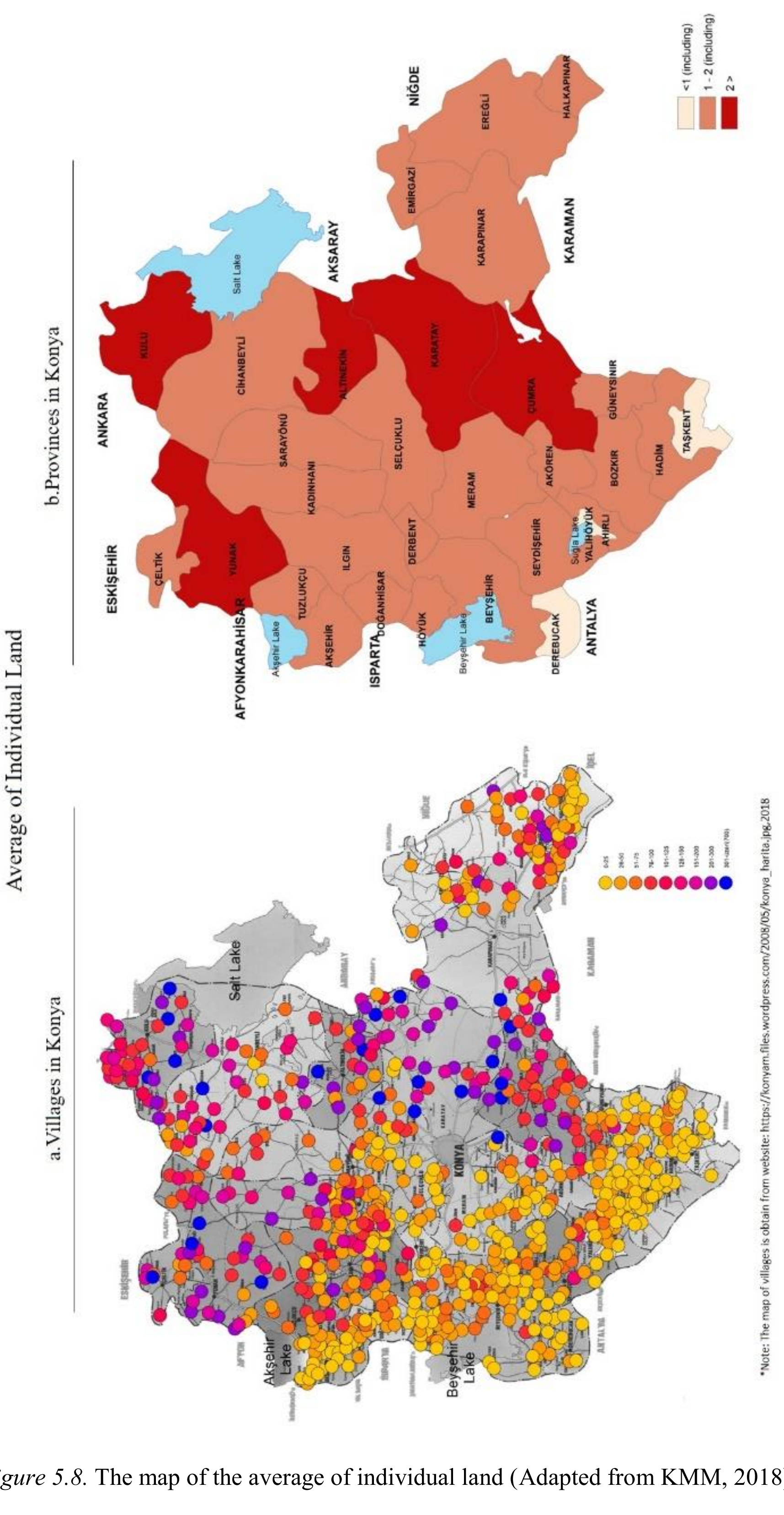


Figure 5.8. The map of the average of individual land (Adapted from KMM, 2018)

Cooperatives

Cooperatives in the villages are very fundamental approaches in terms of socio-economic perspectives. In the present, although there are various cooperatives, it is important for cooperatives to be active or not. A cooperative map was prepared by taking the rate of yes/no responses into consideration in all districts. Afterwards, cooperatives level was determined with 0-25%, 26-50%, 51-75% and more 75% in the all districts. As displayed in Figure 5.9, the cooperative level was higher (75% >) in Çumra, Akşehir and Karapınar. The approximately half of villages (339 villages) had various cooperatives.

Agricultural irrigation cooperatives, agricultural development cooperatives, the beet planter cooperative, which the original Turkish name is *pancar ekicileri kooperatifi*, are located in Karapınar. In relation to the drought, it can be considered that the agricultural irrigation cooperatives will be major stakeholder to solve the irrigation problems in local scale. There are agricultural irrigation cooperatives, dairy cooperatives, agricultural development cooperatives, beet planter cooperatives in villages of Çumra. Although there are 41 rural areas in Çumra, there are no cooperatives in Dedemoğlu, Abditolu, Alemdar, Afşar, Çiçek, Çukurkavak, Doğanlı, Tahtalı and Üçhüyük. In Akşehir, there are agricultural irrigariton cooperatives, dairy cooperatives, agricultural development cooperatives and agricultural sales cooperatives. Even though there no cooperatives in Ortaca, Tekke, Tipiköy, Üçhüyük, Ortaköy ve Yeşilköy, there are more cooperatives in Çakıllar, Gedil, Yazla, Adsiz, Sorkun and Karahüyük (KMM, 2018).

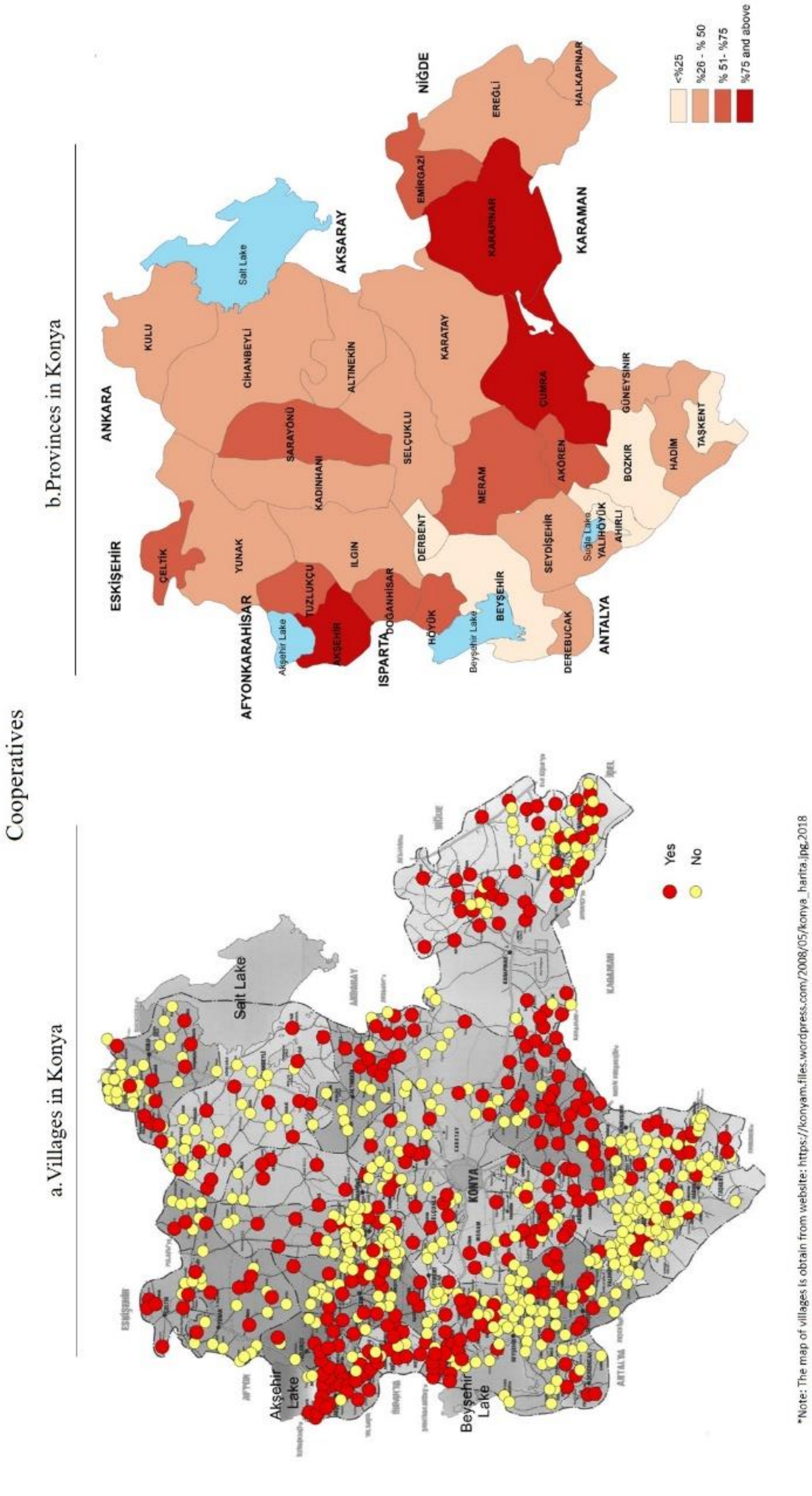


Figure 5.9. The map of the density of cooperatives (Adapted from KMM, 2018)

Good Agricultural Practices

Good agricultural practice was regulated via law and regulations (see Chapter 4.). A good agricultural practice map was prepared by taking the rate of yes/no responses into consideration in all districts. This practice was applied in 66 villages (Figure 5.10). Afterwards, these responses were classified as 0-25%, 26-50%, 51-75% and 76-100% in all districts. The good agricultural practice was focused on villages in Yunak, Çeltik and Kulu. There are good agricultural practices in Turgut, Altınöz, Hatırlı, Harunlar, Karayayla, Kuyubaşı, Sertler, Yeşiloba, and Yeşilyayla villages in Yunak. Moreover, 15 villages in Kulu were carried out: Altılar, Beşkardeş, Boğazören, Bozan, Burunağıl, Celep, Doğutepe, Fevziye, Karacadağ, Kırkkuyu, Kozanlı, Şerefli, Yazıçayır, Zincirlikuyu and Değirmenözü. Çeltik, which has 7 villages, consists of 3 villages such as Torunlar, Adakasım and İshakuşağı.

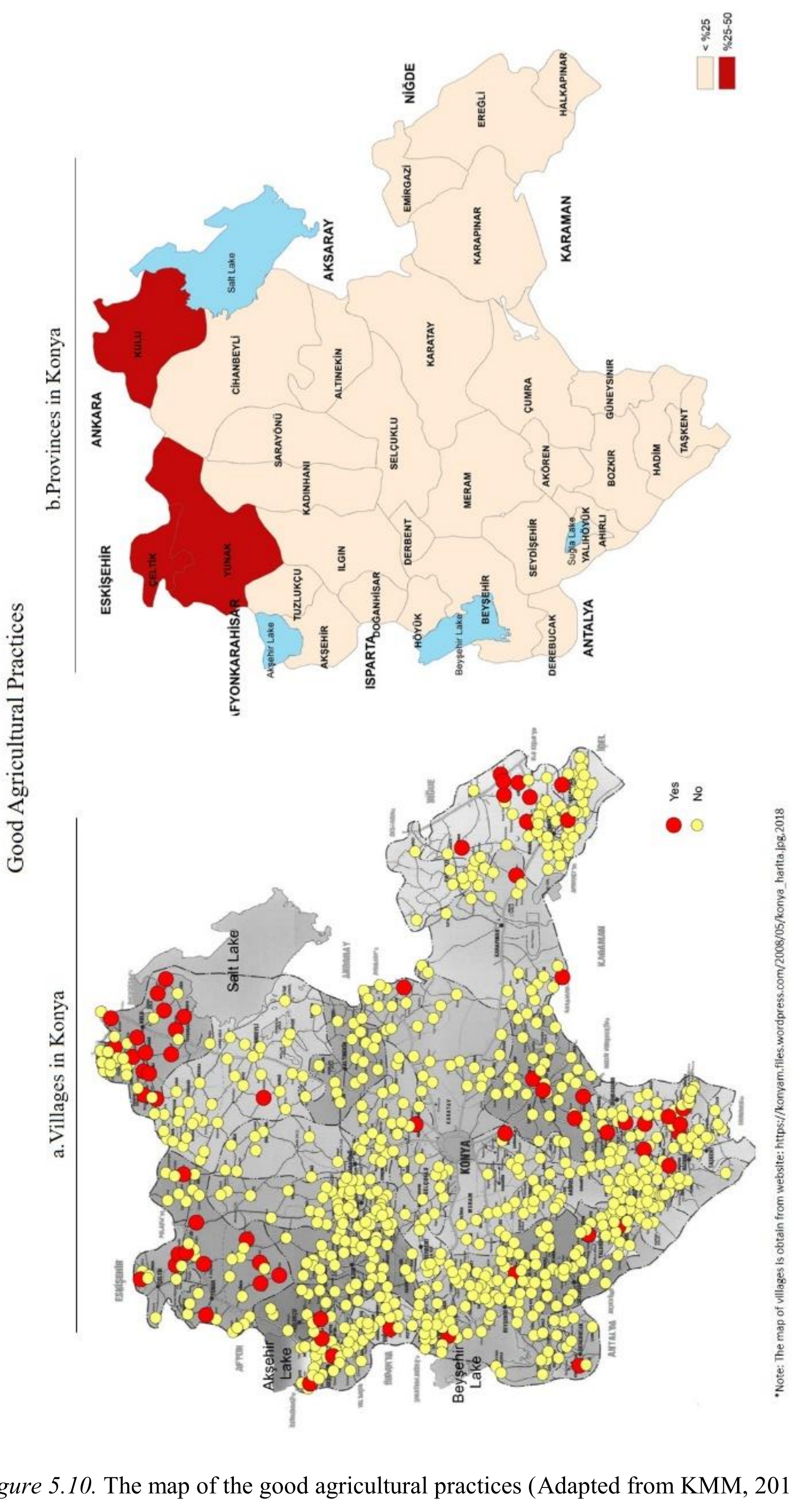


Figure 5.10. The map of the good agricultural practices (Adapted from KMM, 2018)

Whether Farming is carried out by Second Generation or not

As far as willingness to continue agricultural sector in their villages is concerned, the people would suggest that second generation could continue agricultural sector in 238 villages (KMM, 2018). The willingness to continue agricultural sector is connected with future generation; thus, it is important to reduce the negative effects of climate change in the future and to strengthen agricultural productivity. This map was prepared with 0-25%, 26-50%, and over 51% in the all districts (Figure 5.11). According to the willingness to continue agricultural sector, the east of Konya is higher level than the west of Konya. This suggestion was associated with fertile agricultural lands, geographical features, and the size of wetlands. This results were rather high in Derbent, Sarayönü and Emirgazi.

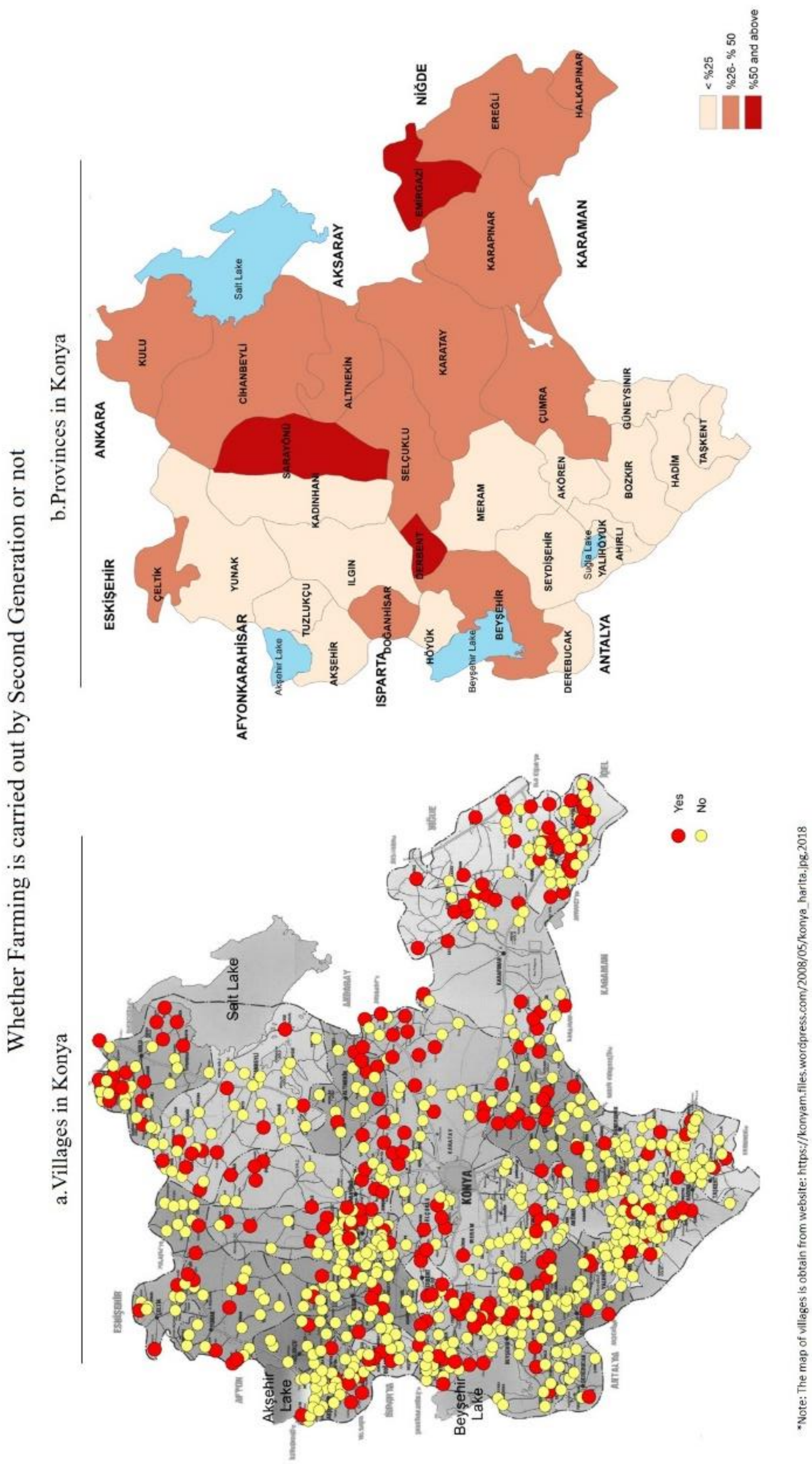


Figure 5.11. The map of the second generation suggestion (Adapted from KMM, 2018)

Certified Organic Agriculture

Like good agricultural practices, certified organic agriculture are regulated by regulations on laws. The selection criteria focused on the kinds of certified organic agriculture in Konya. As indicated in Figure 5.12, certified organic agriculture map was prepared by taking the rate of yes/no responses into consideration in all districts. The practice was applied in 51 villages (KMM, 2018). The villages were classified as 0-25% and 26- 50%, and the certified organic agriculture was concentrated in Çeltik, Akşehir, Doğanhisar and Hüyük. While in Çeltik, black cumins (çörekotu) are produced in İshakusağı and fennels are grown in Adakasım, strawberry is produced Çakıllar, Atakent, Cankurtaran, Gölçayır, Yaylabelen, Saray, and cherry is produced Değirmenköy and Ulupınar, both strawberry and cherry are grown in Çamlı in Akşehir. Whereas strawberry is grown in Yazlıca, Ayaslar, Deştiğin, Fırınlı, Güvendik, Uncular; both strawberry and cherry are produced in Konakkale in Doğanhisar. Strawberry, which is produced in Başlamış, Çamlıca, Çavuş, Değirmenaltı, Göçeri, İmrenler, strawberry and cherry are produced Budak, also strawberry and tomato are grown in Tolca, in Hüyük (KMM, 2018). The organic certified crops vary: fennel, strawberry, tomato, apple, cucumber, potato, carrot, grape, water-melon in all districts.

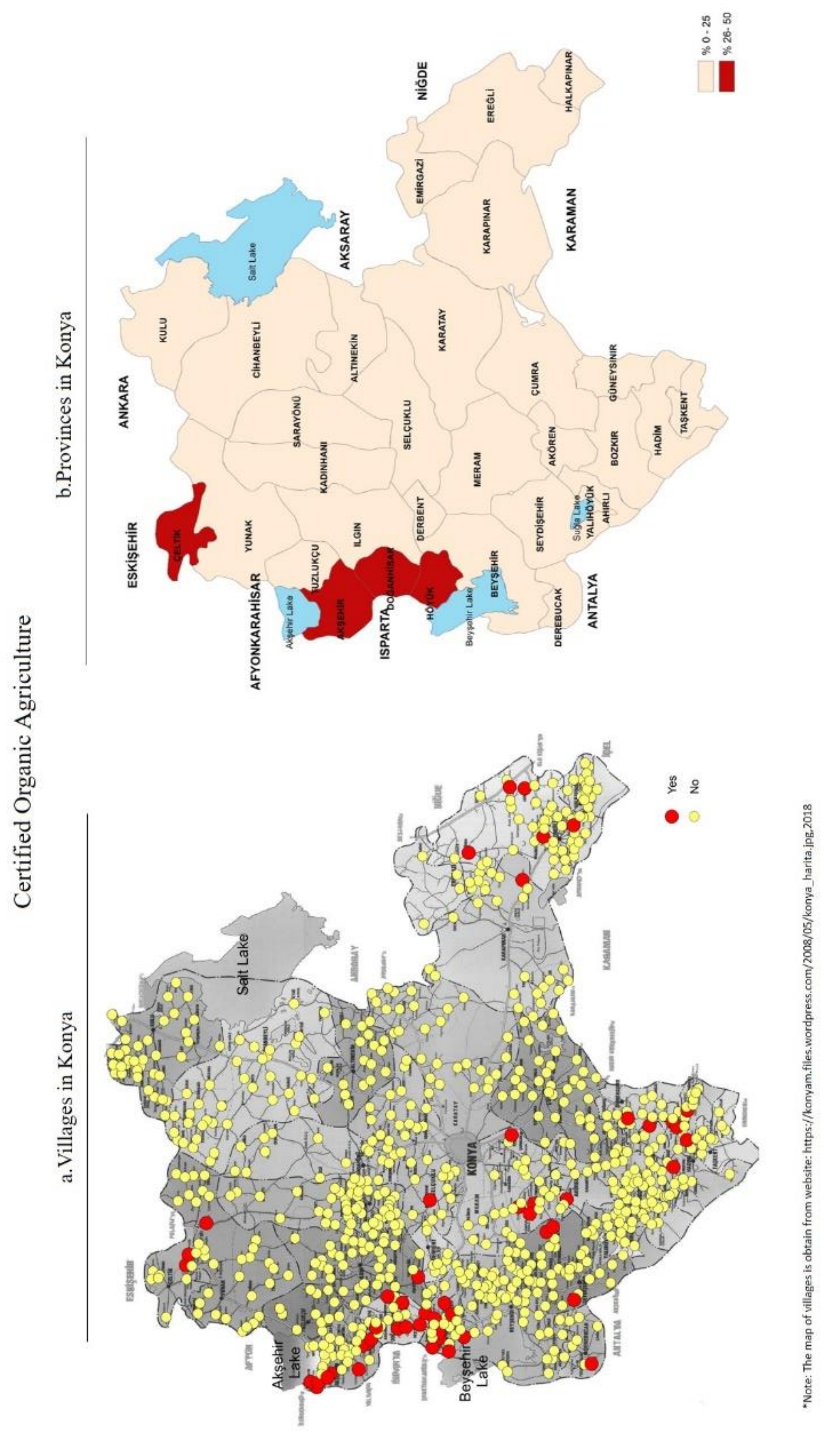


Figure 5.12. The map of certified organic agriculture (Adapted from KMM, 2018)

Evaluation of Selection Criteria

The criteria for selection was evaluated for each village in Konya. The density of the settlements, which had a score of 4 and above, was rated. These points for each district were recreated within themselves.

According to the selection criteria,

- Rural areas where had above and 50% of land consolidation
- Rural areas where had above and 2 points of the wetland
- Rural areas where had above and 2 points of the individual land average
- Rural areas where had above and 75% of cooperatives
- Rural areas where had 26-50% of good agricultural practices areas
- Rural areas where had 50% and above of the second generation suggestion
- Rural areas where had 26-50% of certified organic agriculture
- Rural areas where had above and 3 points of the rate of ensuring the livelihood of production

As shown in Figure 5.13, the map was prepared the following in formula:

The selection points= The total points of criteria in all villages/ the number of villages having only 1 and more points

For example, in Altınekin, total points in villages (17 villages) were determined according to eight criteria such as Topraklık (4 points), Koçkaya (2 points), Yenikuyu (5 points). Afterwards, the total points of villages in the districts were 44 points. The points were rated on the number of villages having only 1 and more points. Thus, in Altınekin, two villages did not participate in the scoring since they did not have any criteria (excluding 0 point). In this context, the score in Altınekin was 2.93 points (from 44/15) based on 15 villages.

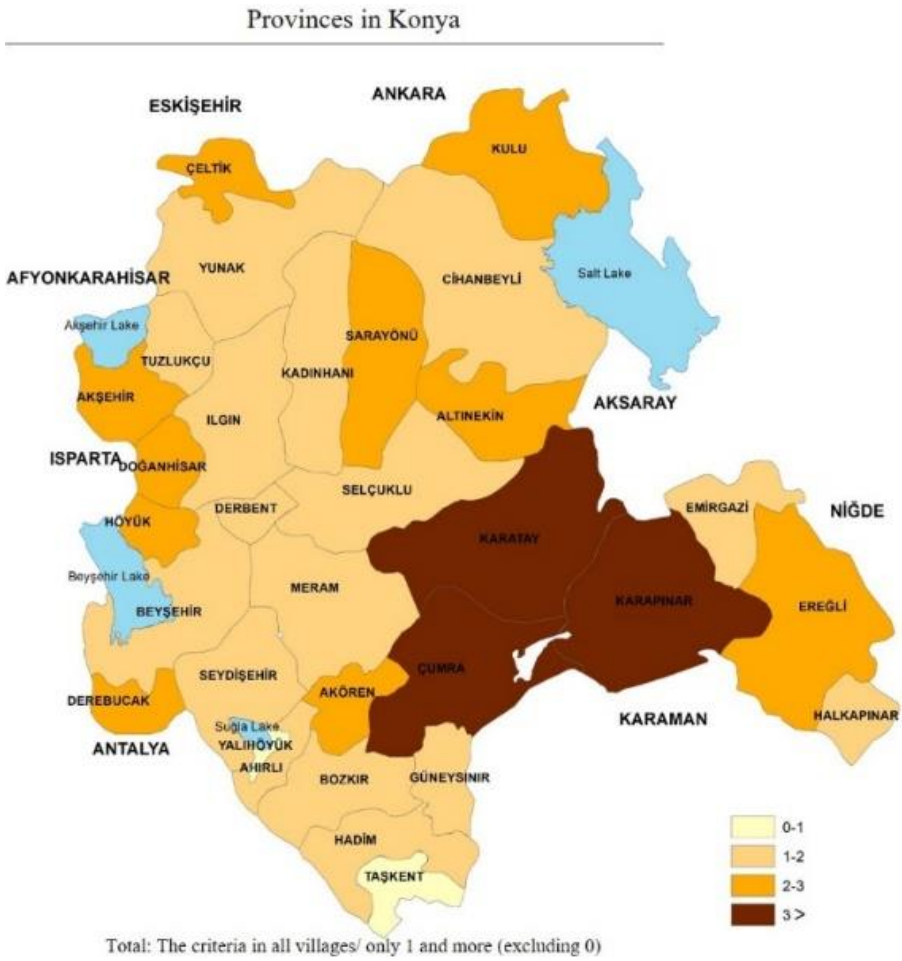


Figure 5.13. The map of the selection criteria (Adapted from KMM, 2018)

The study aimed to investigate whether participants' perceptions, experiences and estimations on adaptation strategies were heterogeneous or not. Thus, these main regions were determined as the north, west, south and south-east of Konya. As a result, eight districts were chosen in terms of geographical similarity, the proximity of sites, and zones' size: Akşehir (2-3 points), Çumra (3 and more points), Ereğli (2-3 points), Karapınar (3 and more points), Doğanhisar (2-3 points), Hüyük (2-3 points), Çeltik (2-3 points), and Yunak (1-2 points). Consequently, the structured questionnaires (farmers) and semi-structured questionnaires (experts) were conducted in order to understand their perceptions, experiences, methods and estimated consequences in the future in eight districts and center of Konya.

5.2.2. Data Collection

Case study areas include center and eight districts in Konya: Akşehir, Doğanhisar, Hüyük, Yunak, Ereğli, Çeltik, Karapınar and Çumra. Konya is located in Konya Closed Basin, where most agricultural activities are on grain products. In Konya, grain production is carried out in 66.19% of the cultivable agricultural areas (Aras, 2014, p.16, ppt). The area presents different climatic and geographical perspectives; Doğanhisar, Hüyük, Akşehir are located near the mountains, but Yunak in partly mountainous area, and lastly Çumra, Karapınar, Çeltik and Ereğli in plain areas. In agricultural areas, especially in 2004 and afterwards, drought was observed and agricultural cultivations decreased in 2007, and this situation still continued until 2007 (Aras, 2014, p.4). Before the farmers' and experts' perceptions, experiences and estimations were analyzed, climate variables and agricultural crop patterns were assessed in the study areas. While qualitative semi-structured questionnaires were conducted from July to September 2018 for experts' perceptions, structured questionnaires were conducted for farmers' perception at the same time. The study investigates risks, actions, methods and future consequences (see details on findings in Chapter 5.2.3.). As seen in Figure 5.14, case study was focused on eight districts and center of Konya.

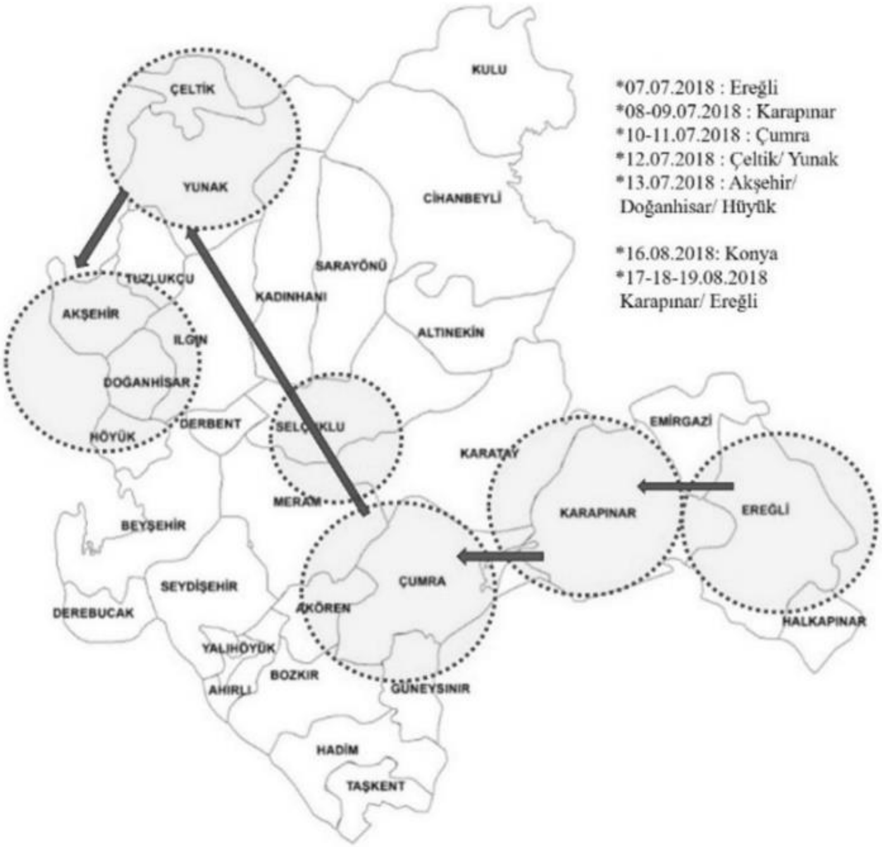


Figure 5.14. The map of case study

This study was conducted using data from a random sample of 72 farmers and 28 experts (Table 5.1). First of all, 72 structured questionnaires were given to farmers from eight districts, after talking to the head of these villages (Appendix A-B). If the headman could not be reached, the questionnaires were given to the farmers, directly. To begin with, the participants were informed about the questionnaire, which was on voluntary basis. Although they needed to sign the form at the start, many participants did not want to sign these forms. As a result, while 54 farmers were given names and surnames,18 farmers did not want to give names. Due to the wide-scope of this demand, the personal information was kept anonymous in order to avoid measurement errors and to keep the natural flow of conservation.

Table 5.1. *The number of the questionnaires of farmers, experts and participants*

Districts	Number of Farmers	Number of Experts	Number of Participants
Akşehir	8	4	12
Çeltik	8	3	11
Çumra	17	6	23
Doğanhisar	4	2	6
Ereğli	18	2	20
Hüyük	4	2	6
Karapınar	9	3	12
Yunak	4	2	6
Konya (Center)	-	4	4
TOTAL	**72**	**28**	**100**

In the second phase, the study was conducted by asking semi-structured questions to 28 experts. These experts have worked with public institutions and organizations, local governments, NGOs and villages as headman in terms of agricultural facilities (Table 5.2). The semi-structured questionnaires were carried out as face to face communication, which was the same with the farmers (Appendix C-D). The ethics committee approval form was shown first, and their name, surname, position, and job were recorded with the consent of participants providing that identifies would be kept anonymous. The study focused on the farmers' and expert' perceptions, observations, risks, actions, methods and estimated consequences.

Table 5.2. *The number of the questionnaires of experts in institutions*

Institutions	Number of Questionnaires
Public Institutions	12
Local Governments	9
NGOs	3
Village Headman	4
TOTAL	**28**

The questionnaires are attached to Appendix A-B and C-D. The research was assessed in five zones in Konya in terms of geographical information, agricultural patterns and climatic variabilities and research findings. The questionnaires are structured as follows: demographic information, information of climate change and the relationship between climate change and planning. The questionnaire collected data on the socioeconomic characteristics: demographic information of the individual, household and living space; information about climate change: identifiability, the individual and social experiences of climate change; the relationship between climate change and planning: the outcomes of mitigation actions, methods and estimated questionnaires of climate change.

5.2.3. Data Analysis

5.2.3.1. The Findings of Konya

As the literature states, the socio-economic problems about agriculture are associated with the changes in temperature and rainfall. The adaptation methods mostly include irrigation systems, crop diversity and changes of harvesting time because of the vulnerability against negative impacts of climate change. This study is based on farmers' and experts' responses to the impacts of climate change. The Konya dataset contains 72 farmers' and 28 experts' observations in eight districts and the center of Konya. The sample districts were selected to include eight different characteristics (see detail on data selection Chapter 5.2.1.). The findings of questionnaires are assessed in terms of the relationship between farmers and experts. The questionnaires include a variety of features: multiple choice, the standard 3 point Likert type scale and open ended questions. The collected data were recorded on SPSS software package (IBM SPSS Statistics 24.0) in October and November 2018, and '*analyze/descriptive statistics*' were used to describe the data. All the findings were visualized via Microsoft Excel Worksheet 2016. The survey on perceived climate change consists of three main parts: demographic information of the participants, general information about climate change of the participants, and the relationship between climate change and planning (Figure 5.15).

