



## Capacity Building in the Field of Climate Change in Turkey Grant Scheme (CCGS)

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### Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries Project

### TRB1 Regional Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries

ELAZIĞ 2018

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# ***TRB1 REGIONAL CLIMATE CHANGE ADAPTATION STRATEGIC PLAN***

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# TABLE OF CONTENTS

Executive Summary

1.Introduction

2.Material and Methods

3. Impact of Climate Change and Climate Change Adaptations Strategies

3.1. Impacts of Climate Change

3.2. Climate Change Adaptation Strategies

4.TRB1 Regional Climate Change Adaptation Strategic Plan

4.1. About TRB1 Region (Bilgol, Elazig, Malatya, Tunceli) and SWOT Analyse for Climate Change Adaptation

4.2. TRB1 Region Strategic Action Plan of Climate Change Adaptation

4.2.1.1.1. Human Resources Capacity Development

4.2.1.1.2. Sectoral Development

4.2.1.1.3. Production of Climate Change Adapted Products in TRB1 Region

4.2.1.1.4. Corporate Governance of Climate Change Adaptation

4.2.1.1.5. Climate Change Adaptation Technologies

5. Some Implementable Best Practices for Climate Change Adaptation in TRB1 Region

Resources





## EXECUTIVE SUMMARY

Climate change has been affecting agriculture, forest, and fishery businesses in the TRB1 region (Bingöl, Elazığ, Malatya, Tunceli). Residents of mountain – forest villages in TRB1 region like many mountain villages in Turkey have been directly affected by climate change especially on economic and social life. The region was active in the production of cereals and raising of animals between the 1940's and 1960's. In the process of climate change kicks in, the production of cereals in dried lands of the region has consistently not been productive as it used to be. Due to the changing climate, most farmers had to move from rural areas to urban centers whilst others also migrated Europe in search of greener pastures. The government of those days instituted a strategic plan for the mountain-forest villages in order to create sustainability for the residents in mountain- forest villages in Turkey. The plan mainly was about foresting the range lands, and villagers within those areas worked as employee thereby reducing the rural-urban drift. The 1970's and 1980's therefore was a good period for villagers to sustain their life as government employees. After two decades, villagers could not have employment opportunities since the range lands of villages were fully occupied with small forests.

People search new business opportunities in the villages as well as in cities. Almost 50% of mountain-forest residents got jobs in the cities of Turkey and migrate from rural to urban after 1980. The rest focus on new agricultural practices such as horticulture (almond, walnut), apiculture, and small ruminants (sheep, goat) production. They gave up vegetable production in the irrigated lands and even grain production in dry lands since grains were replaced with vegetables in irrigate land. Some people who still continue to visit their villages from cities try to plant fruits in dry lands. These group of people used to visit their farms in the weekend during off days of city jobs to irrigated the fruit farms ones a week. The trend of fruits production creates new business in horticulture especially for walnut, almond, grape production among others. In the 1990's, the high altitudes of mountain-forest villages were not productive for horticultural activities due to cold weather that froze and killed blossom.

The Forest Villages Cooperative (ORKÖY) was established under the Ministry of Forest in Turkey for management of sustainability in forest villages. ORKÖY has been supporting forest villagers for dairy business, sheep raising, apiculture, green house production, and house roofing in the 1990's. Climate change affected water and irrigation in the mountain-forest villages thus animal feed production constricted and dairy business decrease. The residents tried to sustain their life with small ruminant business but, there is not enough range for small ruminant in the villages too as there existed a governmental prohibition for sheep raising in the forest areas.

The historical result of climate change created serious problems that directly affected buildings, industries, agriculture, and ecosystem services of most vulnerable areas; mountain-forest villages. Current, the situation of mountain-forest villages in the TRB1 region is that of vulnerability to climate change and threatened sustainability. Income as a result of agricultural production, forestry, and fishery production are not enough to sustain residents the region. Almost 65 % of residents get retirement salary and salary from employee in industry and services in cities. The lands were occupied by horticulture (walnut, almond, apricot, pear, grape, peach, apple). Almost %85 of the farmers has less than 20 da. land in mountain-forest villages in TRB1 region. About 20 % of the irrigated lands have been occupied by horticulture. The





mountain-forest villages in Bingöl province focus on apiculture, horticulture, small ruminant, and dairy-cattle business. 60 % of mountain-forest villages in Elazığ province focus on horticulture and apiculture whereas the remaining 40 % has been focused on small ruminant production (especially sheep raising) and dairy-cattle business. In the Malatya province, 75 % of the mountain-forest villages focus on horticulture and grain production whereas the remaining 25 % focuses on animal raising. Approximately 65 % of mountain-forest villages in Tunceli province is focused on animal raising whilst the remaining 35 % focuses on grain production and horticulture.

The business opportunities for mountain-forest villages as determined are small ruminant raising, horticulture, apiculture, poultry production, fishery, medicinal-aromatic plants cultivation, and wild life tourism which have been proven to embody a lot of potential for climate change adaptation in TRB1 region. Farming System Research and Extension (FSRE) program therefore was chosen as a strategy for climate change adaptation in mountain-forest villages in TRB1 region among others. The strategic combination of agriculture, forestry, and fishery production in its different forms has been determined to be a key factor in climate change adaptation farming system development. Profits and cash projection of climate change adaptation farming systems were calculated and financial resources and governmental support for investment needs were described by concerning on market structure.

There exists an urgent demand for political as well as legal measures as highlighted after analyzing the Economic, Social, Technological, and Environmental structures of the TRB1 region as well as the other mountain-forest villages in Turkey. Capacity building and technological needs for developing adaptation and combating the effects of climate change are assuming an emergency status.

Need assessments of infrastructural investments for mountain-forest villages were determined as well as wild life tourism, water harvesting pools, fences of the villages for protection against pig and pork hazards, irrigation systems, plant nursing of horticulture from native genome.





## 1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) is the international organization that has mandate, through its working groups, to organize international activities and release publications on climate change related issues (<http://www.ipcc.ch>). On the other hand, there is the Nongovernmental International Panel on Climate Change-NIPCC which is a body of nongovernment scientist and scholars who have come together to present a comprehensive, authoritative, and realistic assessment of the science and economics of global warning (<http://climatechangereconsidered.org/about-the-nipcc>). Scientists in the NIPCC believe that climate change is caused by natural forcing which they identified the solar energy reaching the earth and changing orbit of the earth as the two major forcings (NIPCC, 2008) (Herath, 2011) against the popular view of the IPCC that **current changes in the global temperatures are due increased amounts of GHG in the atmosphere as a result of anthropological activities**. Other scientists such as (Jaworowski, 2009) agree with **the major effect of the sun in determining the climate of the earth**. Singer (2011) as well as Jaworowski (2009) though leading figures in the argument against the anthropological cause of the current trends of the climate, have not disputed the potential effect of greenhouse gasses and the fact that their amounts are increasing in the atmosphere above preindustrial periods. The arguments thus far are against ‘expensive’ mitigation measures that seek to reduce greenhouse gas emissions into the atmosphere and **not the capacity building programs for developing adaptation to the changing climate or the establishment of resilience to its impacts on earth**. Hence it is expected that all sustainable development programs should come along with climate change adaptation aspects in order to maximize their impact in reducing vulnerability and strengthen resilience (IFRC, 2009).

Mitigation, adaptation, and resilience to climate change are a common and continuous process in the history of the earth since it was inhabited by living things. **Adaptation as defined by the IPCC refers to ‘the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities in the human system, whilst in a natural system, it is the process of adjustment to actual climate and its effects’** (IPCC, 2012). Climate change adaptation has also been defined as ‘adjustments in ecological, social, and economic systems in response to actual or expected climatic stimuli and their effects or impacts’ (Smit & Pilifosova, 2001). Fankhauser (2016) also defined adaptation as the process of adjustment to climate effects, in order to moderate the negative and/or enhance the positive impacts of climate change. These definitions, though remotely different are in fact pointing to the same issue. The key import of these definitions are the expectation of an event whose impact may be positive or negative and the establishment of an adjustment process to set off the negative whilst taking advantage of the positives.

The concept of adaptation is sometimes confused with climate change resilience (Fankhauser, 2016). The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC, 2012) is what has been defined as resilience. **Clearly whilst adaptation is a process, resilience is a quality of the environment which could be achieved as a result of effective implementation of adaptation process**. The process of adaptation in climate change has been discussed in many fronts by both social and pure science researchers. Chiefly amongst the topics of discussion include the economic impacts, the extent of demand







and options available, and the opportunities or otherwise that come with the process of climate change adaptation. Capacity building for climate change adaptation is also an important aspect to look at in discussing environmental sustainability which will be affected adversely by the impacts of the changing climate.

The economic impacts of climate change adaptation in this context deals with the opportunity costs of implementing adaptation measures as well as expounding on the differences between the potential and achievement of adaptation as a function of costs, barriers, behavioral biases, and available resources. The argument on bearing the burden of the cost for building climate change adaptation is one to be looked at critically. Four entities have been identified as possible costs bearers; Individual countries, Multinational corporations, International institutions, and the Existing generation as a whole (Pages, 2008). Barrett (2007) argues that **the cost of climate change adaptation should greatly go to the developed economies whereas the developing countries also put in much effort to raise their standards of living in order to adapt to the changing climate.** This view is shared by Morris (2013) who opines that every country should bear the cost of developing its own adaptation to climate change with the developed economies strive to support the efforts of the developing ones. As this discussion is moving on, countries especially the developed ones are beginning to consider the effect of these costs on their national budgets (Fankhauser, 2009). After signing the Paris Agreement, the issue of cost bearing was to some extent taking care of as developed country parties have agreed to support both mitigation, and adaptation programs in developing country parties as well as the developing countries also motivated to scale-up their investment in climate change adaptation programs (UNFCCC, 2015).

The Paris Agreement is the recent assignment on Climate Change undertaken by the UNFCCC which some commentators described as highly ambitious and clever as the world almost unanimously agreed on the reality of the impact of climate change and parties to the agreement pledged to take action to manage it (Jacobs, 2015). The three main outcomes of the agreement were:

- 1) To reduce the global temperature rise below 2 °C above pre-industrial levels and to make efforts to limit it to 1.5 °C within this century,
- 2) **To increase the ability for adaptation and resilience to the impacts of climate change alongside reducing the emission of greenhouse gasses** and
- 3) To make financial commitment to the course of climate change with special interest in supporting underdeveloped countries and countries most vulnerable to the impacts of climate change (UNFCCC, 2015).

Prior to the agreement, the IPCC report (which is technically the most authentic report in recent history) indicated unequivocally that **the global surface temperature is rising successively since the 19<sup>th</sup> century**, ocean levels are rising, the glacial ice are melting and the **amount of greenhouse gasses in the atmosphere are significantly rising** (IPCC, 2013).

Developed country parties were committed to raising in an annual basis by 2020, an amount of US\$ 100 billion (Climate Focus, 2016) towards programs of adaptation and mitigation in the World. Recent developments however indicated that the financial commitment has a deficit of about US\$ 40 billion partly due to the lack of responsiveness by the United States (Hornby, 2017). The Green Climate Fund, established by the UNFCCC (<https://unfccc.int>) also recognizes the significance of both public and private financing to the achievement of the Paris Agreement (GCF, 2018). The UNFCCC (2007) upon indicating that





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costing of adaptation is particularly difficult especially going forward in future, still maintained that more investment will be needed to sustain the society from the impact of future climate event, and most of the funding it envisages will be coming from private investors and industry. This idea is also shared by Sachs et al., (2017) as they discuss the need for particularly oil and gas companies to support adaptation and mitigation programs alongside educating their customers and promoting research in green energy.

Finally, it can point out that the burden of funding climate change adaptation and mitigation for that matter should depend on certain factors such as **amount of contribution of an entity to the greenhouse gas emission, the capacity of an entity to make a significant financial contribution, and also considering the entity that benefits from such investment** (Page, 2008). These criteria are sufficient enough to point out who the great burden lies on in term of funding an adaptation program. The problem that arises with cost of adaptation is its uncertainty which public as well as private organizations take into consideration greatly. The literature focuses on two levels of costing: global scale estimates, largely to assess the overall need for adaptation finance funds; and regional and local-scale estimates, often limited to a particular vulnerable economic sector (Chambwera, et al., 2014). This is not expressly a big problem since according to the method of the world bank, sectoral or regional estimates could be consolidated into a global estimate (EACC, 2010, <http://www.worldbank.org/en/news/feature/2011/06/06/economics-adaptation-climate-change>).

Industries, especially that produce the highest amount of greenhouse gas emission, should bear a greater portion of the cost of financing climate change programs alongside making effort to educate their customers on the detriment of continuous use of their product (Frumhoff, et al., 2015). The losses industries are likely to face with worsening climatic condition, writers such as (Tate, 2018) believe that, industry plays should invest in climate change to reduce its effect in the future.

Capacity building of climate change adaptation for agriculture, forest, and fishery is the issue of human and natural systems. Human and natural systems have constantly adapted to and coped with adverse circumstances especially of weather but, with continuing climate change, adaptation will be needed to enhance capacity building such as human resources, marketing, production and operation, accounting and finance, organization, strategic planning, and operations for climate change mitigating, adaptation, and resilience.

Mitigation alone has been shown to be ineffective in avoiding further impacts of climate change in the next few decades. To ensure the safety, security, and sustainable development of communities, it is essential to implement not only initiatives for the long-term mitigation of climate change, but also policies for adaptation to climate change (Mimura, et al., 2010). Climate change provides both an obligation and an opportunity to reconfigure development strategies so that they meet the needs of the present generation without compromising future generations' abilities to meet their needs (El-Ashry, 2016). Adaptation demands are not only for tackling the impacts of climate change but also for taking advantages of the benefits that come with such measures.

Adaptation deals with reducing risk and vulnerability to the impact of climate change, seeking opportunities and building the capacity of nations, regions, private sectors, communities, individuals, and natural systems to cope with climate impacts, as well as mobilizing that capacity by implementing decisions and actions (Tompkins, et al., 2010). It







follows that adaptation is needed everywhere, but more urgently in areas that are more vulnerable to climate change and have less adaptive capacity. Often these are countries and regions that do not have sufficient financial resources to invest in climate adaptation. In addition, along with information about efficient adaptation, the tools for provision of adaptation are also missing. Particularly developing countries and small island states that are most hit by these shortcomings (Knittel, 2016). Clearly, the demand of adaptation is mostly dictated by vulnerability or lack of adaptive capacity. Vulnerability as defined refers to the propensity or predisposition to be adversely affected in this case by the impacts of climate change (IPCC, 2012). It thus follows that, increasing vulnerability will lead to increased negative impact whereas an increase in the adaptive capacity of a community reduces its vulnerability hence the impact of climate change.

Different aspects of the earth, ranging from the biophysical environment established institutions need some form of adaptation to climate change (Noble, et al., 2014). The EU through its LIFE project focuses on the following areas for adaptation: Urban communities, agriculture, forestry, water management, coastal areas and biodiversity (Camarsa, et al., 2015). This indicates that different aspects of our society need different adaptation measures to limit impact to vulnerability or take advantage of opportunities. Agriculture by far has been identified to be part of the aspects of nature most vulnerable to the impact of climate change due to its dependence on the climate (EU Commission, 2015).

Changing of species habitat, which has already started (McClean, et al., 2005) due to droughts, extreme temperatures and irregular precipitation, will have detrimental effect on agriculture in that, more agricultural lands will be lost as already being witnessed in developing countries especially African countries (FAO, 2007). Many are the research publications demonstrating the repercussive influence of food insecurity on social conflicts and wars (Brinkman & Hendrix, 2011). It thus dictates that demand for adaptation measures in agriculture is foremost and must be given priority. As clearly stated above, biodiversity is at the risk of relocation which may result in some form of extinction (McClean, et al., 2005). Business institutions are not left out in the demand for adaptation measures to climate change as its impact affect productivity greatly (Meinel & Schüle, 2018; FORFÁS, 2010).

Many options have been proposed to foster adaptation to climate change. The IPCC proposed;

- **Structural/physical,**
- **Social and**
- **Institutional measures as the three category of adaptation options to work with,**

though recognizing the different options advanced by different writers (Noble, et al., 2014).

**Under the Structural/physical option, the IPCC proposed;**

**-Technological and engineering measures that could be taking as adaptation measures such as R&D into new plant and animal species for agriculture, improvement of drainage system and establishment of social safety net and food banks and distribution of surplus** (Noble, et al., 2014). The Asian Development Bank (2014) suggested eHealth, prophylaxes treatment and protection measures such as long lasting insecticide treated nets as some technological measures for adaptation that has the potential to facilitate quick remedy and improving resilience to the impact of climate change.

**On the social option to adapting to climate change;**

- **Awareness creation and integration into educational systems,**





- **Hazard mapping and rapid response system,**  
- **Adaptive behavioral development and migration,** are some measure to consider in designing an adaptation program (Noble, et al., 2014).

**Institutional measures;**

- **Local governmental institutions and other administrative and policy making bodies of nations and international organizations should be equipped with coordination role and adaptation policy development capacity (Khatri, et al., 2013).**

The IPCC in its AR5 also agrees with this alongside the advancement for economic measures such as governmental subsidies and regulations creation in the area of land management and standards creation (Noble, et al., 2014). The Paris Agreement is by far the highest level of policy developed to tackle issues of climate change. To establish a very good adaptation plan, governments must keep to the agreement and as well establish an anticipatory response policy (El-Ashry, 2016). In fact, making incremental changes now will afford the future generation the capacity to cope with severe climate impacts (Smith & Lenhart, 1996) as a result of our anthropological activities during and post industrial periods. Another proposal is the advancement of Intelligent Transportation Systems (ITSs) which has the potential of improving transportation and adapting to climate change in giving early warning to climatic impacts (Asian Development Bank, 2014).

The selection of an adaptation option is not always an easy task due to the uncertainties in impact prediction and the fact that adaptation programs do not come just to ease vulnerability or take advantage but also come along with other objectives such as poverty reduction or disease management (Noble, et al., 2014). Due to this reason, criteria must be followed **in selecting a suitable option for effective adaptation**. Effectiveness of an option, its feasibility and cost of implementation amongst others are some of the criteria proposed by the (OECD, 2011) in trying to select an adaptation option for a nation. The BASE Evaluation Criteria for Climate Adaptation (BECCA) is a great instrument in evaluating the suitability of an option for climate change adaptation. The BECCA, developed on the basis of the existing academic literature and policy documents that address the issue of adaptation evaluation and revised on the basis of feedback from real-world adaptation cases, consists of lists of evaluation criteria and some guidance notes on how and when to use them (BASE, 2015).

There are many criteria for selecting an adaptation option that governments and policy makers can select from. Effective implementation of these criteria is what is the problem at hand. It is thus clear that the extent of demand for adaptation to climate change is mostly dictated by vulnerability. Since all social niches and institutions will be affected by the impact of climate change, adaptation need to be implemented in all human spheres and natural ecosystems. Many options have been proposed by researchers and institutions which should be taking into consideration and necessary efforts made to put them into practice. These options range from technology to governmental policies. However, a set of criteria must be followed to achieve an effective climate change adaptation plan. The five-point proposal of de Bruin, et al. (2009) where they stated that before an option is selected it should satisfy the following criteria:

- The importance of the option in terms of the expected gross benefits that can be obtained
- The urgency of the option, reflecting the need to act soon and not later
- The no-regret characteristics of the option
- The co-benefits to other sectors and domains
- The effect on climate change mitigation.





Adaptation measures may result in agricultural systems that are more resilient to climate variability (e.g. new crop varieties that are heat-and drought resistant may reduce crop losses during hot, dry summers today), enhanced responses to urban heat waves can save lives now and in the future, coastal adaptation plans can save organisms and reduce the possibility of losses in biodiversity (Scheraga & Grambsch, 1998).

The objective of this study is to determinate strategy of climate change adaptation as business plan for capacity building of sustainability. The aim is to determinate capacity building of climate change adaptation in TRB1 region (Bingol, Elazig, Malatya, Tunceli) of Turkey. Climate change will have significant impacts on development, poverty alleviation, and the achievement of the Millennium Development Goals (MDGs). The target groups are mountain-forest villages of TRB1 region. Survey had been done with interview of 280 mountain-forest village governorates. The impacts of climate change such as new threats emerge against water and food security, agricultural production, nutrition, and public health were taken into consideration for capacity building of climate change adaptation in TRB1 region. The climate change adaptation strategic business plan was prepared not only be important in the future when impacts are moderate to high but will also be helpful in the lives of humanity and environment today (Tubiello, 2012). The strategic plans of Republic of Turkey' government offices, institutions, and other policy making organizations were reviewed to take the issue of climate change adaptation serious as seen in the spirit of the after mouth of the Paris Agreement. Also, some of the measures come with a social or political respects such as lake construction for water harvesting for agriculture were pointed for climate change adaptation. The size of lakes considered optimum with respect of exist the possibility of creating the spread of new pest and diseases which will come at a cost for control. Some of the adaptation measures that come at huge costs for which finding funding is sometime difficult due to the fact that it can enlarge the budget of financing institutions were mentioned in the strategic plan for future thinking (Fankhauser, 2009).

The regional climate change adaptation strategic business plan and implementation of adaptation options will necessitate significant financial commitments from various sources at risk although the level of required funding might vary widely from one option to another (Scheraga & Grambsch, 1998). Implementing bodies also face the risk of running into maladaptation which according to some writers is as dangerous as the impact of climate change been avoided (Magnan, 2016). Care must therefore be taken when designing and implementing an adaptation program. Hope, The Paris Agreement has paved the way for tackling the menace of climate change with more attention given to adaptation plans. The debate on the financing of climate change programs seem to be over however recent updates speak otherwise, considering the actions of some parties especially the United States of America. Adaptation need as seen above are dictated by vulnerability and adaptive capacity of an entity. Every niche of the globe is likely going to face the impact of the changing climate hence needing an adaptation plan. Many are the options available for designing an adaptation plan however, policy makers and governments must be critical in their selection so as to limit the negative effect of maladaptation.



## 2. Material and Methods

Data were collected by 560 questioners' implementations with residents in TRB1 region. The secondary data such as international and national organization plans (Paris Agreement, Climate Change Action Plan, Turkey Climate Change Strategic Plan, Adaptation Strategy Action Plan) were used for the plan. The lists of Mountain and Forest Villages were taken and 294 villages were selected by random sampling. The distribution of the selected villages according to the regional provinces is as follows; Elazığ 116, Bingöl 57, Malatya 84, Tunceli 37.

- Number of selected villages in Elazığ Province; 116 Villages

In the ALACAKAYA district, 4 mountain and forest villages were selected.

In ARICAK district, 4 of 12 mountains and forest villages were selected.

In the district of BASKİL, 32 villages were selected within 30 mountain and forest villages.

16 villages were selected from 57 mountain and forest villages in KARAKOÇAN district.

In the district of KEBAN, 10 villages were selected among 15 mountains and forest villages.

In the district of KOVANCILAR, 10 villages were selected from 32 mountains and forest villages.

6 villages were selected from 23 mountains and forest villages in MADEN district.

In the district, 20 villages were selected from 66 mountain and forest villages.

In the PALU district, 6 villages were selected from 26 mountain and forest villages.

8 villages were selected from 32 mountains and forest villages in SİVRİCE district.

- Number of selected villages in Bingöl Province; 57 villages

In the district of ADAKLI 32 mountain and forest villages could not be selected for security reasons.

In the district of GENÇ 56 mountain and forest villages could not be selected for security reasons.

15 villages were selected from 12 mountains and forest villages in KARLIOVA district.

8 villages were selected from 27 mountains and forest villages in KIĞI district.

6 villages were selected from 19 mountain and forest villages in SOLHAN district.

6 villages were selected from 14 mountain and forest villages in YAYLADERE.

6 villages were selected from 11 mountains and forest villages in YEDİSU district.

16 villages were selected from 63 mountain and forest villages in the central district.

- Number of selected villages in Malatya Province; 84 Village

8 villages were selected from 8 mountains and forest villages in the Kale district.

6 villages were selected from 10 mountain and forest villages in Batağazi district.

6 villages were selected from 11 mountains and forest villages in Akçadağ district.

8 villages were selected from 8 mountain and forest villages in Arapgir district.

2 villages were selected from 8 mountain and forest villages in Arguvan district

6 villages were selected from 12 mountain and forest villages in Darende district.

10 villages were selected from 25 mountain and forest villages in Doğanşehir district.

2 villages were selected from 10 mountains and forest villages in Doğanlı district.

10 villages were selected from 22 mountains and forest villages in Hekimhan district.

4 villages were selected from 5 mountain and forest villages in the Kuluncak district.

6 villages were selected from 44 mountains and forest villages in Pütürge district.



6 villages were selected from 6 mountains and forest villages in Yazihan district.

6 villages were selected from 8 mountains and forest in Yeşilyurt district.

- Number of selected villages in Tunceli Province; 37 villages

6 villages were selected from 14 mountain and forest villages in Çemişgezek district.

4 villages were selected from 27 mountain and forest villages in Hozat district.

7 villages were selected from 55 mountain and forest villages in Mazgirt district.

2 villages were selected from 51 mountain and forest villages in the central district.