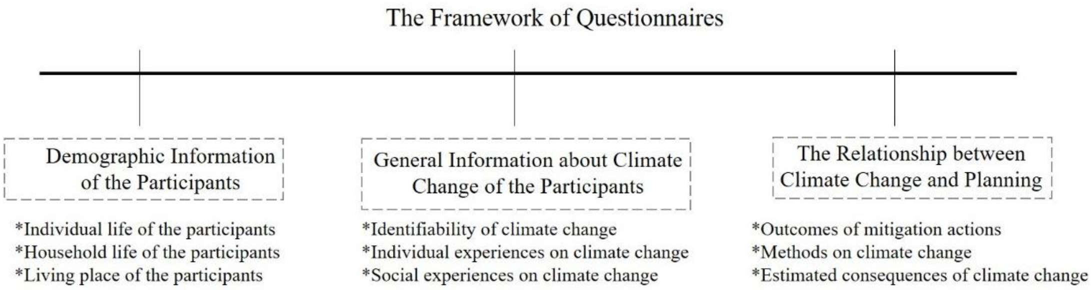


Figure 5.15. The framework of questionnaires

Demographic Information of the Participants

According to the findings pertaining to participants' profile, it can be said that 90.3% of the farmers were male, while 85.7% of the experts were male (Figure 5.16). The study was conducted with both men and women, but the men made up the majority of the participants.

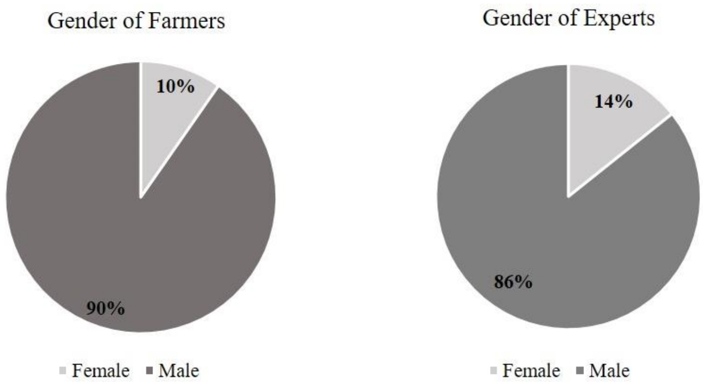


Figure 5.16. The rate of gender of the participants

The educational background of the participants based on role of participants in Konya. While the majority of the farmers (66.7 %) had primary level of education, 64.3% of the experts had bachelor's degree (Figure 5.17). This finding displayed that there was an immense differentiation between the farmers' and the experts' educational background. For this reason, it was observed that the farmers generally used traditional adaptation practices; however, they emphasized the importance of education in order to deal with the negative impacts of climate change. In addition to traditional methods, modern educational techniques help to increase crop productivity and to deal with climatic problems.

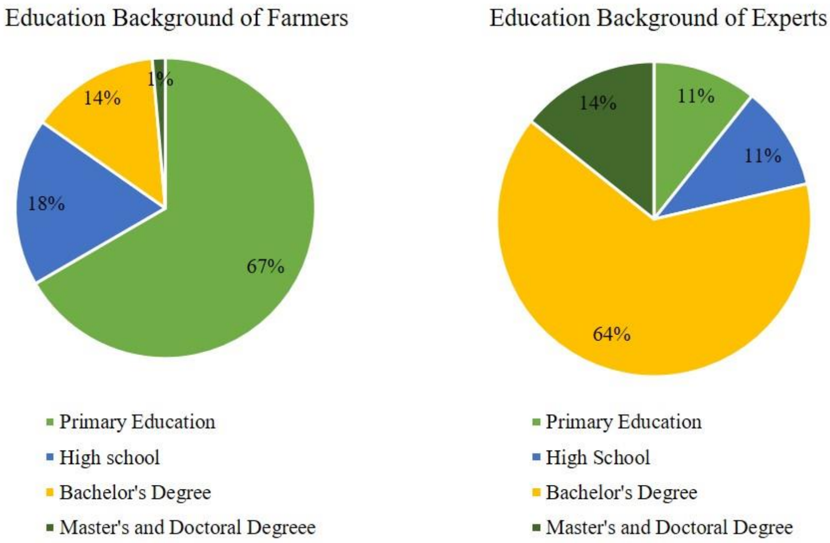


Figure 5.17. Education background of farmers and experts

Household size of the farmers was evaluated in five categorizes. As shown in Figure 5.18a, 48.6% of the farmers had 3-4 household size. On the other hand, while 22.3% of them had a household size of 5-6 persons, 19.5% of them had 1-2 persons. The household sizes were medium, large or small. In addition to household size, Figure 5.18b illustrated that the farm size ranged from <50 to 200> decare, and 34.7 % of the farmers did not answer the question. Although 23.8 % of the farmers had less than 50 decare farm areas, 12.6 % of them had more than 200 decare farm areas. The size of the farms was small, medium or large. However, the farm size differs for each village. For example, while the farm size was medium or large in Çumra, the farm size in Doğanhisar was small due to geographical reasons. The household and farm size of farmers were related to socio-economic vulnerability. In many studies, small holder farmers were vulnerable against the negative impacts of climate change.

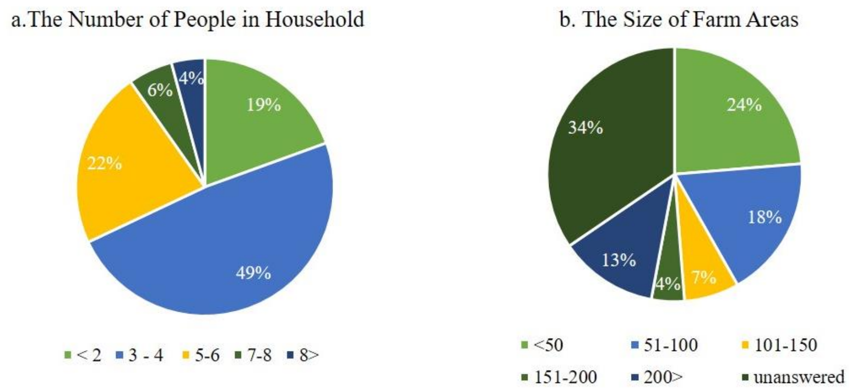


Figure 5.18. The number of people in household (a) and the size of farm areas(b) for the farmers

As far as willingness to continue living in their place of residence is concerned, it can be said that while the highest proportion of the farmers (83.3%) wanted to continue living in their villages, 57.1% of the experts desired to live in their settlements (Figure 5.19). The results showed that although the farmers faced negative results on agricultural productions, they still preferred to live in their villages. The findings underlined that the farmers did not want to migrate from rural to urban areas, so the results are crucial in order to sustain mitigation and adaptation of climate change. Moreover, while the participants, who wanted to migrate to urban areas, underlined economic concerns due to lack of monetary acquisitions, the experts highlighted insufficient social activities. The results are directly related to socio-spatial planning based on social and economic balance.

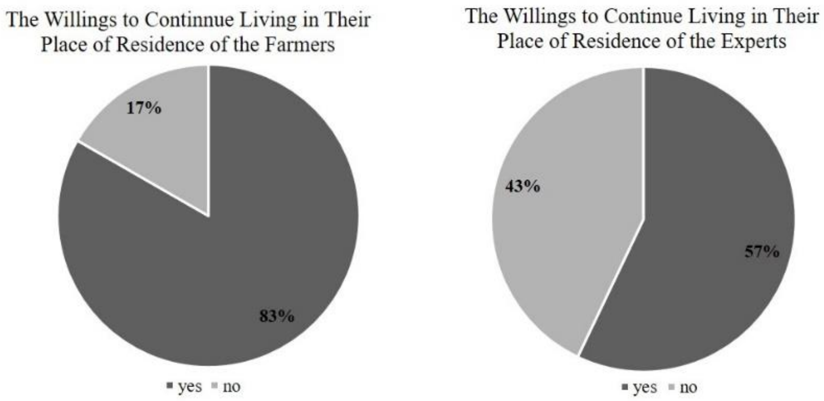


Figure 5.19. The willingness to continue living in their place of residence of the participants

The results showed that the rate of ownership (58.3%) was higher than the rate of tenancy (19.4%). The proximity between residential and agricultural lands was defined by farmers' perceptions in Figure 5.20a. While 43.1% of the farmers stated close proximity, 31.9% of them perceived it as middle proximity in Figure 5.20b. The findings supported some rural planning studies in terms of several perspectives such as transportation, sustainability of agricultural areas, and food security on macro-economic conditions. According to the results, even though approximately 75% of the farmers had close and middle proximity from their residential areas to agricultural areas, it was remarkable that the rate of vehicle use is high in/ outside of villages (see details on transportation vehicles in/outside of the villages in Figure 5.37). On the other hand, the ownership is a significant determinant of adaptation and mitigation actions due to the sense of belonging. There is an inverse proportion between belonging and migration. Thus, the results should be considered as a remarkable advantage at macro economy in terms of food security and agricultural sustainability.

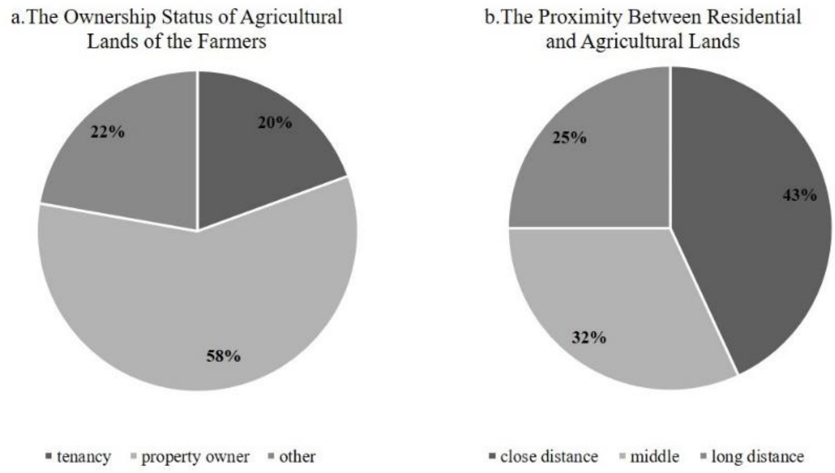


Figure 5.20. The ownership status (a) and the proximity between residential and agricultural lands (b) for farmers

General Information about Climate Change of the Participants

This part focused on general information about climate change based on the participants' perceptions, observations, methods, suggestions, and risks. These findings were associated with the adaptation of perceived climate change, so they were assessed via statistical methods. The results showed how the participants observed extreme climatic events, and their methods and expectations were investigated. The results were based on how the participants understand environmental, social, economic and political contexts in long and short terms. The questionnaires consisted of structured responses and 'other' options. Even though the structured responses focused on data, the other options were also crucial in order to access the participants' grounded knowledge based on experiences life. These methods were used for many questions.

The understanding of participants' perceptions of climate change is fundamental to adapt to climate events. The results indicated high-level perspectives influenced by communication systems such as media, social media, family/neighbor relation, and public organization. As displayed in this radar chart, the farmers focused on global warming (40.3 %), unexpected change in weather (22.4%), depletion of the ozone layer (20.8%). On the other hand, while 53.6% of the experts emphasized global warming, 32.1% and 28.6% of them mentioned the increase in greenhouse effects and CO_2 emissions. 22.4% of the farmers defined under 'other' as unexpected change weather (Figure 5.21). The results indicated that farmers' and experts' perceptions depend on their observations in the past. Especially, the differences in the temperature and rainfall patterns affected the growth of plants; therefore, these differences were related to farmers' perceptions. The following tables show the responses of the participants two the question of how much they know on climate change process.

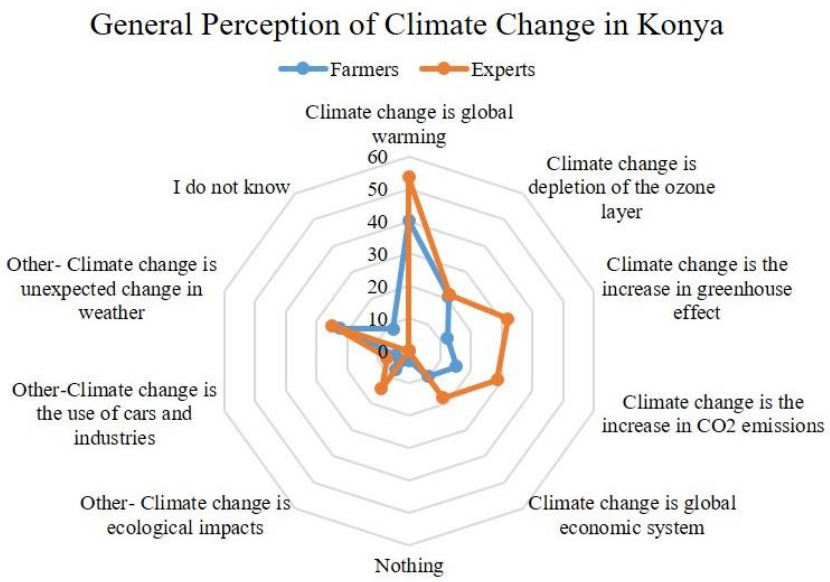


Figure 5.21. General perception of climate change by participants

Regarding the importance of farmers' and experts' perceptions, the components of the climate change were categorized into five groups: the existing reasons of climate change, the future impacts of climate change, climate change adaptation process, action plans and intervention tools or methods and nothing. As demonstrated in Figures 5.22a and 5.22b, while the majority of the farmers (59.7%) highlighted 'nothing', 78,6% of the experts pointed out 'the existing reasons of climate change'. As a result, it was a key finding that most participants could not express their information on adaptations, actions plans and intervention methods of climate change. Also, even though they perceived the impacts on climate change, they could not define the process. The results showed that the participants' information was insufficient in order to deal with the impacts on climate change. Consequently, there was a discrepancy between their perceptions and the process of climate change. Therefore, it is notable that education and planning are required in order to prevent the negative impacts of climate change.

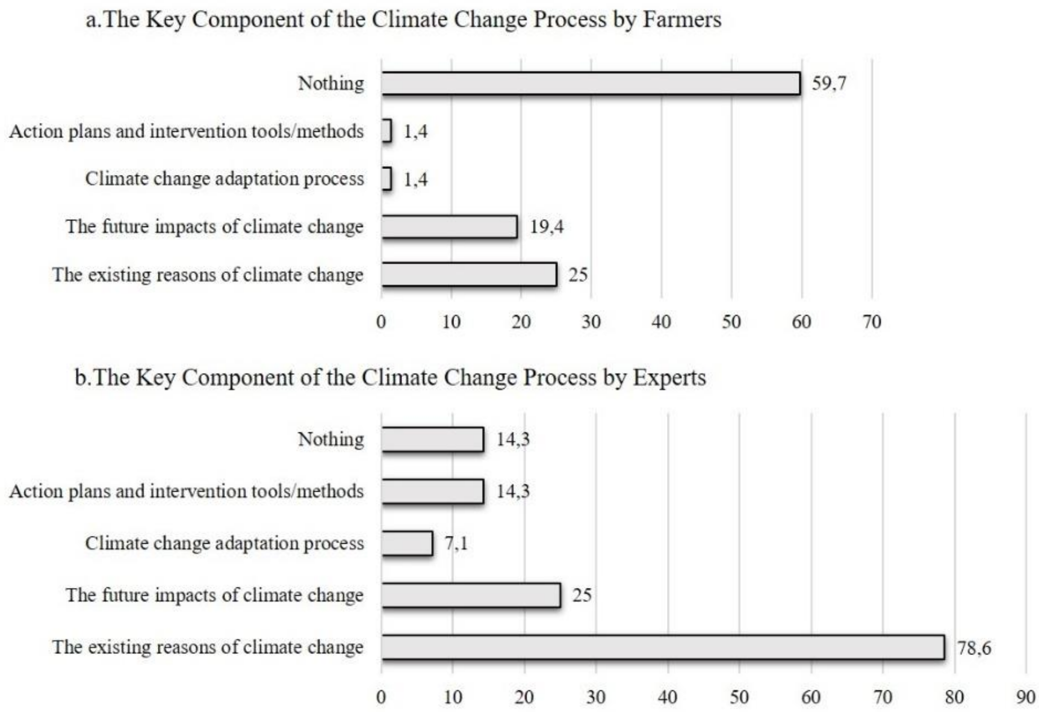


Figure 5.22. The key component of the climate change process by farmers(a) and experts(b)

In the study, the level of climate change was statistically important in terms of agricultural sustainability and lack of water in Konya. As seen in Figure 5.23a, while 47.2% of farmers stated medium level of climate change, 51.4% of them emphasized high level. Compared with the farmers, the responses of the experts were similar in terms of medium level (53.6%) and high level (42.9%) (Figure 5.23b). Severity of drought and water depletion were perceived as the most important problems, so the participants stated them as high and middle level of climate change in Konya. It can be concluded that the public support and collaboration with all stakeholders are some mandatory actions to solve this problem.

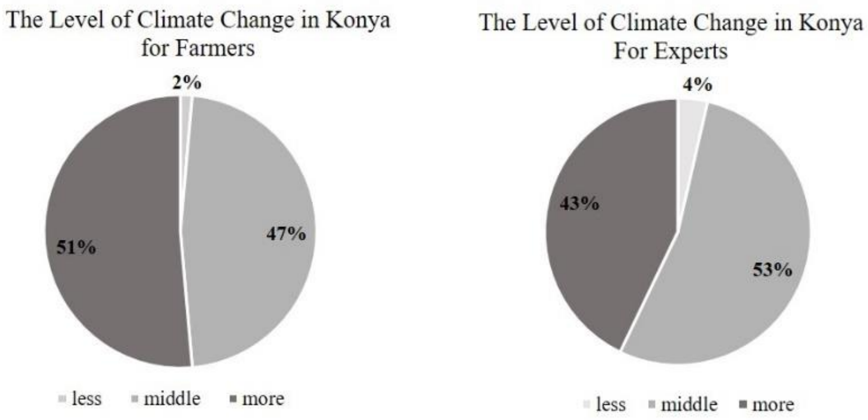


Figure 5.23. The level of climate change for farmers (a) and experts (b)

The results proceeded with an analysis of participants' observations about climate change. The observations of farmers on climate change were in line with the climatic variables. As shown in Figure 5.24, while 62.5% of the farmers observed an increase in annual temperature, 33.6% of them highlighted unexpected change in weather. On the other hand, while 43% of the experts observed as seasonal shift, 39.3% of them emphasized an increase in annual temperatures. There was a consensus in the increase in annual temperatures; however, the seasonal shift and unexpected change weather were defined under 'other' option, and there was a differentiation between farmers' and experts' views. These observations were associated with environmental, socio-economic perspectives such as drought, water depletion, and the decrease in crop productivity. Thus, both farmers and experts presented individual and social experiences in order to reduce the impacts of climate change (see detail on individual and social experiences on climate change in Figure 5.29 and 5.30).

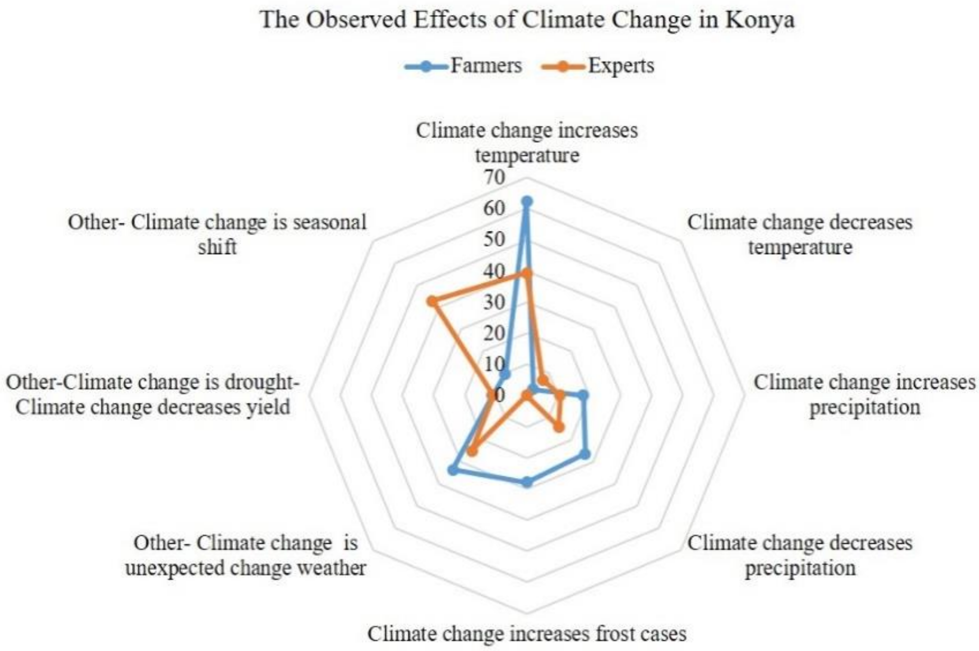


Figure 5.24. The observed effects of climate change of participants in Konya

Despite the climatic events from past to present, the human impacts on climatic conditions have been vital in recent years. According to the graph, in Figure 5.25, displayed that while 61.1 % of the farmers referred to high level of human impacts, 89.3 % of the experts focused on the same level. Climate change-related events were mostly linked to human impacts. Despite its importance, the farmers did not relate them to high level. For instance, as seen in Figure 5.37, the survey found that the majority of the farmers use their cars (81.9% of them in the villages and 94.4% of them outside the villages). They also used motorcycle, minibus, bus, bicycle and tractor but their percentage level was rather low. The results also showed that there was a discrepancy between the participants' behavior and their perceptions.

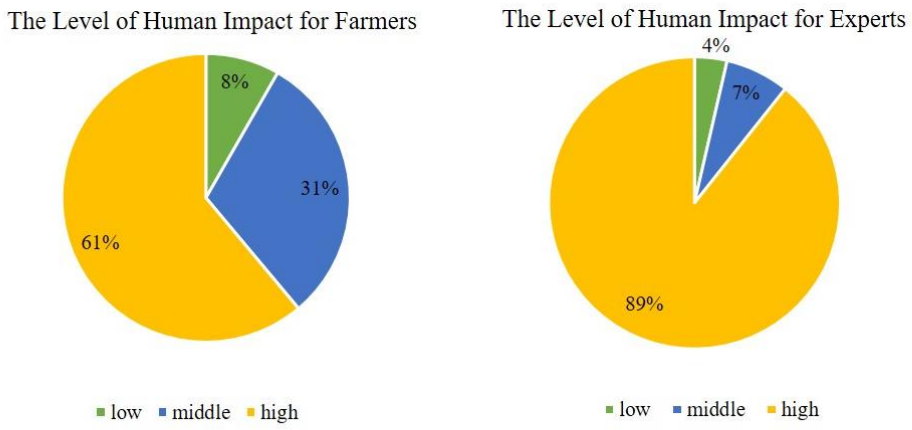


Figure 5.25. The level of human impact in climate change for farmers and experts

According to farmers' observations (51 participants) and experts' observations (28 participants), the human impacts on climate change differed from each other as per this open ended question (Figure 5.26). Even though 25.2 % of the farmers focused on usage of water, 25.1 % of the experts highlighted unawareness and inadequate reforestation-destroying nature, respectively. Also, of the farmers, 14% and 11.1% underlined similarly inadequate reforestation-destroying nature and unawareness. The results presented that the greater the unnecessary usage of water, the greater the environmental and socio-economic problems. On the other hand, like 9.8% of the farmers, 7.2% of the experts stated impacts of urbanization-population growth. Also, 8.4% of the farmers emphasized usage of extreme electricity and vehicles while 18% of the experts underlined similar actions. The human impacts had the most negative influence on adaptation and mitigation decisions against climate change. All these impacts might bring about adverse environmental and socio-economic consequences such as drought, decreased income, decreased crop yields; thus, an integrated planning focuses on all of these variables.

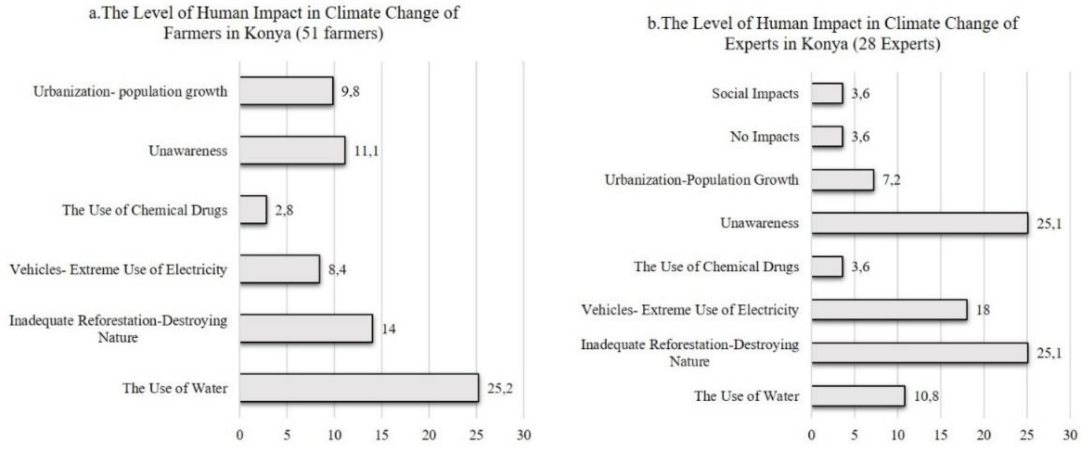


Figure 5.26. The level of human impact in climate change of 51 farmers and 28 experts

According to the findings pertaining to participants, it can be said that there was an intimate connection between climate change and the concern level of participants (Figure 5.27). While 59.7% of the farmers mentioned ‘I am concerned highly, I think it is too late for everything’, 31.9% of them stated ‘I am concerned, but new methods can be developed’. Similarly, while 35.7 % of the experts emphasized ‘I am concerned highly, I think it is too late for everything’, 32.1 % of them underlined ‘I am concerned, but new methods can be developed’. Also, of the experts, 21.4% emphasized ‘I am concerned lowly because future generation could be improved solutions’. Farmers were worried about climate change for future generations since going to face economic distress. On the other hand, the experts supported new methods and solutions to reduce negative impacts of climate change. Based on this debate, increase in awareness and education may be more affective in order to deal with their concerns.

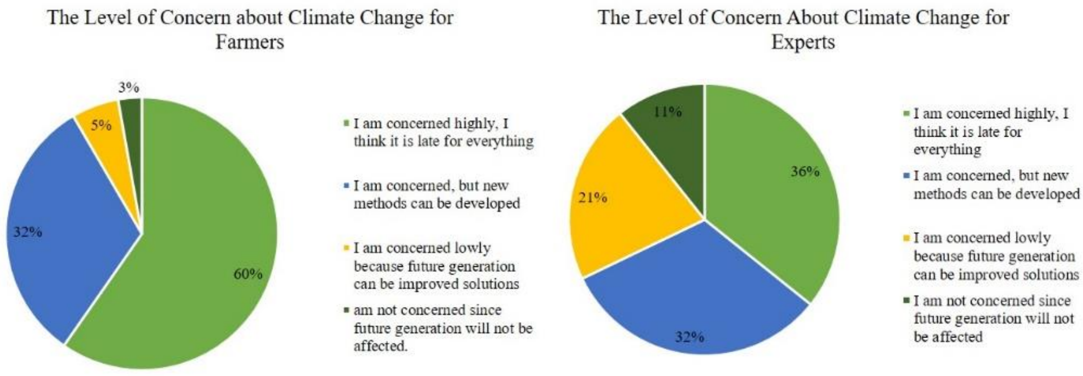


Figure 5.27. The level of concern about climate change for future of farmers and experts

This study investigated farmers' and experts' estimations about risks based on climate change in Konya. The questions consisted of fifteen options and 'other' option where the participants could write own ideas. The findings concerning these risks are characterized according to five different zones in order to show the differences in Chapter 5.2.3.2. Because of these perceived risks based on climate change, participants focused on unavoidable consequences related to natural disaster in their zones. As seen in Table 5.3, the most fundamental risk was water depletion for both farmers (76.5%) and experts (64.3%). Therefore, water management is still a central issue to be solved. As well as water depletion, farmers will suffer from desertification (51.4%), water wars (48.6%) and famine (47.2%) in the future. On the other hand, while 42.9% of the experts focused on desertification, 28.6% of them underlined biodiversity reduction, the decrease in food production and famine, respectively. The natural disasters with major risks are related to each other. For instance, there is a strong linkage among water depletion, water wars, pothole formation and migration in terms of environmental, socio-economic and political perspectives. The last but not least, 9.8% of the farmers and 10.8% of the experts attached new option: 'changed of plant pattern and decreased crop yield'.

Table 5.3. *The risks based on climate change for participants in Konya*

The Risks Based on Climate Change in Konya		
	Farmers(72)	**Experts(28)**
Desertification	51,4	42,9
Famine	47,2	28,6
Water Depletion	76,5	64,3
Biodiversity reduction	15,3	28,6
Air pollution	25	14,3
Land pollution	26,4	21,4
Water pollution	26,4	14,3
Food wars	43,1	3,6
Water wars	48,6	21,4
Increased acid rains	13,9	0
Decreased in food production	45,8	28,6
Migration	26,4	21,4
Epidemic Diseases	38,9	14,3
Pothole Formation	27,8	25
Sandstorm	6,9	17,9
Other-Change of plant pattern, decreased crop yield	9,8	10,8
Other-Natural disaster(reduced groundwater)	1,4	0
Other-Reduced income	0	7,2

As far as the participants' methods based on climate change in the future concerned, the methods against impacts of climate change have been found to be a fundamental determinant. This question examined the participants' suggestions in terms of increasing adaptations against climate change (Figure 5.28). Thus, this question consisted of five option: 'I do not believe in climate change', 'population growth should be balanced', 'new technological developments should be increased', 'renewable energy sources should be increased' and 'other'. The 'other', where the participants could be write own ideas, was rather significant option. The survey revealed that while 50% and 38.9% of the farmers suggested an increase of the renewable energy sources and new technological developments, 53.6% and 28.6% of the experts suggested similarly increased of the renewable energy sources and new technological developments, respectively. The suggestions under 'other' options varied, and 'other' options consisted of 'awareness should be risen', 'administrative collaboration should be strengthened', 'product pattern plan should be prepared', 'usage of energy should be decreased', 'nature conservation should be strengthened' and 'usage of chemical drugs should be decreased'. 8.4% of the farmers and 7.2% of the experts argued that the product pattern plan should be prepared on order to increasing in crop yields and income, decreasing in concerns for future. Along with these, 4.2% of the farmers and 10.8% of the experts suggested a better administrative collaboration among public organizations and institutions, university, industry, NGO and farmers. The results displayed that significant inferences of participants were adaptation actions, education, natural conservation and public collaboration in accordance with the results. An integrated policy planning is necessary for urban and rural areas because these suggestions consist of environmental, socio-economic adaptation and mitigation strategies against climate change.

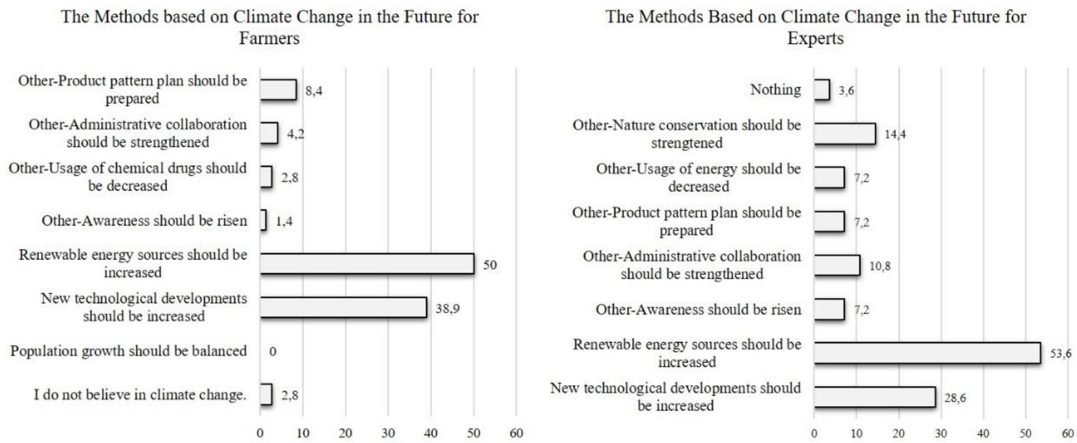


Figure 5.28. The methods based on climate change in the future for farmers and experts

As the participants understood events related to climate change, they developed new solutions. Although farmers understand the climatic impacts, they depend on the conditions in the process due to lack of knowledge, agricultural policies and economic impacts. This part emphasized participants' individual and institutional experiences in order to reduce impacts of climate change (Figure 5.29). Firstly, while 52.8% of the farmers changed the irrigation systems under the influence of the decision-makers, 38.9% of them consulted the experts in order to the increased the income and crop yields. Along with changing of irrigation systems and consulting experts, 36.1% of the farmers changed their product pattern/crop diversification on agricultural lands. Secondly, while 32.1% of the experts stated that reforestation was the key action in order to reduce ongoing impacts on natural areas, 25% of them improved good agricultural practices on agricultural lands. According to the responses, the experts emphasized spatial intervention on natural areas. Also, the institutional experiences involved consulting experts (% 17.9) and changing the irrigation systems (% 17.9). As a result, while the most common adaptation of farmers' individual strategies was irrigation, product pattern/crop diversification, and experts' opinions, experts' strategies varied from institutional efforts as reforestation, good agricultural practices, consulting experts to the changed the irrigation systems. According to these results, participants' responses was related to each other. As their decisions such as irrigation, crop diversity, agricultural practices varied, farmers' practices changed on agricultural lands. These results displayed that public support and information about climate change can influence farmers' and experts' adaptations. For example, using recyclable products, disposal of waste, and chemical fertilizers were related to each other, so an integrated policy planning consists of environmental, socio-economic and policy perspectives as a whole.

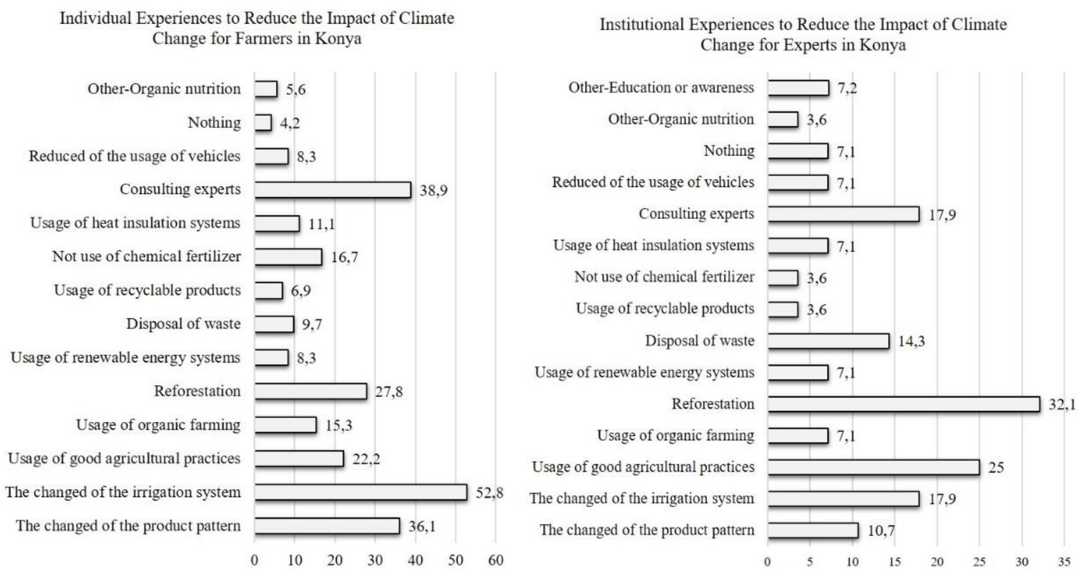


Figure 5.29. Individual and institutional experiences to reduce the impact of climate change in Konya

The study focused on farmers' cooperation in order to reduce the impacts of climate change (Figure 5.30). These options addressed livelihood and environmental issues.

According to the farmers, preparation of annual reports and informative programs, increasing cooperation among institutions, and developing the modern irrigation systems were emphasized by 54.2%, 50% and 47.2%, respectively. Moreover, the farmers suggested some requirements such as reforestation (14%), education (11.2%), product pattern systems (8.4%). Based on the responses, the policy support is obligatory in order to reduce the negative impacts of climate change.

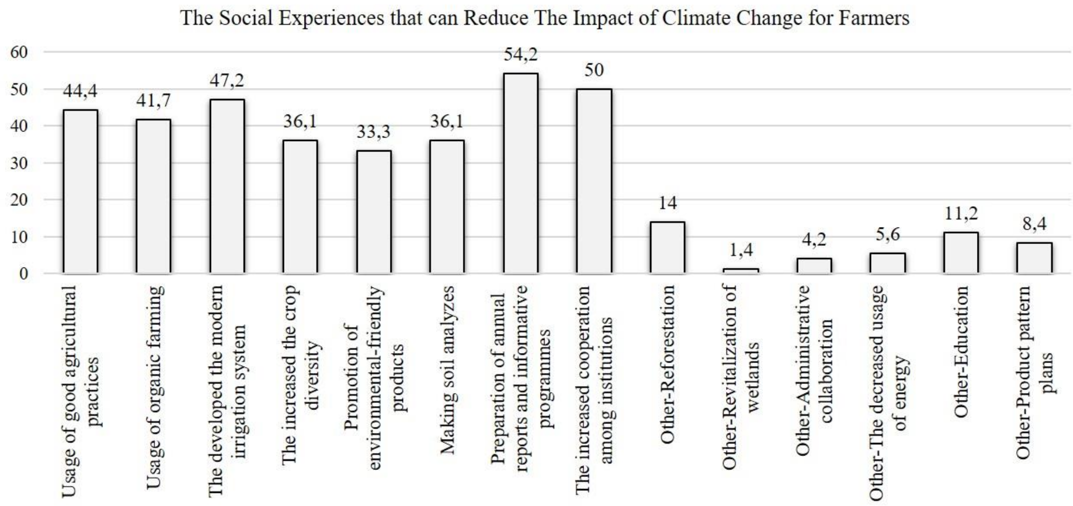


Figure 5.30. The social efforts that can reduce the impact of climate change for farmers

Like farmers, experts play a crucial role in order to lessen the negative impacts of climate-related events. Due to its importance, a part of this section examines experts' views on international, national, local activities as a whole. First of all, a significant part of experts stated that there was not in-depth information about international reports related to climate change. 25.2% of the experts had information about United Nations Development Programme (UNDP), Food and Agricultural Organization of the United Nations (FAO), Kyoto Protocol and a variety of action plans. Furthermore, 10.8% of them had knowledge thanks to their individual education. Secondly, 57.6% of them stated that they had knowledge on national activities. The experts' responses focused on the action plan, modern irrigation systems, erosion, agricultural practices, education programs and energy in national activities. Last but not least, 75% of them pointed out that there were a variety of activities such as determining product pattern systems (25.2%), reforestation (17.9%), awareness (18%), and recycling (7.2%) on a local scale. Despite the importance of point mentioned, most of them stated financial and technical incapability. Experts put forward several estimations about the results of climate change. The important results included damage in plant production or a decreased in crop yields, a declined in crop diversity, changes in product pattern, economic damage, and drought (Figure 5.31). Based on the responses, approximately 37% of the experts stated that the productivity of crops reduced. Furthermore, 28.8% of the experts claimed that economic damage would rise on agricultural lands in Konya. According to 14.4% of the experts, drought is another prediction. There was a consensus that as negative impacts of climate change increase on agricultural lands, economic conditions would be adversely affected due to climate change. These problems can be interpreted as regards food security on macro-economy levels.

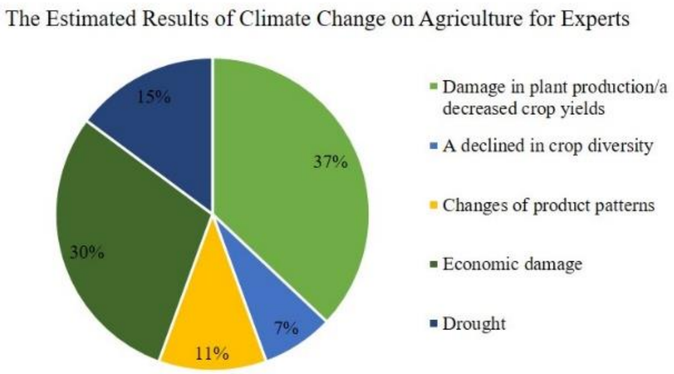


Figure 5.31. The estimated results of climate change on agriculture for experts (27 experts)

In addition to these, almost half of the experts (57.5%) stated that education and awareness are key factors in order to mitigate the adverse impacts of climate change on agricultural lands. Afterwards, the experts focused on an afforestation (17.9%), administrative relations (10.8%), and irrigation and excessive water consuming plants (7.2%), respectively. Considering these responses, environmental activities play a vital role in order to reduce climate change-related events. This study showed that progressive methods suggested by experts in order to increase the participants' awareness. The methods consisted of environmental, socio-economic and policy perspectives. 64.6% of the experts focused on awareness and education. In addition, 14.4% of them stated that administrative collaborations had significance, and 10.8% of them emphasized the importance of modern irrigation systems (Figure 5.32).

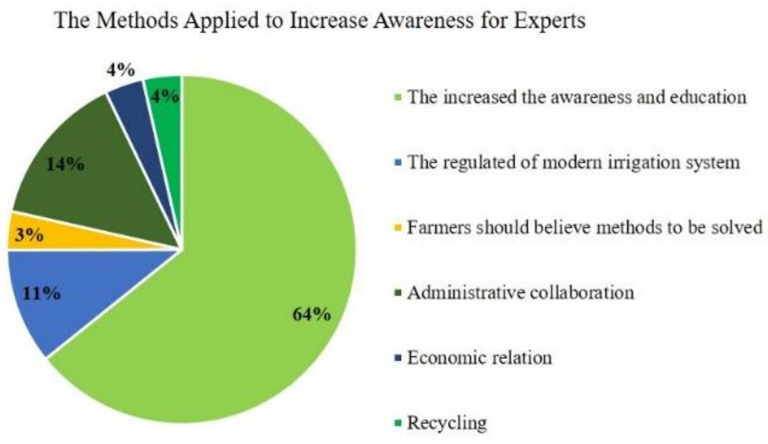


Figure 5.32. The methods applied to increase awareness for the experts

The experts' suggested methods had statistically positive outcomes on socio-spatial planning. For instance, if households' awareness increased on events related to climate change, the use of underground water would decrease. Besides, these methods could contribute to mitigation and adaptation regarding the impacts of climate change on agricultural land; thus, the positive effects on food security could be strengthened thanks to these methods. Education and awareness could be fortified thanks to an integrated plan.

According to the findings pertaining to participants' views, 50% of the farmers and experts stated that the resilience level was lower in order to deal with the negative impacts of climate change in Konya (Figure 5.33). Based on their responses, majority of participants mentioned that the negative impacts of climate change would increase in the future. In order to deal with these negative impacts, various communication systems could help to increase participants' awareness. The results showed that of the farmers, 72.2%, 37.5%, and 19.4% learned knowledge about climate change via media (TV/radio), social media/internet and neighbor/family. These communication systems could help to extend climate change' awareness; therefore, the systems could affect adaptation and mitigation strategies in the future.

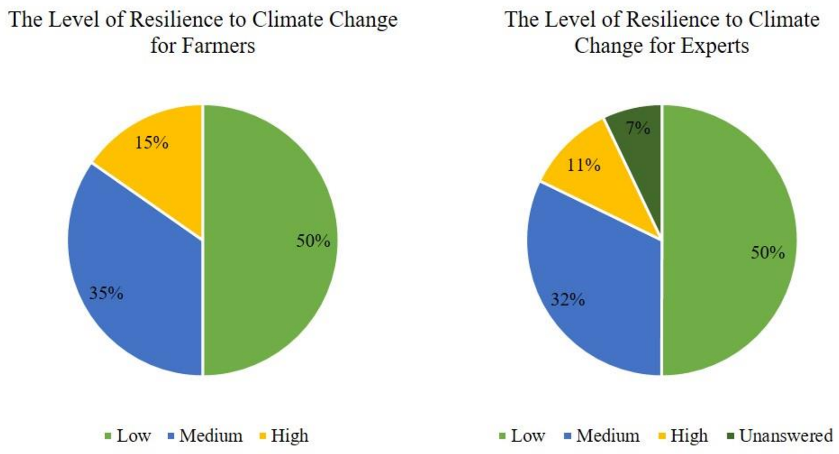


Figure 5.33. The level of resilience to climate change for farmers and experts

The results (Figure 5.34) displayed that farmers (88.9%) and experts (75%) believed in the economic risks of climate change to high extent. Based on the responses, it can be said that farmers were more worried than experts. Crop quality and yields were directly related to weather conditions; thus, these agricultural changes could affect farmers' incomes. The majority of the participants had concerns due to basic livelihood conditions.

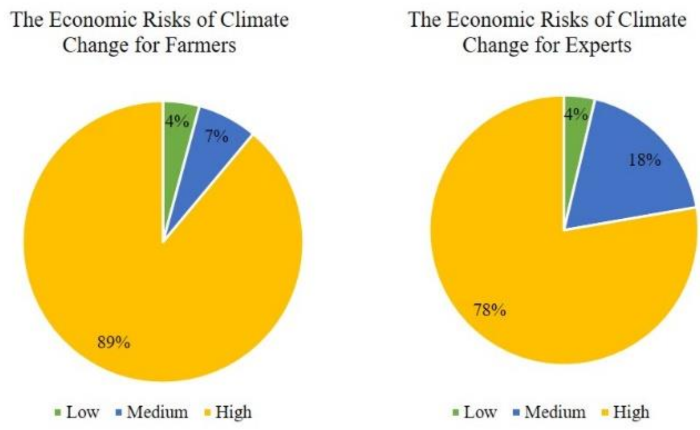


Figure 5.34. The economic risks of climate change for farmers and experts (27 experts)

The results (Figure 5.35) indicated that how the food production and marketing will affect in Konya if the mitigation and adaptation actions did not occur on agricultural lands. While 29.2% of the farmers underlined high impacts of climate change, 42.9%

of the experts stated similar level in Konya. Based on the responses, food production and marketing could be affected from unavoidable results of climate change. However, the participants did not concentrate on just only response. Thus, there was not common idea about the impacts of climate change on food production and marketing in Konya.

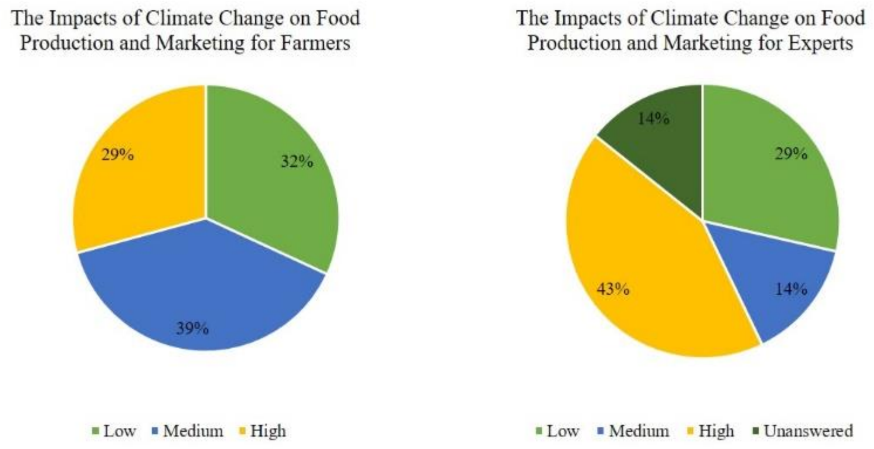


Figure 5.35. The impacts of climate change on food production and marketing for the farmers and experts

With regards to the agricultural lands, various facilities are necessary in order to enable to socio-economic advantages in villages. As seen in Figure 5.36, the farmers' requirements focused on two fundamental facilities in villages: market areas (62.5%) and socio-cultural facilities (61.1%). There was an enormous similarity between estimated risks and insufficient facilities in villages. As mentioned in the previous assessments, the farmers focused on insufficient education and economic risks. The farmers' concerns were associated with lack of facilities. Moreover, farmers consider that their opportunities were insufficient in order to market their products and access to educational programs, and these problems were associated with lack of facilities in terms of spatial perspectives in the villages. As a result, as these facilities increase thanks to an integrated planning in the villages, their adaptation capacity can increase against the impacts of climate change.

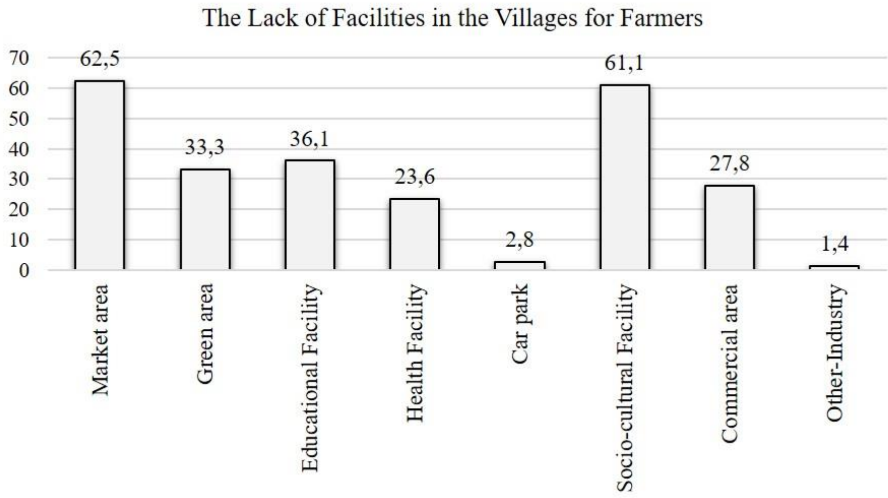


Figure 5.36. The lack of facilities in their villages for farmers

As mentioned the many studies, transportation related to the usage of fossil fuels are directly related to impacts of climate change. Thus, this section of questionnaires examined what kind of transportation vehicles were used by farmers in and outside the villages (Figure 5.37). The findings displayed that while 81.9% of the farmers used their cars in the villages, 94.4% of them used their cars outside the village. On the other hand, even though 61.1% of the farmers stated high level of human impacts (Figure 5.25), they did not appear aware of the relationship between the usage of cars and the negative impacts of climate change. In addition to these, even though 43.1% of the farmers stated that the distance between farmers' residential areas and agricultural lands were rather close (Figure 5.20), it was quite obvious that the usage of cars was higher than the usage of bicycle in the villages. Farmers did not aware of the importance of their' behaviors on climate change.

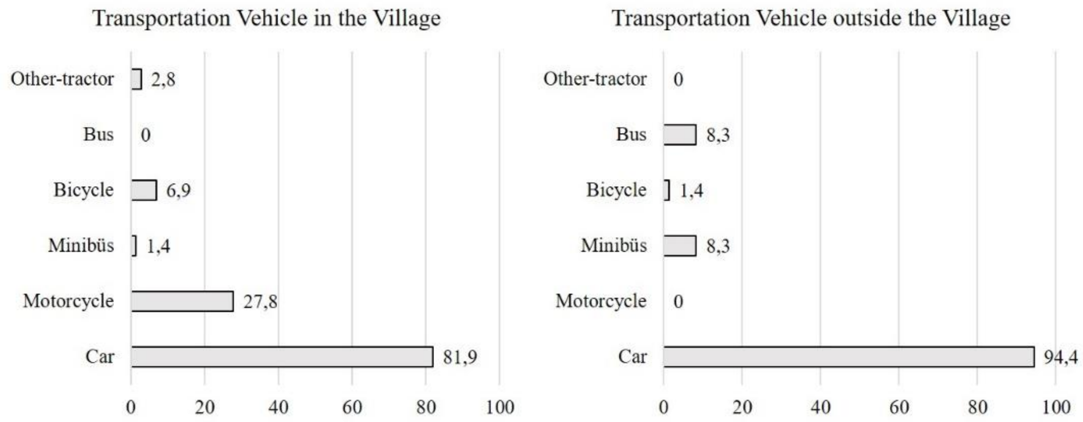


Figure 5.37. Transportation vehicles in/outside the village for farmers

As seen in Figure 5.38, this open-ended question was responded by approximately 65% of farmers. While 22.4% of the farmers agreed that seasonal change occurred in present, 14% of them suggested the necessary of planning, crop diversity and product pattern change. On the other hand, the farmers drew attention to weather abrupt change (9.8%) and drop of crop yields (8.4%). Along with, only a few farmers stated the decreased of underground water, usage of vehicles, and unawareness. When asked issues about climate change, farmers focused on their observations on weather conditions and their suggestions on agricultural policy. They were not really aware of the reasons of climate change, so discrepancies occurred between their implementations such as the usage of vehicles and their observations on climate-related events. Another climatic issues focused on economic risks on agricultural sectors such as the drop of crop yields. Therefore, an integrated planning may be fortified adaptation strategies against climate change in terms of environmental and socio-economic perspectives.

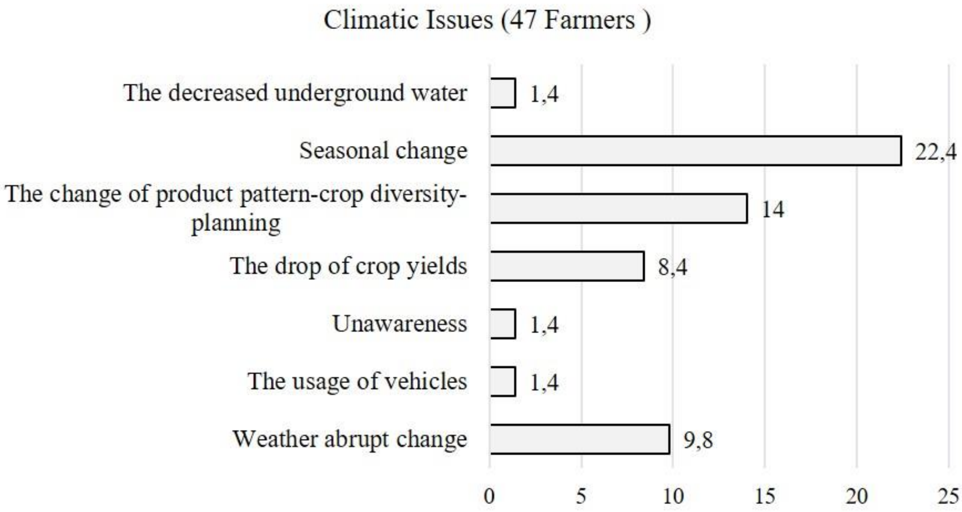


Figure 5.38. Climatic issues for farmers

This question consisted of eight options: public institutions and organizations, local governments, media, university, NGOs, private sector, neighborhood representative, and other. It determined stakeholders' importance of administrative network in order to deal with the negative impacts of climate change. According to the findings pertaining to participants' suggestions, it can be said that while farmers focused on the importance of public institutions and organizations (72.2%) and university (48.6%), the experts emphasized strong administrative collaboration as a whole (Figure 5.39 and 5.40). For experts, although public institutions and organizations (89.3%) were higher level, there was similar percentages among local government (57.1%), media (53.6%), university (53.6%) and NGOs (50%). As a result, there is a necessary of better communication between stakeholders and farmers. Moreover, strong social network is necessary components to adapt to climate-related events.

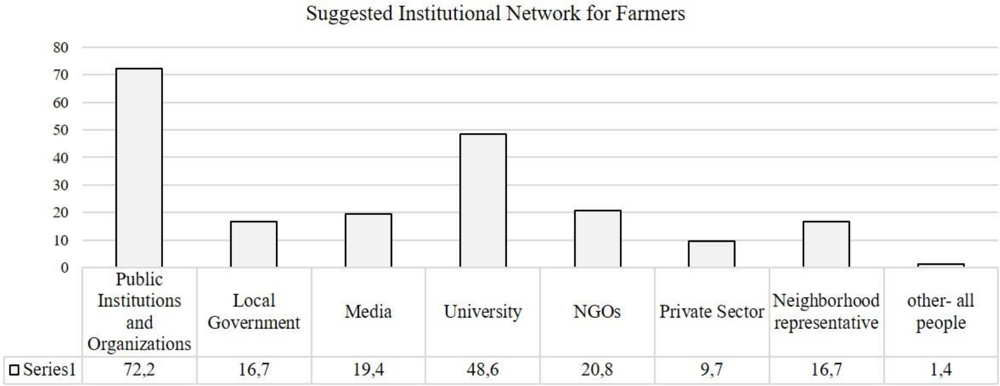


Figure 5.39. Suggested institutional network for farmers

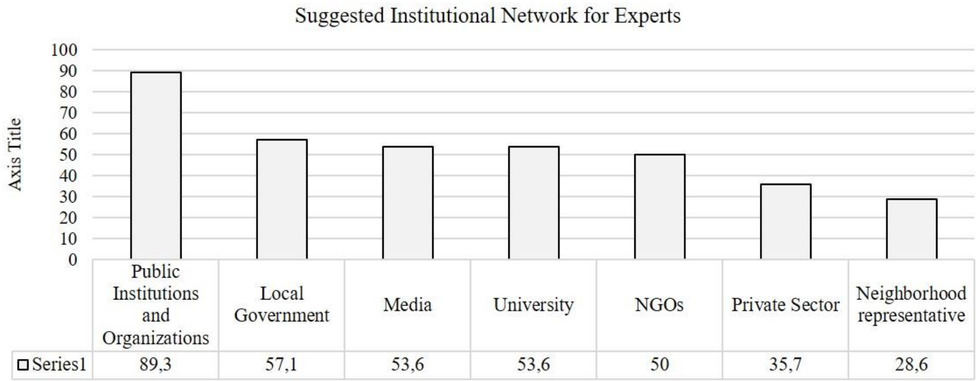


Figure 5.40. Suggested institutional network for experts

As seen in Figure 5.41, the question focused on farmers' mitigation and adaptation actions in rural areas. According to the farmers, 59.7% stated that the protection and productivity of water resources should be increased in terms of environmental sustainability. Furthermore, 51.4% and 45.8% of them claimed the importance product patterns plan and renewable energy resources in terms of socio-economic sustainability. In addition to these, 48.6% of the farmers suggested education and information programs. However, only 27.8% of the farmers focused on disaster risk management in rural areas in terms of planning perspectives. The results showed that the farmers did not believe disaster risk management as an indicator of adaptations in climate-related events. There is an interesting gap between farmers and experts in terms of planning and implementations.

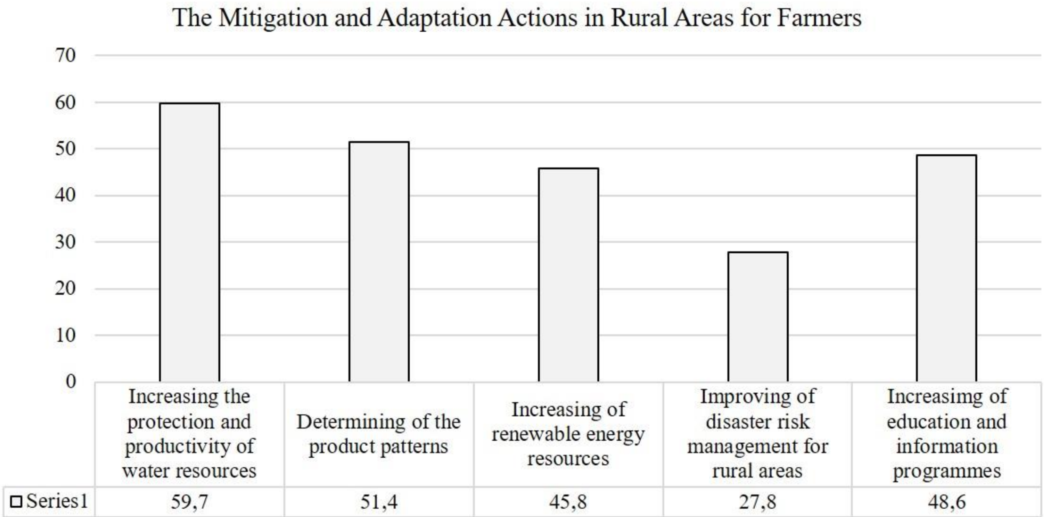


Figure 5.41. The mitigation and adaptation actions in rural areas for the farmers

The Relationship Between Climate Change and Planning

This section of the questionnaire examines how these actions will contribute to rural development if the mitigation or adaptation actions occur on agricultural lands. This question focused on three fundamental levels: low, medium, high impacts (Figure 5.42). The results displayed that, even though farmers and experts stated similar estimations, they produced different options. First of all, there was consensus that the outcomes of mitigation actions of climate change as regard urban sprawl, urban-rural migration and food dependency were lower. Of the farmers, 43.1%, 23.6% and 19.4% of the farmers stated urban sprawl, urban-rural migration and food dependency. Experts highlighted similar actions: urban sprawl (53.6%), food dependency (35.7%), urban-rural migration (28.6%) and employment (28.6%). Not only farmers but also experts highlighted that these actions were not merely associated with impacts of climate change. In contrast, participants believed that these actions were affected by environmental, social, economic and political conditions. Secondly, farmers and experts related climate change to reduced poverty, urban-rural migration and environmental pollution to a medium extent. Farmers related it to reduced poverty

(48.6%), urban-rural migration (45.8%) and environmental pollution (40.3%); experts agreed with them in similar percentages: reduced poverty (50%), urban-rural migration (25%) and environmental pollution (32.1%) and food dependency (32.1%). Last but not least, although farmers and experts were related mitigation actions to increased production and reduced drought, they thought differently in terms of environmental and socio-economic conditions. While 68.1% and 59.6 % of the farmers associated mitigation actions with increased production and reduced drought, 78.6% and 71.4% of the experts related them to the similar actions. However, whereas farmers believed that mitigation actions increase employment (55.6%), experts believed that they reduce environmental pollution (67.9%). These results showed that while experts stressed adaptation actions of climate change in terms of environmental context, the farmers emphasized socio-economic acquisitions with mitigation actions.

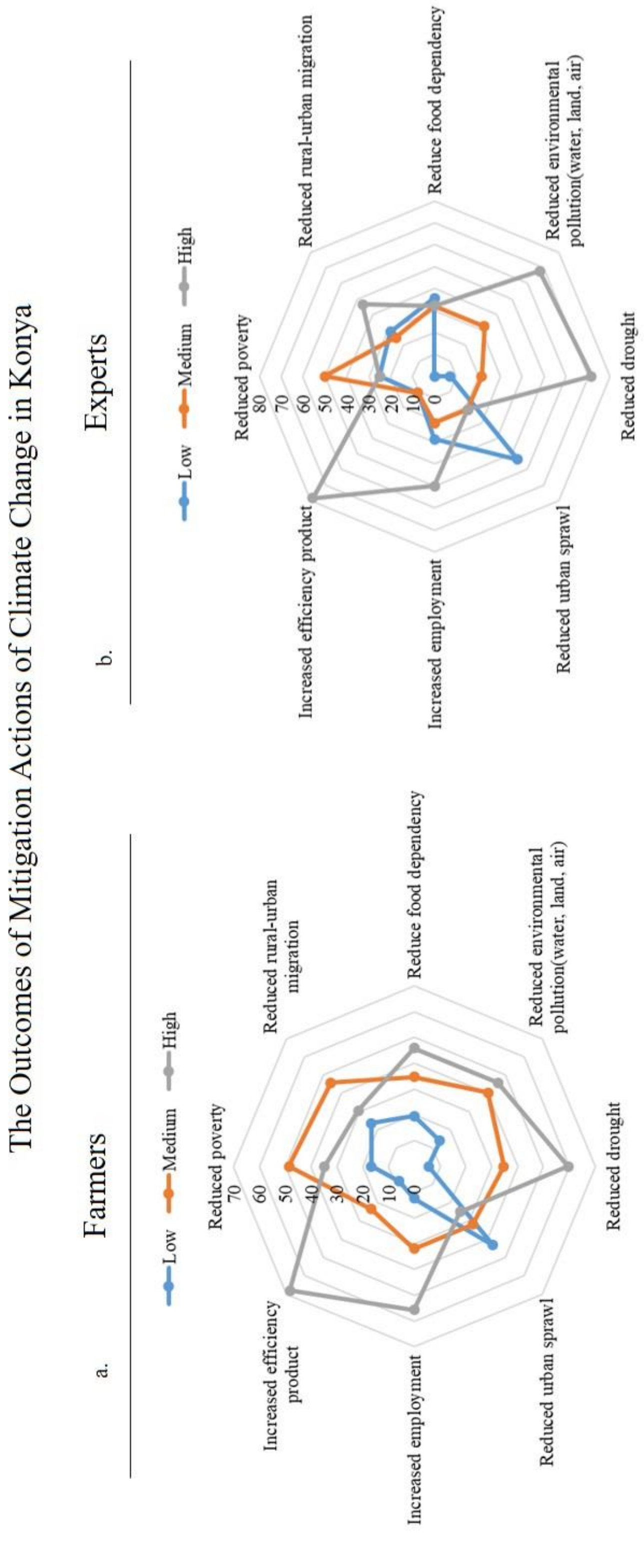


Figure 5.42. The outcomes of mitigation actions for farmers(a) and experts(b) in Konya

This analysis of the farmers' methods revealed three levels for adaptation related to climate change. These methods were employed to adapt to climatic risks in agricultural lands of different districts. The findings concerning these methods were examined according to five zones in Chapter 5.2.3.2. First of all, as displayed in Figure 5.43, the farmers who used land consolidation (44.4%), public transportation system (43.1%) and organic farming (30.6%) believed that their impacts were low. Like farmers, the experts attached low ranking to land consolidation (25%), public transportation system (32.1%) and organic farming (32.1%). Secondly, 40.3%, 36.1% and 33.3% of the farmers ranked fertilization system, good agricultural practices, waste generation and public transportation system at medium level. Similarly, the experts ranked land consolidation (50%), organic farming (39.3%), fertilization system and waste generation (32.1%) at medium level. At high level, whereas 56.9% and 55.6% of the farmers highlighted good agricultural practices and fertilization systems, 64.3% and 60.7% of the experts focused on good agricultural practices and fertilization system, respectively. These results showed that experts and most commonly farmers believed in the effectiveness of these methods to medium extent. However, there was differentiation between farmers and experts in terms of being informed about the crops and waste generations. While 73.6% of the farmers suggested that having detailed information about the crops would be a better methods of dealing with climate change, 57.1% of the experts stated regulated waste generation was one of the better methods. These results showed that the farmers' practices were highly related to their socio-economic conditions such as education; moreover, the experts associated environmental and policy conditions such as agricultural practices. As a result, the participants' suggestions are related to each other, and these methods should be systematized in the development process of adaptation planning.

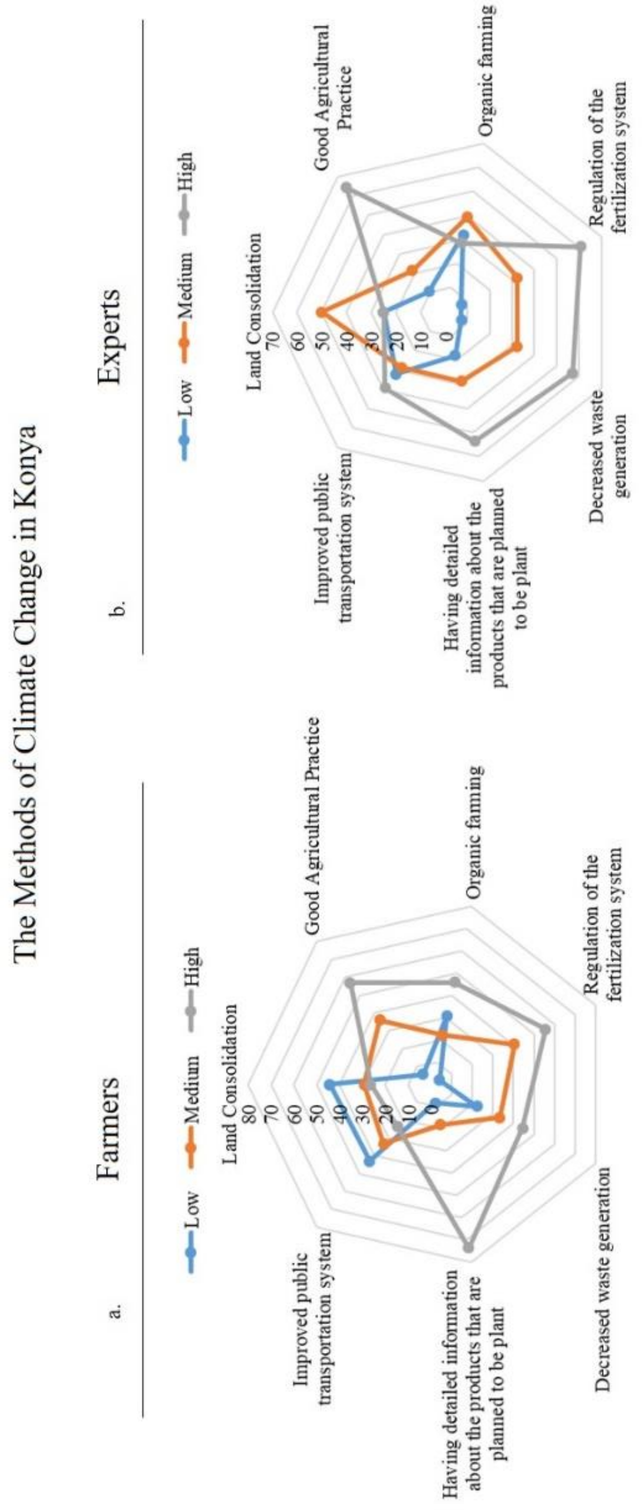


Figure 5.43. The methods of climate change for farmers(a) and experts(b) in Konya

Majority of people will likely suffer from the negative impacts of climate change in the future. As seen in Figure 5.44, the participants estimated similar consequences according to the impacts of climate change. Many participants worried about the results of climate change in the future; thus, they focused on three level: low, medium and high. The first three responses were related to each other. Of the farmers, 37.5% estimated that seasonal abrupt change would occur to a high extent, and 32.1% of the experts highlighted similar response at high level. Afterwards, 25% of farmers and 28.6% of the experts stressed that seasonal effects would be more severe at high level. Firstly, 29.2%, 16.7% and 15.3% of the farmers highlighted various options: 'agricultural areas, which will be fertile lands in the future, may be opened to development in the present', 'new technological developments enable to adaptations' and 'the negative impacts of climate change will reduce with planning and modern education' to a low extent. On the other hand, the experts mentioned similar options: 'agricultural areas, which will be fertile lands in the future, may be opened to development in the present' (25%), 'new technological developments enable to adaptations' (21.4%) and 'agriculture production will not be done in many areas' (17.9%) at low level. Secondly, the participants revealed various consequences about climate change at medium level. Of the farmers, 38.9%, 37.5% and 30.6% underlined that agricultural production would not be done in many areas, new technological developments would enable to adaptations, and agricultural areas, which would be fertile lands in the future, may be opened to development in the present. The experts also highlighted 'new technological developments enable to adaptations' (39.3%), 'the negative impacts of climate change will reduce with planning and education system' (28.6%) and 'agricultural areas, which will be fertile lands in the future, may be opened to development in the present' (21.4%) at medium extent. Last but not least, there are main similarity between farmers' and experts' responses at high level. While 75% and 70.8% of the farmers emphasized that product pattern plans would be needed and water crises among sectors would rise, 82.1% and 85.7% of the experts emphasized similar consequences to a high extent. 58.3% of the farmers highlighted 'negative impacts will reduce with planning and education system'. However, 60.7%

of the experts worried about 'agriculture production will not be done in many areas'. As a result, the results showed that water depletion would be one of the vital risks in the future. Along with water depletion, agricultural protected areas would be a better adaptation strategy against climate change in Konya (see Chapter 3.1.1). An integrated planning is fundamental solutions in order to deal with the impacts of climate change.