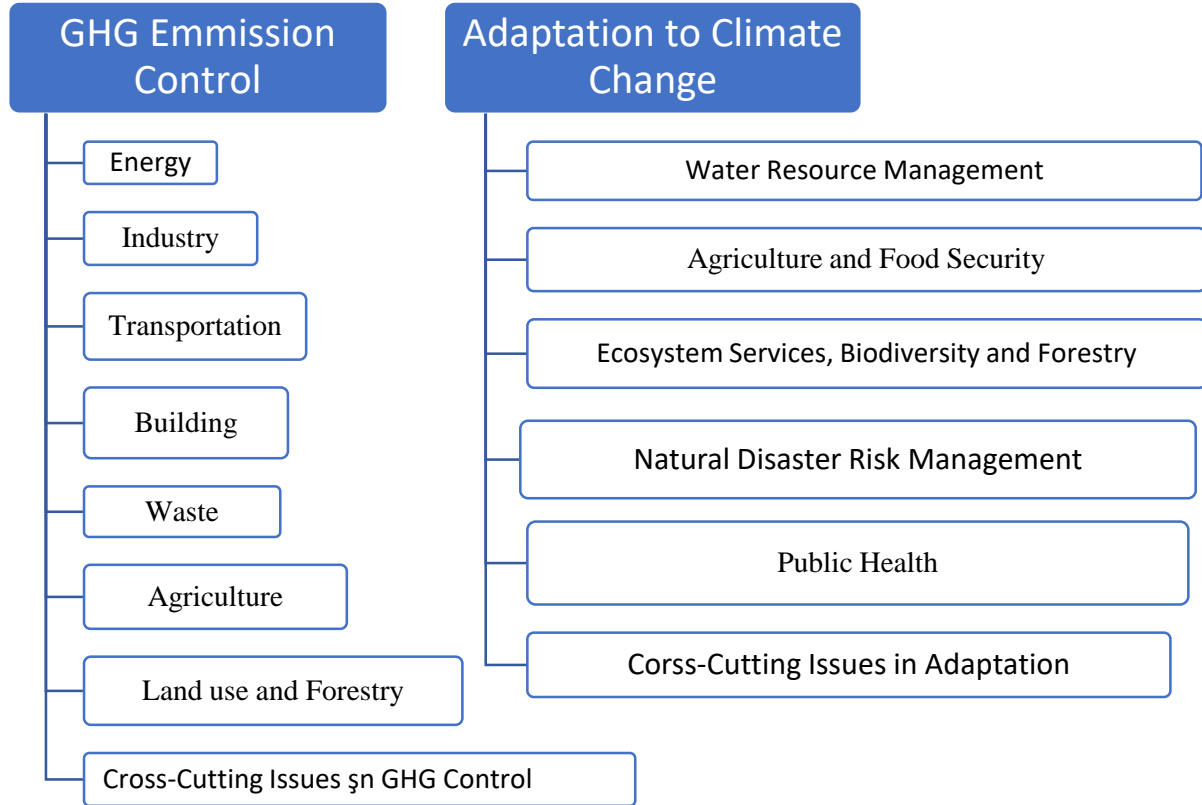
No choice could be made for security reasons among 74 mountain and forest villages in the town of Nazimiye. No choice could be made for security reasons from 54 mountain and forest villages in the town of Ovacık. 18 villages were selected from 36 mountain and forest villages in Pertek district. No choice could be made for security reasons from 42 mountain and forest villages in the town of Pülümür.

The secondary data such as international and national organization plans (Paris Agreement, Climate Change Action Plan, Turkey Climate Change Strategic Plan, Adaptation Strategy Action Plan) were used for the plan. Strategic focus of Climate Change Adaptation (CCA) in TRB1 Region are mitigation, adaptation, resilience, technology, and finance. Within the scope of combating climate change Turkey's main objective is to contribute to the global efforts in line with the sustainable development policies on the basis of common but differentiated responsibilities and taking Turkey's and TRB1 regions' special circumstances into account.

The Turkey's National Climate Change Action Plan was taken into consideration for the preparation of TRB1 region strategic plan. National climate change action plan is based on the policy of the XI. Development Plan which states that "In the framework of the national circumstances of Turkey, and with the participation of the relevant parties, a National Action Plan that sets forth the policies and measures for reducing greenhouse gas emissions will be prepared (<http://onbirinciplan.gov.tr/oik-ve-calisma-grubu-listeleri>). Growth, consumption-saving, agricultural production, soil and water uses in agriculture, energy safety, transportation, tourism, civil societies of growth, partnership of government and private sector, dynamic of private sector in regional development, and rural development were chosen as related to CCA in TRB1 region. The description of GHG emission control and adaptation to climate change were investigated in TRB1 region as follow;







The capacity building of climate change adaptation was described by PESTEL (Politic, Economic, Social, Technic, Ecologic, Legal) analyses or method. Adjustment in Economic, Social, Technological, and Ecological can be possible with Political and Legal forcing. In this study capacity development of climate change mitigation, adaptation, resilience was determined that requires;

- Fundamentals of information systems for Politic, Economic, Social, Technologic, Ecologic, and Legal on climate change in regions or nationals
- Information Technology Components of Business Information Systems
- Development and Management of Business Systems
- Human Resource Information Systems
- Marketing Information Systems
- Accounting/Finance Information Systems
- Production Information Systems
- Enterprise Resource Planning from Data to Intelligence.

TRB1 regional climate change adaptation strategic plan focused on international strategies such as Mitigation, Adaptation, Resilience, Technology, and Finance. Strategic focus of capacity building was described as six components as follows

- Human resources management (Awareness raising, Research activities)
- Marketing plan (Marketing of climate change adapted products)
- Production plan (Marketing of climate change adapted products)
- Financial plan (Financial supports of climate change adapted products)
- Strategic plan (Mitigation, Adaptation, Resilience, Technology, and Finance)
- Organization plan (Climate Change Platform)





### 3. Impact of Climate Change and Climate Change Adaptations Strategies

#### 3.1. Impacts of Climate Change

In line with the Decision 26/CP.7 taken within the context of the United Nations Framework Convention on Climate Change (UNFCCC) in 2001, Parties were invited to recognize that Turkey has a special position in comparison to that of other countries listed in the ANNEX-1 and it was decided to exclude Turkey from the list of countries in the ANNEX-2 of the Convention. Following this decision, Turkey has become a party to the UNFCCC in 2004. Since Turkey was not listed in Annex-B of the Kyoto Protocol to which Turkey became a party in 2009, it does not have any quantified emission limitation or reduction commitment. **Turkey became a party to the UNFCCC in 2004 and to the Kyoto Protocol in 2009.** With reference to Turkey's sui generis position, the need to improve Turkey's access to **finance, technology and capacity building** in a way to allow Turkey to carry out its responsibilities as set forth in the UNFCCC, is still being negotiated.

##### **Impact of climate change on water resources**

Shifting precipitation patterns from snowfall to rainfall and faster melting snow covers would lead to water shortages in elevated areas where urban and agricultural water requirements and supply are regulated on the basis of the "snow load" throughout the year. Such an alteration of the water cycle would lead to considerable changes in the supply and quality of water resources, and impact many climate-based sectors, including food production, where water is vital. Increasing temperatures in Turkey as a result of climate change would lead to increased summer temperatures, reduced winter precipitation, loss of surface waters, more frequent arid seasons, degradation of soil, erosion in coastal regions and floods all of which are direct threats to water resources.

Some measures which should be taken to managed the impact of climate change on water resources are: development of non-conventional techniques for using water resources; increasing the number of research activities focusing on the management of irrigation efficiency that are based on estimations on increase in water demand as a result of climate change; developing high-quality crops that can survive on low-quality irrigation water; and developing other plant species that are resistant to aridity and salinity.

##### **Impact of climate change on agricultural sector and food safety**

Climate change will affect production, production sites, and stockbreeding activities. The volume and frequency of these changes as well as the possibility of increased occurrence will lead to a higher risk of reduction in the agricultural yield. All these are directly related to food safety. Impact of climate change on agriculture sector is pivotal for food safety because the Turkish agricultural sector is a priority sector for socio-economic reasons and it is where the population's food supply mostly comes from. As a result of impacts of climate change, amount of water for agriculture will diminish, quality of water will decrease, biodiversity and ecosystem services will not be protected, sustainable agricultural production patterns will change, pastures will degrade, stockbreeding activities will be affected and farmers will find themselves incapacitated in terms of adaptation to climate change, and all these will eventually risk food safety. Climate change in Turkey, is expected to lead to increasingly negative impacts on water and soil resources and rural development that are vital for food production and food safety.





### **Impacts of climate change on ecosystem services, biodiversity and forestry**

Climate change will also result in loss of biodiversity. This will significantly affect species, ecosystems that are crucial for the society and related services. Ecosystems, humic soil that store carbon, wetlands and benthic zone have a direct role in regulating climate. It is also known that salt marsh ecosystems and dunes provide protection against storms. Climate change, probably along with other changes in forest health and fertility is already causing alterations in the geographical distribution of some tree species. Climate change further increases the stress on sectors such as fishing and aqua-production and has been forecasted to lead to more coastal erosions and extreme impacts on coastal and marine ecosystems.

### **Impacts of climate change on natural disasters**

The frequency, magnitude and nationwide geographical distribution of natural disasters like floods and drought triggered by the changes in the water cycle are expected to be increased. Increasing quantity of surface water in winter will necessitate additional measures against floods and improvement of the existing infrastructure. Similarly, there are regions where the impact of precipitation will increase. So, in rural and in urban areas there will be flood risks or existing level of risk will be higher.

### **Impacts of climate change in public health**

Changing climatic conditions will also have significant impact on human health. The more frequent climate events unfold, the more diseases that are linked to weather conditions will be observed and deaths will increase. An increase in the number of very hot days will directly affect the elderly and acute health problems in people with chronic cardiovascular diseases. Also, the increased flood risk as a result of climate change will also increase the risk of contagious diseases and affect geographical distribution of such pathogens causing those diseases.

## **3.2. Climate Change Adaptation Strategies**

Agriculture, rural livelihoods, sustainable management of natural resources and food security are inextricably linked within the development and climate change challenges of the twenty-first century. Indeed, not only is food security an explicit concern under climate change; successful adaptation and mitigation responses in agriculture can only be achieved within the ecologic, economic and social sustainability goals set forth by the World Food Summit, the Millennium Development Goals and the UNFCC.

The most important challenge for agriculture in the twenty first century is the need to feed increasing numbers of people - most of whom are in developing countries - while at the same time, conserving the local and global environment in the face of limited soil and water resources and growing pressures associated with socio-economic development and climate change. Projected population and socio-economic growth will double current food demand by 2050. To meet this challenge in developing countries, cereal yields need to increase by 40 percent, net irrigation water requirements by 40-50 percent, and 100-200 million ha of additional land may be needed, largely in sub-Saharan Africa and Latin America. Many developing countries will continue to experience serious poverty and food insecurity, due to localized high population growth rates, poor socio-economic capacity and continued natural resource degradation.

Climate change pressures will be compounded by a pronounced lack of sufficient knowledge, infrastructure, organization and resources that local populations and national governments need to cope with and adapt to. The recent increases in food prices and their immediate negative





impacts on food security demonstrate that the current system is already, unexpectedly, quite vulnerable. Although climate change will result in both challenges and opportunities for agriculture, it is well understood that factors that may have led to the current food security crisis are likely to multiply under climate change. In particular, climate change may further enhance the food import dependence of most developing countries.

Smallholder and subsistence farmers, pastoralists and fisher folks in developing countries may not be able to cope with climate change effectively, due to reduced adaptive capacity and higher climate vulnerability. Under such conditions, pressure to cultivate marginal land or to adopt sustainable cultivation practices as yields drop is likely, and may increase land degradation, water scarcity and endanger biodiversity. This vicious dynamic may lead to large-scale migrations, as rural poor populations abandon regions that no longer can support livelihoods, food and fuel.

Key impacts of climate change:

1. Global warming
2. Extreme climate events
3. Undernourishment
4. Food stability, utilization and access

Adaptation and mitigation strategies to limit damage from climate change in developing countries must be consistent with, build upon and provide new direction for existing and future development plans focusing on rural poverty and agricultural development at all relevant scales, from national to international.

If emissions of greenhouse gases, including those from agriculture, are not controlled in the coming decades, continued growth of their atmospheric concentrations is projected to result in severe climate change throughout the twenty-first century. If “dangerous anthropogenic interference” with the climate system is to be avoided in the coming decades and warming is to be limited to “acceptable temperature increases, then stabilization of atmospheric concentrations must be achieved. This will require significant cuts in global emissions, starting now and certainly no later than 2020-2030. In particular, a number of mitigation strategies in the agriculture and forestry sectors have been identified as useful in achieving the goal of stabilization of atmospheric concentrations between 450-550 ppm CO<sub>2</sub>. These include reduced deforestation and degradation of tropical forest (REDD), sustainable forest management (SFM) and forest restoration (FR), including afforestation and reforestation (A/R). In agriculture, reduction of non-CO<sub>2</sub> gases through improved crop and livestock management and agroforestry practices, enhanced soil carbon sequestration in agricultural soils via reduced tillage and soil biomass restoration have to be advanced.

#### **Adaptation and Mitigation Strategies**

The most common strategies aim to reduce the impacts of climate change (mitigation) and to cope with the impacts of climate change (adaptation). Put plainly, mitigation aims to avoid the unmanageable and adaptation aims to manage the unavoidable. Mitigation is widely discussed and successfully applied in various context at the international, national, regional, local and even individual levels. It includes technical and infrastructural investments, renewable energy implementation (to reduce climate change and improve energy security) as well as improving energy efficiency (Laukkonen et al., 2009:287-292).