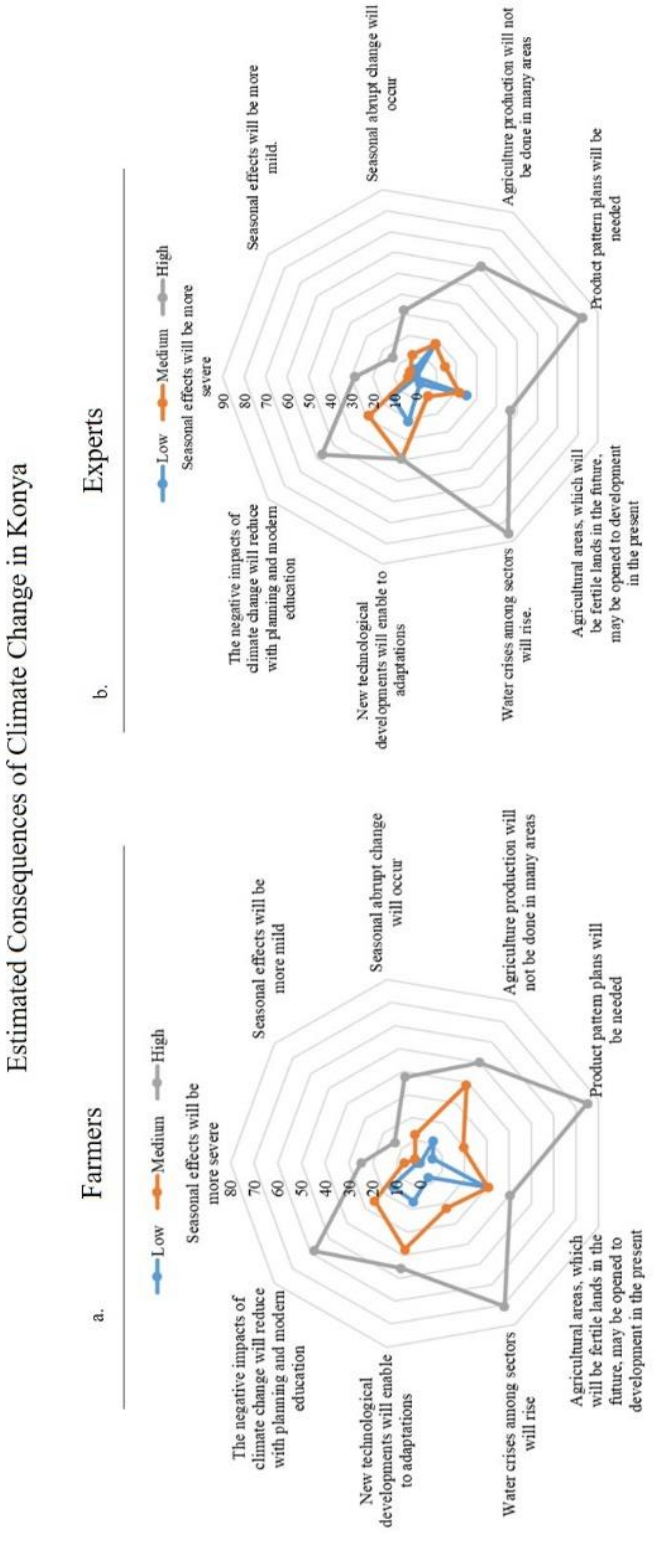


Figure 5.44. Estimated consequences of climate change for farmers(a) and experts(b) in Konya

As indicated in Table 5.4, even though farmers and experts underlined similar responses, they produced different options. According to the outcomes of mitigation actions of climate change, there was a consensus between experts and farmers in Konya. If the mitigation and adaptation actions occurred on agricultural lands, urban sprawl would affect at low extent, while the increase of production would affect at high level. Another issue was methods-related to climate change. For farmers, the lowest perceived methods were land consolidations according to agricultural practices. Experts stated organic farming to a low extent. However, the farmers suggested that having detailed information about the crops would deal with the negative impacts of climate change, and experts stated importance of good agricultural practices against the impacts of climate change. As a result, the participants' estimations on climate change are related to each other to a low extent. They underlined 'agricultural areas, which will be fertile lands in the future, may be opened to development in the present' at low level. However, there are a differentiation between farmers and experts to a high extent. Farmers estimated that that product pattern plans would be needed, and the experts underlined that water crises among sectors would rise at high level. Although both farmers and experts focus on similar issues, they highlight their fundamental problems. Farmers observed the impacts of climate change; however, they depend on short term process. Hence, the main subject of planning discipline is to solve the dilemma in short term and long term.

Table 5.4. *The participants' main focus among the outcomes of mitigation actions, methods and estimated consequences in future for planning in Konya*

		Low	Medium	High
Mitigation Actions	Farmers	Urban sprawl reduces (43.1%)	Poverty reduces (48.6%)	Production increases (68.1%)
	Experts	Urban sprawl reduces (53.6%)	Poverty reduces (50%)	Production increases (78.6%)
Methods	Farmers	Land Consolidation (44.4%)	Fertilization System (40.3%)	Detailed information about the crops (73.6%)
	Experts	Organic Farming/ Transport (32.1%)	Land Consolidation (50%)	Good agricultural practices (64.3%)
Estimated Consequences in Future	Farmers	Agricultural areas, which will be fertile lands in the future, may be opened to development in the present (29.2%)	Agriculture production will not be done in many areas (38.9%)	Product pattern plans will be needed (75%)
	Experts	Agricultural areas, which will be fertile lands in the future, may be opened to development in the present (25%)	New technological development will enable to adaptation (39.3%)	Water crises among sectors will rise (85.7%)

5.2.3.2. The Findings of Zones

Adapting to climate risks on agricultural lands is one of the vital strategies in order to increase food security. This study examined farmers' and experts' perceptions, methods and estimations. This study was conducted in eight sites in Konya; Akşehir, Doğanhisar, Hüyük, Çeltik, Yunak, Ereğli, Karapınar, Çumra and center of Konya. The selected sites were determined from data of KMM. Along with eight factors in KMMs' data, they represent various climatic variabilities in Konya, and high dependence on agricultural sectors. The study examined whether their observations, risks, adaptation actions, methods and estimated consequences were heterogeneous or not. The study included five zones. The five zones were chosen geographical similarity, the proximity of sites and zones' sizes. In the following in Figure 5.45, five zones were classified as Zone 1 (Akşehir, Doğanhisar and Hüyük), Zone 2 (Çeltik and Yunak), Zone 3 (Ereğli), Zone 4 (Karapınar), Zone 5 (Çumra). The participants' income varied in these zones: 4000-5000 TL (31%) in Zone 1, 4000-5000 TL (42%) in Zone 2, 1001-2000 TL (33%) in Zone 3, 3001-4000 TL (33%) in Zone 4, and 5000> TL (47%) and 1000-2000 TL (41%) in Zone 5.

Figure 5.45. Zones in Konya

Zone 1 was located near the mountainous areas in the east of Konya, and Zone 2 in partly mountainous area, and Zone 3, 4 and 5 located in plain areas. The sizes of all zones were formed approximately between 1900 km² and 3000 km² (Table 5.5).

Table 5.5. *The size of zones(Adapted from the reports of districts, 2014)*

	Zone 1	**Zone 2**	**Zone 3**	**Zone 4**	**Zone 5**
Total Size (km²)	1919,2 km²	2931,93 km²	2260 km²	2939,17 km²	2090,6 km²

*Note: The data are obtained from the reports of Akşehir, Doğanhisar, Hüyük, Çumra, Karapınar, Ereğli, Yunak, Çeltik

The aim of classification was to show common perspectives in different locations. In these zones, the participants' perceptions, methods and estimations were analyzed using qualitative method. The approach provides a way to rank adaptation strategies in different locations in Konya. Thus, the climatic variabilities in local areas were determinants of adaptation to climatic risks because these factors were inputs in order to create strategies in socio-spatial planning. More importantly, the participants' perceptions are associated with adaptation strategies in the future since the risks of climate change can decrease their adaptation strategies on the local scale. However, the adaptation strategies vary from urban areas to rural areas. Similarly, the strategies on villages vary on local scale. In this section, the study revealed not only significant positive and negative impacts of climate change on local scale, but also participants' observations, actions, methods and estimated consequences in each zones. In the following sections, the geographical information, agricultural information and the survey results were assessed in each zones.

Zone 1

This study was conducted in three districts: Akşehir, Doğanhisar and Hüyük the west of Konya. Zone 1 has different characteristics in terms of geography and climatic variables (rainfall). Especially, this zone includes various ponds and Akşehir Lake. Compared to Doğanhisar, Akşehir and Hüyük have generally higher amount of wetland. Moreover, a lot of cooperatives are located in the villages in Akşehir. However, compared to other zones, Zone 1 has higher average of certified organic agriculture (see 'The amount of wetland', 'Cooperatives', 'Certified Organic Agriculture' Chapter 5.2.1). This sections focus on three parts: geographical information, agricultural information, and the survey results. First of all, as seen in Figure 5.46, Akşehir is to the north of Isparta, the south of Tuzlukçu, the east of Afyonkarahisar and the west of Ilgın. The districts' total geographical area (except for the water resources) is 853 km². Akşehir is located on the foot of Sultan Mountains. Besides, it includes Akşehir Lake (The report of Akşehir District, 2014, p.2). According to TUİK dataset (2019b), its agricultural areas is 489272 decare in 2018. Another district is Doğanhisar. It is located in the north of Hüyük, the south of Akşehir, the west of Ilgın, and the east of Isparta. The districts' total geographical area is 516,8 km². In district, there are Doğanhisar, Koçaş, Çepişli, Karaçay and Karaağaç Streams, and Doğanhisar and Ayaslar ponds for irrigation (The report of Doğanhisar District, 2014, p.2). As well as the geographical areas, its agricultural area is 164725 decare in 2018 (TUİK, 2019b). Thirdly, Hüyük is one of the districts in Zone 1. It is the north of Beyşehir, the south of Doğanhisar, the west of Beyşehir and the east of Beyşehir Lake. The districts' total geographical area is 549,4 km², and Hüyük, which is very rich in terms of rivers, includes Yenice, Eflatun, Ozan, Pınarbaşı and İlmen rivers (The report of Hüyük District, 2014, p.2). Its agricultural area is 186294 decare in 2018 (TUİK, 2019b).

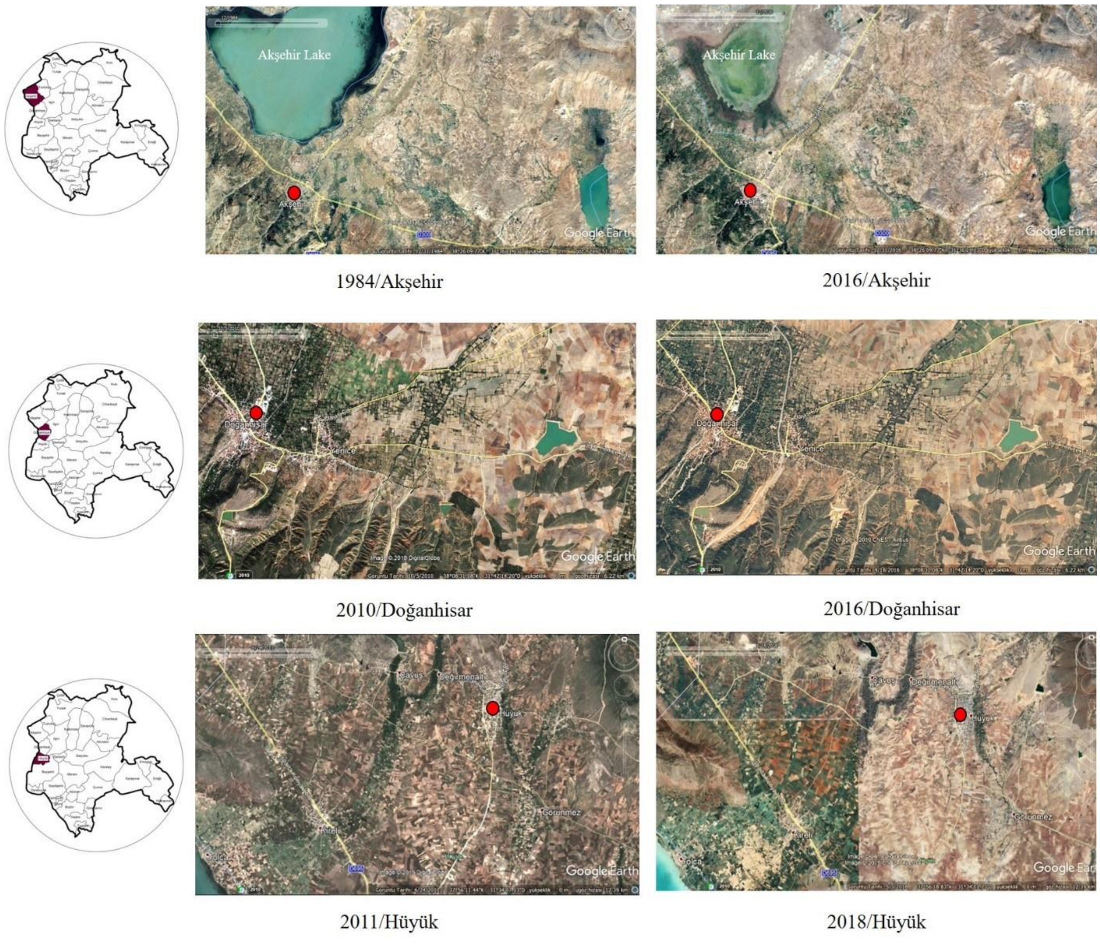


Figure 5.46. Akşehir, Doğanhisar, and Hüyük satellite photography (Adapted from Google earth (December 31, 1984), (December 31, 2016), (October 5, 2010), (September 18, 2016), (June 24, 2011), (May 3, 2018), Retrieved April 20, 2019)

Weather data (temperature and rainfall patterns) for the selected three sites in Zone 1 was obtained from website climate-data.org. The study examined climatic variabilities of the atmosphere. Its average temperature, minimum-maximum temperature and annual precipitation were assessed in Akşehir, Doğanhisar and Hüyük. In Akşehir, average temperature is 1.3℃ in January and 21.5℃ in July. While there is a rising rate in the maximum temperature during July (28.4℃) and August, the rainfall trend decreases in July (15mm), August(12mm) and September (18mm). In Doğanhisar, average temperature is -0.1℃ in January and 20.6℃ in July. Its maximum temperature rises during July (27.8℃)-August (27.9℃), the rainfall trend decreases in July (12mm), and August (11mm). Also, in Hüyük, average temperature is -0.3℃ in January and 20.7℃ in July. Its maximum temperature patterns are July (27.8℃)-August (27.9℃), and the rainfall trends are in July (11mm), and August (11mm) in Hüyük (İklim Akşehir, n.d.; İklim Doğanhisar, n.d.; İklim Hüyük, n.d.). For this reason, the rate of temperature and rainfall is similar to each three districts.

This section of the study in Zone 1 investigates how the agricultural areas changed in 2004, 2008, 2013 and 2018. According to TUIK, 2019b, it focuses on four agricultural patterns: fruit, drink and spice plant areas, fallow areas, vegetable areas, and grain and other crop product areas (Figure 5.47). First of all, the fruits, drinks and spice plants areas generally increased from 2004 and 2018 in Zone 1. However, the size of these areas rapidly decreased from 2004 (9650 decare) to 2008 (4610 decare) in Hüyük. Afterwards, in Hüyük, the size of these areas was 11829 decare in 2018. Secondly, the fallow areas were ranked 372030 decare in 2004, 21353 decare in 2008, 25171 decare in 2013 and 50628 decare in 2018 in Akşehir. According to the results, the fallow areas dramatically decreased from 2004 (372030 decare) to 2008 (21353 decare) in Akşehir. Although the fallow areas decreased from 2004 to 2018 in Akşehir, in Doğanhisar, the fallow areas dramatically increased from 2004 (15520 decare) to 2008 (66441 decare). However, the size of areas in Doğanhisar was 13640 decare in 2018. Also, in Hüyük, the size of fallow areas gradually decreased from 2004 (203880 decare) to 2018 (10000 decare). Thirdly, while the vegetable areas of Akşehir increased from 2004 (9460 decare) to 2008 (10828 decare), they decreased from 2008 (10828 decare) to 2013 (7894 decare). However, the size of vegetable areas once again rose in 2018 (9341 decare) in Akşehir. Although there is a significant fluctuation in 2013 in Doğanhisar, the size of vegetable areas remained similar in 2004, 2008 and 2018. In Hüyük, the size of vegetable areas changed from 2004 (1530 decare) to 2018 (1450 decare). Finally, the size of the grain and other crop product areas were ranked 287360, 169690, and 106410 decare in Akşehir, Doğanhisar and Hüyük in 2004, while these sizes of crop patterns changed 390930, 130701, and 163015 decare in Akşehir, Doğanhisar and Hüyük in 2018. Thus, while this size of patterns increased in Akşehir and Hüyük, it decreased in Doğanhisar from 2004 to 2018.

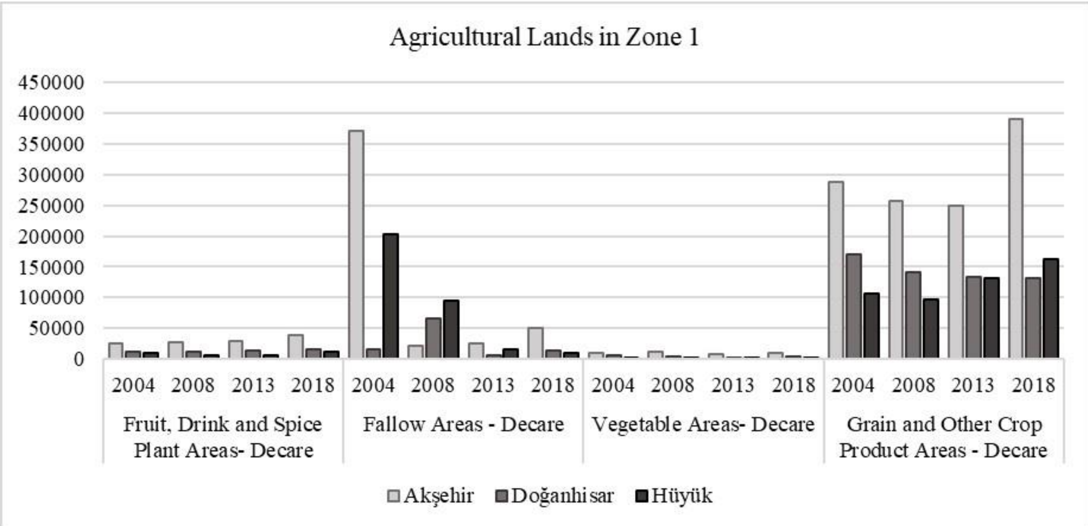


Figure 5.47. Agricultural lands in Zone 1 in 2004-2008-2013-2018 (TUİK, 2019b)

Last but not least, the findings are based on the farmers' and experts' observations in Zone 1. As shown in Table 5.6, the majority of the farmers (68.8 %) stated 'climate change increased precipitation', 37.5% of the experts highlighted in the 'other' options new focuses: 'other-climate change is drought and/or decreases in yield' and 'other-climate change is seasonal shift'. The observed effects of climate change varied based on role of participants in Zone 1. The findings displayed that there were various observations about the impacts of climate change. These observations are in line with their own experiences. For example, as extreme rainfall increased, the quality of crops would decrease, thus the farmers' income could be affected by these unexpected weather conditions. These observations can be assessed in terms of adaptation strategies in socio-spatial planning.

Table 5.6. *The observed effects of climate change in Zone 1*

The Observed Effects of Climate Change in Zone 1		
	Farmers (16)	**Experts(8)**
Climate change increases temperature	18,8	12,5
Climate change decreases temperature	0	0
Climate change increases precipitation	68,8	25
Climate change decreases precipitation	0	12,5
Climate change increases frost events	25	0
Other- Climate change is unexpected change weather	44,1	25
Other-Climate change is drought- Climate change decreases yield	12,6	37,5
Other- Climate change is seasonal shift	25,2	37,5

This section of questionnaire investigated farmers' and experts' predictions on risks in the future. The question regarding environmental, social, economic conditions has multiple options and 'other'. First of all, both the farmers (87.5%) believed that food production would decrease in the future, and also the experts (62.5%) claimed that food production would decrease in the future. According to the 50% of the farmers' and 37.5% of the experts' perceptions, water depletion will be a serious risk in the future. Also, 37.5% of the farmers claimed epidemic diseases, and 25% of the experts emphasized similar risk (Table 5.7). In addition to these, of the participants, 25% stated famine and land pollution. The percentage of pothole formation and sandstorm were rather lower in Zone 1. As a result, if the climatic conditions were unsuitable, the crop yield would decrease. For example, in case study research, one farmer that was interviewed in Akşehir claimed that if cherry trees did not face frost, their yield and quality would reduce.

Table 5.7. *The risks based on climate change in Zone 1*

The Risks Based on Climate Change in Zone 1		
	Farmers (16)	**Experts(8)**
Desertification	18,8	0
Famine	25	25
Water Depletion	50	37,5
Biodiversity reduction	6,3	25
Air pollution	12,5	0
Land pollution	25	25
Water pollution	12,5	12,5
Food wars	31,3	0
Water wars	18,8	25
Increased acid rains	12,5	0
Decreased in food production	87,5	62,5
Migration	6,3	12,5
Epidemic Diseases	37,5	25
Pothole Formation	6,3	0
Sandstorm	0	0
Other- change of plant pattern, decreased crop yield	12,6	25

The analysis of mitigation methods revealed three levels low, medium and high. First of all, 56.3% of the farmers related climate change to reduced urban sprawl, and 37.5% of the experts associated climate change with reduced rural-urban migration and urban sprawl at a low level. According to the farmers, the mitigation actions of climate change regarding reduced rural-urban migration (56.3%), reduced poverty (50%) and increased employment (50%) were medium. Also, 50% of the experts stated reduced poverty, food dependency and environmental pollution at a medium level. At high level, farmers (68.8% and 62.5%) and experts (87.5% and 75%) stated similar the outcomes of mitigation actions: reduced drought and increased efficiency product. The mitigation actions against climate change have no important effect on urban sprawl. The finding displayed that urbanization, which is associated with Urban Heat Island, is not considered to have impact on climate change on agricultural lands at a high level. Especially, for the participants, water was crucial components regarding drought. As seen in Figure 5.48, ponds were built in order to accumulate water in Hüyük. This finding also was associated with the impacts of wide-dried Akşehir Lake. Besides, crop yields based on water depletion and extreme rainfall, thus the farmers’ income are affected by these adverse impacts of climate change. In brief, the participants highlighted environmental and economic results.

Figure 5.48. The pond in Çavuş, Hüyük (Personal Photography, 2018)

The section of the questionnaire investigated how the methods would improve against the negative impacts of climate change. The questionnaire made up three levels: low, medium and high. At a low level, 62.5% of the farmers stated land consolidation, the experts (37.5%) mentioned improved public transportation systems. However, 50% of the experts stated improved public transportation system at a high level. At a medium level, while 56.3% of the farmers claimed that the methods of climate change as regards improved public transportation system were medium, 62.5% of the experts emphasized regulation of the fertilization systems. Farmers related it to having detailed information about the products that are planned to be plant (75%), and the experts believed that the methods decrease waste generation (62.5%) at a high level. Besides, 56.3% of the farmers underlined the importance of organic farming. These findings were associated with education and awareness against climate change impacts, which were socio-economic components. On the other hand, according to the participants, land consolidation was insufficient method for decrease impacts of climate change in Zone1. For this reason, the methods should be regulated regarding mountainous topographical conditions. As seen in Figure 5.49, crops were determined according to local conditions. For example, strawberries are produced in the villages in Doğanhisar. These methods should vary in local scale according to peculiar characteristics of villages.

Figure 5.49. Agricultural area in Doğanhisar (Personal Photography, 2018)

The findings of estimated consequences of climate change revealed at three levels. The first three responses were related climate change in terms of temperature changes. As shown in Figure 5.50, while 43.8% of the farmers stated that seasonal abrupt change would occur, 37.5% of them mentioned that seasonal effects would be more mild in Zone 1. The farmers were related climate change to rainfall patterns in Zone 1. On the other hand, 37.5% of the experts emphasized that 'seasonal effects will be more severe' and 'seasonal abrupt change will occur'. Also, of the farmers, 37.5% claimed that agricultural areas, where would be fertile lands in the future, may be opened to development at a low level. At a medium level, 56.3% of the farmers focused on 'agriculture production will not be done in many areas'. Experts (62.5%) highlighted 'new technological developments enable to adaptations'. At a high level, of the farmers, 62.5% emphasized that 'product pattern plans will be needed' and 'negative impacts of climate change will reduce with planning and modern education'. 75% of the experts estimated that 'water crises among sectors will rise'. Therefore, lack of education and planning, water depletion were essential problems in Zone 1. Whereas the experts focused on water crises, importance of planning and modern education, decreased in crop yields and faulty location selection, the farmers stated that planning and modern education, new technological development, water crisis, product pattern plan were rather considerable highlights on climate change in terms of socio- spatial planning.

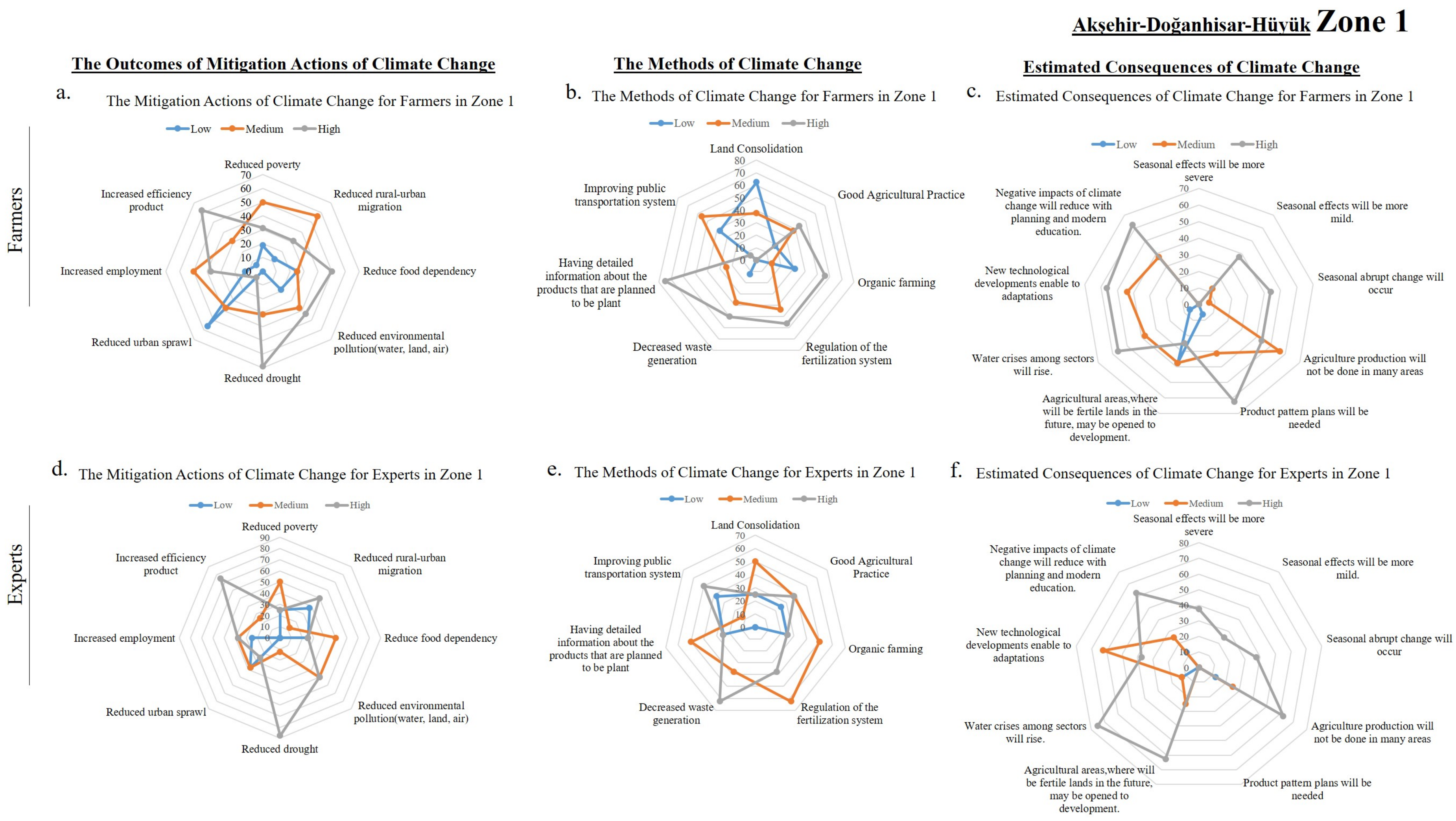


Figure 5.50. The outcomes of mitigation actions(a-d), methods (b-e), and estimated consequences (c-f) of climate change in Zone1

Zone 2

Zone 2 includes two districts: Çeltik and Yunak. These districts share borders to the north of Konya. This zone has fertile agricultural lands where good agricultural practices are employed Moreover, Çeltik has higher rate of ensuring the livelihood of production, certified organic agricultural lands and wide wetland areas, while Yunak has wider individual lands (see Chapter 5.2.1). Like Zone 1, this section includes three parts: geographical information, agricultural information, and the survey results. Firstly, as display in Figure 5.51, Çeltik is located to the north of Yunak, the south of Eskişehir, the west of Ankara (Polatlı) and the east of Afyonkarahisar. The districts' total geographical area is 590,83 km ^{2}. Çeltik, which is located on flat plain, consists of water channels of Akgöl and akin to Küçük Hasan Lake (The report of Çeltik District, 2014, p.2). Moreover, its agricultural area is 308152 decare in 2018 (TUİK, 2019b). Another district is Yunak. It is located to the north of Kadınhanı and Ilgın, the south of Çeltik, the west of Cihanbeyli and the east of Afyonkarahisar. The districts' total geographical area is 2341,1 km ^{2}, and its agricultural lands is 1204103 decare in 2018 (TUİK, 2019b). Yunak, where is located on low sloping area, consists of a lot of wadis such as Karataş, Bayatkolu, Mollahalil rivers (The report of Yunak District, 2014, p.2).

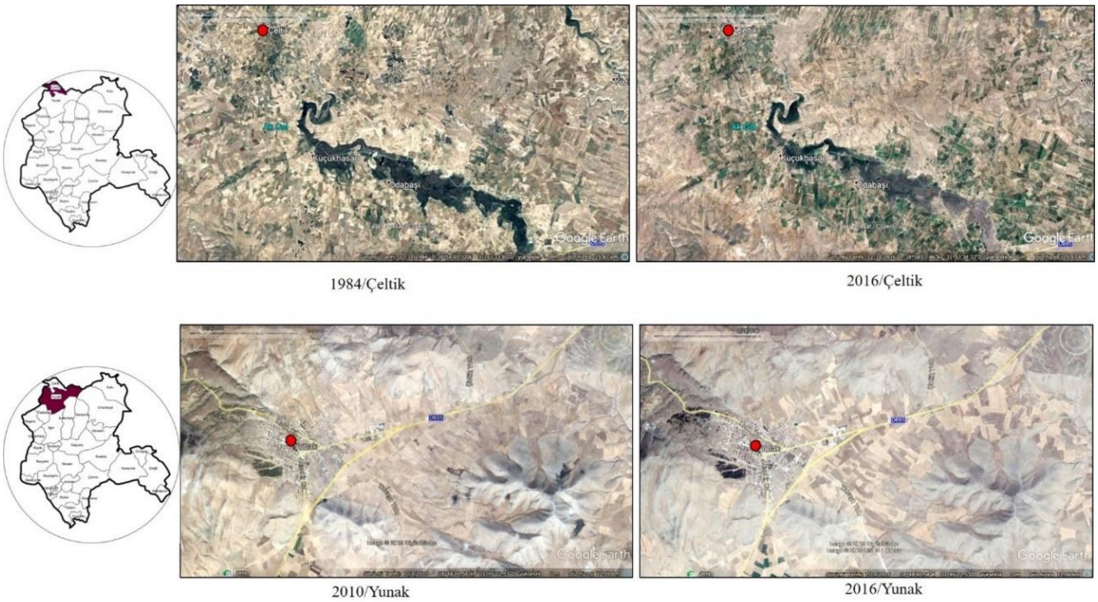


Figure 5.51. Çeltik/1984-2016 and Yunak/2010-2016 satellite photography (Adapted from Google earth (December 31, 1984), (December 31, 2016), (October 5, 2010), (July 7, 2016), Retrieved April 20, 2019)

Weather data (temperature and rainfall) for the selected two sites in Zone 2 was obtained from website climate-data.org. The study also examined climatic variabilities of the atmosphere. As far as average temperature, minimum-maximum temperature, and annual precipitation change in Çeltik are concerned, the average temperature is 1℃ in January and 21.7℃ in July in Çeltik while its annual precipitation averages about 14mm in July. The maximum temperature increases during June (25.6℃) and September (25.1℃) in Çeltik. 29℃ in July is the highest of the maximum temperatures in Çeltik. Similar to Çeltik, the average temperature is 0.3℃ in January and 20.9℃ in July while its annual precipitation averages about 14mm in July in Yunak. The maximum temperatures for Yunak are as follows: June (24.8℃), July (28.3℃), August (28.2℃), and September (24.5℃). While August (9mm) receive the lowest rate of the rainfall in Çeltik, it does so (10mm) in Yunak (İklim Çeltik, n.d.; İklim Yunak, n.d).

This section of the analysis examines how the size of the agricultural product pattern changed. According to TUİK dataset (2019b), this section presents four patterns: fruit, drink and spice plant areas, fallow areas, vegetable areas, and grain and other crop product areas. Overall, the areas of fruit, drinks and spice plants dramatically increased from 2004 (1970 decare) to 2018 (12000 decare) in Çeltik. Besides, even though the size of these product patterns increased from 2004 (9810 decare) to 2018 (13372 decare), the agricultural size decreased in 2008 (6010 decare) in Yunak. The increased sizes of fruits, drinks and spice plants in Çeltik is higher than the increased sizes in Yunak. Another kind of agricultural land is fallow area. Agricultural produce data of fallow areas in 2013 (5370 decare) is the lowest level compared to other years in Yunak. However, in 2018, the fallow size increased 297300 decare in Yunak. On the other hand, in Çeltik, the fallow areas gradually decreased from 2004 (227330 decare) to 2018 (8300 decare). Thirdly, the vegetable areas significantly decreased from 2004 (2930 decare) to 2018 (1315 decare) in Yunak; however, these areas rapidly increased from 2004 (340 decare) to 2018 (8070 decare) in Çeltik. Fourthly, according to the sizes of grain and other crop product areas, these sizes decreased both Yunak and Çeltik from 2004 to 2018. In Yunak, the total grain and other crop product areas were 1023320 decare in 2004 while these areas were 892116 decare in 2018. On the other hand, there was low fluctuation from 2004 (309180 decare) to 2018 (279782 decare) in terms of the size of grain and other crop product areas in Çeltik (Figure 5.52).

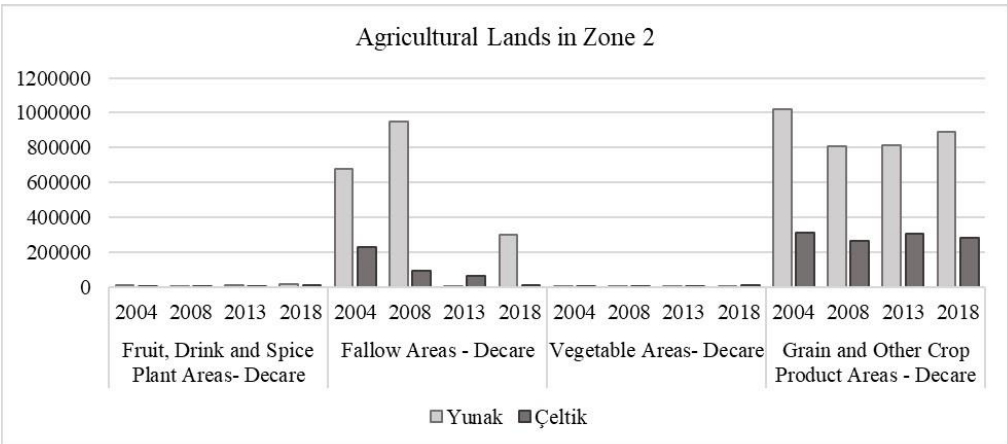


Figure 5.52. Agricultural lands in Zone 2 in 2004-2008-2013-2018 (TUİK, 2019b)

Thirdly, the findings based on the farmers' and experts' observations in Zone 2. The majority of the farmers (66.7 %) claimed that climate change increased temperature. Similarly, 60% of the experts highlighted similar response. As displayed in Table 5.8, experts and farmers highly observed an increase in temperature. According to the findings pertaining to participants, while 40% of the experts stated that climate change decreased precipitation, 33.3% of the farmers highlighted similar response. These observations are related to water depletion. Thus, the farmers change product patterns on agricultural lands in order to deal with environmental problems.

Table 5.8. *The observed effects of climate change in Zone 2*

The Observed Effects of Climate Change in Zone 2		
	Farmers(12)	Experts(5)
Climate change increases temperature	66,7	60
Climate change decreases temperature	0	0
Climate change increases precipitation	0	0
Climate change decreases precipitation	33,3	40
Climate change increases frost cases	8,3	0
Other- Climate change is unexpected change weather	24,9	20
Other-Climate change is drought- Climate change decreases yiel	33,2	0
Other- Climate change is seasonal shift	0	20

The findings displayed the participants' perceptions based on risks of climate change. As shown in Table 5.9, 83.3% of the farmers and 60% of the experts stated that water depletion is significant risks in Zone 2. Of the experts, 40% emphasized biodiversity reduction and migration, while 41.7% of the farmers underlined desertification and famine. On the other hand, both farmers and experts did not emphasize some risks: increased acid rains, water pollution and sandstorm. However, the participants added in the 'other' options new risks: change of the plant pattern and decreased of crop yields, natural disaster (reduced groundwater) and reduced income.

Table 5.9. *The risks based on climate change in Zone 2*

The Risks Based on Climate Change in Zone 2		
	Farmers(12)	Experts(5)
Desertification	41,7	20
Famine	41,7	20
Water Depletion	83,3	60
Biodiversity reduction	0	40
Air pollution	0	20
Land pollution	8,3	20
Water pollution	0	0
Food wars	25	0
Water wars	33,3	0
Increased acid rains	0	0
Decreased in food production	25	0
Migration	8,3	40
Epidemic Diseases	25	20
Pothole Formation	16,7	0
Sandstorm	0	0
Other- change of plant pattern, decreased crop yield	24,9	20
other-natural disaster (reduced groundwater)	8,3	20
other-reduced income	8,3	20

The findings of mitigation actions' outcomes examined three levels: low, medium and high (Figure 5.55). First of all, 41.7% of the farmers stated that the mitigation actions would reduce urban sprawl at a low level. Moreover, 60% and 40% of the experts mentioned that the mitigation actions would reduce urban sprawl and food dependency at a low level. On the other hand, the results showed that all of the experts believed that the mitigation actions would reduce environmental pollution, increase employment and efficiency product to at a high level. Furthermore, of the farmers, 66.7% and 58.3% claimed that these actions would increase efficiency product and reduce drought at a high level. These results showed that while the farmers focused on efficiency products and drought, the experts emphasized environmental pollution, employment and efficiency product at a high level. As a result, even though the farmers perceived impacts of climate change, they do not aware the impacts of climate change on urban-rural relations.

Figure 5.53. The proximity between agricultural lands and village, in Çeltik (Personal Photography, 2018)

The part of the questionnaire investigated what kinds of methods would contribute to reduce the negative impacts of climate change in Zone2. First of all, of the farmers, 50% and 41.7% stated improved public transportation and land consolidation to at a low level. Moreover, 60% of the experts highlighted land consolidation, organic farming, and improved public transportation system at a low level. On the other hand, while 83.3% of the farmers were believed having detailed information about the products that ate planned to be plant, 75% of the them were believed good agricultural practices at a high level. Also, all of the experts emphasized good agricultural practices, and 80% of them suggested that regulation of the fertilization system, decreased waste generation, and having detailed information about the products that are planned to be plant would be better methods against the negative impacts of climate change. These results displayed that farmers' practices are mostly depended on social and political conditions such as agricultural practices and education programs, while the experts' practices highly focus on socio-economic conditions such as waste generation and education programs. Accordingly, these methods directly bring about crop diversity. For example, new alternative crops were cultivated regarding the environmental conditions in Çeltik; thus, the product pattern were varied (Figure 5.54). Correspondingly, all results include environmental, socio-economic, and political methods, and these results are related to each other.

Figure 5.54. Diversity of crops in agricultural area in Çeltik (Personal Photography, 2018)

The participants have worried about impacts of climate change. This section includes various estimations in order to deal with the impacts of climate change in Zone 2. The first three responses are depended on weather conditions. 33.3% of the farmers stated seasonal abrupt change would occur at a medium level, and 40% of the experts had similar response to at a high level. 33.3% of the farmers emphasized 'agricultural areas, where will be fertile lands in the future, may be opened to development' at a low level. 40% of the experts mentioned 'agriculture production will not be done in many areas' and 'agricultural areas, where will be fertile lands in the future, may be opened to development' at a low level. On the other hand, 91.7% of the farmers highlighted 'product pattern plans will be needed' and 83.3% of them stated 'water crises among sectors will rise' at a high level. In addition to these, 80% of the experts claimed that 'negative impacts of climate change will reduce with planning and modern education' and 'water crises among sectors will rise'. As a result, although water crisis is common problems of the participants, the participants' results varied. The farmers stated the importance of product pattern plans, whereas the experts underlined the importance of education and awareness programs. Accordingly, the planning and education can be related to adapt to climate change.

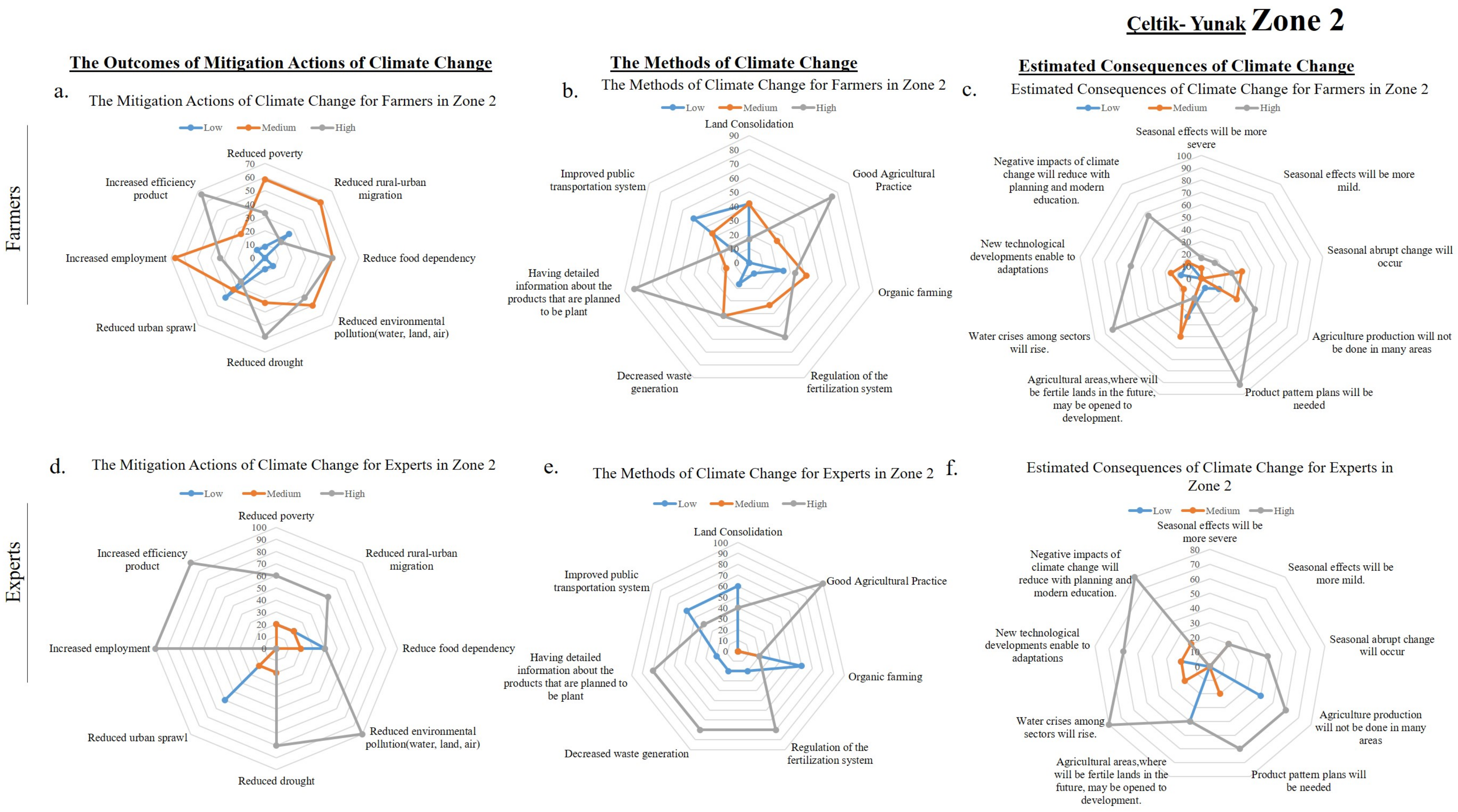


Figure 5.55. The outcomes of mitigation actions(a-d), methods (b-e), and estimated consequences (c-f) of climate change in Zone2

Zone 3

Zone 3, which is referred to Ereğli, is located in the south-east of Konya. Zone 3 has high rate of ensuring the livelihood of production, the amount of wetland as decare (see Chapter 5.2.1). Like Zone 1 and 2, this section includes three parts: geographical information, agricultural information and the survey results. First of all, as seen in Figure 5.56, Ereğli is to the north of Halkapınar and Taurus Mountains, the south of Aksaray, the east of Ayrancı (Karaman) and the west of the Ulukışla (Niğde). The districts' total geographical area is 2260 km². It is founded between the Konya plain of the Central Anatolian and Taurus Mountains, and there are Hasan Mountain and Karacadağ in the north of Ereğli (The report of Ereğli District, 2014, p.2). Its agricultural land is 1268701 decare (TUİK, 2019b). According to the "Ereğli Ovası-ORTO28" (n.d.), Akgöl has been largely dried since second half of the 1990s. the dams over the rivers and over-usage of the groundwater occurred serious drought, and most of the largest and efficient reeds have been destroyed. As well as overgrazing, the reduction of groundwater brings about wind erosion (p.88).

Figure 5.56. Ereğli satellite photography 1984 -2016 (Adapted from Google earth (December 31, 1984), (December 31, 2016) Retrieved April 20, 2019)

The weather dataset in Zone 3 was obtained from website climate-data.org. It is investigated how the climatic variabilities (temperature and rainfall) changed from January to December. Its average, maximum, minimum temperature patterns and annual precipitation values were assessed in Zone 3. These variables are rather important factors in terms of socio-spatial planning. The average temperature is 0.3°C in January and 21.9°C in July in Zone3. The maximum temperature is 30.3°C in July, and the minimum temperature is -4.2°C in January. Moreover, its annual precipitation average is about 5mm in July and August (İklim Ereğli, n.d.). Water depletion and drought can be associated with lack of rainfall and high temperature. However, the high temperature value can be advantage in terms of renewable energy systems.

The part of the analysis examined how the size of the agricultural product pattern changed. The part included four patterns: fruits, drinks and spice plants areas, fallow areas, vegetable areas and grain and other crop product areas. Firstly, according to the fruits, drinks and spice plants areas (Figure 5.57), these sizes increased from 2004 (48280 decare) to 2018 (56264 decare); however, these areas decreased in 2013 (39237 decare) in Zone 3. Secondly, the fallow areas varied from year to year. For example, the size of fallow area is 436110 decare in 2004, it is 187090 decare in 2013. In 2018, the size of fallow areas once again increased 332700 decare in Zone 3. According to the sizes of vegetable areas in Zone 3, there is a major fluctuation from 2004 (32720 decare) to 2018 (69495 decare). Finally, the size of grain and other crop product areas gradually increased from 2004 (551470 decare) to 2018 (810242 decare) (TUİK, 2019b).

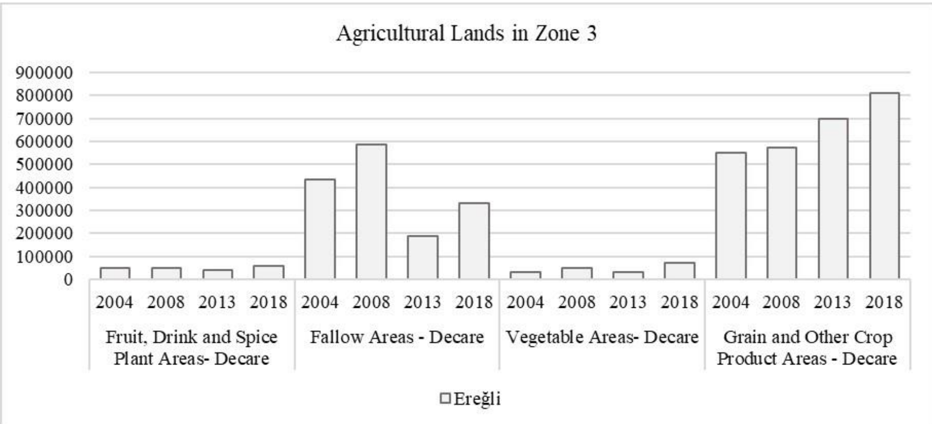


Figure 5.57. Agricultural lands in Zone 3 in 2004-2008-2013-2018 (TUİK, 2019b)

Despite the climatic events from past to present, the results proceeded with an analysis of participants' observations about climate change in Zone 3. As indicated in Table 5.10, the majority of the farmers (88.9%) claimed that climate change increased temperature, and 50% of the experts highlighted both ‘climate change increases temperature’ and ‘other-climate change is seasonal shift’. According to the findings pertaining to farmers, 55.6% of the them emphasized that climate change increased frost cases, and 44.4% of them underlined climate change decreased precipitation. These observations are associated with natural risks such as water depletion, drought.

Table 5.10. *The observed effects of climate change in Zone 3*

The Observed Effects of Climate Change in Zone 3		
	Farmers(18)	Experts(2)
Climate change increases temperature	88,9	50
Climate change decreases temperature	11,2	0
Climate change increases precipitation	5,6	0
Climate change decreases precipitation	44,4	0
Climate change increases frost cases	55,6	0
Other- Climate change is unexpected change weather	16,8	0
Other-Climate change is drought- Climate change decreases yiel	5,6	0
Other- Climate change is seasonal shift	0	50

The results indicated that the farmers’ and expert’ estimations about risks varied from environmental perspectives to socio-economic perspectives. As far as the risks based on climate change is concerned, it can be said that majority of farmers stated that food wars (%77.8), desertification-water depletion-water wars (72.2%) and epidemic diseases-famine (66.7%) would occur in the future (Table 5.11). All of the experts worried about water depletion in Zone 3. Furthermore, experts emphasized that biodiversity and food producition would decrease, pollution (water, land and air) would increase in the future. According the experts, pothole formation and sandstorm were considerable natural risks in the future.

Table 5.11. *The risks based on climate change in Zone 3*

The Risks Based on Climate Change in Zone 3		
	Farmers(18)	Experts(2)
Desertification	72,2	0
Famine	66,7	0
Water Depletion	72,2	100
Biodiversity reduction	38,9	50
Air pollution	55,6	50
Land pollution	55,6	50
Water pollution	55,6	50
Food wars	77,8	0
Water wars	72,2	0
Increased acid rains	16,7	0
Decreased in food production	55,6	50
Migration	55,6	0
Epidemic Diseases	66,7	0
Pothole Formation	33,3	50
Sandstorm	11,1	50
Other- change of plant pattern, decreased crop yield	11,2	0
other-natural disaster	5,6	0

This part of the questionnaire investigated how these actions would contribute to rural development if the mitigation or adaptation actions occurred on agricultural lands in Zone 3. The question had three levels: low, medium and high. The experts stated that urban sprawl was at a low level, and they underlined that the mitigation actions would reduce poverty and food dependency at a medium level. However, the experts stressed that if the mitigation and adaptation actions occurred on agricultural lands, rural-urban migration would decrease, and employment-efficiency product would increase at a high level. On the other hand, 88.9% of the farmers stated that employment and efficiency of the product would increase at a high level. Moreover, farmers highlighted similar actions: reduced drought (61.1%), reduced poverty, food dependency and urban sprawl (50%) at a high level. Although all of the experts stressed the decrease of rural-urban migration, only 38.9% of the farmers stated that the impact of these were significance at a high level. These results showed that participants focused on both socio-economic conditions and environmental conditions.

The findings concerning these methods against climatic risks are examined in Zone 3. 61.1% of the farmers stressed that land consolidation was the method employed at a low level. The experts' responses portrayed that land consolidation, organic farming, decreased waste generation and having detailed information about the crops were significant at a medium level. At high level, 77.8% of the farmers highlighted having detailed information about the crops would be a better method of deal with climate change, while 50% of the experts stated good agricultural practice, regulation of the fertilization system and improved public transportation system. Accordingly, of the farmers, 66.7% and 61.1% stated that good agricultural practices, and organic farming-regulation of the fertilization at a high level.

As seen in Figure 5.60, the estimated consequences in the future were assessed in Zone 3. The first three responses were related to each other. While 44.4% and 38.9% of the farmers estimated 'seasonal abrupt change will occur' and 'seasonal effects will be more severe', half of the experts stressed similar actions at a high level. At a medium level, 61.1% of the farmers stated 'new technological developments enable to adaptations', 50% of the experts refer 'agriculture production will not be done in many areas', 'product pattern plans will be needed', 'agricultural areas, where will be fertile lands in the future, may be opened to development' and 'new technological developments enable to adaptations'. At a high level, while 77.8% and 66.7% of the farmers stated 'product pattern plans will be needed', and 'agriculture production will not be done in many areas', all of the experts stressed 'water crises among sectors will rise' and 'negative impacts of climate change will reduce with planning and modern education'. As a result, as seen in Figure 5.58, modern irrigation systems were occurred in order to deal with water depletion. In addition, the new technological systems are rather important. For example, this figure showed renewable energy systems. Although some solutions were improved in Zone 3, an integrated planning was vital solution in terms of drought, energy, and natural protected areas (Figure 5.59). These finding displayed that planning and education programs are fundamental solutions; thus, all strategies are connected with each other.

Figure 5.58. Irrigation system and renewable energy near agricultural area in Ereğli (Personal Photography, 2018)

Figure 5.59. Soil areas in Ereğli (Personal Photography, 2018)

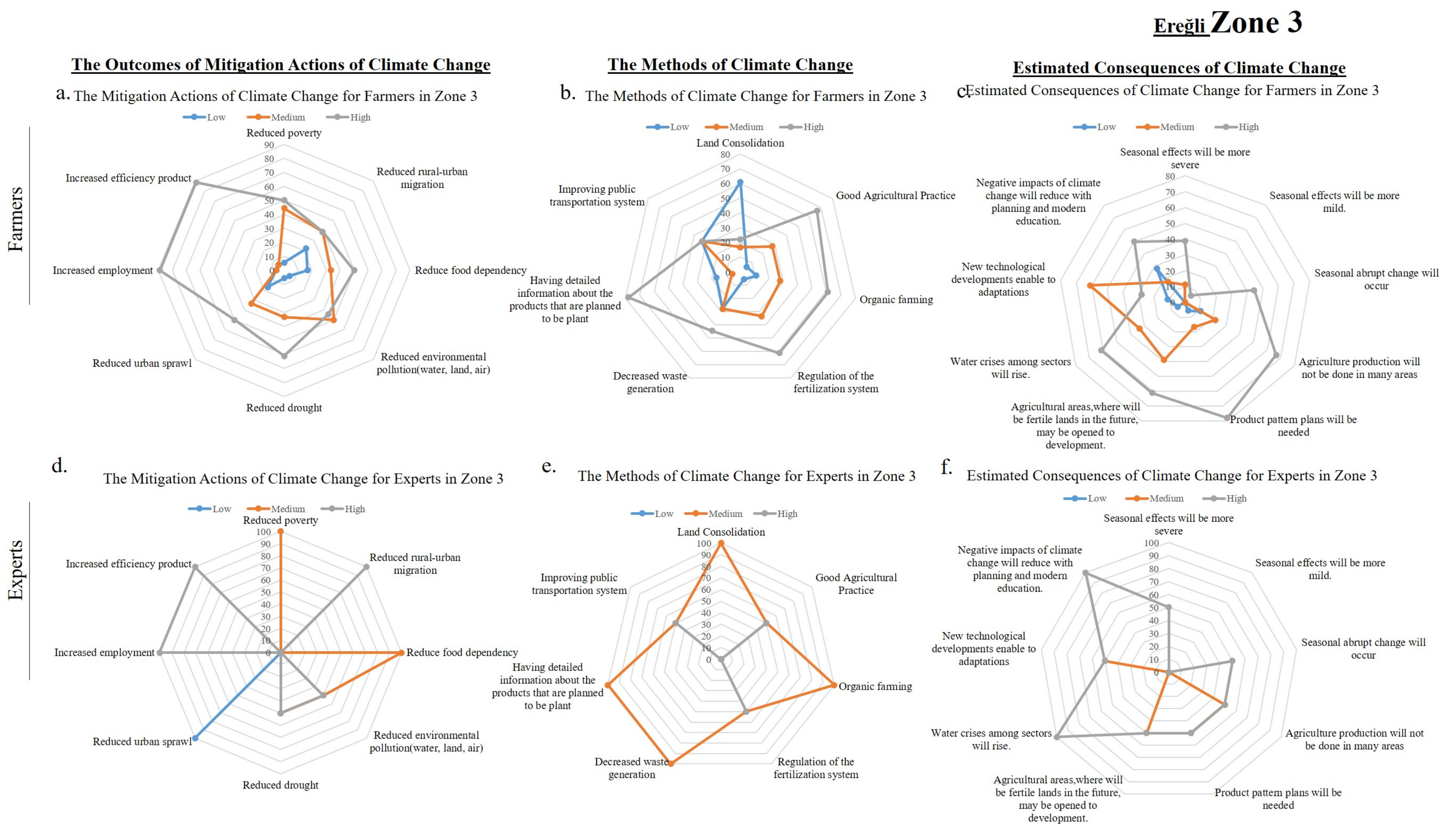


Figure 5.60. The outcomes of mitigation actions(a-d), methods (b-e), and estimated consequences (c-f) of climate change in Zone3

Zone 4

Zone 4, which is referred to Karapınar, is located to the south-east of Konya. The villages in zone 4 has high level in terms of the rate of ensuring the livelihood of production, land consolidation, the amount of wetland, cooperatives (see Chapter 5.2.1.). However, the people have faced with natural risks such as pothole formation, wind erosion from past to present. Thus, the findings are significant inferences based on the negative impacts of climate change. This section includes three parts: geographical information, agricultural information and the survey assessments. First of all, Karapınar is the north of Ayrancı (Karaman), the south of Aksaray, the east of Çumra, and the west of Ereğli. It consists of Karacadağ, Uzecek Mountain, Acıgöl and Meke, Meyil, Çıralı, Obruk, which are crater lakes. There are a lot of pothole in the north of Karapınar. The districts' total geographical area is 2939.17 km² (The report of Karapınar District, 2014, p.2). Its agricultural land is 1223647 decare in 2018 (TUİK, 2019b). According to "Hotamış Sazlığı- ORTO13" (n.d.), Hotamış reeds were dried in the present, thus there are barren vegetation areas and agricultural areas on the lake in the present (Figure 5.62). From on environmental point of view, the agricultural areas expanding over Hotamış Lake are also a serious threat (p.56).

Figure 5.61. Karapınar satellite photography in 1984-2016 (Adapted from Google earth (December 31, 1984), (December 31, 2016), Retrieved April 20, 2019)

Figure 5.62. Agricultural area in Hotamış village in Karapınar,2018 (Personal Photography, 2018)

Weather data (temperature and rainfall) was obtained from website: climate-change.org. As far as average, maximum, minimum temperature and rainfall pattern in Zone 4 are concerned, the average temperature was -0.9°C in January and 21.6°C in July. The maximum temperature is 29.1°C in July, and the minimum temperature is -4.5°C in January. Its annual precipitation average is about in July (8mm), August(5mm) and September (11mm) in Zone 4. August (5mm) receive the lowest rate of the rainfall in Karapınar (İklim Karapınar, n.d.).

The part of the analysis investigated how the size of the agricultural product pattern changed. Like Zone 1,2,3, the part included four patterns: fruits, drinks and spice plants areas, fallow areas, vegetable areas and grain and other crop product areas. As indicated in Figure 5.63 (TUIK,2019b), the size of fruits, drinks and spice plants areas rapidly decreased from 2004 (14110 decare) to 2013 (2035 decare). In 2018, this size is 4359 decare in 2018. However, the size of these areas in 2018 is lower size than in 2004. Another agricultural land is fallow area. The fallow areas were 1474850 decare in 2004 while these areas were 176510 decare in 2018. These areas in Zone 4 decreased from 2004 to 2018. Moreover, the size of vegetable areas gradually increased from 2004 (8840 decare) to 2018 (26450 decare), and the sizes of the grain and other crop product areas fluctuated from in 2004 (884970 decare) to in 2018 (1016328 decare).

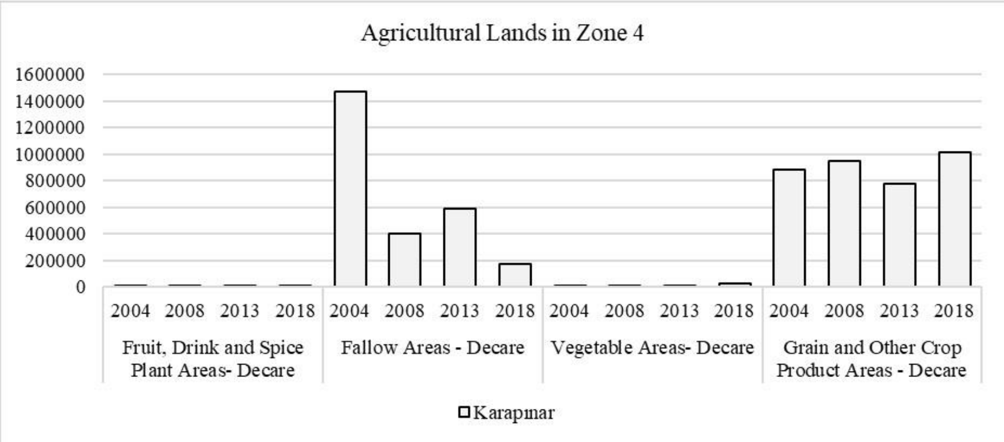


Figure 5.63. Agricultural lands in Zone 4 in 2004-2008-2013-2018 (TUİK, 2019b)

As far as the participants' observations based on climate change in the present concerned, it can be said that the observations highlighted fundamental determinants on weather conditions. 55.6% of the farmers stressed that climate change increased temperature, while the experts' responses (33.3%) varied concerning 'climate change increased temperature', 'climate change decreases temperature', 'other-climate change is unexpected change weather', and 'other-climate change is seasonal shift' (Table 5.12). The results showed a common response did not seem according to the experts' observations.

Table 5.12. *The observed effects of climate change in Zone 4*

The Observed Effects of Climate Change in Zone 4		
	Farmers(9)	Experts(3)
Climate change increases temperature	55,6	33,3
Climate change decreases temperature	0	33,3
Climate change increases precipitation	0	0
Climate change decreases precipitation	33,3	0
Climate change increases frost cases	0	0
Other- Climate change is unexpected change weather	33,3	33,3
Other-Climate change is drought- Climate change decreases yiel	0	0
Other- Climate change is seasonal shift	33,3	33,3

According to the findings pertaining to participants, there is a strong connection between natural risks and the climate change. Of the farmers, 88.9% and 77.8% stated fundamental risks: water depletion and pothole formation. Afterwards, 55.6% of the farmers underlined that water wars would occur in the future, and 44.4% of them stressed desertification, famine, migration and epidemic diseases in Zone 4. On the other hand, all of the experts participating in the interviews emphasized desertification. On the other hand, 66.7% of the experts emphasized water depletion, water wars, pothole formation (Table 5.13).

Table 5.13. *The risks based on climate change in Zone 4*

The Risks Based on Climate Change in Zone 4		
	Farmers(9)	**Experts(3)**
Desertification	44,4	100
Famine	44,4	0
Water Depletion	88,9	66,7
Biodiversity reduction	22,2	0
Air pollution	33,3	0
Land pollution	11,1	0
Water pollution	33,3	0
Food wars	33,3	0
Water wars	55,6	66,7
Increased acid rains	22,2	0
Decreased in food production	33,3	0
Migration	44,4	0
Epidemic Diseases	44,4	33,3
Pothole Formation	77,8	66,7
Sandstorm	33,3	33,3
Other- destruction of nature	22,2	0
other-natural disaster	33,3	0

Water is a serious problem in Zone 4. The risks are associated with water depletion such as pothole formation, desertification, wind erosion. A significant part of the porthole formation of Turkey has taken place in Karapınar (Figure 5.64). The pothole formation which is related to irrigation systems directly affects the agricultural sector. In addition, it plays a vital role not only in rural areas both also in urban areas. In recent years, pothole formation has increased in agricultural areas in Karapınar; thus, the agricultural sector faces the risk of decreased cultivation areas due to the increase in pothole formations. Another risk is desertification and wind erosion. In the past, the villages were affected by wind erosion (Figure 5.65). Then, afforestation was carried out in the vicinity of these villages. Case study research showed that afforestation is a fundamental solution for natural risks such as desertification, sandstorms, and wind erosion. However, an integrated planning is one of the significant stategies to deal with the negative impacts of climate change in terms of environmental, socio-economic and political perspectives.

Figure 5.64. The pothole formation in Karapınar (HaberTürk, 2018, September 29)

Figure 5.65. Desertification areas Örnektepe in Karapınar (Personal Photography, 2018)

As shown in Figure 5.66, a village in Karapınar was abandoned due to the negative impacts of wind erosion. In the case study, it was observed that the villages were exposed to the negative impacts of climatic conditions in Karapınar. These samples indicated that the natural disasters related climatic conditions led to environmental and socio-economic risks in villages. As a result, it can be said that these impacts on agriculture are crucial problems in terms of agricultural sustainability in Karapınar. As displayed in the past, the farmers can abondon their villages and agricultural lands due to such fundamental risks as pothole formation. From a macro-economic perspective, these risks can affect food security on a national scale.

Figure 5.66. Abandoned village after wind erosion in Karapınar (Personal Photography, 2018)

The analysis of mitigation methods revealed three levels: low, medium and high. As demonstrated in Figure 5.67, 33.3% of the farmers related climate change to reduced urban sprawl, and 66.7% of the experts associated climate change with reduced food dependency and urban sprawl at a low level. According to the farmers, the mitigation actions' outcomes of climate change as regards reduced poverty (55.6 %) were medium. Furthermore, all of the experts stated reduced poverty, and 66.7% of them stressed reduced rural-urban migration, environmental pollution and increased employment at a medium level. At a high level, farmers (88.9%) and experts (66.7%) stated if the mitigation or adaptation actions occurred, efficiency of a product would increase in the future. 77.8% of the farmers underlined that employment would increase in the future.

A part of the questionnaire investigated how the methods would improve against the negative impacts of climate change. The questionnaire was made up three levels: low, medium and high. At a low level, 44.4% of the farmers stated that land consolidation was important, the experts (66.7%) mentioned the significance of organic farming in Zone 4. At a medium level, while 33.3% of the farmers claimed good agricultural farming, regulation of the fertilization systems, decreased waste generation and improved public transportation systems, all of the experts emphasized the significance of land consolidation. Farmers (77.8%) and experts (66.7%) related it to having detailed information about the products at a high level. 66.7% of the farmers highlighted good agricultural practices, regulation of the fertilization system at a high level.

The estimated consequences in the future were assessed in Zone 4. The first three responses were related to each other. While 44.4% of the farmers estimated that seasonal effects would be more severe, 33.3% of the experts stressed similar actions at a high level. However, 66.7% of experts stated that seasonal abrupt change would occur at a medium level. At a low level, 33.3% of the farmers emphasized that agricultural areas, where they could be fertile lands in the future, may be opened to development, water crises among sectors could rise, and that new technological developments would enable adaptations. 66.7% of the experts also stated that agricultural areas, where there could be fertile lands in the future, may be opened to development. At a medium level, 55.6% of the farmers highlighted that agriculture production would not be done in many areas and new technological developments would enable adaptations. Besides, all of the experts stressed that negative impacts of climate change would reduce with planning and modern education. At a high level, 66.7% of the farmers stressed that product pattern plans would be needed, and all of the experts underlined that water crises among sectors would rise. 66.7% of the experts also emphasized that agriculture production would not be done in many areas, and product pattern plans would be needed in Zone 4. As a result, water crisis can be seen as one of the vital risks. The product pattern plans, education programs, agricultural production should be systematized via an integrated planning. Thus, the adaptation and mitigation actions should be assessed not only on a national scale but also on a local scale.

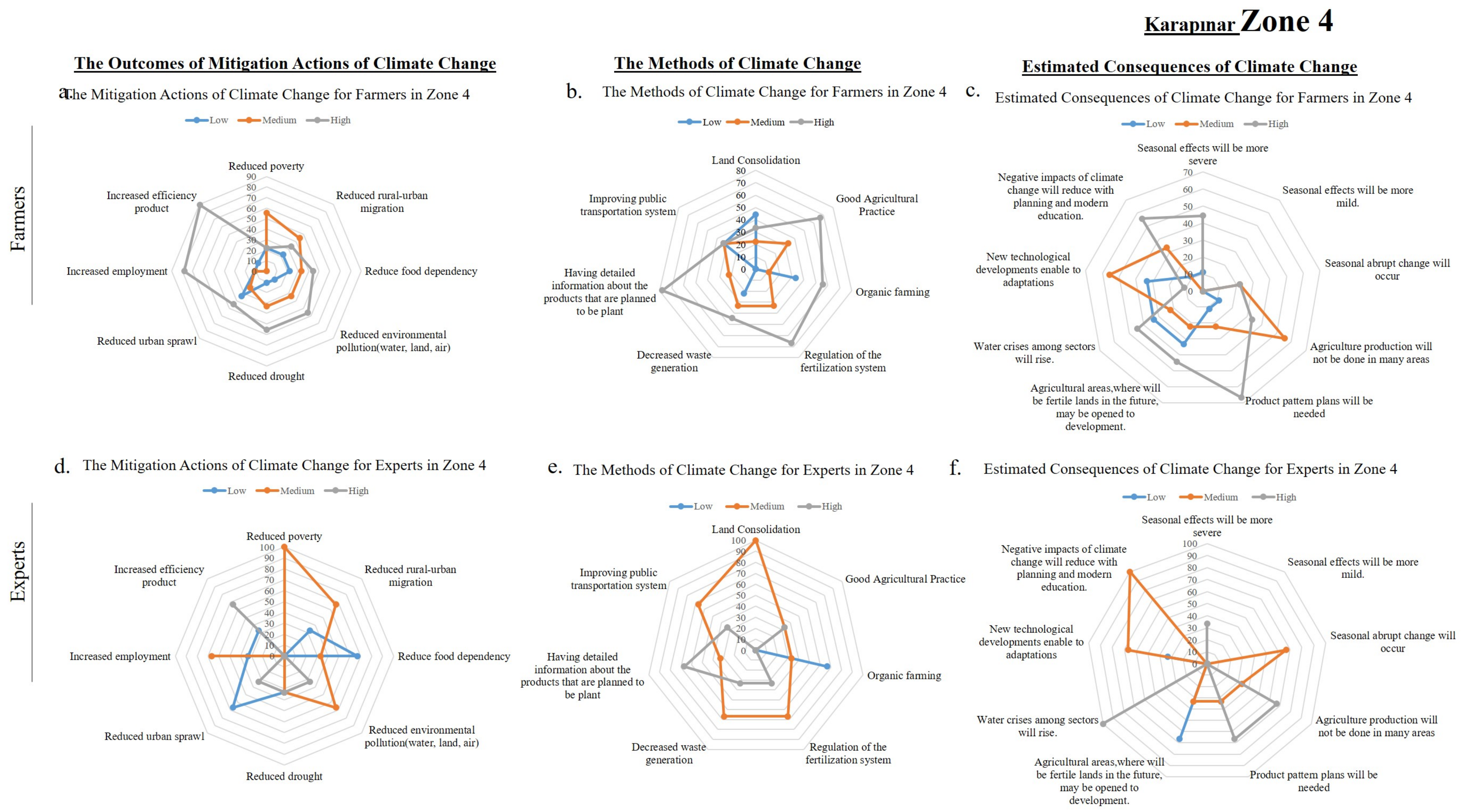


Figure 5.67. The outcomes of mitigation actions(a-d), methods (b-e), and estimated consequences (c-f) of climate change in Zone4

Zone 5

Zone 5, which is referred to Çumra, is located in the south of Konya. Zone 5 has higher rate of ensuring the livelihood of production, land consolidation, the amount of wetland, the average of individual land, and cooperatives in the villages (see Chapter 5.2.1.). Similarly, this section includes three parts: geographical information, agricultural information and the survey results. According to the geographical information, Çumra is located the north of Güneysınır, Bozkır, Karaman, the south of Karatay, the east of Akören and the west of Karapınar (Figure 5.68). The districts' total geographical area is 2090.6 km². It is founded on Konya plain, and it consists of Obruk Lake, Abaz, Kel, Çökek, Kabakbaşı, Karaburun and Karadağ Mountains (The report of Çumra District, 2014, p.2). Its agricultural area is 1331718 decare in 2018 (TUİK,2019b).