Diminishing water resources, forest fires, drought, desertification and ecological degradation among others are impacts of climate change that are evident in Turkey. Noticeable temperature





increases and a precipitation regime that can impact all economic sectors, settlements and climate-related natural disaster risks. Because of inertia with both the climate change and socio-economic systems upon which greenhouse gas emission depend, we are bound to face a degree of climate change and its related negative impacts, regardless of the mitigation strategy chosen. However, the sooner the mitigation activities begin, the lower the likelihood of extreme impacts. Nonetheless, adaptation will be needed to protect livelihoods and food security in many developing countries that are expected to be the most vulnerable, even under moderate climate change.

Climate change brings critical new perspectives to important global challenges relevant to food security and rural livelihoods. Mainstreaming climate change issues into development is a necessary step of overall development policy, but it is not sufficient. To be sufficient, sustainable development policies must also be reformulated in order to include important new temporal and spatial scales that have become relevant only because of climate change. Actions to limit damage from climate change need to be implemented now in order to be effective. Mitigation actions involve direct reduction of anthropogenic emissions or enhancement of carbon sinks that are necessary for limiting long term climate change. Adaptation is necessary to limit potential risks of the unavoidable residual climate change now and in coming decades. Importantly, there are significant differences in the policy nature underlying adaptation and mitigation actions. It follows that a significant challenge of climate policy is to identify and then develop instruments that allow for a portfolio of adaptation and mitigation strategies that are effective in time and space and focus on balancing actions across the most appropriate sectors, and within the chosen scope of specific climate response policies. In the case of a focused priority on food security and rural vulnerability, a number of limitations on the usefulness of certain mitigation strategies may emerge with respect to adaptation requirements. One important example is related to bioenergy and biofuel production which, as a mitigation strategy, may have benefits for rural incomes and thus development. However, in order to prevent serious negative repercussions on food prices, ecosystem functions including biodiversity and carbon cycling and local food availability, need to be planned at the appropriate regional and local scales, and in conjunction with focused rural developmental policy. While adaptation strategies that minimize expected impacts on access, stability and utilization of food resources involve largely local- to regional –scale actions, safeguarding food availability also required a global perspective. Climate change adaptation strategies should aim at maintaining, or even increasing, food production in key exporting developed and developing regions, or in regions key to regional food security.

Useful synergies for adaptation and mitigation in agriculture, relevant to food security exist and should form the core of climate policy planning and implementation at national and local levels. These include avoided deforestation, forest conservation and management, agroforestry for food and energy, land restoration, recovery of biogas and waste, and in general, a wide set of strategies that lead to conservation of soil and water resources by improving their quality, availability and efficiency of use. These strategies are often deeply rooted in local cultures and knowledge, as well as the focus of research support and application by key international agencies and non-governmental organizations (NGOs). They all tend to increase resilience of production systems in the face of increased climatic pressures, while providing significant carbon sequestration or reducing land based greenhouse gas emission.





- Altering inputs, varieties and species for increased resistance to heat shock and drought, flooding and salinity; altering fertilizer rates to maintain grain or fruit quality; altering amounts and timing of irrigation and other water management; altering the timing or location of cropping activities.
- Managing river basins for more efficient delivery of irrigation services and prevent water logging, erosion and nutrient leaching; making wider use of technologies to “harvest” water and conserve soil moisture; use and transport water more efficiently.
- Diversifying income through the integration of activities such as livestock raising, fish production in rice paddies, etc.
- Making wider use of integrated pest and pathogen management, developing and using varieties and species resistant to pests and diseases; improving quarantine capacity and monitoring programmes.
- Increasing use of climate forecasting to reduce production risk.
- Matching livestock stocking rates with pasture production, altered pasture rotation, modification of grazing times, alteration of forage and animal species/breeds, integration within livestock/crop system including the use of adapted forage crops, re-assessing fertilizer applications and the use of supplementary feeds and concentrates.
- Undertaking changes in forest management, including hardwood/softwood species mix timber growth and harvesting patterns, rotation periods; shifting to species or areas more productive under new climatic conditions, planning landscapes to minimize fire and insect damage, adjusting fire management systems; initiating prescribed burning that reduces forest vulnerability to increased insect outbreaks as a non-chemical insect control; and adjusting harvesting schedules.
- Introducing forest conversation, agroforestry and forest-based enterprises for diversification of rural incomes.
- Altering catch size and effort and improving the environment where breeding occurs; reducing the level of fishing in order to sustain yields of fish stocks.

### **Climate change adaptation and mitigation measures at the local level**

It is widely accepted that the poorest communities are the most vulnerable, because they lack access even to the most basic urban services placing them at a comparative disadvantage and challenging their capacity to take on additional stresses caused by climate change. Such complex vulnerabilities require comprehensive responses that link climate change adaptation and mitigation efforts to the sustainable development of these communities enhancing their adaptive capacity (Laukkonen and et al, 2009:287-292).







#### 4. TRB1 Regional Climate Change Adaptation Strategic Plan

##### 4.1. About TRB1 Region (Bilgol, Elazig, Malatya, Tunceli) and SWOT Analyse for Climate Change Adaptation

Turkey is subdivided into 7 geographic regions since the formation of the Turkish Republic in 1923. In the 21 Century, Turkey described 26 sub-regions for geographic, demographic and economic purposes. TRB1 is one of the regions consisting of Bingöl, Elazığ, Malatya, and Tunceli cities or provinces. TRB1 takes the 20<sup>th</sup> place among 26 Regions with a share of 1.4% of total GVA. The TRB1 is an important economic region historically through several civilizations and in recent times is crucial for the development of the entire country as it is home to about 1.673.852 individuals, has a growing industrial sector (especially food and textile), good water and energy resources, with strategic geographical conditions and historical touristic importance and also contributes 1,3 % of overall GDP to the country. The provinces of the TRB1 Region consisting of Malatya, Elazığ, Bingöl, and Tunceli historically have an important role in the economic activities for different civilizations as mentioned above.

Agriculture, forestry, and fishery activities are predominant on most of the lands in the TRB1 region. For instant, Elazığ, which is central in the region, is neighbored by Bingöl in the east, Malatya in the west, Diyarbakır in the south and Tunceli in the north, has a large water resources. Elazığ is also surrounded by Lake Hazar, the Keban Dam, The Karakaya, the Kralkızı and the Özlüce Dams on three sides like a peninsula. Those water resources provide many opportunities for fishery production. Elazığ province import almost 17-thousand-tonnes fish every year. There are potentials for fish production I the Munzur river in Tunceli province as well as the Euphrates river in Elazığ and Malatya provinces too. Climate change has undermined this potential as it has decreased fish production due to increasing temperatures of the water resources.

Agriculture and forestry land extension have also been affected greatly in the region by climate change. There has been a transition from agriculture to other sectors similar to the overall trend in the country. However, the trend in the TRB1 region does not follow the national trend as the region is geared towards stability in the share of agriculture to economic development. While the transition in Turkey has been in favor of services sector, the TRB1 region has been moving mostly towards industrialization. According to Regional Total Value Added Data in 2017, TRB1 Region takes the 15<sup>th</sup> place in agriculture, 16<sup>th</sup> place in industry and 7<sup>th</sup> place in services with shares of 15%, and 64 % respectively within Gross Value Added in the Region.

**Figure: Share of TRB1 Region within the Total Gross Value Added by Sectors**

	2004 %	2007 %	2011 %	2017 %
Agriculture	2	2.2	2.2	2.2
Industry	1	1	1.2	1.1
Services	1.4	1.4	1.4	1.5
GSKD (Gross value added)	1.4	1.3	1.4	1.3
Performance	21 <sup>st</sup>	21 <sup>st</sup>	20 <sup>st</sup>	19 <sup>st</sup>

Source: Socio Economic Development Index TURKSTAT

The most important economic activity in the region is agriculture. Horticulture and animal breeding are dominant areas in agriculture activity. Apricots, grapes, almonds, walnuts, cherry, mulberry, are some important fruits in the region. Unfortunately, agro industries such as fruit





processing are not strong in the region. Industries like textile, mining and quarrying have an important place in the economy of the region. The Gross Added Value (GAV) per capita of the region is 60% of the national average. The service sector is the biggest contributor to GAV in the region. The TRB1 region is ranked 20th among the 26 regions covered by RCOP in terms of industrial least development. There are seven organized industrial zones in the TRB1: one in Bingöl, one in Tunceli, two in Elazığ and three in Malatya. The process of Infrastructural development is still ongoing in these organized industrial zones in Bingol, Tunceli, and Darende (Malatya).

**Figure: Share of Sectors within Gross Value Added, 2004-2011**

TR		2004 %	2007 %	2011 %	2017%
Agriculture	Turkey	10.7	8.5	9	8.5
	TRB1	15.4	14.3	14	14.5
Industry	Turkey	28	27.8	27.5	27.0
	TRB1	21.3	19.9	22.8	21.0
Services	Turkey	61.3	63.7	63.5	64.0
	TRB1	63.2	65.8	63.2	65.5

Source: Socio Economic Development Index, TURKSTAT

Majority of the women in the TRB1 region work in the agricultural sector. Accordingly, the non-agricultural unemployment rate is higher than the national average. Therefore, increasing women's employment in the non-agricultural sectors is a strategic regional priority.

	Turkey	TRB1
<b>Agriculture</b>	24.6	39.2
<b>Industry</b>	26	18.1
<b>Services</b>	49.4	42.7

**Table: Women's Employment by Sector 2013 (Source: TURKSTAT)**

The Elazığ province is one of the region's most economically developed and the highest exporter in the region with USD 227 million in 2014, mainly from mining and quarrying operations, which account for 92 % of the exports. According to General Directorate of Mineral Research and Exploration and Fırat University Department of Geology, the Elazığ province has rich deposits of minerals such as gold, silver, copper, lead, zinc, iron, chromium, manganese, limestone, marble, granite, travertine, calcite, silica sand and quartzite, gypsum and decorative building stone, brick clay, industrial clay, pumice, molybdenum, tungsten, charcoal as well as hot springs, mineral water, fluorite, and pyrite chalcocite. The most valuable and important minerals of Elazığ are chrome and marble. The biggest Ferro-Chrome plant of Turkey is located in Elazığ, containing 22 chrome quarries, and there are 25 marble factories based in Elazığ, containing 100 marble quarries. Elazığ Cherry Marble is the most important type of marble. In addition to mining, fish farming, food and beverage manufacturing, molding, machinery, textiles and furniture production are the important building blocks of the province's economy. **Due to the contribution of mining in the province, it can be recognized that the mining sector provides a good opportunity for climate change adaptation as an alternative income sources for families in the region.**

In the 1970s, Elazığ was one of the seven potential metropolitan provinces which were identified by State Planning Organization (predecessor of the Ministry of Development) of Turkey. The Socio-Economic Development Index (SEDI) 2004-2011 prepared by TURKSTAT saw the TRB1 region becoming 20<sup>th</sup> among 26 regions. NUTS level 2 regions in Turkey, Bingol



is 72<sup>th</sup>; Tunceli is 58<sup>th</sup>, Malatya is 42<sup>th</sup> while Elazig, the most developed province in TRB1 Region takes the 39<sup>th</sup> place out of 81 NUTS Level 3 provinces. In the same index, Turkish cities are categorized into 6 groups according to their socioeconomic development level and Elazig in such grouping falls under the 4<sup>th</sup> category. An important player in the Elazig economy is the organized industrial zone that spreads over two million square meters of industrial space and employs 4.928 people in 127 enterprises. Elazig is ranked 27<sup>th</sup> among 81 cities of Turkey according to the study of “inter-provincial competitiveness index 2009-2010” by “the International Competitiveness Research Institution” and “Deloitte Turkey”. Elazig has the highest “Accessibility” and “Human Capital and Life Quality” indexes.

(Sector Economic Activity)	By First High Priority Sector Competitiveness	Second Priority competitiveness	High Sector Competitiveness	Third Priority Competitiveness	High Sector Competitiveness	Other
1. Agriculture	Seafood	Health		Education		Viticulture
2. Mining	Marble	Chromium		Quarrying		Virgin
3. Production	Food	Cast-Maker		Furniture		PVC
4. Energy	Solar Energy	Hydro Electric		Wind Power		Energy From Waste Products
5. H I Services	Tourism	Health		Education		Logistics

**Table: Elazig Competitive Industrial Sector (Source: Elazig Chamber of Commerce)**

Elazig has also become one of 12 provinces announced as “Centers of Attraction” by the state Planning Organization. Situated on the crossing point of the transit roads that connect the East Anatolian Region to the west Elazig is a province with significant geographical advantages. Elazig is a province, which provides services to Tunceli and Bingöl prominently and also other provinces in the region partly in transportation and other infrastructural opportunities it has. Elazig has a good transportation infrastructure that enables access to every point in Turkey through network of highways and railroads. Elazig province has been chosen center for TRB1 regional development in the study. There are head-quarters for the Firat Development Agency and East Anatolia Development Program in Malatya and Erzurum provinces respectively. Elazig is also the pivot of TRB1 region.