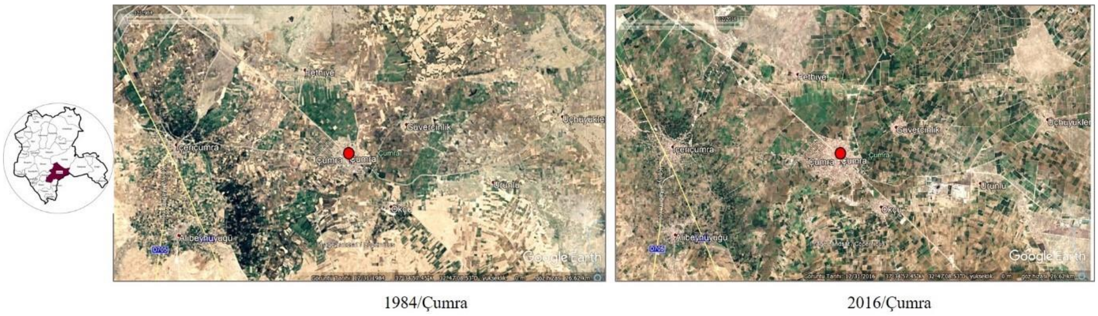


Figure 5.68. Çumra satellite photography in 1984-2016 (Adapted from Google earth (December 31, 1984), (December 31, 2016), Retrieved April 20, 2019)

Weather data (temperature and rainfall pattern) was obtained from website: climate-data.org. The section investigated variabilities of the weather conditions. Its average, maximum and minimum temperature and annual precipitation were evaluated in Zone 5. The average temperature is 0.3°C in January and 22°C in July in Çumra. The maximum temperature is 29.3°C in July, and the minimum temperature is -4°C in January. Moreover, its annual precipitation average is about 5mm in July as well as 4mm in August (İklim Çumra, n.d.). Especially, although its agricultural lands are wide areas, water depletion is very important risks in terms of both environmental and socio-economic conditions.

According to TUİK (2019b), the section of the analysis investigated how the size of the agricultural product pattern changed in 2004, 2008, 2013 and 2018 in Zone 5. The section included four patterns: fruits, drinks and spice plants areas, fallow areas, vegetable areas and grain and other crop product areas (Figure 5.69). Firstly, while the size of fruits, drinks and spice plants areas rapidly decreased from 2004 (11220 decare) to 2008 (3230 decare). Afterwards, these sizes dramatically increased in 2013 (10825 decare). However, the size once again decreased in 2018 (6979 decare). Another agricultural pattern is fallow area. The size of fallow areas rose from 2004 (138920 decare) to 2008 (467158 decare). However, its fallow area decreased in 2018 (131000 decare). Thirdly, its size of vegetable area increased from 2004 (15350 decare) to 2018 (56893 decare). According to the size of grain and other crop product area, it also increased from 2004 (864630 decare) to 2018 (1136846 decare).

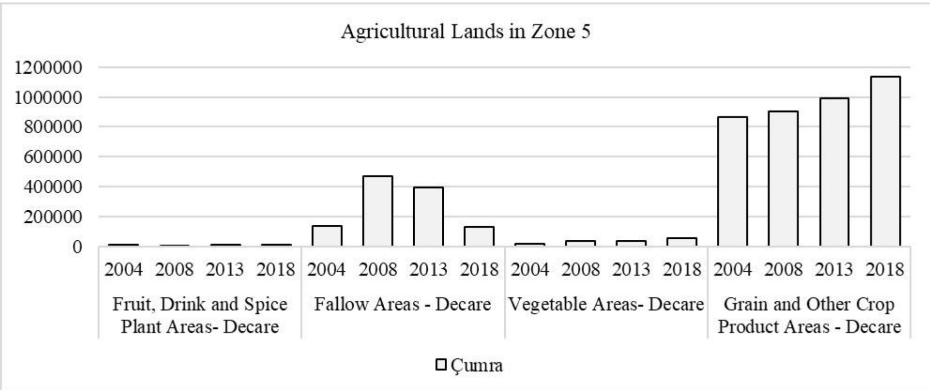


Figure 5.69. Agricultural lands in Zone 5 in 2004-2008-2013-2018 (TUİK, 2019b)

As displayed in Table 5.14, the findings based on the farmers' and experts' observations in Zone 5. These observations are in line with their experiences. While the majority of the farmers (76.5 %) stated that climate change increased temperature, 50.1% of the experts added in the 'other' option: climate change was seasonal shift. On the other hand, of the farmers, 29.4% underlined that climate change decreased precipitation, and 33.3% of the experts claimed that climate change increased temperature. These observations could associate with desertification or drought and water depletion.

Table 5.14. *The observed effects of climate change in Zone 5*

The Observed Effects of Climate Change in Zone 5		
	Farmers(17)	Experts(6)
Climate change increases temperature	76,5	33,3
Climate change decreases temperature	0	0
Climate change increases precipitation	5,9	0
Climate change decreases precipitation	29,4	16,7
Climate change increases frost cases	11,8	0
Other- Climate change is unexpected change weather	0	16,7
Other- Climate change is seasonal shift	0	50,1

Regarding the importance of the risks, the components of the climate change were categorized into sixteen groups. It is aimed to found considerable risks regarding climate change. As demonstrated in Table 5.15, 70.6% of the farmers focused on desertification. On the other hand, majority of the experts (83.3%) emphasized the increase of desertification while all of experts stressed that water depletion would be fundamental risk in the future. However, 58.5% of the farmers worried about water depletion and water wars. Accordingly, half of experts underlined that famine and pothole formation would increase in the future. It can be concluded that an integrated planning, which are prepared by all stakeholders both national and local scale, is necessary intervation to solve these risks in terms of environmental and socio-economic perspectives.

Table 5.15. *The risks based on climate change in Zone 5*

The Risks based on Climate Change in Zone 5		
	Farmers(17)	**Experts(6)**
Desertification	70,6	83,3
Famine	52,9	50
Water Depletion	58,8	100
Biodiversity reduction	5,9	0
Air pollution	11,8	0
Land pollution	17,6	16,7
Water pollution	23,5	0
Food wars	35,3	0
Water wars	58,8	33,3
Increased acid rains	17,6	0
Decreased in food production	11,8	16,7
Migration	17,6	16,7
Epidemic Diseases	17,6	0
Pothole Formation	23,5	50
Sandstorm	0	33,3
Other- change of plant pattern, decreased crop yield	5,9	0

The outcomes of mitigation actions revealed three levels low, medium and high in Zone 5. The findings concerning these actions are related to ongoing consequences of climate change (Figure 5.71). Firstly, if the measures against climate change ensure, 64.7% of the farmers stated that urban sprawl would reduce at a low level, and 50% of the experts associated climate change with reduced urban-rural migration, urban sprawl and increased employment. At a medium level, %47.1 of the farmers focused on increased efficient product, and 50% of the experts stated that poverty would reduce in Zone 5. Besides, of the farmers, 52.9% and 47.1% believed that drought and environmental pollution would reduce at a high level. In addition, all of experts and 83.3% of them claimed that drought would reduce and efficiency product would increase in the future at a high level. As displayed in Figure 5.70, there are close proximity between residential areas and agricultural areas; thus, it can be said that agricultural sustainability could be faced with increasing urbanization pressure on rural areas. Thus, the impacts of climate change on urban areas can affect the agricultural lands in terms of productivity, fertile lands.

Figure 5.70. The proximity between residential areas and agricultural areas in Çumra (Personal Photography, 2018)

According to the findings pertaining to participants' views, farmers attached low ranking to organic farming (52.9%), and improved public transportation system (58.8%), and 33.3% of the experts also ranked land consolidation and organic farming at a low level, respectively. At a medium level, 52.9% of the farmers believed in good agricultural practice and regulation of the fertilization system, and 50% of the experts attached at a medium level ranking to land consolidation. In addition to these, 58.8% of the farmers highlighted land consolidation and having detailed information about products. Majority of experts (66.7%) believed in good agricultural practices, regulation of the fertilization system, decreased waste generation and having detailed information about products.

Thirdly, the first three results related to each other in terms of weather conditions. Both farmers (41.2%) and experts (33.3%) emphasized that seasonal abrupt change would occur in Zone 5 at a high level. At a low level, of the farmers, 47.1% stated that agricultural areas, where would be fertile lands in the future, may be opened to development, 33.3% of the experts highlighted similar results in the future, 33.3% of the experts also stated that new technology developments would enable to adaptation. At a medium level, 35.3% of the farmers underlined that agricultural production would not be done in many areas, and 33.3% of the experts claimed that agricultural areas, where would be fertile lands in the future, may be opened to development. At a level, all of farmers and 76.5% of them believed in water crises among sectors would rise and product pattern plans would be needed. Similarly, 83.3% of the experts underlined same consequences in Zone 5. The results showed that water crises among sectors was one of the most important estimated consequences. Another estimated result was the necessary of product patterns plans. On the other hand, events related to urbanization were not strongly linked to the impacts of climate change.

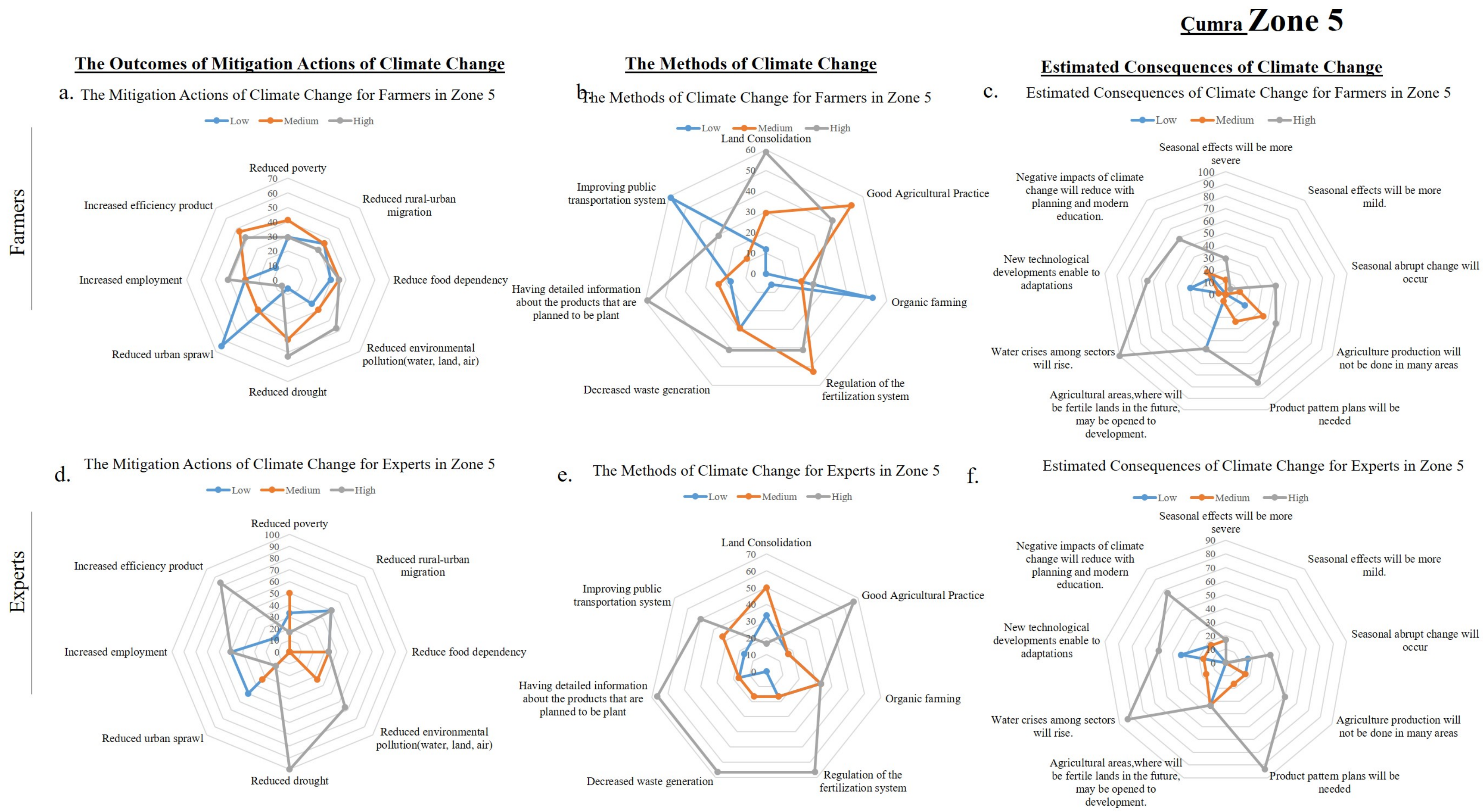


Figure 5.71. The outcomes of mitigation actions(a-d), methods (b-e), and estimated consequences (c-f) of climate change in Zone5

CHAPTER 6

CONCLUSION

6.1. The Main Problematic Issues

The effects of GHG emissions that have increased rapidly after industrialization period bring about an increase of urban heat island in urban areas, and a decrease in crop productivity and quality in rural areas. This situation leads to serious environmental and socio-economic problems in rural and urban areas. Along with rapid population growth and the increase in food demands, various environmental and socio-economic problems can occur in different regions. Even though different impacts are observed in different regions in worldwide, it is estimated that Mediterranean Basin will be adversely affected due to the negative impacts of climate change. Especially, an increase in temperature and a decrease in rainfall will cause water depletion. Moreover, agricultural sector, which is priority sector of food system in national economy, will be seriously affected by climate change.

In recent years, many studies have carried out on climate change and food security. These two concepts are particularly associated with rural development. Even though many factors affect agricultural sustainability, climate change is one of the fundamental factors in agricultural sustainability. From research methods, while the impacts of climate change are mostly assessed climatic models, qualitative studies have increased in recent years. The qualitative studies focus on the relationship between the impacts of climate change and perceptions. The environmental and socio-economic impacts on rural areas are discussed in many studies. Environmental impacts focus on soil, land and water resources, while socio-economic impacts emphasize poverty, migration and diseases. In this context, climate change results in the serious problems on a national and local scale. The reduce in negative impacts of climate change contribute to improve the quality of life and achieve sustainable development. Adaptation and mitigation actions are significant principles for farmers, who have agricultural income on a local scale. Furthermore, food systems are associated with the impacts of climate change on a national and international scale. On the other hand, it is estimated that if the temperature increases 1.5°C and 2°C, crop quality and yield will decrease. In this case, food availability, food accessibility, food stability and food utilization will face risks related climate change. Thus, the determination of the impacts of climate change on agricultural lands is fundamental issue in order to sustain food systems and rural areas.

In this research, climate change is a multidimensional concept; thus, environmental, socio-economic and planning perspectives of climate change are tackled as a whole in rural areas. People in rural areas interact with each other rather than in urban areas, and their perceptions can be affected by these interactions. This study focuses on both experts' and farmers' perceptions on a local scale. Although several studies have been carried out on climatic modelling, many studies on vulnerable farmers' perceptions and experiences increases in recent years. From planning perspectives, even though fertilization, drought resilience crops, irrigation systems, land consolidation and organic agriculture are main principles based on climate change on agricultural lands, the necessary of socio-economic studies was also highlighted in international and national plans. For this reason, in this thesis, socio-economic impacts on rural areas will be investigated as well as environmental impacts. As far as planning literature is concerned, studies based on models and simulations are not sufficient. Furthermore, socio-economic impacts of climate change are crucial indicators. Thus, the impacts of climate change on agricultural lands are assessed in terms of not only environmental but also socio-economic perspectives. Moreover, perceptions, experiences, observed effects, risks, the outcomes of mitigation actions, agricultural methods, and estimated consequences are priority criteria in order to deal with the negative impacts of climate change.

The thesis aims to determine the impacts of climate change on a micro-meso scale and macro scale and to evaluate short and long term strategies based on farmers' and experts' perceptions, experiences and estimates in rural areas. Konya province was selected as case study. Konya has an important agricultural lands. However, after 2007, it was affected by drought. Especially, valuable wetlands such as Akşehir Lake and Hotamış Lake dried up, and some areas of these wetlands were turned into agricultural lands. Although this situation increases agricultural production nowadays, climate change is a significant threat on wetlands due to trigger water depletion. Konya Closed Basin has faced serious problem in terms of agricultural water consumption. The zones in Konya were selected from dataset based on "Residential Location in the Rural Areas of Konya", which was prepared by KMM in 2018. For data selection, eight criteria were determined, and eight provinces were selected for carried out questionnaires. The questionnaires were carried out 72 farmers and 28 experts to determine their' perceptions, experiences and estimations on climate change. The questionnaires consist of three main parts: demographic information of the participants, general information about climate change of the participants, and the relationship between climate change and planning.

6.2. Reflection of the Findings

From a demographic information of the participants' perspective, the evaluations and recommendations are summarized as follows:

The findings displayed that male participants were more common for both farmers and experts. There is a serious difference in terms of their educational levels. While majority of farmers had a primary level, majority of experts had a bachelor's level. Especially, lack of information can affect adaptation and mitigation actions. Moreover, the awareness and level of knowledge on climate change issues is low; thus, this situation can directly relate to education level. Furthermore, about half of the farmers had a household size of 3-4 people. There is no balance in terms of land size, but majority of farmers had property owner. About 75% of the farmers said there are close and middle proximity between residential and agricultural lands. 57.1% of the experts and 83.3% of the farmers want to continue living in their place of residence. Especially, this situation is related to sense of belonging for farmers. On the other hand, most of farmers had property owner lands; hence, there is a strong network between willing to continue living place and sense of belonging. This situation is positive impact for planning perspectives in order to agricultural sustainability. In this respect, sense of belonging can trigger participation, and it can be significant criteria in order to strengthen adaptation and mitigation actions.

From a general information about climate change of the participants' perspective, the evaluations and recommendations are summarized as follows:

In terms of climate change, 'global warming' is determination of the first rank in terms of both farmers and experts. However, while most of farmers had no information about climate change, majority of experts had information about existing reasons of climate change. Indeed, both groups had not enough information about the adaptation process and action plans. This situation can result in serious barriers for adaptation and mitigation process. Therefore, the increase in public support on a local level can strengthen climate change process. Furthermore, about half of the participants stated that the level of climate change is higher. Two groups observed an increase in temperature. However, farmers emphasized unexpected change in weather, and experts observed seasonal shift. Thus, participants' different observations are noteworthy issues.

The human activities bring about the increase in the impacts of climate change. According to experts' overviews, human impacts on climate change is higher than farmers' overviews. Farmers' experiences stressed the usage of water, inadequate reforestation and destroying nature; furthermore, experts' experiences highlighted inadequate reforestation and destroying nature, unawareness, and the extreme usage of electricity and vehicles. There are differences between farmers' and experts' underlined issues. On the other hand, while 59.7% of farmers had high concerns about climate change, 35.7% of the experts had high concerns on climate change. Farmers are more pessimistic about climate change than experts, and lack of information results in an increase in concerns. Thus, it can be considered that educational programs, strong administrative network and an integrated planning are fundamental principles in order to cope with the negative impacts of climate change.

In terms of risks based on climate change, both groups highlighted water depletion and desertification. Hence, it is extremely important to determine of protected areas and to strengthen an integrated planning systems. Besides, both farmers and experts underlined two principles to deal with climate change: product pattern planning and administrative collaboration. From a planning perspectives, these principles are related to environmental and political issues.

Both farmers and experts improved several implementations related to climate change. Whereas farmers' individual experiences mostly focused on the change of irrigation system, consulting experts, and the change of product pattern, experts' institutional experiences had forestation, good agricultural practices, the change of irrigation system and consulting experts. These findings indicated that there was a harmony between farmers and experts. This situation is very important advantage in order to adapt to climate change. In other words, public support contributes to improved strong network between stakeholders. According to social practices, farmers highlighted preparation of annual reports and informative programs, and institutional collaboration, while experts underlined an increase in educational and awareness programs, and administrative collaboration. Therefore, both farmers and experts emphasize two major principles to deal with climate change: education and awareness programs and administrative collaboration. From a planning perspectives, these principles are related to socio-economic and political issues.

Almost half of the participants stated that the resilience level to climate change was low. Even though majority of participants stressed that climate change was an economic risk, there was no common idea in terms of food production and marketing. The majority of farmers highlighted the necessary of market areas and socio-cultural facilities in villages. Thus, climate change is one of the main risk factors of agricultural sustainability. On the other hand, farmers highly use their cars. It can be said that farmers do not know the connection between climate change and reason of climate change such as usage of cars.

There are several fundamental issues on climate change: seasonal change, weather abrupt change, the change of product patterns, product pattern planning and crop diversity. When asked about institutional collaborations to reduce the impacts of climate change, farmers and experts focuses on public institutions and organizations as priority administrative. Besides, farmers also underlined the importance of university, experts stated co-organization for all stakeholders. Thus, the importance of public support was underlined once again. When asked mitigation and adaptation actions, farmers stressed environmental and socio-economic issues. Majority of farmers do not emphasize disaster risk management. For this reason, it can be inferred that farmers directly tend to observe the results of these actions.

From the relationship between climate change and planning of the participants' perspective, the evaluations, estimations and recommendations are summarized as follows:

According to farmers and experts, if mitigation actions are improved by decision-makers, production will highly increase. The reduce in urban sprawl are associated with mitigation actions at a lower level. Thus, whereas the mitigation actions result in economic benefits in rural areas, they consider different factors of urbanization rather than climate change.

In terms of methods, farmers stated having detailed information about the crops, while experts highlighted good agricultural practices at a high level. On the other hand, the impacts of various agricultural practices on climate change are lower. Agricultural practices should improve related to local dynamics.

According to the estimated consequences of climate change in the future, farmers highly emphasize the necessary of product pattern plans, while experts draw attention to water crises among sectors in the future. On the other hand, not only farmers but also experts stressed 'agricultural areas, which will be fertile lands in the future, may be opened to development in the present' at a lower level. Similar to mitigation actions, both farmers and experts are stated that urbanization are affected by many factors, and the impacts of climate change on urban sprawl is low. On the other hand, river basin management plans are very important in order to protect water resources. As well as these plans, the determination of farmers' socio-economic conditions and estimations can provide an opportunity for an integrated planning.

Five zones are determined in order to understand differences between experts' and farmers' observations in different climatic zones (Table 6.1). **These five zones' evaluations and recommendations** are summarized as follows:

In Zone 1, there were main differences in the rankings between experts' and farmers' observed effects at a high level. While farmers focused on an increase in precipitation and unexpected weather change, experts underlined seasonal shift and a decrease in yield, drought. The farmers' and experts' highest perceived risks were a decrease in food production and water depletion. According to the outcomes of mitigation actions, there was a consensus between farmers and experts in terms of reduced drought and increased efficiency product. Furthermore, the methods based on experiences rankings showed clearly that farmers highlighted the significance of detail information about crops, organic farming and regulated fertilization, whereas experts focused on waste generation and improving public transport system. From estimated consequences, farmers stated the importance of product pattern plans and planning-educational system. Experts also stressed that water crises would occur and agricultural production would not be done.

In Zone 2, there is a consensus between experts' and farmers' observed effects at a high level in terms of an increase in temperature and a decrease in precipitation. The participants perceived water depletion as the highest risks. On the other hand, farmers stressed famine and desertification, experts focused on biodiversity reduction and migration. From mitigation actions perspectives, if mitigation actions against climate change were improved, efficiency products would increase and drought would reduce for farmers. For experts, they believed an increase in employment and efficiency product, and a decrease in environmental pollution. According to the methods based on climate change, participants stated the importance good agricultural practices and regulated fertilization. Indeed, farmers also highlighted the importance of detail information about crops. Moreover, farmers and experts drew attention water crises and the necessary of planning and education. In addition, farmers emphasized the necessary of product pattern plans.

In Zone 3, the participants observed an increase in temperature as the highest risks. Whereas farmers stressed an increase in frost cases, experts emphasized seasonal shift. Farmers underlined food wars as higher risk. Water depletion also was common risks for participants. If mitigation actions were strengthened, employment and product efficiency would increase. Also, experts stressed a reduce in urban-rural migration. Experts and farmers also emphasized methods to deal with climate change such as good agricultural practices. Farmers believed the importance of detail information about crops; besides, the experts underlined regulated fertilization and public transportation system. There are main differences the participants' estimated consequences. Farmers claimed that product pattern plans were mandatory strategy, and agricultural production would not be done. For experts, water crises and planning-educational system were estimated consequences.

In Zone 4, the participants observed an increase in temperature at a high level. Although water depletion was a serious risk, they underlined the importance of pothole formation. If the mitigation actions were increased, product efficiency would increase in rural areas. Both farmers and experts highlighted the significance of detail information about crops in terms of methods. From estimated consequences, farmers focused on the necessary of product pattern plan and education-planning systems, while experts highlighted water crises, product pattern and a decreased in agricultural production.

In Zone 5, the participants' observations on climate change was an increase in temperature. For farmers, a decrease in precipitation was important observation. Experts also emphasized seasonal shift. On the other hand, desertification and water depletion were serious risks in rural areas. From a mitigation action perspective, there was a consensus that drought would reduce. Moreover, farmers highlighted a decrease in environmental pollution. Experts also emphasized an increase in product efficiency. Farmers believed the importance of land consolidation, and detail information about crops, and experts also underlined the necessary of good agricultural practices, regulated fertilization and waste generation. From an estimated consequences perspective, to prevent of water crises and to improve of product pattern plans were priority principles.

Table 6.1. *The compare with all zones*

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	
Observed Effects	✓ Precipitation increases ✓ Unexpected weather change	✓ **Temperature increases** ✓ Precipitation decreases	✓ **Temperature increases** ✓ Frost cases increases	✓ **Temperature increases**	✓ **Temperature increases** ✓ Precipitation decreases	Farmers
	✓ **Seasonal shift** ✓ Drought-Decreased yield	✓ **Temperature increases** ✓ Precipitation decreases	✓ **Temperature increases** ✓ **Seasonal shift**	✓ **Temperature increases** ✓ Temperature decreases ✓ Unexpected weather change ✓ **Seasonal shift**	✓ **Seasonal shift** ✓ **Temperature increases**	Experts
Risks	✓ Decreased food production ✓ **Water depletion**	✓ **Water depletion** ✓ Famine ✓ **Desertification**	✓ Food wars ✓ **Desertification** ✓ **Water depletion**	✓ **Water depletion** ✓ Pothole formation	✓ **Desertification** ✓ **Water depletion** ✓ Water wars	Farmers
	✓ Decreased food production ✓ **Water depletion**	✓ **Water depletion** ✓ Biodiversity reduction ✓ Migration	✓ **Water depletion**	✓ Desertification ✓ **Water depletion** ✓ Water wars Pothole formation	✓ **Water depletion** ✓ Desertification	Experts
Mitigation Actions	✓ Reduced drought ✓ **Increased efficiency product**	✓ **Increased efficiency product** ✓ Reduced drought	✓ Increased employment ✓ **Increased efficiency product**	✓ Increased employment ✓ **Increased efficiency product**	✓ Reduced drought ✓ Reduced environmantal pollution	Farmers
	✓ **Reduced drought** ✓ **Increased efficiency product**	✓ Reduced environmental pollution ✓ Increased employment ✓ **Increased efficiency product**	✓ Reduced urban-rural migration ✓ Increased employment ✓ **Increased efficiency product**	✓ **Increased efficiency product**	✓ **Reduced drought** ✓ **Increased efficiency product**	Experts
Methods	✓ **Detail information about crops** ✓ Organic farming ✓ Regulated fertilization	✓ **Detail information about crops** ✓ Good agricultural practices	✓ **Detail information about crops** ✓ Good agricultural practices	✓ **Detail information about crops** ✓ Good agricultural practices ✓ Regulated fertilization	✓ Land consolidation ✓ **Detail information about crops**	Farmers
	✓ Waste generation ✓ Public transport system	✓ **Good agricultural practices** ✓ Regulated fertilization ✓ Waste generation ✓ Detail information about crops	✓ **Good agricultural practices** ✓ Regulated fertilization ✓ Public transport system	✓ Detail information about crops	✓ **Good agricultural practices** ✓ Regulated fertilization ✓ Waste generation ✓ Detail information about crops	Experts
Estimated Consequences	✓ **Product pattern plans** ✓ **Planning-Education**	✓ **Product pattern plans** ✓ Water crises	✓ **Product pattern plans** ✓ Agricultural production will not be done	✓ **Product pattern plans** ✓ **Planning-Education**	✓ Water crises ✓ **Product pattern plans**	Farmers
	✓ **Water crises** ✓ Agricultural production will not be done ✓ Planning-Education ✓ Development areas	✓ **Water crises** ✓ Planning-Education	✓ **Water crises** ✓ Planning-Education	✓ **Water crises** ✓ Agricultural production will not be done ✓ Product pattern plans	✓ Product pattern plans ✓ **Water crises**	Experts

This study contributes to appear local responses based on farmers and experts in order to deal with climate change in Konya, Turkey. Short and long term problems on rural areas are noteworthy in terms of climate change. ıt is the subject of planning discipline to strengthen the relationship between short term strategies and long term strategies. Therefore, three hypotheses were determined on a micro-meso and macro scale. Within the scope of this research, three hypotheses are tested as follows:

The **first hypothesis** of the research is that *"the agricultural sector is faced with socio-economic risks as well as environmental risks based on climate change on a micro and macro scale."*

From a demographic information of the participants' perspective, lack of educational levels are an important problem in order to deal with socio-economic risks. From a general information about climate change of the participants' perspective, the lack of information about climate change process is a serious challenge in order to deal with climate change. Thus, the increase in public support on a local level can strengthen climate change process. In addition to these, both groups highlighted water depletion and desertification. Therefore, even though these risks seem to be environmental risks, they seriously trigger socio-economic problems. From the relationship between climate change and planning of the participants' perspective, the increase in crop productivity are related to economic benefit. Based on socio-economic perspectives, the information about crops, and technical agricultural practices are associated with the reduce in economic risks. Moreover, the increase in training and awareness programs contribute to the prevention of socio-economic risks as well as environmental risks. Thus, climate change triggers socio-economic risks on rural areas.

The **second hypothesis** of the research is that *"the farmers will suffer from negative impacts of climate change in terms of socio-economic conditions in the future. If the social network and collaboration with all stakeholders are strengthened, the negative impacts of climate change can be decreased in rural areas on a macro scale."*

From a demographic information of the participants' perspective, majority of farmers had property owner; moreover, there is a strong relationship between willing to continue living place and sense of belonging. Thus, these findings can contribute to participatory planning approach based on collaboration of all stakeholders. From the relationship between climate change and planning of the participants' perspectives, the necessary of product pattern plans and water crises among sectors in the future are fundamental issues in terms of climate change. These focal points are associated with short and long term strategies, and an integrated planning can form the balance between long term strategies and short term strategies. From a general information about climate change of the participants' perspective, the administrative collaboration and the training and awareness programs are very important in order to deal with climate change. Moreover, the emphasis on university and public institutions and organizations by farmers and the emphasis on collaboration of all stakeholder by experts are associated with social network and collaboration. Thus, these findings support this hypothesis.

The **third hypothesis** of the research is that *"although farmers focus on autonomous adaptation on a micro scale, experts emphasize planned adaptation on a macro scale. The dilemma between micro and macro scale can been reduced via planning discipline."*

When asked about the individual and institutional experiences, while farmers focus on micro-scale strategies such as changing irrigation systems, changing product patterns, and consulting experts, experts underline long term strategies such as afforestation, good agricultural practices and consulting experts. In this process in climate change, the balance between short and long term policies is the fundamental subject of planning discipline. At present, although climate change-related solutions have been developed, determining of long term strategies and short terms strategies is the core issue of planning discipline. As seen in Figure 6.1, farmers focus on short term solutions on a micro-meso scale, while experts focus on long term strategies on a macro scale.

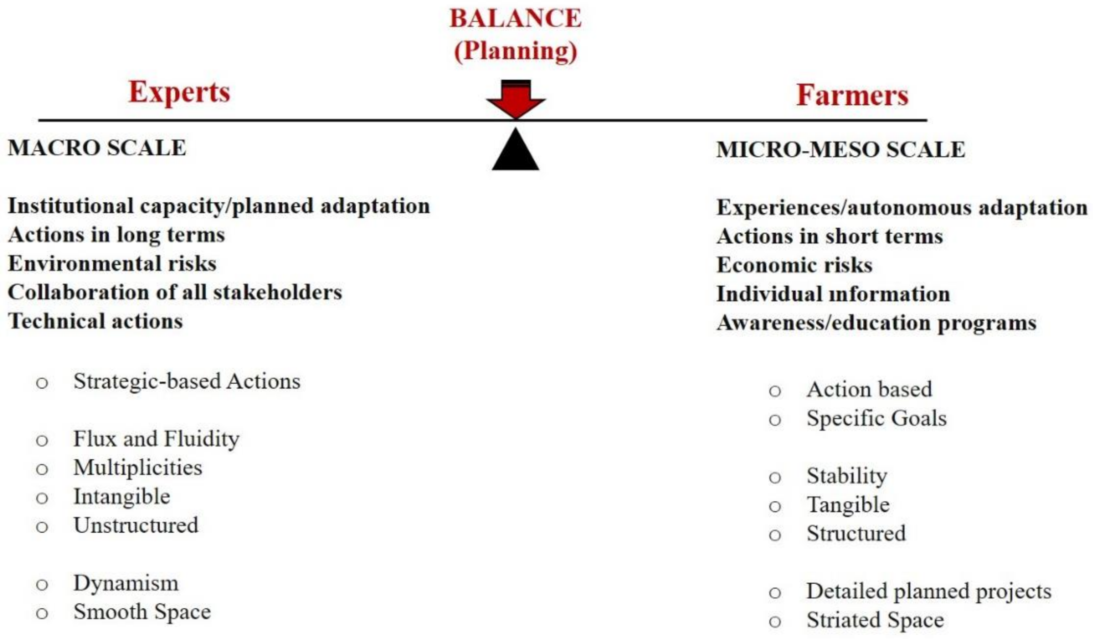


Figure 6.1. The planning approaches of farmers and experts on a micro-maso and macro scale

As a result, in this thesis the impacts of climate change on rural areas is evaluated within not only the framework long term strategies but also short term strategies based on participants' perceptions, experiences and estimations. The main challenges between agricultural policies and climate change are: lack of information about climate change strategies, lack of collaboration of all stakeholders, and insufficient innovation solutions. Thus, determining of strategies on a micro-meso and macro scale is the subject of planning discipline, and the relationship between farmers and experts can be strengthened by planning. Planning is a process toward solving the short term and long term dilemma in terms of social objectives and aims. The impacts and outcomes of climate change on agriculture is a social issue rather than individual; hence, it is an issue of planning discipline. The balance between long term strategies and short term strategies can be achieved through an integrated planning. To strengthening of experiences, to raise of awareness and training programs are associated with short term strategies on a micro-meso scale, while to strengthening of institutional capacity, and collaboration of all stakeholders are related to long term strategies on a macro scale.