#### Development Indexes of TRB1 Region

	Socio Economic Development Index (2003)	Socio Economic Development Index (2011)	Socio Economic Development Index (2010, KTU)	Competitiveness Index (URAK, 2009-2010)	Competitiveness Analysis of Province and Regions (2010, ITU)
Bingol	76	72	75	71	5.Group (Resistant to Development)
Elazig	36	39	46	27	4.Group (Resistant to Development)
Malatya	41	42	47	28	4.Group (Resistant to Development)
Tunceli	52	58	63	74	5.Group (Resistant to Development)

Source: FKA, TRB1 Region Plan, 2004-2023





As can be seen from the data summarized in the figure below, population of TRB1 Region and Elazig seems to increase regularly since 2012. The figure also shows that the highest number of population age ranged between 15-34 years.

#### POPULATION AND DEMOGRAPHIC

Figure: Population by Sex and Age in Turkey, TRB1 Region, and Center Pivot –Elazig

Year	Region	Population	Women (Rate)	Men (Rate)	Population 15 Years and Over	Young Population (15-24)	Young Population (15-24) Rate
2012	Turkey	75.627.384	49,81%	50,19%	56.770.205	12.591.641	16,65%
	TRB1	1.673.852	49,51%	50,49%	1.253.415	314.825	18,81%
	Elazig	562.703	50,31%	49,69%	424.427	101.400	18,02%
2015	Turkey	78.741.053	49,82%	50,18%	59.854.833	12.899.667	16,38%
	TRB4	1.700.468	49,68%	50,32%	1.293.006	309.282	18,19%
	Elazig	574.304	50,29%	49,71%	440.897	104.643	18,22%

Source: TURKSTAT

The population of young people in Elazig is increasing at a faster rate as against the national figure in recent times which is seen to be in a declining state. Examining the population data of Elazig, it can be observed that the “economically active population” consisting of ages between 15-54 which are actively working or looking for work comprises about 61 % of the total population of the province. The remaining 39 comprises those who are not economically active such as children, the elderly and retirees. Elazig is the pivot of the TRB1 region for a concentric development.

#### **Economic and Industrial Structure of Elazig Making it the Pivot of TRB1 region for concentric development**

Elazig is the most developed city (and province) in the region according to a report that was carried out by the Ministry of Development, making it the most developed region of the Eastern Anatolia Region. Construction of the dam, the industry and the mining accounts for the high level of urbanization surpassing the average levels for Eastern Anatolia. The most important factor promoting the growth of Elazig since the 1970s has been the construction of the Keban Dam and the hydroelectric power plant located at a distance of 45 km away from city and the resulting huge dam reservoir. This reservoir covers an area of 68.000 hectares and floods around a hundred villages with a hundred others losing a large part of their agricultural lands. Industries connected with construction of the dam such as a cement mill contributed to the economic growth in the region and results in a striking gap between the male and female populations in Elazig, the former outnumbering the latter by some eight thousand throughout the seventies. The economic structure of Elazig has exhibited development based on agriculture and followed by food, mining-stone and soil, iron and metals, furniture and wood products, plastics, and general manufacturing sectors. 17 thousand people are employed in the industrial sector and the sector’s share in the Province’s economy is 25%. In addition, the Keban Dam, which is located in Elazig, provides 8 % of the total electricity consumed all over the country. Elazig can be considered as being rich in terms of underground resources. The main minerals extracted in the province are marble, copper, chromium, fluoride, chalcopryrite, zinc, lead, manganese, molybdenum, iron and tungsten.





Industrialization process that has been initiated by the state in the 1930s is still ongoing with great speed. Therefore, the Elazig province has a significant substructure for industrialization. Small industrial Estates, Organized Industrial Manufacturing Zone, Animal Production Organized Industrial Zone, Elazig Business Development Centre and Elazig Fırat Teknokent-which all provide important opportunities to investors. There are 21.092 registered firms in Elazig according to the statistics provided by TURKSTAT. This amounts to almost 0.6 % of firms in Turkey and one-third of the firms in the TRB1 Region. Majority of those firms (7.517) are active in the field of wholesale. The second highest area of activity among Elazig's firms belongs to transport and storage. From 2013 to 2014 some of the sectors have improved in a number of registered firms additionally to transport and storage fields. These include agriculture; forestry; fishery; mining and quarrying; manufacturing; electricity steam and air conditioning production and distribution; construction; information and communication; real estate activities; vocational, scientific and technical activities and culture, arts, entertainment, recreation and sports. Upon examination of the number of enterprises in manufacturing industry in TRB1 Region, it can be seen that in Elazig manufacture of food products sector is ranked first with 17 %; and manufacture of other non-metallic mineral products ranked second with 14 %; followed by other mining and quarrying with 13 %. It can be seen that "manufacturing of food products" is ranked first due to intense agricultural activities in the province. In terms of industrial employment, industry employment consists of 61 % workers and 3 % engineers.

Table: Number of Enterprises in Elazig according to Business Registry Records 2014

	Turkey	TRB1	Elazig
<b>Agriculture, forestry and fishing</b>	<b>30.066</b>	<b>435</b>	<b>205</b>
Mining and quarrying	7.740	254	165
Manufacturing	42.584	5.772	2.031
<b>Electricity, gas, steam and air conditioning production</b>	<b>5.955</b>	<b>100</b>	<b>61</b>
Construction	266.080	5.321	1.897
Wholesale and Retail trade; repair of motor vehicles	1.225.454	20.716	7.517
Accommodation and food service activities	307.698	5.341	2.106
Transportation and storage	541.350	10.592	3.495
Finance and insurance activities	24.118	340	125
Real estate activities	54.324	496	186
Education	30.187	457	152
Human Health and social work activities	44.050	494	216
Information and communication	42.592	535	174
<b>Water supply; sewerage, waste management and remediation activities</b>	<b>4.550</b>	<b>42</b>	<b>7</b>
Professional, scientific and technical activities	201.293	2.304	769
Administrative and support service activities	54.461	604	210
Culture, arts, entertainment, recreation and sports	35.293	535	174
Other service activities	222.636	4.047	1.545
<b>TOTAL</b>	<b>3.525.431</b>	<b>58.434</b>	<b>21.092</b>

Source: TURKSTAT Regional Statistics 2014





## SWOT Analyze of TRB1 Region for Climate Change in Agriculture, Forestry, and Fishery

The main agricultural activity of the area centers around vineyards and Elazığ also serves as a market hub for other agricultural products. The state-run vineyards of Elazığ are notable for their production of Buzbag, a full-flavored red wine. Water products, food products and manufacture of beverages, casting, machinery, textile and furniture sectors are important building blocks for the economy of Elazığ with their competitiveness. In water product sector, with 14.400 tons of trout production and the potential in the sector, Elazığ is a global center thanks to its dam, lakes and streams. The trout cultivation rate has dramatically increased in the last 15 years in Elazığ. Besides, Elazığ is highly rich in terms of its fruit and vegetable growth potentials. Especially grape, apricot, strawberry, mulberry with Boğazkere grapes and Baskil apricots are world renowned products. Öküzgözü grape has been nominated geographical signification by the Turkish Patent Institute.

Figure: The Major Type of Agricultural Products Produced in Elazığ

Fruit	Grape, Apricot, Apple, Strawberry, Mulberry, Pear
Vegetables	Tomato, Paper, Cucumber, Onion, Melon, Watermelon
Field Products	Wheat, Barley, Sugar Beet, Corn, Clover
Livestock	Bovine, Ovine, Apiculture, Fishery, Poultry Husbandry (Broiler)

Source: TURKSTAT

## SWOT Analyze of TRB1 Region for Climate Change

STRENGTHS	WEAKNESS
<p>1. Transportation alternatives such as Metro bus. Elazığ and Malatya municipalities have electrical cars for public transportation. Tunceli and Bingöl provinces have small buses for public transportation.</p> <p>2. There are potentials for the branding of local products (e.g. grapes, apricot, mulberry, cherry, pear, almond, walnut) and climate change adaptation production genome as well as production systems in dry areas.</p> <p>3. Aquaculture production is very integrated with international marketing and domestic consumption.</p> <p>4. Possibility of finance from the European Union for climate change adaptation project (especially for projects involving energy generation from biomass).</p> <p>5. Development alternatives, mining-marble, agriculture-cultivation of grapevines, livestock, aquaculture as income diversification program.</p> <p>6. Central geographical location which is important for its logistics.</p> <p>7. The tendency for organic products all over the world.</p>	<p>1. The lack of collaboration within public institutions and awareness raising. weakness in natural forest management, road infrastructure connectivity and wild life sustainability.</p> <p>2. Lack of awareness for local products (e.g. grapes, apricot, mulberry, cherry, pear, almond, walnut) production towards climate change adaptive genome and dry area production systems.</p> <p>3. Aquaculture production has been affected by climate change with warm water</p> <p>4. Lack of project experiences that funded by the European Union for climate change adaptation project</p> <p>5. Lack of agricultural land for development alternatives, mining-marble, agriculture-cultivation of grapevines, livestock, aquaculture as income diversification program.</p> <p>6. Inadequate understanding of the R&amp;D industry and concept</p> <p>7. Lack of industrialized firms</p> <p>8. Lack of business partnership culture</p>





	<p>9.Domination of the public organizations</p> <p>10.Low level of competitiveness</p> <p>11.Lack of major players in the industry</p> <p>12.Not being able to benefit from underground resources.</p> <p>13.Lack of university-industry cooperation.</p> <p>14.Bureaucracy and complex procedures governing investment despite the considerable efforts to revise the existing legislative framework</p>
<b>OPPORTUNITIES</b>	<b>THREATS</b>
<p>1. TRB1 region has opportunities of alternative transportation infrastructure like in-forest natural roads for walking, biking, horse riding, ATV, and electrical cars driving. This alternative road will give opportunities for leisure and wild life production and tourism.</p> <p>2. There are dry resistant or climate change adaptive local genome and production system for local products that has potentials for branding (e.g. grapes, apricot, mulberry, cherry, pear, almond, walnut).</p> <p>3.Climate change adapted aquaculture production is possible in TRB1 region.</p> <p>4.Possibility of research collaboration with EU members for the finance from the European Union for climate change adaptation project.</p> <p>5.Possibility of developing alternatives, mining-marble, agriculture-cultivation of grapevines, livestock, aquaculture as income diversification program in forest land.</p> <p>6.The only civil airport which is appropriate for Cargo flights</p> <p>7.The presence of the first organized industrial region for animals in Turkey.</p> <p>8.Wide irrigable area and rich water resources.</p> <p>9.Regulation of pastures in the region for grazing animals.</p> <p>10.Development of cooperation mechanisms between the countries.</p> <p>11.Appropriate conditions for wind turbine installation in the Aegean Sea and the Sea of Marmara.</p>	<p>1. There is infrastructure investment need of forest inside road where funding is main threats.</p> <p>2. Lack of climate change adaptation action in TRB1 region for local products (e.g. grapes, apricot, mulberry, cherry, pear, almond, walnut) due to less collaboration of public–private partnership for climate change adaptive productions.</p> <p>3.Changing common aquaculture production is required education and extension in TRB1 region</p> <p>4.Lack of information and knowledge on finance from the European Union for climate change adaptation project</p> <p>5.Lack of collaboration within government offices for developing alternatives, mining-marble, agriculture-cultivation of grapevines, livestock, aquaculture as income diversification program in forest land.</p> <p>6.The exchange rate between Turkish lira and foreign currencies affects the investment cost</p> <p>7.The over-fragmentation of agriculture land.</p> <p>8.The equipment used for construction of RES power plants is imported</p>





## 4.2. TRB1 Region Strategic Action Plan of Climate Change Adaptation

### 4.2.1. Human Resources Capacity Development

According to the data obtained from 294 mountain and forest village field studies selected from Bingöl, Elazığ, Malatya and Tunceli provinces, the current situation and problems for capacity building in order to ensure adaptation to climate change and what needs to be done are determined as follows;

#### Human Resources Capacity

The development of human resource capacity within the scope of capacity building for adaptation to climate change is handled in two components;

- To increase awareness, perception, comprehension, analysis and synthesis capabilities of local people on climate change and adaptation
- To train experts who will conduct research, publications, projects and consultancy activities in agriculture, forestry and aquaculture sectors in adaptation to climate change in the region

The following activities were carried out in order to increase the awareness and perception of the local people on climate change, and to improve their understanding and build their capacity for them to analyze and synthesize the concepts of climate change mitigation, adaptation and resilience;

- In field studies; Climate Paris Agreement, Turkey's climate change strategy document, climate change action plan, compliance strategy action plan, the country's strategic framework document, and IPA II programs are selected as baseline for the implementation of the prepared questionnaires. Interviews were conducted with 1000 people in villages and 280 questionnaires were applied.
- Since most of the people who volunteered for the survey and interview did not want to shoot video, additional mountain and forest villages were visited. 294 mountain and forest villages were studied and 280 mountain and forest villages' results were evaluated.
- The aim of the project is to build capacity for the sustainability of production by taking into account the historical effects of climate change to represent 280 forest and mountain villages of the TRB1 Region. Political, Economic, Social, Technological, Ecological, Legal (PESTEL) analysis was conducted to create capacity. The economic, social, technological and ecological conditions of the region were determined and policy recommendations were put forward and legal regulations were determined.

Awareness and Perceptions on Climate Change A pre-evaluation questionnaire was conducted for the purpose of measurement and compared with the Final Assessment questionnaire applied in the last month of the project. The following important conclusions have been reached in the comparison of pre- and post-project measurement and perception measurement on climate change and adaptation;

1. The question "Do you think the climate of your region has changed?" is directed during the meetings. The answer to this question was 100 % yes. This change is expressed as a threat to sustainability. Only children (7-12 year olds) interpreted the climate change positively and said that it is not snowing in January and we can play football outside. When it is asked to children that "How will farmers water their





fields when it does not snow?" and "What if you don't have food product?" The answer of the children to the question is "The water of the Euphrates never runs out! Let them have the water to water their fields. Look everywhere is water". This situation shows that adaptation to climate change requires a special study with the target group being only children.

2. In the preliminary evaluation questionnaire for participants, "Are you worried about the future of climate change?" question was asked. While 210 people (75%) said yes, the number of those who said yes in the final evaluation questionnaire was 142 (50.71%). The reason for this is the use of drought-tolerant rootstocks, water harvesting and alternative sources of income, which have been taken into consideration in adaptation to climate change. For example, manufacturers;
  - Anhydride fruit (apricot, vineyard) cultivation,
  - Use of new technologies,
  - Indoor farming systems,
  - Construction of irrigation ponds,
  - Opening of water wells,
  - Using drought resistant rootstocks,
  - Solar energy applications,
  - Beekeeping and
  - They have recognized tourism activities as important achievements in adapting to climate change.

It is estimated that the impacts of the continental climate in the region is lighter compare to previous years, making it another factor for the observation. Since the winters are not as cold as in the past, the efforts of the producers to grow Mediterranean climate products have been observed in Elazığ and Malatya provinces. In districts within Malatya and Elazığ, individual efforts, and even successes of producers were determined in the cultivation of non-continental products such as citrus fruits, olives, pistachios, pomegranates, figs and persimmon. Another reason for the difference between the preliminary questionnaire and the final questionnaire is that the seasons are different. While the preliminary questionnaire is conducted in the winter season and the last survey is conducted in the beginning of autumn, it is possible to make an evaluation as the interpretations of the interviewees have been different.

3. The answer of the following question "How important is climate change for your region?" were taken and showed below;

Scale	Pre-Questionnaire (People)	Final Questionnaire (People)
Not Important	0	0
Less Important	10 (%3,57)	9 (%3,21)
Moderately Important	70 (%25,00)	31 (%11,07)
Important	80 (%28,57)	60 (%21,43)
Very Important	120 (%42,86)	180 (%64,29)





Climate change in the region is expressed as very important by 7 out of every 10 people within the region.

4. The question "What can be mentioned as climate change?" has been answered with more than one expression. The first answers and the most important issues are summarized below;

Climate Change	Pre-Questionnaire (People)	Final Questionnaire (People)
Drought increased	65 (%23,21)	68 (%24,29)
Rainfall decreased	61 (%21,79)	72 (%25,71)
Temperatures increased	40 (%14,28)	41 (%14,64)
Weather conditions suddenly changed	15 (%5,36)	8 (%2,86)
Water decreased	45 (%16,71)	50 (%17,86)
Snowfall decreased	16 (%5,71)	12 (%4,29)
Spring rains decreased	13 (%4,64)	12 (%4,29)
Four seasons uninhabitable	4 (%1,43)	2 (%0,71)
Global warming increased	6 (%2,14)	2 (%0,71)
Spring rains summer season	4 (%1,43)	2 (%0,71)
Ozone layer pierced	2 (%0,71)	2 (%0,71)
Environmental pollution increased	2 (%0,71)	1 (%0,36)
Climate-related disasters increased	2 (%0,71)	1 (%0,36)
Other (products not growing, plant diseases increased, bees are dying)	5 (%1,79)	7 (%2,50)

According to these results, significantly number of people interviewed and surveyed who live in the mountain and forest villages express climate change concept as follow;

- Reduction of precipitation,
- Drought increase,
- Reduction of water,
- Increased temperatures



#### 4.2.1. Sectoral Development

In the effort of the Republic of Turkey to provide its people with welfare and high living standards with less carbon intensity also aims to promote energy efficiency, increase the use of clean and renewable energy resources and to integrate its development policies with climate change policies. Agriculture, forestry, and fishery sectors in TRB1 region were taken into consideration with less carbon intensity, renewable energy uses, and resources efficiency. Water uses efficiency, no-tillage, solar energy, and drought resistant products are some best practices of climate change policies for agriculture, forestry, and fishery.

Per capita electricity consumption and per capita greenhouse gas emission levels in Turkey are about one third of those in other OECD countries. On the other hand, the energy intensity of the Turkish economy is higher than that of other OECD countries nearly by one third. GDP in Turkey increased by 170.82 % between 1990 and 2008 whereas the increment in total greenhouse gas emission was only 95.96 % indicating that economic development will be based less on greenhouse gas emitting activities. On the other hand, the decrease in the energy intensity of economy between 1990 and 2008 was 29,41% and in the same term, carbon intensity of the energy supply increased by 15.06%. In this study, electric consumption issue was considered to be produce from solar energy in TRB1 region.

GHG emission control and adaptation to climate change in TRB1 region requires the following actions;

- GHG emission control in TRB1 region;
  - Renewable energy production and consumption such as solar energy and biogas from the waste.
  - Bio-sectors and bio-industries such as agriculture, forestry, fishery, bio products of mining, and recycling waste products
  - Establishing infrastructure for transportation in forest areas
  - Eco-building
  - Biogas production from waste
  - Focusing on land use of forestry and agricultural and fishery production into forests.
- Adaptation to climate change in TRB1 region
  - Water resource management; Collection rains for irrigation, modern irrigation systems, and increasing water use efficiency
  - Agriculture and forest security; Production of agricultural products into forest as combination of agriculture, forest, and fishery such as farming systems.
  - Ecosystem services, biodiversity, and forestry; Establishing ecosystem services for the combination of agriculture, forestry, fishery, and agro-tourism.
  - Natural disaster risk management; Rejuvenating cultural implementation for forests
  - Public health; Recycling of wastes for biogas production
  - Cross cutting issues in adaptation; Technology production and uses, research and development activities, technology transfer, farming system research and education, cultural implementations, etc.



Before becoming a party to the UNFCCC, Turkey, in 2001 has carried out an institutional structuring and with the Prime Ministerial Circular No.2001/2 established the Coordination Board on Climate Change (CBCC). The Board was restructured in 2004 after Turkey became a party to the UNFCCC and in 2010 its remit was expanded with the participation of new members. Considering greenhouse gas emission for different sectors by years a constant increase is seen until 2007 except for the period of economic crisis in 2001. It can also be said that the global financial crisis between 2008 and 2009 had a positive impact on mitigation of greenhouse gas emissions. When the sectors are compared, it is seen that greenhouse gas emissions from agricultural activities and wastes remained almost constant since 2005 and that the total increase in emission levels is largely a result of energy generation, energy consumption and industrial processes.

### **Energy Sector**

Energy sector has the largest share of total emissions with 75 %. Energy sector includes emissions from fuel used in energy generation, industry, transportation and other sectors (buildings, agriculture, forestry and fisheries). Waste and industrial sectors follow with 9 % share each and agriculture sector with 7 % share. Greenhouse gas emissions from fuel combustion accounts for 99.3% of emissions under the title of “Energy” in the 2009 National Inventory Report. The main document on climate change is the National Climate Change Strategy (2010-2020) that was approved by the Higher Planning Council on May 3<sup>rd</sup>, 2010. This document sets forth the activities that need to be carried out by each sector to combat climate change and also measures that need to be in place for adaptation to climate change.

When the suitability conditions for solar power plant are examined according to their values, it is seen that TRB1 Region is one of the regions with high solar energy potential. It is necessary to encourage licensed and unlicensed production in solar energy and to ensure the implementation of exemplary projects in this area. For this reason, licensed and unlicensed production of solar energy plants in the World and Turkey should be examined. The implementation of similar ones should be applied in the region. For this purpose, research studies should be carried out in the Organized Industrial Zones. Regarding wind energy, the TRB1 Region has a low potential in general, but detailed measurement and analysis studies should be conducted on areas with potential locally. In addition, the use of biogas and geothermal water resources in the plant and animal production in the region should be developed locally, especially in greenhouses. (Firat Development Agency, 2014:172).

By decreasing energy input costs of regional enterprises, increasing the sectoral competitiveness and encouraging the use of renewable energy resources in the Region should be encouraged. For this purpose, investment projects on renewable energy should be supported. Such as:

- Investment projects that generate electricity with solar power and hydraulic power sources.
  - Investment projects that provide electricity generation from other renewable energy sources (including biogas, geothermal, biomass, etc.).
  - Projects that enable the use of renewable energy sources for irrigation, heating and drying purposes.
  - Projects involving R & D and promotional activities related to renewable energy sources.
- Declining manufacturing costs and increasing public awareness of environmental dangers means that solar is one of the fastest growing sources of renewable energy.







Table : Wind Power by Region and Average Wind Speeds

REGION	AVERAGE WIND POWER DENSITY	ANNUAL AVERAGE WIND SPEED (M / S)
Marmara	51,41	3,29
Aegean	23,47	2,65
Mediterranean	21,36	2,45
Central Anatolia	20,14	2,46
Black Sea	21,31	2,38
Eastern Anatolia	13,19	2,12
Southeastern Anatolia	29,33	2,69
AVERAGE	25,82	2,58

### Renewable Energy Resources (RES)

In principal, there is a need of an appropriate legal and regulatory framework, as well as energy planning and strengthening of national policies for RES development that could reduce risks associated with RES cooperation projects. In this context, technology transfer will enhance the science and technology capacity on renewable energy production, strengthening also the political will in this field. Due to its considerable RES potential Turkey should aim to get in bilateral negotiations with selected EU member states to analyze RES export possibilities in the mid-to long term. In addition, in case non-economic barriers, such as complex and long-lasting administrative processes for the approval of new projects, as well as additional payments such as licensing costs, fixed and auctioned grid connection fees, balancing costs in case of direct marketing are encountered, then investment opportunities will be emerged.

Public acceptance could also be enhanced taking into consideration the opportunities that stem from several environmental benefits gained from its implementation as a result of a decarbonized energy mix (e.g. lower local pollutants). It is associated with the fact that renewables are considered carbon-free and non-pollutant energy resources. In addition, the job creation and economic stimulation in rural areas, Turkish RES industry development, revenues from exports and safer working conditions provide a stable and favorable environment for RES cooperation mechanisms.

### Industry Sector

The share of Turkish industry in the GDP is 20-25 % and it has a considerable impact on economic growth figures. On the basis of production share, the food industry and textiles are the two most prominent sectors with shares of 18.8 % and 16.3 % respectively. Petroleum products sector (8.8%), iron and steel sector (6.2%), automotive sector (5.8%), and chemicals sector (5%) follows these sectors. Greenhouse gas emissions generated as a result of industry can be handled in two groups as manufacture based and energy based. Turkey's final energy consumption in 2009 was 80.574 MTEP and the industry's share in this was 25.966 MTEP about 32 % of total consumption. Also, total final electricity consumption in Turkey in 2009 was 13.4 MTEP and the industry's share in this was 6 MTEP about 44.5% (MENR, 2011). Amount of greenhouse gas emission from industrial processes reached to 31.7 Mt from 13.1 Mt (an increase of 142%) between the years 1990-2009 (TURKSTAT 2011). Main sources of emission in the industry sector are the production of cement, sugar, fertilizer, steel-iron and







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certain chemicals. Industry's energy efficiency efforts have basically two pillars: 1) Energy efficiency efforts to ensure efficient use of energy during industrial processes in a way to reach greenhouse gas emission mitigation targets; 2) Efforts to create a low carbon industry to ensure a transition to clean technologies that generate high levels of greenhouse gas emission. Within the Turkish Industry Strategy Document', approved by the higher Planning Council Decision dated December 7<sup>th</sup> 2010 underlies the low carbon and low fossil fuel economies and indicates the importance of clean energy use, energy efficiency and use of clean technologies. Moreover, the strategy document also underlines the importance of implementing industrial policies in line with the National Climate Change Strategy (2010-2020), the EU Integrated Environmental Approximation Strategy -2007-2023 (UCES), Turkish National Action Program for Desertification and the national Biodiversity Strategy Document. KOSGEB was assigned the task to facilitate the implementation of the Energy Efficiency Law and other activities to be carried out at the SME level. Also EİE was given the task to establish financial mechanisms for projects up to 1 million TL; similarly, the responsibility to establish financial mechanisms for projects above the 1 million TL thresholds was given to the Treasury secretariat. In order to train specialist workforce that the industry needs in the field of energy efficiency, the General Directorate of Electrical Power Resources, Survey and Development Administration organizes energy management trainings.