6.3. Recommendation for Future Research

Within the scope of the study, local responses based on farmers and experts are assessed in order to deal with the impacts of climate change on agriculture. Farmers' and experts' perceptions, experiences and estimations are analyzed in order to understand the impacts of climate change on rural areas. However, there was several limitations related to the research process. Limited number of women as participants in the study is major limitation of this study, and some districts focused on research process due to limited time.

Agriculture and weather condition are directly related to these concepts in rural areas due to sustain basic economic system based on agriculture. However, water depletion is one of the most important risks in terms of not only environmental but also socio-economic conditions. In particularly, migration related economic livelihoods, the deterioration of food system, the drop in crop yields, and drop in farmers' incomes threaten socio-economic conditions. For future research, it is recommended to increase sample areas in different climatic regions in Turkey. According to planning perspective, agricultural master plan, environmental plan, development plans can be examined in detail in terms of environmental perspectives. Moreover, planning principles related climate change can be developed by analyzing the farmers' and experts' actions on a micro-meso and macro scale.

REFERENCES

Adams, R. M., Fleming, R. A., Chang, C. C., McCarl, B. A., & Rosenzweig, C. (1995). A Reassessment of the Economic Effects of Global Climate Change on U.S. Agriculture. *Climatic Change*, *30*; 147-167.

Ağaçayak, T., & Öztürk, L. (2017). Türkiye'de Tarım Sektöründen Kaynaklanan Sera Gazı Emisyonlarının Azaltılmasına Yönelik Stratejiler. *İMP-Mercator Politika Notu.* İstanbul.

Alauddin, M., & Sarker, M. A. R. (2014). Climate Change and Farm-Level Adaptation Decisions and Strategies in Drought-Prone and Groundwater-Depleted Areas of Bangladesh: An Empirical Investigation. *Ecological Economics*, *106*; 204-213.

Ali, A., & Erenstein, O. (2017). Assessing Farmer Use of Climate Change Adaptation Practices and Impacts on Food Security and Poverty in Pakistan. *Climate Risk Management*, *16*; 183-194.

Aras, İ. (2014). Bölgemizde Tarım Alanları Azalıyor Mu? 1-14. MEVKA. Konya. Retrieved September 30, 2018 from http://www.mevka.org.tr/Yukleme/Uploads/DsyIlaYpv7212017101106AM.pdf

Aras, İ. (2014, ppt). Bölgemizde tarımsal üretim. Presentation. MEVKA. Konya.

Aşıcı, A. A. (2017). *İklim İçin Yeşil Ekonomi Politikaları Nasıl Bir Kent? Nasıl Bir Enerji Sistemi? Nasıl Bir Toprak Kullanımı?* 1-82.

Atay, M.U. (2015). *The Impact of Climate Change on Agricultural Production in Mediterranean Countries.* PhD Thesis, METU Department of Earth System Science, Ankara, Turkey.

Bajracharya, B., Childs, I., & Hastings, P. (2011). Climate Change Adaptation Through Land Use Planning and Disaster Management: Local Government Perspectives from Queensland. In *17th Pacific Rim Real Estate Society Conference*.

Balaban, O. (2012). Climate Change and Cities: A Review on the Impacts and Policy Responses. *METU Journal of the Faculty of Architecture*, *29*(1); 21-44.

Berke, M.Ö., Dıvrak, B.B., & Sarısoy, H.D. (2014). Konya'da Suyun Bugünü Raporu. *WWF and Eti Burçak*; 1-65. Retrieved July 05, 2017 from http://awsassets.wwftr.panda.org/downloads/konya_da_suyun_bugnu_raporu.pdf

Binder, C., & Schöll, R. (2010). Structured Mental Model Approach for Analyzing Perception of Risks to Rural Livelihood in Developing Countries. *Sustainability*, *2*; 1-29.

Blanc, E., & Reilly, J. (2017). Approaches to Assessing Climate Change Impacts on Agriculture: An Overview of the Debate. *Review of Environmental Economics and Policy*, *11*(2); 247-257.

Brundtland, G. H. (1987). *Report of the World Commission on Environment and Development: Our Common Future*. Oslo. Retrieved February 25, 2018 from http://www.un-documents.net/our-common-future.pdf

Bryan, E., Deressa, T. T., Gbetibouo, G. A., & Ringler, C. (2009). Adaptation to Climate Change in Ethiopia and South Africa: Options and Constraints. *Environmental Science & Policy*, *12*; 413-426.

Bryan, E., Ringler, C., Okoba, B., Roncoli, C., Silvestri, S., & Herrero, M. (2013). Adapting Agriculture to Climate Change in Kenya: Household Strategies and Determinants. *Journal of Environmental Management*, *114*; 26-35.

Calzadilla, A., Zhu, T., Rehdanz, K., Tol, R. S., & Ringler, C. (2013). Economywide Impacts of Climate Change on Agriculture in Sub-Saharan Africa. *Ecological Economics*, *93*; 150-165.

Crawford, E. (1997). Arrhenius' 1896 Model of the Greenhouse Effect in Context. *Ambio*, *26*; 6-11.

Davies, M., Guenther, B., Leavy, J., Mitchell, T., & Tanner, T. (2009). Climate Change Adaptation, Disaster Risk Reduction and Social Protection: Complementary Roles in Agriculture and Rural Growth? *IDS Working Papers*, 320; 01-37.

Dellal, İ., McCarl, B. A., & Butt, T. (2011). The Economic Assessment of Climate Change on Turkish Agriculture. *Journal of Environmental Protection and Ecology*, *12*(1); 376-385.

Draft version of the Büyük Menderes Basin Management Plan (Büyük Menderes Nehir HavzasıYönetim Planı Taslağı). (2018). *Technical Assistance for the Conversion of River Basin Action Plans into River Basin Management Plans.*

Draft version of the Konya Basin Management Plan (Konya Havzası Yönetim Planı Taslağı). (2018). *Technical Assistance for the Conversion of River Basin Action Plans into River Basin Management Plans*.

Draft version of the Meriç Ergene Basin Management Plan (Meriç Ergene Nehir Havzası Yönetim Planı Taslağı). (2018). *Technical Assistance for the Conversion of River Basin Action Plans into River Basin Management Plans*.

Draft version of the Susurluk Basin Management Plan (Susurluk Nehir Havzası Yönetim Planı Taslağı). (2018). *Technical Assistance for the Conversion of River Basin Action Plans into River Basin Management Plans*.

DSİ. (2014*). Devlet Su İşleri Genel Müdürlüğü 2014 Yılı Faaliyet Raporu*. Ankara.

Dudu, H. (2013). *Climate Change, Agriculture and Trade Policy: CGE Analyses at Regional, National and Global Level.* PhD thesis, METU Department of Economics, Ankara, Turkey.

Ebi, K. L., & Semenza, J. C. (2008). Community-Based Adaptation to the Health Impacts of Climate Change. *American Journal of Preventive Medicine*, *35*(5); 501-507.

Eitzinger, A., Binder, C. R., & Meyer, M. A. (2018). Risk Perception and Decision-Making: Do Farmers Consider Risks from Climate Change? *Climatic Change*, *151*; 507-524.

Ekşi, N. (2016). İklim Mültecileri. *Göç Araştırmaları Dergisi*, *2(2)*; 10-58.

Elasha, O., Medany, M., Niang-Diop, I., Nyong, T., & Tabo, R., & Vogel, C. (2006). Background Paper on Impacts, Vulnerability and Adaptation to Climate Change in Africa. In *UNFCCC Convention,* Ghana.

Elum, Z. A., Modise, D. M., & Marr, A. (2017). Farmer's Perception of Climate Change and Responsive Strategies in Three Selected Provinces of South Africa. *Climate Risk Management*, *16*; 246-257.

Ereğli Ovası ORTO28 Restorasyon Aşaması Gerileme (-3). (n.d.) Retrieved April 20, 2019 from https://www.dogadernegi.org/wp-content/uploads/2018/11/ort028-eregli-ovasi-onemli-doga-alanlari-kitabi.pdf

Erkan, M.A., Kılıç, G., Çamalan, G., Güser, Y., Çetin, S., Odabaşı, E., Soydam, M., Akgündüz, A.S., Ayvacı, H., Eren, O.& Arabacı, H. (2018). *Meteorolojik Karakterli Doğal Afetler 2017 Yılı Değerlendirmesi.* Araştırma Dairesi Başkanlığı Meteorolojik Afetler Şube Müdürlüğü. Turkish State Meteorological Service. Ankara.

Falco, C., Galeotti, M., & Olper, A. (2018). *Climate change and Migration: Is Agriculture the Main Channel?* (No. 100). IEFE, Center for Research on Energy and Environmental Economics and Policy, Universita'Bocconi, Milano, Italy.

FAO. (2006). Food Security. *Policy Brief (2).*

FAO. (2013). *Climate Smart Agriculture Sourcebook ;*557.

FAO. (2016). *Climate Change and Food Security: Risks and Responses*. Retrieved November 09, 2018 from http://www.fao.org/3/a-i5188e.pdf

FAO. (2017). *FAO's Work on Climate Change.* United Nations Climate Change Conference.

FAO. (n.d.). *FAO and the 17 Sustainable Development Goals.* Retrieved November 09, 2018 from http://www.fao.org/3/a-i4997e.pdf

FAO. (n.d.a). *Migration, Agriculture and Climate Change*. Reducing Vulnerabilities and Enhancing Resilience.

Gedikli, B. (2018). Approaches to Climate Change in Spatial Planning and Design: International and Turkish Experiences. *METU Journal of the Faculty of Architecture*, *35*(1). 89-109.

Google earth. (December 31, 1984). Akşehir, Konya. 38° 26'09.77" K, 31°36'21.13" D, Göz hizası 51.05 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 1984). Çeltik, Konya. 38° 58'07.32" K, 31°53'33.80" D, Göz hizası 25.87 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 1984). Çumra, Konya. 37° 34'57.45" K, 32°47'08.53" D, Göz hizası 26.62 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 1984). Ereğli, Konya. 37° 31'34.84" K, 33°57'25.10" D, Göz hizası 40.45 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 1984). Karapınar, Konya. 37° 43'16.87" K, 33°30'42.48" D, Göz hizası 77.35 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 2016). Akşehir, Konya. 38° 26'09.77" K, 31°36'21.13" D, Göz hizası 51.05 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 2016). Çeltik, Konya. 38° 58'07.46" K, 31°53'34.32" D, Göz hizası 25.87 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 2016). Çumra, Konya. 37° 34'57.45" K, 32°47'08.53" D, Göz hizası 26.62 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 2016). Ereğli, Konya. 37° 31'34.84" K, 33°57'25.10" D, Göz hizası 40.45 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (December 31, 2016). Karapınar, Konya. 37° 43’16.87” K, 33°30’42.48” D, Göz hizası 77.35 km. Image Landsat/Copernicus. Google Earth Pro. April 20, 2019.

Google earth. (July 7, 2016). Yunak, Konya. 38° 48’46.58” K, 31°46’22.53” D, Göz hizası 12.06 km. Image 2019 DigitalGlobe and Image 2019 CNES/Airbus. Google Earth Pro. April 20, 2019.

Google earth. (June 24, 2011). Hüyük, Konya. 37° 56’11.44” K, 31°34’07.13” D, Göz hizası 12.39 km. Image 2019 DigitalGlobe. Google Earth Pro. April 20, 2019.

Google earth. (May 3, 2018). Hüyük, Konya. 37° 56’18.83” K, 31°34’01.73” D, Göz hizası 12.39 km. Image 2019 DigitalGlobe and Image 2019 CNES/Airbus. Google Earth Pro. April 20, 2019.

Google earth. (October 5, 2010). Doğanhisar, Konya. 38° 08’31.08” K, 31°42’14.20” D, Göz hizası 6.22 km. Image 2019 DigitalGlobe. Google Earth Pro. April 20, 2019.

Google earth. (October 5, 2010). Yunak, Konya. 38° 48’46.58” K, 31°46’22.53” D, Göz hizası 12.06 km. Image 2019 DigitalGlobe. Google Earth Pro. April 20, 2019.

Google earth. (September 18, 2016). Doğanhisar, Konya.38°08’31.08” K, 31°42’14.20” D, Göz hizası 6.22 km. Image 2019 CNES/Airbus. Google Earth Pro. April 20, 2019

GRID Arendal&UNEP. (2002, May). *Impact of Temperature Rise on Robusta Coffee in Uganda*. Retrieved May 19, 2019 from http://www.grida.no/resources/7048

HaberTürk. (2018, September 29). *Karapınar’daki Obruklar Havadan Görüntülendi. Retrieved April 27, 2019, from* https://www.haberturk.com/karapinar-daki-obruklar-havadan-goruntulendi-2161444

Hannah L., Donatti C.I., Harvey C.A, Alfaro E., Rodriguez D.A., Bouroncle C., Castellanos E., Diaz F., Fung E., Hidalgo H.G., Imbach P., Läderach P., Landrum J.P., & Solano A.L. (2017). Regional Modeling of Climate Change Impacts on Smallholder Agriculture and Ecosystems in Central America. *Climatic Change*, *141*; 29-45.

Hertel, T. W., & Rosch, S. D. (2010). *Climate Change, Agriculture and Poverty*. The World Bank.

Hotamış Sazlığı ORTO13 Restorasyon Aşaması Gerileme (-3). (n.d.). Retrieved April 20, 2019 from https://www.dogadernegi.org/wp-content/uploads/2018/11/ort013-hotamis-sazligi-onemli-doga-alanlari-kitabi.pdf

How does the Global Climate Change Affect the Climate of Turkey? (n.d.). Retrieved November 11, 2018, from http://climatechangeinturkey.com/climate-change-basics-how-does-the-climate-of-turkey-change.html

Hürriyet. (2019, April 30). *Karapınar'da Obruk Sayısı 332'ye Çıktı*. Retrieved April 30, 2019, from http://www.hurriyet.com.tr/galeri-karapinarda-obruk-sayisi-332ye-cikti-41198740

İklim Akşehir. (n.d.). Retrieved December 29, 2018, from https://tr.climate-data.org/asya/tuerkiye/konya/aksehir-15763/

İklim Çeltik. (n.d.). Retrieved December 29, 2018, from https://tr.climate-data.org/asya/tuerkiye/konya/celtik-26567/

İklim Çumra. (n.d.). Retrieved January 01, 2019, from https://tr.climate-data.org/asya/tuerkiye/konya/cumra-15436/

İklim Doğanhisar. (n.d.). Retrieved December 29, 2018, from https://tr.climate-data.org/asya/tuerkiye/konya/doganhisar-26562/

İklim Ereğli. (n.d.). Retrieved January 01, 2019, from https://tr.climate-data.org/asya/tuerkiye/konya/eregli-14999/

İklim Hüyük. (n.d.). Retrieved December 29, 2018, from https://tr.climate-data.org/asya/tuerkiye/konya/hueyuek-21428/

İklim Karapınar. (n.d.). Retrieved January 01, 2019, from https:// tr.climate-data.org/asya/tuerkiye/konya/karapınar-925589/

İklim Yunak. (n.d.). Retrieved December 29, 2018, from https://tr.climate-data.org/asya/tuerkiye/konya/yunak-19357/

IPCC (1992). *Climate Change: The 1990 and 1992 IPCC Assessment IPCC First Assessment Report Overview and Policymaker Summaries and 1992 IPCC Suplement*, Canada: IPCC.

IPCC (1995). *Climate Change 1995: IPCC Second Assessment Report,* A Report of the Intergovernmental Panel on Climate Change. Retrieved November 4, 2018, from https://www.ipcc.ch/pdf/climate-changes-1995/ipcc-2nd-assessment/2nd-assessment-en.pdf

IPCC (2001). Watson, R. T., Albritton, D. L., Barker, T., Bashmakov, I. A., Canziani, O., Christ, R. et al., (eds.) *Climate Change 2001: Synthesis Report Summary for Policymakers*.

IPCC (2007). In Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.), *Climate Change 2007: Synthesis Report,* Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland.

IPCC (2013). *IPCC Factsheet: What is the IPCC?* Geneva, Switzerland

IPCC (2014). In Core Writing Team, Pachauri, R.K. and Meyer, L.A. (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. IPCC: Geneva, Switzerland.

IPED (2012). Konya Su Potansiyeli ve Kuraklığın Suya Etkilerinin Analizi Projesi Raporu;1-37. Retrieved April 26, 2019 from http://planlama.mevka.org.tr/attachments/article/150/Konced%20Konya%20 Su%20Potansiyeli.pdf.

İyi Tarım Uygulamaları Hakkında Yönetmelik. (2010). Official Gazette, 27778, December 12, 2010.

Kadıoğlu, M., Ünal, Y., İlhan, A., & Yürük, C. (2017). *Türkiye'de İklim Değişikliği ve Tarımda Sürdürülebilirlik.* 1-168. Retrieved May 01, 2019 from http://www.tgdf.org.tr/wp-content/uploads/2017/10/iklim-degisikligi-rapor-elma.compressed.pdf

Keller, M., Zamudio, A. N., Bizikova, L., Sosa, A. R., & Gough, A. M. (2018). Food Security and Climate Change from A Systems Perspective: Community Case Studies from Honduras. *Climate and Development*; 1-13.

KMM (2018). Residential Locations in the Rural Areas of Konya. Retrieved May, 2018, updated http://e-desen.konya.bel.tr/. from http://www.konya-e-desen.com/kriterDetay

Köksoy, N, E. (2012). TR52 Bölgesi (Konya Karaman) Kuraklık Indeksi. *Bölgesel Araştırma Raporları Serisi*. MEVKA. Konya. *4*; 1-83.

KOP BKİ (2017). Kırsal Dezavantajlı Alanlarda Tarımsal-Kırsal Kalkınmaya Yönelik Model Geliştirilmesi ve Elma, Kiraz, Üzüm ve Çilek Meyvelerinde Değer Zinciri Analizi Araştırma Etüt Projesi; 1-435.

Massey, D. S., Axinn, W. G., & Ghimire, D. J. (2010). Environmental Change and Out-Migration: Evidence from Nepal. *Population and Environment*, *32*; 109-136.

McLeman, R., & Smit, B. (2006). Migration as an Adaptation to Climate Change. *Climatic Change*, *76*; 31-53.

Mendelsohn, R., & Dinar, A. (1999). Climate Change, Agriculture, and Developing Countries: Does Adaptation Matter? *The World Bank Research Observer*, *14*(2); 277-293.

Mendelsohn, R., & Williams, L. (2004). Comparing Forecasts of the Global Impacts of Climate Change. *Mitigation and Adaptation Strategies for Global Change*, *9*; 315-333.

Mendelsohn, R., Nordhaus, W. D., & Shaw, D. (1994). The Impact of Global Warming on Agriculture: A Ricardian Analysis. *The American Economic Review*; 753-771.

Mertz, O., Mbow, C., Reenberg, A., & Diouf, A. (2009). Farmers' Perceptions of Climate Change and Agricultural Adaptation Strategies in Rural Sahel. *Environmental Management*, *43*; 804-816.

MoAF & CEM (n.d.). *Çölleşme İzleme Sistemleri.* Retrieved April 30, 2019 from http://www.cem.gov.tr/erozyon/AnaSayfa/collesmePageGrup/collesme_projeler/hids_proje.aspx?sflang=tr

MoD & ASC. (2014). *Tarım Arazilerinin Sürdürülebilir Kullanımı Çalışma Grubu Raporu;* 1-79. Ankara.

MoEF (2007). *Türkiye Iklim Değişikliği Birinci Ulusal Bildirimi.* Çevre Yönetimi Genel Müdürlüğü. Ankara.

MoEU (2012a). *Türkiye'nin İklim Değişikliği Uyum Stratejisi ve Eylem Planı 2011-2023.* Ankara.

MoEU (2012b). *Türkiye Cumhuriyeti İklim Değişikliği Eylem Planı 2011-2023*. Ankara.

MoEU (2012c). İklim Değişikliğinin Farkında mıyız? *Türkiye'nin İklim Değişikliği II. Ulusal Bildiriminin Hazırlanması Projesi Yayını,* 1-20. Ankara.

MoEU (2013). *Türkiye İklim Değişikliği 5. Bildirimi*. Ankara. Retrieved May 03, 2019 from http://www.dsi.gov.tr/docs/iklimdegisikligi/iklim_degisikli%C4%9Fi_5_ulusal_bidirim_tr.pdf?sfvrsn=2

MoEU (n.d.). *Türkiye İklim Değişikliği Stratejisi 2010 2023.* Ankara.

MoEU (n.d.a). *Teşkilat Yapısı.* Retrieved May 3, 2019 from https://iklim.csb.gov.tr/teskilat-yapisi-i-4368

MoFAL (2015). *Kırsal Kalkınma Eylem Planı 2015-2018*. 1-52.

MoFWA (2014*). Ulusal Havza Yönetim Stratejisi 2014-2023*.

MoFWA (n.d.). *Ulusal Kuraklık Yönetimi Strateji Belgesi ve Eylem Planı 2017-2023*.

Mumtaz, M., De Oliveria, J.A.P., & Ali, S.H. (2019). Climate Change Impacts and Adaptation in Agricultural Sector: The Case of Local Responses in Punjab, Pakistan. *Climate Change and Agriculture.* IntechOpen.

NASA (2018a, October 15). *What's the Difference Between Climate Change and Global Warming?* Retrieved November 4,2018, from Global Climate Change: Vital Signs of the Planet: https://climate.nasa.gov/faq/

NASA (2018b, October 15). *The Causes of Climate Change*. Retrieved November 4, 2018, from Global Climate Change: Vital Signs of the Planet: https://climate.nasa.gov/causes/

Nelson, G.C., Van Der Mensbrugghe, D., Ahammad, H., Blanc, E., Calvin, K., Hasegawa, T., Havlik, P., Heyhoe, E., Kyle, P., Lotze-Campen, H., von Lampe, M., Mason d'Croz, D., van Meijl, H., Müller, C., Reilly, J., Robertson, R., Sands, R. D., Schmitz, C., Tabeau, A., Takahashi, K., Valin, H. & Willenbockel, D. (2014). Agriculture and Climate Change in Global Scenarios: Why Don't the Models Agree. *Agricultural Economics*, *45*(1), 85-101.

NTV (2017, November 27). *Çankırı'da 'Obruk' Gerginliği: Deprem gibi Sallanıyor, Çok Ses Yapıyor.* Retrieved April 30, 2019, from https://www.ntv.com.tr/turkiye/cankirida-obruk-gerginligi-deprem-gibi-salliyor-cok-ses-yapiyor,V2DryK_w2UGqgdGzC7yE9w

O'Brien, G., O'Keefe, P., Rose, J., & Wisner, B. (2006). Climate Change and Disaster Management. *Disasters*, *30*(1); 64-80.

Oke, T.R. (1979). *Review of Urban Climatology 1973-1976*, World Meteorological Organization, Geneva.

On Dört İlde Büyükşehir Belediyesi ve Yirmi Yedi İlçe Kurulması ile Bazı Kanun ve Kanun Hükmünde Kararnamelerde Değişikli Yapılmasına Dair Kanun (2012). The Law Number: 6360. Published Official Gazette: 6.12.2012. Number: 28489 Retrieved April 16,2019 from http://www.mevzuat.gov.tr/MevzuatMetin/1.5.6360.pdf.

Organik Tarımın Esasları ve Uygulamasına İlişkin Yönetmelik. (2010). Official Gazette, 27676, August 18, 2010.

Polat, K. (2017). *The Role of Good Agricultural Practices for Mitigation and Adaptation with Climate Change in Ramsar Sites: Case Study in Göksu Delta.* PhD Thesis, Ankara Üniversitesi, Fen Bilimleri Enstitüsü. Ankara.

Reilly, J., Tubiello, F., McCarl, B., Abler, D., Darwin, R., Fuglie, K., Hollinger, S., Izaurralde, C., Jagtap, S., Jones, J., Mearns, L., Ojima, D., Paul, E., Paustian, K., Rıha, S., Rosenberg, N., & Rosenzweig, C. (2003). U.S. Agriculture and Climate Change: New Results. *Climatic Change*, *57*; 43-67.

Roco, L., Engler, A., Bravo-Ureta, B., & Jara-Rojas, R. (2014). Farm Level Adaptation Decisions to Face Climatic Change and Variability: Evidence from Central Chile. *Environmental Science & Policy*, *44*; 86-96.

Sanderson, M. R., Bergtold, J. S., Stamm, J. L. H., Caldas, M. M., Ramsey, S. M., & Aistrup, J. (2018). Climate Change Beliefs in an Agricultural Context: What is the Role of Values Held by Farming and Non-Farming Groups? *Climatic Change*, *150;* 259-272. https://doi.org/10.1007/s10584-018-2283-2

Shikuku, K. M., Winowiecki, L., Twyman, J., Eitzinger, A., Perez, J. G., Mwongera, C., & Läderach, P. (2017). Smallholder Farmers' Attitudes and Determinants of Adaptation to Climate Risks in East Africa. *Climate Risk Management*, *16*; 234-245.

Shukla, R., Agarwal, A., Sachdeva, K., Kurths, J., & Joshi, P. K. (2019). Climate Change Perception: An Analysis of Climate Change and Risk Perceptions among Farmer Types of Indian Western Himalayas. *Climatic Change*, *152*(1); 103-119.

Smit, B., & Skinner, M. W. (2002). Adaptation Options in Agriculture to Climate Change: A Typology. *Mitigation and Adaptation Strategies for Global Change*, *7*(1); 85-114.

Tacoli, C. (2009). Crisis or Adaptation? Migration and Climate Change in A Context of High Mobility. *Environment and Urbanization*, *21*(2); 513-525.

TEMA & WWF-Türkiye (2015). *İklim Değişikliğinin Yerel Etki Raporu*. 1-54. Retrieved November 24, 2018 from http://www.tema.org.tr/folders/14966/categorial1docs/97/Yerel%20Etkiler%20Analizi_v11.pdf

The report of Akşehir District. (2014). Retrieved October 30, 2018 from http://aksehirtso.org.tr/uploaded/dosya/IMG10000_1580_82%20%C4%B0l%C3%A7e_%C3%96zel_Raporu(Ak%C5%9Fehir).pdf.

The report of Çeltik District. (2014). Retrieved October 30, 2018 from http://aksehirtso.org.tr/uploaded/dosya/IMG10000_1570_73%20%C4%B0l%C3%A7e_%C%96zel_Raporu(%C3%87eltik).pdf

The report of Çumra District. (2014). Retrieved October 30, 2018 from http://www.konyadayatirim.gov.tr/images/dosya/%C3%87UMRA.pdf .

The report of Doğanhisar District. (2014). Retrieved October 30, 2018 from http://www.mevka.org.tr/Yukleme/Uploads/DsyO8t1kD719201732458PM.pdf

The report of Ereğli District. (2014). Retrieved October 30, 2018 from http://www.konyadayatirim.gov.tr/images/dosya/ERE%C4%9EL%C4%B0.pdf

The report of Hüyük District. (2014). Retrieved October 30, 2018 from http://www.mevka.org.tr/Yukleme/Uploads/DsyzMRRID719201732747PM.pdf

The report of Karapınar District. (2014). Retrieved October 30, 2018 from http://www.konyadayatirim.gov.tr/images/dosya/KARAPINAR.pdf

The report of Yunak District. (2014). Retrieved October 30, 2018 from http://aksehirtso.org.tr/uploaded/dosya/IMG10000_1568_71 %20%C4%B0l%C3%A7e_%C3%96zel_Raporu(Yunak).pdf

The World Bank (2013). *Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience.* Washington DC. Retrieved November 09, 2018 from http://www.academia.edu/26766360/Turn_down_the_heat_climate_extremes _regional_impacts_and_the_case_for_resilience_-_executive_summary

Thomas, D. S., Twyman, C., Osbahr, H., & Hewitson, B. (2007). Adaptation to Climate Change and Variability: Farmer Responses to Intra-Seasonal Precipitation Trends in South Africa. *Climatic Change*, *83*, 301-322.

Timmins, C. (2006). Endogenous Land Use and the Ricardian Valuation of Climate Change. *Environmental &Resource Economics*, *33*; 119-142.

Tripathi, A., & Mishra, A. K. (2017). Knowledge and Passive Adaptation to Climate Change: An Example from Indian Farmers. *Climate Risk Management*, *16*; 195-207.

TUİK (2019a). The Agricultural Land Areas in Konya in 2013 and 2018. Retrieved April 25, 2019 from https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr.

TUİK. (2019b). Agricultural Dataset of Akşehir, Doğanhisar, Hüyük, Çeltik, Yunak, Ereğli, Karapınar, Çumra in 2004, 2008, 2013, 2018. Retrieved April 12, 2019 from https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr

Turkish Exporters Assembly. (2016). *Türkiye Ihracatçılar Meclisi Tarım Raporu*. İstanbul. 1-160. Retrieved May 01, 2019, from http://www.tim.org.tr/files/downloads/raporlar/tarim_raporu_2017.pdf

Turkish State Meteorological Service, DSİ, OGM, SYGM, CEM, & Doğa Koruma ve Milli Parklar Genel Müdürlüğü. (n.d.). *İklim Değişikliği İhtisas Heyeti Raporu.* Retieved April 30, 2019, from https://www.mgm.gov.tr/FILES/iklim/yayinlar/2013/iklim-Degisikligi-ihtisas-Raporu-2013.pdf

Turkish State Meteorological Service & MoFWA. (2015). *Yeni Senaryolar ile Türkiye İklim Projeksiyonları ve İklim Değişikliği.* Araştırma Dairesi Başkanlığı Klimatoloji Şube Müdürlüğü. Ankara. Retrieved April 30, 2019, from https://www.mgm.gov.tr/FILES/genel/kitaplar/2017MeteorolojikAfetlerDegerlendirmesi.pdf

U.S. EPA. (2008). "Urban Heat Island Basics." *In: Reducing Urban Heat Islands: Compendium of Strategies. Draft.* Retrieved November 9, 2018 from https://www.epa.gov/sites/production/files/2014-06/documents/basicscompendium.pdf

UNCED. (1992a). *The Rio Declaration on Environment and Development;* 1-5. Retrieved November 4, 2018, from http://www.unesco.org/education/pdf/RIO_E.PDF

UNCED. (1992b). *The Earth Summit and Agenda 21.* p.1-14. Retrieved November 4, 2018, from http://www.unesco.org/education/pdf/RIO_E.PDF

United Nation. (2008). *Climate Change and Disaster Risk Reduction*. International Strategy for Disaster Reduction. Briefing Note 01. Geneva.

United Nation. (2015). *Paris Agreement.*

United Nations (2002a). *United Nations Framework Convention on Climate Change;* 1-32.

United Nations (2002b). *Johannesburg Declaration on Sustainable Development.* World Summit on Sustainable Development.

United Nations. (1972*). Report of the United Nations Conference on the Human Environment.* Stockholm. Retrieved February 25, 2018 from http://www.un-documents.net/aconf48-14r1.pdf

United Nations. (1998). *Kyoto Protocol to the United Nations Framework Convention on Climate Change*.

United Nations. (2000). *United Nations Millennium Declaration*.

Vermeulen, S. J., Campbell, B. M., & Ingram, J. S. (2012). Climate Change and Food Systems. *Annual Review of Environment and Resources*. *37*; 195-222.

Wamsler, C. (2014). *Cities, Disaster Risk and Adaptation*. Routledge. USA.

Webb, N. P., Marshall, N. A., Stringer, L. C., Reed, M. S., Chappell, A., & Herrick, J. E. (2017). Land Degradation and Climate Change: Building Climate Resilience in Agriculture. *Frontiers in Ecology and the Environment*, *15*(8), 450-459.

WMO (1979). *Proceedings of the World Climate Conference.* A Conference of Experts on Climate and Mankind. No.537. Geneva, Switzerland.

World Food Summit. (1996). *Rome Declaration on World Food Security.* Rome: FAO. Retrieved from http://www.fao.org/docrep/003/w3613e/w3613e00.HTM

WWF-Türkiye and Eti Burçak. (2010). Türkiye'nin Yarınları Projesi Sonuç Raporu; 1-32. Retrieved April 26, 2019 from http://d2hawiim0tjbd8.cloudfront.net/downloads/wwf__turkiyenin_yarinlari_projesi_final_raporu.pdf

Yang, L., Qian, F., Song, D., & Zheng, K. (2016). Research on Urban Heat Island Effect. *Procedia Engineering, 169;* 11–18.

Yıldırım, A. İ., Demir, S.K., & Yayla, U. (2017). Konya; 1-83. Retrieved April 22, 2019 from https://konya.tarimorman.gov.tr/Belgeler/tydd_belge_2018/ilcebazindatarimistatistik.pdf

Ziervogel, G., & Frayne, B. (2011). *Climate Change and Food Security in Southern African Cities*. African Food Security Urban Network (AFSUN).

APPENDICES

A. Questionnaire Form for Farmers

Questionnaire Number: ....

Farmers' Spatial Information

Village/ Neighborhood: ....

District: ....

A. DEMOGRAPHIC INFORMATION

Personal Information

A.1. Gender? □ (1) Female □ (2) Male

A.2. Age? ....

A.3. Birthplace? ....

A.4. Education Background?

□ (1) analphabetic □ (2) Lettered . (3) Primary education

□ (4) High School □ (5) Bachelor's degree □ (6) Master's and Doctoral Degree

A.5. Do you work in different sector?

□ (1) Yes □ (2) No

A.5. 1. If it is "yes", which sector do you work?

□ (1) Public Sector □ (2) Private Sector □ (3) University

□ (4) self-employed □ (5) Cooperative/unity □ (6) Other...........

Household Information

A.6.Number of people in household? ....

	1.	**2.**	**3.**	**4.**	**5.**
A.6.1. Relationship status					
A.6.2. Gender					
A.6.3. Age					
A.6.4. Birthplace					
A.6.5. Education					
A.6.6. Working Status					
A.6.7. Job					
A.6.8. Sector					

A.6.1. (1) Mother, (2) Father, (3) Wife/Husband, (4) Child, (5) Brother/Sister, (6) kin, (7) friend, (8) other

A.6.2. (1) Female (2) Male

A.6.5. (1) analphabetic (2) Lettered (3) Primary education (4) High School

(5) Bachelor's degree (6) Master's and Doctoral Degree

A.6.6. (1) working (2) not-working (3) Housewife (4) Student (5) Retired (6) Other

A.6.8. (1) Public (2) Private (3) Other

A.7. How much does your family's income in a month?

 (1) Less than 1000 TL (2) 1001-2000 TL (3)2001-3000 TL

 (4) 3001- 4000 TL (5) 4001-5000 TL (6) More than 5000 TL

A.8. How many years are you doing farming?..........., Farming size……..

General Information about Living Place

A.9. How many years have you lived in Konya? ....

A.10. How many years have you lived in this neighborhood/ village in Konya?.....................................

A.10.1. If you have not lives, where have you lives before?

 (1) In another village/neighborhood in Konya, ...

 (2) In a village/neighborhood outside in Konya, ...

 (3) Abroad, ...

A.11. Do you want to continue living in your place of residence in this village/neighborhood? Why?

 (1) Yes................. (2) No ....

A.11.1. If your answer is "no", where would you like to migrate? Why? ....

A.12. What is the ownership status of the agricultural lands?

 (1) tenancy (2) property owner (3) other............................

A.13. What is the proximity between residential and agricultural areas?

 (1) close distance (2) middle (3) long distance

A.13.1. If your answer is "long distance", where do you live? ....

A.14. What kind of housing do you live in?

 (1) Single Family House (2) Multi-storey building

B. KNOWLEDGE ABOUT CLIMATE CHANGE AND ASSESSMENTS

Identifiability of Climate Change

B.1. Which options are associated with perception of climate change all the world?

□ (1) Climate change is global warming

□ (2) Climate change is depletion of the ozone layer

□ (3) Climate change is the increase in greenhouse effect

□ (4) Climate change is the increase in CO_2 emissions

□ (5) Climate change is global economic system

□ (6) Nothing

□ (7) Other................

B.2. Which issues do you have knowledge about the general process of climate change?