Biotechnology provides tools for adapting and modifying the biological organisms, products, processes and systems found in nature to develop processes that are eco-efficient and products that are not only more profitable but also more environment-friendly. It is also providing an increasing range of tools for industry to continue improving cost and environmental performance beyond what could normally be achieved using conventional chemical technologies (OECD, 2001)

Industrial bio-technology is a new approach to pollution prevention, resource conservation, and cost reduction. Industrial biotechnology involves working with nature to maximize and optimize existing biochemical pathways that can be used in manufacturing. The industrial biotechnology revolution rides on a series of related developments in three fields of study of detailed information derived from the cell: genomics, proteomics, and bioinformatics. As a result, scientists can apply new techniques to a large number of microorganisms ranging from bacteria, yeasts, and fungi to marine diatoms and protozoa. Bio-based technologies are just beginning to be used in forestry, pulp and paper, chemicals and plastics, mining, textile production, and energy sectors. (<https://www.bio.org/articles/what-industrial-biotechnology>).

- Educate stakeholders in the TRB1 region about industrial biotechnology
- Inspire a wider inquiry in the TRB1 region into industrial biotechnology
- Industrial biotechnology can utilize many renewable feed-stocks, such as corn and other agricultural crops and crop residue. It may provide new sources of income for farmers in the TRB1 region.



Table: Some Industrial Biotech Applications by Industrial Sectors

<ul style="list-style-type: none"> <li>■ Biological Fuel Cells</li> <li>■ Fine and Bulk Chemicals</li> <li>■ Chiral Compound Synthesis</li> <li>■ Synthetic Fibers for Clothing</li> <li>■ Pharmaceuticals</li> <li>■ Food Flavoring Compound</li> <li>■ Biobased Plastics</li> <li>■ Biopolymer for Automobile Parts</li> <li>■ BioEthanol</li> <li>■ Transportation Fuel</li> </ul>	<ul style="list-style-type: none"> <li>■ Nutritional Oils</li> <li>■ Oil and Gas Desulphurization</li> <li>■ Leather Degreasing</li> <li>■ Bio hydrogen</li> <li>■ Biopolymers for Plastic Packaging</li> <li>■ Coal Bed Methane Water Treatment</li> <li>■ Chem/Bio Warfare Agent</li> <li>■ Decontamination</li> <li>■ Pulp and Paper Bleaching</li> <li>■ Biopulping (paper industry)</li> </ul>	<ul style="list-style-type: none"> <li>■ Enzyme Food Processing Aids</li> <li>■ Metal Ore Heap Leaching</li> <li>■ Electroplating/Metal Cleaning</li> <li>■ Rayon and Other Synthetic Fibers</li> <li>■ Metal Refining</li> <li>■ Vitamin Production</li> <li>■ Sweetener Production (high fructose syrup)</li> <li>■ Oil Well Drill Hole Completion (non toxic cake breakers)</li> </ul>	<ul style="list-style-type: none"> <li>■ Road Surface Treatment for Dust Control</li> <li>■ Textile Dewatering</li> <li>■ Vegetable Oil Degumming</li> <li>■ Specialty Textile Treatment</li> </ul>
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### Transportation Sector

The total amount of CO<sub>2</sub> equivalent greenhouse gas emissions from the transportation sector in Turkey is 17 % of total emissions (TURKSTAT 2011). There are basically two reasons as to why this is lower than developed countries. Firstly, developed countries have a more advanced energy efficiency level in other emission generating sectors. Whereas in Turkey, energy efficiency in other sectors in Turkey are still relatively low, meaning that CO<sub>2</sub> emissions in other sectors are high. Hence, percentage of transportation sector in the total emissions seems small. The second reason is mobility. Where, in developed countries mobility or in other words number of per capita trips is high and trip durations are longer; this is not so in developing countries such as Turkey where mobility is less. Carbon emissions from transportation activities between 1990 and 2007 increased from 24 Mt to 42.9 Mt (79 % increment). It is well-known that the two sub-sectors of transportation generating the most greenhouse gas emissions are road and air transportation. On the contrary, railroad transportation activity is creating the least amount of greenhouse gas emissions. Also, electricity generation which is the basic energy for railroad transportation is another sector that generates CO<sub>2</sub>. However, considering emissions generated per load or passenger, it is clear that railroad transportation is the most environment-friendly, less polluting and a sustainable mode of transport. In the Ninth Development Plan for the term 2007-2013, it is stated that a balanced, rational and effective transportation infrastructure utilizing all modes of transport in technically and economically shall be established. For this the entire system shall be handled in a holistic manner and policies focusing on railroads for transportation of goods, seeking to transform important port areas into logistics centers and prioritizing safety in all modes of transport shall be pursued. Pedestrian and bicycle transportation would accompany public transport services in a way to allow the establishment of a sustainable intercity transportation system and these modes of transport would be prioritized and encouraged. 5% biofuel can be added to other types of fuel in Turkey.



There is a SCT (special consumption tax) exemption applicable up to 2 % bio-diesel mixed portion of fuel. However, there are no obligations as to use of bio-diesel in motor vehicles. In addition, decisions regarding incentivizing the use of renewable fuels such as bio-diesel should benefit from various analyses on the impacts of the fuel concerned on other sectors such as agriculture and food safety. Pricing policy for the use of the transportation infrastructure can be designed in a way to promote sustainable and environment-friendly modes of transportation so as to reduce the demand on the other modes that generate more greenhouse gas emissions. Green wave zones at city centers in order to reduce traffic jams in downtown areas are also beneficial in terms of reducing greenhouse gas emissions.

Forest roads connect the most remote parts of the forest to existing township, county and state roads and highways, providing access to forest lands for timber management, fish and wildlife habitat improvement, fire control, hunting and a variety of recreational activities. For the purpose of these guidelines, road construction includes excavation of gravel quarries and borrows pits.

In TRB1 region, access to forest roads should be supported and ATV, Horse, bicycle, walking transportation should be supported and encouraged. For the purpose of

- a) Providing funding for the construction of harvesting roads.
- b) Improving the environmental and biodiversity value of the forests.
- c) Improving the economic value of the forests.
- d) Providing access for emergency vehicles.

### **Waste Sector**

Waste sector plays an important role in climate change and global warming as one of the main sectors generating methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>), the primary greenhouse gases. The share of the waste sector in the total greenhouse gas emission in 2009 was 9.18%, being the second largest sector after energy. According to TURKSTAT data, as of 2008, the total amount of urban wastes collected in Turkey was 24,360,863 tons/year (1.15 kg/person/day) as 82 % of the total population and 99 % of the municipal population benefit from waste collection services.

Packaging wastes constitute 30 % of all municipal wastes in terms of weight and 50 % in terms of volume. Packaging wastes are recyclable, therefore transporting these wastes to the landfill instead of recycling plants causes reduction of materials' life period, extraction of new raw material, processing and transporting leads to consumption of energy and generation of more greenhouse gas emissions. For this reason, package wastes have to be collected separately at the source and recycled, in order to combat climate change and to have a sustainable waste management system. Waste management policies are covered in the Eighth and Ninth Development Plans. Policies such as recycling of package wastes, integrated waste management, centralized planning and implementation of waste management services at the municipal level, determining realistic Environment and cleaning Tax (ECT) figures that are based on actual costs and ensuring due tax collection and other policies relating to increasing the financial capacity of the General Directorate of the Provincial Bank of Turkey have been handled in the Eighth Development Plan. Fees for environmental services are necessary in two ways: first it is an important component of the investment strategy as a source of funding; and second, these fees are needed to ensure compliance with the "polluter pays" principle. However, fees that are collected from users shall compensate for the services that are provided by local





administrators. As one of the important sources that generate funds for environmental investments, tariffs are significant tools to ensure the sustainability of services. Consumers' ability to pay and investment costs have to be considered during the design tariffs.

As important as the renewables are for Turkey's energy strategy in the coming years, technologies in such fields as waste processing and greenhouse gas reduction are also often cited together with this new form of power generation as critically important supplementary practices. Sustaining the environment by resorting to renewable resources is accompanied by a number of measures and regulations that are either currently in effect, or will soon be in effect. Some of these regulations deal with lowering carbon emissions, increasing generation/transmission efficiency, and promoting the use of waste management technologies (<http://www.invest.gov.tr/en-US/sectors/Pages/Energy.aspx>) .

Biogas, which is almost the same as the natural gas and its usage areas, is used as a multi-directional energy source for direct heating and illumination, and it is possible to convert it to electric energy and to mechanical energy (gas turbine-generator, cogeneration, fuel cells). If this gas is compressed, it can also be used as a compressed natural gas (CNG) as a fuel for motor vehicles. In addition, biogas production by-products can be used for various purposes (Firat Development Agency, 2016:9).

There are four types of biogas plants. Capacity classification of these facilities [2]:

- Family type: 6 -12 m<sup>3</sup> capacity
- Farm type: 50 -100 -150- m<sup>3</sup> capacity
- Village type: 100 - 200 m<sup>3</sup> capacity
- Industrial scale plants: 1000 - 10.000 m<sup>3</sup> capacity.

TRB1 Region is appropriate for establishing such plants. Establishment of family type, farm type and village type biogas plants should be encouraged in the region.

### **Agriculture Sector**

Due to agricultural activities, the agriculture sector is an emission source, but is also considered as a sink because of biomass and soil. Furthermore, agricultural products are considered as alternative renewable energy sources. On the other hand, changes in land use which is both the cause and result of climate change directly affects the agriculture sector.

Strategies, policies and plans for agriculture are as follow:

- ✓ Achieving food security and safety and sustainable use of natural sources will be taken into account in creating an agricultural structure that is highly organized and competitive.
- ✓ The main principles include making efficient use of soil resources through the use of highly productive agricultural fields for agricultural production purposes, utilizing agricultural lands in line with their capabilities determined with analyses and by making use of proper agricultural techniques as well as through land use planning and widespread erosion prevention.
- ✓ Importance and priority will be placed in the effective use of water resources through saving water within a comprehensive mechanism, which is rearranged to provide a strong and structural coordination among relevant institutions, enabling the planning of activities for developing water resources basin-wise with an integrated approach, and providing flexibility in meeting the changing consumption demands.





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- ✓ Effective protection of natural ecosystem of forests against various factors, primarily fires and pests and its management in a multipurpose and efficient way will be aimed by considering the protection-utilization balance, biological diversity, gene sources, forest health, non-wood products and services and ecotourism development.
- ✓ In such a way as to directly contribute to the competitiveness of agricultural production, irrigation investments will be expanded with the aim of increasing the production of those agricultural products with high production value in a cost effective manner, and land consolidation investments will be expanded against the mitigation of land fragmentation observed in agricultural holdings.
- ✓ Along with increasing the scale of agricultural enterprises, modernization efforts of agricultural, food enterprises, primarily the improvement of production techniques and production conditions, will be supported within the framework of the determined priorities by utilizing the Pre-Accession Supports of the EU, as well. Furthermore, agriculture-industry integration will be encouraged.
- ✓ By providing agricultural credit subsidies and support payments to producers through various channels, financial services for the agricultural sector will be diversified.
- ✓ With the aim of increasing productivity and producer incomes in a stable way, training and extension services in various subjects, mainly the use of pesticides, fertilizers, and quality deeds, and also irrigation, plant and animal health and food hygiene, will be increased in agricultural production and marketing stages towards ensuring food safety from the farm to the table.
- ✓ Emphasis will be placed on carrying out these services in a way to include young and women farmers by producer organizations with strengthened structures.
- ✓ As far as activities in the area of animal husbandry, where products with relatively high value-added are obtained, are concerned; increasing the competitiveness prior to EU Accession will be aimed by placing emphasis on animal breeding, fighting against animal diseases and pests, organizing the rehabilitation and use of pastures increasing qualitative fodder plant production and dissemination services.
- ✓ The main principles to be adhered in the fisheries policies include determination of fisheries policies on the basis of establishing resource utilization balance in fishery production by conducting stock assessment studies in line with the EU acquis, ensuring environmental sustainability in agricultural activities in parallel with the increasing demand and the recently provided supports, and establishing the required administrative structure in compliance with these goals.







National agricultural policies to combat climate change are; the management of soil and water resources; modernization of irrigation; support policies and other policy supporting crop, livestock and animal feed production; and those that focus on the development and improvement of agricultural infrastructure.