□ (1) The existing reasons of climate change

□ (2) The future impacts of climate change

□ (3) Climate change adaptation process

□ (4) Action plans and intervention tools/methods

□ (5) Nothing

B.3. Which level of climate change do you experience in Konya?

□ (1) less □ (2) medium □ (3) more

B.4. What are the observed effects of climate change in Konya?

□ (1) Climate change increases temperature

□ (2) Climate change decreases temperature

□ (3) Climate change increases precipitation

□ (4) Climate change decreases precipitation

□ (5) Climate change increases frost cases

□ (6) Other ....

B.5. What is the level of human impact in climate change in Konya?

□ (1) low □ (2) medium □ (3) high

B.5.1. Why?..

Individual Experiences on Climate Change

B.6. What is level of concern about climate change for future?

- (1) I am concerned highly, and I think it is late for everything.
- (2) I am concerned, but new methods can be developed.
- (3) I am concerned lowly because future generation can be improved solutions.
- (3) I am not concerned since future generation will not be affected.

B.7. In Konya, which risks based on climate change will occur in the future?

 (1) Desertification (2) Famine (3) Water depletion

 (4) Biodiversity reduction (5) Air pollution (6) Land pollution

 (7) Water pollution (8) Food wars (9) Water wars

 (10) Increased acid rains (11) Decreased in food production (12) Migration

 (13) Epidemic Diseases (14) Pothole Formation (15) Sandstorm

 (16) Nothing (17) Other…………

B.8. Which methods based on climate change should be developed in the future?

 (1) I do not believe in climate change.

 (2) Population growth should be balanced.

 (3) New technological developments should be increased.

 (4) Renewable energy sources should be increased.

 (5) Other ....

B.9. What are your individual efforts and experiences to reduce the impact of climate change in Konya?

 (1) The changed of the product pattern (2) The changed of the irrigation system

 (3) Usage of good agricultural practices (4) Usage of organic farming

 (5) Reforestation (6) Usage of renewable energy systems

 (7) Disposal of waste (8) Usage of recyclable products

 (9) Not use of chemical fertilizer (10) Usage of heat insulation systems

 (11) Consulting experts (12) Reduced of the usage of vehicles

 (13) Nothing (14) Other……….

Social Experiences on Climate Change

B.10. What are the social efforts and experiences that can reduce the impact of climate change on rural areas?

 (1) Usage of good agricultural practices

 (2) Usage of organic farming practices

 (3) The developed the modern irrigation systems

 (4) The increased the crop diversity

 (5) Promotion of environmental-friendly products

 (6) Making soil analyzes

 (7) Preparation of annual reports and informative programs

 (8) The increased cooperation among institutions

 (9) Other.................................

B.11. Which tools do you use to get information about climate change?

 (1) Media (TV/Radio) (2) Internet/Social Media (3) Family/Neighbor Relations

 (4) University (5) Public Institutions and Organizations (6) Private Sector

 (7) Local Governments (8) Neighborhood representative (9) NGOs

 (10) Other ....

B.12. What is the level of resilience to climate change?

 (1) low (2) medium (3) high

B.13. What is the risk of economic livelihood of climate change?

 (1) low (2) medium (3) high

B.14. What is the opportunity of economic livelihood of climate change?

 (1) low (2) medium (3) high

B.15. In Konya, what is the impacts of climate change on food production and marketing?

 (1) low (2) medium (3) high

B.16. Which facilities is inadequate in your living place?

 (1) Market area (2) Green Area (3) Educational Facility

 (4) Health Facility (5) Car-parking (6) Socio-cultural Facility

 (7) Commercial Area (8) Other....................

B.17. Which transportation vehicles do you usually use in the village?

□ (1) Car □ (2) Motorcycle □ (3) Minibus

□ (4) Bicycle □ (5) Bus □ (6) Other ....

B.18. Which transportation vehicles do you usually use outside the village?

□ (1) Car □ (2) Motorcycle □ (3) Minibus

□ (4) Bicycle □ (5) Bus □ (6) Other ....

B.19. How often do you talk about climatic issues with people living in your areas?

□ (1) low □ (2) medium □ (3) high

B.19.1. What are these issues?

....

B.20. Which institutions should take an active role in order to mitigate the negative effects?

□ (1) Public Institutions and Organizations □ (2) Local Government □ (3) Media

□ (4) University □ (5) NGOs □ (6) Private Sector

□ (7) Neighborhood representative □ (8) Other...................

B.21. What activities should be undertaken in rural areas to reduce adverse impacts of climate change by decision-makers?

□ (1) Increasing the protection and productivity of water resources

□ (2) Determining of the product patterns

□ (3) Increasing of renewable energy resources

□ (4) Improving of disaster risk management for rural areas

□ (5) Increasing of education and information programs

C. THE RELATIONSHIP BETWEEN PLANNING AND CLIMATE CHANGE

C.1. To what extent do you think the climate change measure, will ensure the following?

	(1) Low	(2) Medium	(3) High
C.1.a. Reduced poverty			
C.1.b. Reduced rural-urban migration			
C.1.c. Reduce food dependency			
C.1.d. Reduced environmental pollution(water, land, air)			
C.1.e. Reduced drought			
C.1.f. Reduced urban sprawl			
C.1.g. Increased employment			
C.1.h. Increased efficiency product			

C.2. Which methods will mitigate the adverse impacts of climate change?

	(1)Low	(2)Medium	(3)High
C.2.a.Land Consolidation			
C.2.b. Good Agricultural Practice			
C.2.c. Organic farming			
C.2.d. Regulation of the fertilization system			
C.2.e. Decreased waste generation			
C.2.f. Having detailed information about the products that are planned to be plant			
C.2.g.Improved public transportation system			

C.3. If the measures are not taken, what are your estimations based on climate change?

	(1) Low	(2) Medium	(3) High
C.3.a. Seasonal effects will be more severe.			
C.3.b. Seasonal effects will be more mild.			
C.3.c. Seasonal abrupt change will occur			
C.3.d. Agriculture production will not be done in many areas.			
C.3.e. Product pattern plans will be needed.			
C.3.f. Agricultural areas, which will be fertile lands in the future, may be opened to development in the present.			
C.3.g. Water crises among sectors will rise.			
C.3.h. New technological developments will enable to adaptations			
C.3.i. The negative impacts of climate change will reduce with planning and modern education.			
C.3.j. There will be no change.			

THANK YOU FOR YOUR CONTRIBUTIONS.

B. Çiftçi Anketi

Anket Sayı Numarası: ....

Görüşme Yapılan Üreticinin Mekansal Bilgileri:

Köy/ Mahalle Adı:...

İlçe Adı: ....

A. DEMOGRAFİK BİLGİLER

Kişisel Bilgiler

A.1. Cinsiyetiniz nedir? □ (1) Kadın □ (2) Erkek

A.2. Yaşınız kaç? ....

A.3. Doğum yeriniz neresi? ....

A.4. Eğitim durumunuz nedir?

□ (1) Okur-yazar değil □ (2) Okur-yazar □(3) İlköğretim

□ (4) Lise □ (5) Yüksekokul/Üniversite □(6) Lisansüstü(Yüksek lisans-doktora)

A.5. Başka Bir Sektörde Çalışıyor musunuz?

□ (1) Çalışıyor □ (2) Çalışmıyor

A.5. 1. Çalışıyorsanız, hangi sektörde çalışıyorsunuz?

□ (1) Kamu Sektörü □ (2) Özel Sektör □ (3) Üniversite

□ (4) Serbest Meslek □(5) Kooperatif/ Birlik □(6) Diğer...........

Hanehalkı Bilgileri

A.6.Haneniz kaç kişiden oluşuyor? ....

	1.	**2.**	**3.**	**4.**	**5.**
A.6.1. Yakınlık Durumu					
A.6.2. Cinsiyeti					
A.6.3.Yaşı					
A.6.4. Doğum Yeri					
A.6.5. Eğitim					
A.6.6. Çalışma Durumu					
A.6.7. Meslek					
A.6.8. Sektör					

A.6.1. (1) Anne, (2) Baba, (3) Eş, (4) Çocuk, (5) Kardeş, (6) Akraba, (7)Arkadaş, (8) Diğer

A.6.2. (1) Kadın (2) Erkek

A.6.5. (1) Okur-yazar değil (2) Okur-yazar (3) İlköğretim (4) Lise (5) Yüksekokul/Üniversite

(6) Lisansüstü(Yüksek lisans-doktora)

A.6.6. (1) Çalışıyor (2) Çalışmıyor (3) Ev Hanımı (4) Öğrenci (5) Emekli (6) Diğer

A.6.8. (1) Kamu (2) Özel (3)Diğer

A.7. Hanenizin bir ay içerisinde yaklaşık geliri ne kadardır?

 (1) 1000 TL'den az (2) 1001-2000 TL (3)2001-3000 TL

 (4) 3001- 4000 TL (5) 4001-5000 TL (6) 5000 TL ve üzeri

A.8. Kaç yıldır çiftçilik yapıyorsunuz?..........., Alanı.........

Yaşadığınız Yer İle İlgili Genel Bilgi

A.9. Kaç yıldır Konya'da yaşıyorsunuz?...

A.10. Kaç yıldır bu mahallede/köyde yaşıyorsunuz? ....

A.10.1. Eğer yaşamıyorsanız, daha önce nerede yaşıyordunuz?

 (1) Konya'da başka bir köyde/mahallede, ...

 (2) Konya'da dışında bir köyde/mahallede, ...

 (3) Yurtdışında,............................

A.11. Yaşamınıza bu mahalle/köyde devam etmek istiyor musunuz? Neden?

 (1) evet................. (2) hayır ....

A.11.1. Cevabınız hayır ise, nereye göç etmek istersiniz? Neden? ....

A.12. Üretim yaptığınız alanın mülkiyet durumu nedir?

 (1) kiracı (2) mülk sahibi (3) diğer ....

A.13. Üretim yaptığınız ve yaşadığınız alan arası yakınlık durumu nedir?

 (1)yakın (2) orta (3) uzak

A.13.1. Cevabınız *uzak(3)* ise, nerede yaşıyorsunuz?..............................

A.14. Nasıl bir konutta yaşıyorsunuz?

 (1) Tek katlı (2) Çok Katlı

B. İKLİM DEĞİŞİKLİĞİ İLE İLİŞKİLER VE DEĞERLENDİRMELER

İklim Değişikliğine İlişkin Bilgiler ve Tanımlanabilirlik

B.1. Sizce tüm dünyada iklim değişikliği algısı hangisi ile ilişkilidir?

 (1) Küresel ısınma

 (2) Ozon tabakasının delinmesi

 (3) Sera gazı etkisinin artması

 (4) CO_2 salınımının artması

 (5) Küresel ekonomik sistem

 (6) Hiçbiri

 (7) Diğer................

B.2. İklim değişikliği genel süreci ile ilgili bilgi sahibi olduğunuz konular hangisidir?

 (1) iklim değişikliğinin sebepleri

 (2) iklim değişikliğinin gelecekteki sonuçları

 (3) iklim değişikliğine adaptasyon ve müdahale yöntemleri ve araçları

 (4) Eylem planları ve müdahale araçları

 (5) Hiçbiri

B.3. Sizce Konya' da iklim değişikliği hangi düzeyde yaşanmaktadır?

 (1) yaşanmıyor (2) orta/kısmen (3) şiddetli

B.4. Konya' da iklim değişikliğinin etkilerinden hangilerini gözlemliyorsunuz?

 (1) Sıcaklık artışı

 (2) Sıcaklık azalması

 (3) Yağış artışı

 (4) Yağış azalması

 (5) Don olaylarının artması

 (6) Hiçbiri

 (7) diğer................

B.5. Konya'da iklim değişikliğinde insan etkisini hangi düzeydedir?

 (1) düşük (2) orta (3) yüksek

B.5.1. Neden?..

İklim değişikliğine İlişkin Bireysel Deneyimler

B.6. İklim değişikliğinin gelecek üzerine etkileri sizce hangi düzeyde kaygı oluşturuyor?

 (1) çok kaygılıyım, herşey için geç olduğunu düşünüyorum.

 (2) kaygılıyım, fakat yeni yöntemler geliştirilebilir.

 (3) az kaygılıyım, gelecek nesiller çözüm yöntemleri bulabilir.

 (3) Kaygılı değilim, gelecek nesillerin etkileneceğini düşünmüyorum.

B.7. Konya'da, iklim değişikliğine bağlı hangi risklerin meydana geleceğini düşünüyorsunuz?

 (1) Çölleşme (2) Kıtlık (3) Su kıtlığı

 (4) Biyolojik Çeşitliliği azalması (5) hava kirliliği (6) Toprak kirliliği

 (7) Su kirliliği (8) Gıda Savaşları (9) Su Savaşları

 (10) Asit Yağmurları (11) Gıda Üretiminde Azalma (12) Göç

 (13) Salgın Hastalıklar (14) Obruk Oluşumu (15) Kum Fırtınası

 (16) Hiçbiri (17) Diğer.................

B.8. Konya'da iklim değişikliğinin olumsuz etkileri azaltacak hangi yöntemler geliştirilmelidir?

 (1) İklim değişikliğine inanmıyorum.

 (2) Nüfus artışının dengeli olmalıdır.

 (3) Yeni teknolojik gelişmeler artırılmalıdır.

 (4) Yenilenebilir enerji kaynakları artırılmalıdır.

 (5) Diğer......................

B.9. Konya'da iklim değişikliğinin etkilerini azaltmak için bireysel olarak gösterdiğiniz çabalar nelerdir?

 (1) Ürün desenini değiştirmek (2) Sulama sistemini değiştirmek

 (3) İyi tarım uygulamalarını kullanmak (4) Organik tarım yapmak

 (5) Ağaçlandırmak yapmak (6) Yenilenebilir enerji sistemlerini kullanmak

 (7) Çöpleri ayrıştırmak (8) Geri dönüştürülebilir ürünler kullanmak

 (9) Kimyasal gübre kullanmamak (10) Isı yalıtım sistemlerini kullanmak

 (11) Uzmanlara danışmak (12) Araç kullanımını azaltmak

 (13) Hiçbiri (14) Diğer..................

İklim değişikliğine İlişkin Toplumsal Deneyimler

B.10. Kırsal alanda iklim değişikliğinin etkilerini azaltmak için yapılabilecek toplumsal çalışmalar nelerdir?

 (1) İyi tarım uygulamalarının geliştirilmesi

 (2) Organik tarım uygulamalarının artırılması

 (3) Modern sulama sistemlernin geliştirilmesi

 (4) Ürün çeşitliliğinin artırılması

 (5) Çevre dostu ürünlerin teşvik edilmesi

 (6) Toprak analizlerinin yapılması

 (7) Yıllık raporlar hazırlanarak, bilgilendirme çalışması yapılması

 (8) Kurumlar arası işbirliğinin artırılması

 (9) Diğer..

B.11. İklim değişikliği ile ilgili bilgilere ulaşmak için hangi araçları kullanıyorsunuz?

 (1) Medya (TV/Radyo) (2)İnternet/Sosyal Medya (3)Aile/Komşu İlişkileri

 (4) Üniversite (5) Kamu kurum ve kuruluşları (6) Özel sektör

 (7) Yerel Yönetimler (8) Muhtarlar (9) STK'lar

 (10) Diğer..

B.12. Sizce Konya hangi düzeyde iklim değişikliğine dirençlidir?

 (1) düşük (2) orta (3) yüksek

B.13. İklim değişikliği hangi düzeyde ekonomik geçim riski oluşturmaktadır?

 (1) düşük (2) orta (3) yüksek

B.14. İklim değişikliği hangi düzeyde ekonomik fırsat oluşturmaktadır?

 (1) düşük (2) orta (3) yüksek

B.15. Konya, gıda üretimi ve pazarlaması açısından hangi düzeyde toplumsal bir fayda oluşturmaktadır?

 (1) düşük (2) orta (3) yüksek

B.16. Yakın çevrenizde hangi alanların/donatıların eksik olduğunu düşünüyorsunuz?

 (1) Pazar alanı (2) Yeşil alan (3) Eğitim Tesisi

 (4) Sağlık Tesisi (5) Otopark (6) Sosyo-kültürel Tesis

 (7) Ticaret Alanı (8) Diğer..

B.17. Genellikle köy içinde hangi ulaşım araçlarını kullanırsınız?

 (1) Otomobil (2) Motosiklet (3) Minibüs

 (4) Bisiklet (5) Otobüs (6) diğer..............................

B.18. Genellikle köy dışında hangi ulaşım araçlarını kullanırsınız?

 (1) Otomobil (2) Motosiklet (3) Minibüs

 (4) Bisiklet (5) Otobüs (6) diğer..............................

B.19. Çevrenizde yaşayanlar ile hangi düzeyde iklimsel konulardan bahsediyorsunuz?

 (1) düşük (2) orta (3) yüksek

B.19.1. Bu konular nelerdir?

....

B.20. İklim değişikliği olumsuz etkilerini azaltmak için hangi kurumlar etkin rol almalıdır?

 (1) Kamu kurum ve kuruluşları (2) Yerel Yönetimler (3) Medya

 (4) Üniversite (5) STK'lar (6) Özel sektör

 (7) Muhtarlar (8) Diğer...............

B.21. İklim değişikliği olumsuz etkilerini azaltmak için karar vericiler kırsal alanda hangi faaliyetlerde bulunmalıdır?

 (1) Su kaynaklarının korunması ve verimliliğinin artırılması

 (2) Mekana uygun ürün deseninin belirlenmesi

 (3) Yenilenebilir enerji kaynaklarının artırılarak teşvik edilmesi

 (4) Kırsal alanlar için afet risk yönetiminin geliştirilmesi

 (5) Eğitim ve bilgilendirme çalışmalarının artırılması

C. İKLİM DEĞİŞİKLİĞİ VE PLANLAMA İLİŞKİSİ

C.1. İklim değişikliği ile ilgili olarak alınacak önlemlerin aşağıdakilerden hangisini sağlaması olasıdır?

	(4) Düşük	(5) Orta	(6) Yüksek
C.1.a. Yoksulluğu azaltır			
C.1.b. Kırdan kente göçü azaltır			
C.1.c. Gıda bağımlılığını azaltır			
C.1.d. Çevre kirliliğini azaltır(toprak, su, hava...)			
C.1.e. Kuraklık riskini düşürür			
C.1.f. Kentsel saçaklanmayı azaltır			
C.1.g. İstihdamı artırır			

C.1.h. Üretim gücünü artırır			

C.2. Hangi yöntemler iklim değişikliğinin olumsuz etkilerini azaltacaktır?

	(1) Düşük	(2) Orta	(3) Yüksek
C.2.a. Arazi Toplulaştırma			
C.2.b. İyi Tarım Uygulamaları			
C.2.c. Organik tarım uygulamaları			
C.2.d. Gübreleme sisteminin düzenlenmesi			
C.2.e. Atık oluşumunun azalması			
C.2.f. Üretilmesi planlanan ürünler hakkında detaylı bilgi sahibi olmak			
C.2.g.Toplu taşıma sistemlerinin geliştirilmesi			

C.3. Hiç önlem alınmazsa, iklim değişikliğine dayalı tahminleriniz nedir?

	(4) Düşük	(5) Orta	(6) Yüksek
C.3.a. Mevsimsel etkiler daha sert olacak			
C.3.b. Mevsimsel etkiler daha ılıman olacak			
C.3.c. Ani mevsimsel değişimler meydana gelecek			
C.3.d. Tarımsal üretim yapılamayacak			
C.3.e. Ürün deseni değiştirilmesi gerekecek			
C.3.f. Gelecekteki verimli olabilecek tarım alanları			

günümüzde gelişmeye açılacak			
C.3.g. Sektörler arasında su krizi ortaya çıkacak			
C.3.h.Yeni teknolojik gelişmeler ile adaptasyon sağlanacak			
C.3.i. Planlama ve modern eğitim ile olumsuz etkiler azalacak			
C.3.j. Herhangi bir değişim olmayacak			

KATKILARINIZ İÇİN TEŞEKKÜR EDERİZ.

C. Questionnaire Form for Experts

Questionnaire Number: ....

Experts' Spatial Information

Institution:..

Village/ Neighborhood: ....

District: ....

A. DEMOGRAPHIC INFORMATION

Personal Information

A.1. Gender? □ (1) Female □ (2) Male

A.2. Age? ....

A.3. Birthplace? ....

A.4. Education Background?

□ (1) analphabetic □ (2) Lettered □ (3) Primary education

□ (4) High School □ (5) Bachelor's degree □ (6) Master's and Doctoral Degree

A.5. Job? ....

A.6. Profesional Issues? ....

General Information about Living Place

A.7. How many years have you lived in Konya? ....

A.8. How many years have you lived in this neighborhood/ village in Konya?.....................................

A.8.1. If you have not lives, where have you lives before?

□ (1) In another village/neighborhood in Konya, ...

□ (2) In a village/neighborhood outside in Konya, ...

□ (3) Abroad, ...

A.9. Do you want to continue living in your place of residence in this village/neighborhood? Why?

□ (1) Yes................. □ (2) No ....

A.9.1. If your answer is "no", where would you like to migrate? Why? ....

B. KNOWLEDGE ABOUT CLIMATE CHANGE AND ASSESSMENTS

Identifiability of Climate Change

B.1. Which options are associated with perception of climate change all the world?

□ (1) Climate change is global warming

□ (2) Climate change is depletion of the ozone layer

□ (3) Climate change is the increase in greenhouse effect

□ (4) Climate change is the increase in CO_2 emissions

□ (5) Climate change is global economic system

□ (6) Nothing

□ (7) Other................

B.2. Which issues do you have knowledge about the general process of climate change?

□ (1) The existing reasons of climate change

□ (2) The future impacts of climate change

□ (3) Climate change adaptation process

□ (4) Action plans and intervention tools/methods

□ (5) Nothing

B.3. Which level of climate change do you experience in Konya?

□ (1) less □ (2) medium □ (3) more

B.4. What are the observed effects of climate change in Konya?

□ (1) Climate change increases temperature

□ (2) Climate change decreases temperature

□ (3) Climate change increases precipitation

□ (4) Climate change decreases precipitation

□ (5) Climate change increases frost cases

□ (6) Other ....

B.5. What is the level of human impact in climate change in Konya?

□ (1) low □ (2) medium □ (3) high

B.5.1. Why?..

Individual Experiences on Climate Change

B.6. What is level of concern about climate change for future?

 (1) I am concerned highly, and I think it is late for everything.

 (2) I am concerned, but new methods can be developed.

 (3) I am concerned lowly because future generation can be improved solutions.

 (3) I am not concerned since future generation will not be affected.

B.7. In Konya, which risks based on climate change will occur in the future?

 (1) Desertification (2) Famine (3) Water depletion

 (4) Biodiversity reduction (5) Air pollution (6) Land pollution

 (7) Water pollution (8) Food wars (9) Water wars

 (10) Increased acid rains (11) Decreased in food production (12) Migration

 (13) Epidemic Diseases (14) Pothole Formation (15) Sandstorm

 (16) Nothing (17) Other…………

B.8. Which methods based on climate change should be developed in the future?

 (1) I do not believe in climate change.

 (2) Population growth should be balanced.

 (3) New technological developments should be increased.

 (4) Renewable energy sources should be increased.

 (5) Other ....

B.9. What are your institutional efforts and experiences to reduce the impact of climate change in Konya?

 (1) The changed of the product pattern (2) The changed of the irrigation system

 (3) Usage of good agricultural practices (4) Usage of organic farming

 (5) Reforestation (6) Usage of renewable energy systems

 (7) Disposal of waste (8) Usage of recyclable products

 (9) Not use of chemical fertilizer (10) Usage of heat insulation systems

 (11) Consulting experts (12) Reduced of the usage of vehicles

 (13) Nothing (14) Other……….

Social Experiences on Climate Change

B.10. Which international activities are you influencing about climate change? Which level are you affected by these studies?

....
....
....
....
....

B.11. Which national activities are you influencing about climate change? Which level are you affected by these studies?

....
....
....
....
....

B.12. What are the activities carried out on a local scale with regard to climate change?

....
....
....
....
....

B.13. How do you evaluate the effects of climate change on agriculture?

....
....
....
....
....

B.14. What are the social efforts and experiences that can reduce the impact of climate change on rural areas?

....
....
....
....
....

B.15. Which methods should be applied in order to increase awareness?

....
....
....

....
....

B.16. What is the level of resilience to climate change?

 (1) low (2) medium (3) high

B.17. What is the risk of economic livelihood of climate change?

 (1) low (2) medium (3) high

B.8 What is the opportunity of economic livelihood of climate change?

 (1) low (2) medium (3) high

B.19. In Konya, what is the impacts of climate change on food production and marketing?

 (1) low (2) medium (3) high

B.20. Which institutions should take an active role in order to mitigate the negative effects?

 (1) Public Institutions and Organizations (2) Local Government (3) Media

 (4) University (5) NGOs (6) Private Sector

 (7) Neighborhood representative (8) Other....................

C. THE RELATIONSHIP BETWEEN PLANNING AND CLIMATE CHANGE

C.1. To what extent do you think the climate change measure, will ensure the following?

	(7) Low	(8) Medium	(9) High
C.1.a. Reduced poverty			
C.1.b. Reduced rural-urban migration			
C.1.c. Reduce food dependency			
C.1.d. Reduced environmental pollution(water, land, air)			
C.1.e. Reduced drought			
C.1.f. Reduced urban sprawl			
C.1.g. Increased employment			
C.1.h. Increased efficiency product			

C.2. Which methods will mitigate the adverse impacts of climate change?

	(1)Low	(2)Medium	(3)High
C.2.a.Land Consolidation			
C.2.b. Good Agricultural Practice			
C.2.c. Organic farming			
C.2.d. Regulation of the fertilization system			
C.2.e. Decreased waste generation			
C.2.f. Having detailed information about the products that are planned to be plant			
C.2.g.Improved public transportation system			

C.3. If the measures are not taken, what are your estimations based on climate change?

	(7) Low	(8) Medium	(9) High
C.3.a. Seasonal effects will be more severe.			
C.3.b. Seasonal effects will be more mild.			
C.3.c. Seasonal abrupt change will occur			
C.3.d. Agriculture production will not be done in many areas.			
C.3.e. Product pattern plans will be needed.			

C.3.f. Agricultural areas, which will be fertile lands in the future, may be opened to development in the present.			
C.3.g. Water crises among sectors will rise.			
C.3.h. New technological developments will enable to adaptations			
C.3.i. The negative impacts of climate change will reduce with planning and modern education.			
C.3.j. There will be no change.			

THANK YOU FOR YOUR CONTRIBUTIONS.

D. Uzman Anketi

Anket Sayı Numarası: ....

Görüşme Yapılan Görevlinin Kurum Bilgileri:

Kurum Adı:..

Köy/ Mahalle Adı:..

İlçe Adı: ....

A. DEMOGRAFİK BİLGİLERİ

Kişisel Bilgiler

A.1. Cinsiyetiniz nedir? □ (1) Kadın □ (2) Erkek

A.2. Yaşınız kaç? ....

A.3. Doğum yeriniz nedir? ....

A.4. Eğitim durumunuz nedir?

□ (1) Okur-yazar değil □ (2) Okur-yazar □(3) İlköğretim

□ (4) Lise □ (5) Yüksekokul/Üniversite □(6) Lisansüstü(Yüksek lisans-doktora)

A.5. Mesleğiniz nedir?.................................

A.6. Çalıştığınız kurumdaki uzmanlık alanınız nedir?.......................................

Yaşadığınız Yer İle İlgili Genel Bilgi

A.7. Kaç yıldır Konya'da yaşıyorsunuz?...

A.8. Kaç yıldır bu ilçede yaşıyorsunuz? ....

A.8.1. Eğer yaşamıyorsanız, daha önce nerede yaşıyordunuz?

□ (1) Konya'da başka bir ilçede, ...

□ (2) Konya'da dışında bir ilçede, ...

□ (3) Yurtdışında,............................

A.9. Yaşamınıza bu ilçede devam etmek istiyor musunuz? Neden?

 (1) evet................. (2) hayır ....

A.9.1. Cevabınız hayır ise, nereye göç etmek istersiniz? Neden? ....

B. İKLİM DEĞİŞİKLİĞİ İLE İLİŞKİLER VE DEĞERLENDİRMELER

İklim Değişikliğine İlişkin Bilgiler ve Tanımlanabilirlik

B.1. Sizce tüm dünyada iklim değişikliği hangileri ile ilişkilidir?

 (1) Küresel ısınma

 (2) Ozon tabakasının delinmesi

 (3) Sera gazı etkisinin artması

 (4) CO_2 salınımının artması

 (5) Küresel ekonomik sistem

 (6) Hiçbiri

 (7) Diğer................

B.2. İklim değişikliği genel süreci ile ilgili bilgi sahibi olduğunuz konular hangisidir?

 (1) iklim değişikliğinin sebepleri

 (2) iklim değişikliğinin gelecekteki sonuçları

 (3) iklim değişikliğine adaptasyon süreci

 (4) Eylem planları ve müdahale araçları

 (5) Hiçbiri

B.3. Sizce Konya’ da iklim değişikliği hangi düzeyde yaşanmaktadır?

 (1) yaşanmıyor (2) orta /kısmen (3) şiddetli

B.4. Konya’ da iklim değişikliğinin etkilerinden hangilerini gözlemliyorsunuz?

 (1) Sıcaklık artışı

 (2) Sıcaklık azalması

 (3) Yağış artışı

 (4) Yağış azalması

 (5) Don olaylarının artması

 (6) Hiçbiri

 (7) diğer................

B.5. Konya'da iklim değişikliğinde insan etkisini hangi düzeydedir?

 (1) düşük (2) orta (3) yüksek

B.5.1. Neden?..

İklim değişikliğine İlişkin Bireysel Deneyimler

B.6. İklim değişikliğinin gelecek üzerine etkileri sizce hangi düzeyde kaygı oluşturuyor?

 (1) çok kaygılıyım, herşey için geç olduğunu düşünüyorum.

 (2) kaygılıyım, fakat yeni yöntemler geliştirilebilir.

 (3) az kaygılıyım, gelecek nesiller çözüm yöntemleri bulabilir.

 (3) Kaygılı değilim, gelecek nesillerin etkileneceğini düşünmüyorum.

B.7. Konya'da, iklim değişikliğine bağlı hangi risklerin meydana geleceğini düşünüyorsunuz?

 (1) Çölleşme (2) Kıtlık (3) Su kıtlığı

 (4) Biyolojik Çeşitliliği azalması (5) hava kirliliği (6) Toprak kirliliği

 (7) Su kirliliği (8) Gıda Savaşları (9) Su Savaşları

 (10) Asit Yağmurları (11) Gıda Üretiminde Azalma (12) Göç

 (13) Salgın Hastalıklar (14) Obruk Oluşumu (15) Kum Fırtınası

 (16) Hiçbiri (17) Diğer.................

B.8. Konya'da iklim değişikliğinin olumsuz etkileri azaltacak hangi yöntemler geliştirilmelidir?

 (1) İklim değişikliğine inanmıyorum.

 (2) Nüfus artışının dengeli olmalıdır.

 (3) Yeni teknolojik gelişmeler artırılmalıdır.

 (4) Yenilenebilir enerji kaynakları artırılmalıdır.

 (5) Diğer......................

B.9. Konya'da iklim değişikliğinin etkilerini azaltmak için bireysel olarak gösterdiğiniz çabalar nelerdir?

 (1) Ürün desenini değiştirmek (2) Sulama sistemini değiştirmek

 (3) İyi tarım uygulamalarını kullanmak (4) Organik tarım yapmak

 (5) Ağaçlandırmak yapmak (6) Yenilenebilir enerji sistemlerini kullanmak

 (7) Çöpleri ayrıştırmak

 (8) Geri dönüştürülebilir ürünler kullanmak

 (9) Kimyasal gübre kullanmamak

 (10) Isı yalıtım sistemlerini kullanmak

 (11) Uzmanlara danışmak

 (12) Araç kullanımını azaltmak

 (13) Hiçbiri

 (14) Diğer.................

İklim değişikliğine İlişkin Toplumsal Deneyimler

B.10. İklim değişikliği ile ilgili etkilendiğiniz uluslararası çalışmalar hangileridir? Bu çalışmalardan hangi düzeyde etkileniyorsunuz?

....
....
....

B.11. İklim değişikliği ile ilgili etkilendiğiniz ulusal çalışmalar hangileridir? Bu çalışmalardan hangi düzeyde etkileniyorsunuz?

....
....
....

B.12. İklim değişikliği ile ilgili yerel ölçekte nasıl çalışmalar yürütüyorsunuz?

....
....
....
....

B.13. İklim değişikliği tarım üzerine etkilerini nasıl değerlendiriyorsunuz?

....
....
....
....

B.14. İklim değişikliği tarım üzerine olumsuz etkilerini azaltmak için hangi toplumsal çalışmalar yapılmaktadır?

....
....
....

B.15. Farkındalığı artırmak için, uygulanması gereken yöntemler neler olabilir?

....
....
....
....

B.16. Sizce Konya hangi düzeyde iklim değişikliğine dirençlidir?

 (1) düşük (2) orta (3) yüksek

B.17. İklim değişikliği hangi düzeyde ekonomik geçim riski oluşturmaktadır?

 (1) düşük (2) orta (3) yüksek

B.18. İklim değişikliği hangi düzeyde ekonomik fırsat oluşturmaktadır?

 (1) düşük (2) orta (3) yüksek

B.19. Konya, gıda üretimi ve pazarlaması açısından hangi düzeyde toplumsal bir fayda oluşturmaktadır?

 (1) düşük (2) orta (3) yüksek

B.20. İklim değişikliği olumsuz etkilerini azaltmak için hangi kurumlar etkin rol almalıdır?

 (1) Kamu kurum ve kuruluşları (2) Yerel Yönetimler (3) Medya

 (4) Üniversite (5) STK'lar (6) Özel sektör

 (7) Muhtarlar (8) Diğer...............

C. İKLİM DEĞİŞİKLİĞİ VE PLANLAMA İLİŞKİSİ

C.1. İklim değişikliği ile ilgili olarak alınacak önlemlerin aşağıdakilerden hangisini sağlaması olasıdır?

	(10) Düşük	(11) Orta	(12) Yüksek
C.1.a. Yoksulluğu azaltır			
C.1.b. Kırdan kente göçü azaltır			
C.1.c. Gıda bağımlılığını azaltır			
C.1.d. Çevre kirliliğini azaltır(toprak, su, hava...)			
C.1.e. Kuraklık riskini düşürür			

C.1.f. Kentsel saçaklanmayı azaltır			
C.1.g. İstihdamı artırır			
C.1.h. Üretim gücünü artırır			

C.2. Hangi yöntemler iklim değişikliğinin olumsuz etkilerini azaltacaktır?

	(4) Düşük	(5) Orta	(6) Yüksek
C.2.a. Arazi Toplulaştırma			
C.2.b. İyi Tarım Uygulamaları			
C.2.c. Organik tarım uygulamaları			
C.2.d. Gübreleme sisteminin düzenlenmesi			
C.2.e. Atık oluşumunun azalması			
C.2.f. Üretilmesi planlanan ürünler hakkında detaylı bilgi sahibi olmak			
C.2.g.Toplu taşıma sistemlerinin geliştirilmesi			

C.3. Hiç önlem alınmazsa, iklim değişikliğine dayalı tahminleriniz nedir?

	(10) Düşük	(11) Orta	(12) Yüksek
C.3.a. Mevsimsel etkiler daha sert olacak			
C.3.b. Mevsimsel etkiler daha ılıman olacak			
C.3.c. Ani mevsimsel değişimler meydana gelecek			

C.3.d. Tarımsal üretim yapılamayacak			
C.3.e. Ürün deseni değiştirilmesi gerekecek			
C.3.f. Gelecekteki verimli olabilecek tarım alanları günümüzde gelişmeye açılacak			
C.3.g. Sektörler arasında su krizi ortaya çıkacak			
C.3.h.Yeni teknolojik gelişmeler ile adaptasyon sağlanacak			
C.3.i. Planlama ve modern eğitim ile olumsuz etkiler azalacak			
C.3.j. Herhangi bir değişim olmayacak			

KATKILARINIZ İÇİN TEŞEKKÜR EDERİZ.