Some agricultural supports financed by the general budget are as follows:

1. Agricultural support budget:
  - Land Based Supports
  - Deficiency Payments
  - Livestock support: This support covers cultivation of fodder crops to achieve quality fodder crops
  - Supports available through the environmentally based agricultural land protection program
  - Urban development supports
  - Premium payments for insured crops
  - Compensatory payments
2. Other agricultural supports
3. Agricultural loans with reduced interest rates
4. Import policy tools
5. Export policy tools
6. Agricultural infrastructure investments

There are two types of investments for greenhouse gas emission mitigation. The first investment type is comprised of direct expenditures or investments on greenhouse gas emission mitigation activities or on efforts to increase the capacity of sink. Examples of such investments can be state subsidies on the use of biodiesel and on afforestation to store carbon, where economically valuable production activities cannot be carried out. The second type of investments is the one that are carried out by state agencies to indirectly mitigate greenhouse gas emissions to ensure development and sustainability. Examples such investments are land consolidation, modernization of irrigation systems, organic agriculture and good agricultural practices.

Investments to support efforts for combating climate change in Turkey are as follows:

- Land Consolidation: A basic definition of land consolidation is to merge split properties without any infrastructure work. A broader definition of the term is to merge split properties in a way to include all services that relate to irrigation, drainage, transportation, soil and water protection measures as well as rural settlement requirements. A decision-making support system was also designed using optimization methods. This support system will be used to support the identification of crop cultivation areas for each basin, amount of support for each crop in each basin and amount of export and imports. As a result, greenhouse gas emissions will be mitigated through the protection of natural resources and minimization of energy consumption in agriculture.
- Good Agricultural Practices: Good agricultural practices can be defined as all activities that need to be carried out to ensure and agricultural production system that is “livable” in social terms, profitable and efficient in economic terms; and that protects human health as much as protecting animal health and welfare, and is environment-friendly.





- **Organic Agriculture Practices:** Among many crops that are produced using organic agriculture methods are hazelnuts, walnuts, pistachios, dried figs, dried apricots, dried raisin, beans, and aromatic plants for medical purposes, cotton, berries and fresh fruits and vegetables.
- **Zero-Tillage or Reduced Tillage Agriculture:** Zero-tillage is direct sowing using planters, without any initial tillage. Zero-tillage production reduces tillage efforts; hence the energy required for agricultural activities would be less. Also organic matter content of the soil would increase, leading, in return, to an increase in the soil's sink capacity.
- **Closed Drainage and Land Improvement Efforts:** Drainage, in Turkey, is a problem observed in an area of 3 million ha as a result of wrong irrigation techniques and natural phenomena. Drainage problem also paved the way for other environmental problems such as high levels of ground waters, salinity and excessive amounts of sodium.

Awareness raising and capacity building efforts on the impacts of climate change on agriculture as well as combating these impacts are not at a sufficient level. Agricultural training and awareness raising efforts covering areas such as reduction of energy consumption, sustainable use of resources, improvement of irrigation tools and techniques, improvement of tillage tools and techniques, correct use of fertilizers, livestock breeding, manure management and stubble burning are closely- although indirectly- linked to climate change efforts.

### **Land Use And Forestry Sector**

Land use types are generally divided into two categories:

1. **Land Cover:** This represents land covered with biological or physical elements i.e. natural marquis land, natural rocky land, natural meadows, etc.
2. **Land Use:** this represents land use patterns resulting from human impact i.e. agricultural lands, mown meadows, golf courses etc.

Land use types are as follows:

1. **Artificial Land (Surfaces)**
  - 1.1. Settlements
  - 1.2. Industrial, Commercial and Transportation Areas
  - 1.3. Mining, Dumping and Construction Sites
  - 1.4. Non-agricultural Vegetative Land
2. **Agricultural Land**
  - 2.1. Non-irrigated Farmlands and Continuously irrigated Lands
  - 2.2. Paddy Fields
  - 2.3. Cultivated Agriculture
  - 2.4. Other Agricultural land
3. **Forest and Natural Land**
4. **Wetlands and Water Masses**

Some important issues pertaining to forestry: effective protection of the natural forest ecosystem from forest fires, pests and other detrimental factors, balance in use –protection; improving biodiversity, gene sources, forest health, non-wood products and services and eco-tourism facilities; multi-purpose and efficient forest management; catchment-based industrial afforestation and afforestation for the protection of soil as well as improving public health and





as prevention against desertification; rehabilitation efforts, better use of land through urban forestry and agro-forestry; improving/supporting private/individual afforestation efforts and public awareness raising (State Planning Organization, 2006).

The problems about the forestry and land use can be listed as: lacking cadaster works and road infrastructure; limited number of national parks and similar protected areas; insufficient attention on non-wood products and services; insufficient forest tending efforts; limited size of annually afforested areas and insufficient level of eco-system training (State Planning Organization, 2006).

Actions and strategies for the expansion of forests, conservation of biodiversity and improving the welfare of forest villagers will in return multiply sinks in the forestry sector and reduce the amount of greenhouse gas emissions caused by the people in and around the forest areas. These actions and policies cover issues pertaining to combating desertification and erosion; protection and ensuring the sustainability of forest areas as well as water resources; improving the welfare of the forest villagers by supporting them economically and socially, increasing the public awareness on climate change; encouraging the use of renewable energy sources in lieu of fossil fuels and private afforestation activities.

#### 4.2.4. Corporate Governance of Climate Change Adaptation

##### International Climate Change Organizations

SN	Name of Organization	Web site
1.	International Organization For Migration (IOM)	<a href="https://www.iom.int/">https://www.iom.int/</a>
2.	International Institute For Sustainable Development (IISD)	<a href="https://www.iisd.org/">https://www.iisd.org/</a>
3.	International Panel on Climate Change (IPCC)	<a href="http://www.ipcc.ch/">http://www.ipcc.ch/</a>
4.	United Nations Environment Program (UNEP)	<a href="https://www.unep-wcmc.org/">https://www.unep-wcmc.org/</a>
5.	Food And Agriculture Organization of The United Nations (FAO)	<a href="http://www.fao.org/home/en/">http://www.fao.org/home/en/</a>
6.	Centre For International Climate And Environmental Research (CICERO)	<a href="http://www.cicero.oslo.no/no">http://www.cicero.oslo.no/no</a>
7.	The Agricultural Model Intercomparison and Improvement Project (AgMIP)	<a href="http://www.agmip.org/">http://www.agmip.org/</a>
8.	United Nations Development Programme (UNDP)	<a href="http://www.undp.org/content/undp/en/home.html">http://www.undp.org/content/undp/en/home.html</a>
9.	International Union For Conservation of Nature (IUCN)	<a href="https://www.iucn.org/">https://www.iucn.org/</a>





10.	Asia Pacific Adaptation Network (APAN)	<a href="http://www.asiapacificadapt.net/">http://www.asiapacificadapt.net/</a>
11.	International Institute for Applied Systems Analysis (IIASA)	<a href="http://www.iiasa.ac.at/">http://www.iiasa.ac.at/</a>
12.	World Food Programme (WFP)	<a href="http://www.wfp.org/climate-change/innovations">http://www.wfp.org/climate-change/innovations</a>
13.	Responding to Climate Change (RTCC)	<a href="http://www.rtcc.org/">http://www.rtcc.org/</a>
14.	START	<a href="https://start.org/">https://start.org/</a>
15.	International Centre For Tropical Agriculture (CIAT)	<a href="http://ciat.cgiar.org/">http://ciat.cgiar.org/</a>
16.	Joint Global Change Research Institute (JGCRI)	<a href="http://www.globalchange.umd.edu/">http://www.globalchange.umd.edu/</a>
17.	International Centre for Climate Change and Development (ICCCAD)	<a href="http://www.icccad.net/">http://www.icccad.net/</a>
18.	Grantham Research Institute on Climate Change and the Environment	<a href="http://www.lse.ac.uk/GranthamInstitute/">http://www.lse.ac.uk/GranthamInstitute/</a>
19.	International Institute For Environment And Development (IIED)	<a href="https://www.iied.org/">https://www.iied.org/</a>
20.	Global Cities Research Institute	<a href="http://global-cities.info/content/program/climate-change-adaptation">http://global-cities.info/content/program/climate-change-adaptation</a>

#### Climate Change Funding Institutions

SN	Institution	Web site
1.	Green Climate Fund (GCF)	<a href="https://www.greenclimate.fund/home">https://www.greenclimate.fund/home</a>
2.	International Fund For Agricultural Development (IFAD)	<a href="https://www.ifad.org/">https://www.ifad.org/</a>
3.	Global Environment Facility (GEF)	<a href="https://www.thegef.org/">https://www.thegef.org/</a>
4.	Adaptation Fund	<a href="https://www.adaptation-fund.org/">https://www.adaptation-fund.org/</a>
5.	United States Agency for International Development (USAID)	<a href="https://www.usaid.gov/">https://www.usaid.gov/</a>
6.	The European Research Council (ERC)	<a href="https://erc.europa.eu/">https://erc.europa.eu/</a>
7.	European Commission	<a href="https://ec.europa.eu/info/energy-climate-change-environment_en">https://ec.europa.eu/info/energy-climate-change-environment_en</a>
8.	Swedish Research Council	<a href="https://www.vr.se/english">https://www.vr.se/english</a>
9.	Climate Investment Funds (CIF)	<a href="https://www.climateinvestmentfunds.org/">https://www.climateinvestmentfunds.org/</a>
10.	European Research Area for Climate Services (ERA4CS)	<a href="http://www.jpi-climate.eu/ERA4CS">http://www.jpi-climate.eu/ERA4CS</a>



11.	United States Environmental Protection Agency (EPA)	<a href="https://www.epa.gov/research-grants/climate-change-research-grants">https://www.epa.gov/research-grants/climate-change-research-grants</a>
12.	Climate for Development in Africa (ClimDev-Africa)	<a href="http://www.climdev-africa.org/">http://www.climdev-africa.org/</a>
13.	Africa Climate Change Fund (ACCF)	<a href="https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/africa-climate-change-fund/">https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/africa-climate-change-fund/</a>
14.	International Development Research Centre (IDRC)	<a href="https://www.idrc.ca/en/about-idrc">https://www.idrc.ca/en/about-idrc</a>
	The EEA And Norway Grants	<a href="https://eeagrants.org/">https://eeagrants.org/</a>
15.	Government of the United Kingdom	<a href="https://www.gov.uk/">https://www.gov.uk/</a>
16.	The International Climate Initiative (IKI)	<a href="https://www.international-climate-initiative.com/en/">https://www.international-climate-initiative.com/en/</a>
17.	Nordic Development Fund (NDF)	<a href="https://www.ndf.fi/">https://www.ndf.fi/</a>
18.	Global Climate Change Alliance+	<a href="http://www.gcca.eu/">http://www.gcca.eu/</a>
19.	ClimateWorks	<a href="https://www.climateworks.org/">https://www.climateworks.org/</a>
20.	Global Facility for Disaster Reduction and Recovery (GFDRR)	<a href="https://www.gfdr.org/en">https://www.gfdr.org/en</a>

#### Innovative Products to Tackle Climate Change

SN	Product	Organization	Climate Change Group
1.	climate-smart rice	IRRI	Resilience
2.	SALTS4Rice	IRRI	Adaptation
3.	CML-562, CML-563, CML-564 and CML-565	CIMMYT	Resilience
4.	AutoNaut surface vessel	AutoNaut Ltd	Mitigation
5.	Piñatex	Ananas Anam Ltd	Mitigation
6.	The LEAP Food Security Early Warning Tool	WFP	Resilience
7.	R4 Rural Resilience Initiative (R4)	WFP and Oxfam America	Adaptation
8.	EP 960443 B1 and EP 874387 B1	IMEC	Mitigation
9.	Helical turbine	Northeastern University	Mitigation
10.	Multibrid M5000	Aerodyn	Resilience and Mitigation <a href="https://en.wind-turbine-models.com/turbines/22-multibrid-m5000">https://en.wind-turbine-models.com/turbines/22-multibrid-m5000</a>





11.	Highly-efficient biomass system	Dall Energy Aps	Mitigation and Adaptation <a href="http://www.dallenergy.com/">http://www.dallenergy.com/</a> <a href="https://www.theillwarming.dk/">https://www.theillwarming.dk/</a>
12.	Bio-latrline technology	Tusk Engineers	Adaptation and Mitigation <a href="https://www.youtube.com/watch?v=AuaeleSDij0">https://www.youtube.com/watch?v=AuaeleSDij0</a>
13.	tele-irrigation system	Tech Innov and Orange Niger	Adaptation and Mitigation <a href="http://www.tele-irrigation.net/">http://www.tele-irrigation.net/</a>

#### Some Useful Web Site of Climate Change Adaptation Platforms

##### Climate-ADAPT European Climate Adaptation Platform

<https://climate-adapt.eea.europa.eu/metadata/publications/adapting-to-climate-change-eu-agriculture-and-forestry>

The World's population has been growing as geometric progressing where agriculture and forestry production are arithmetic. Scientists have been studying on for the balance between production and consumption of food for the sustainability. Unfortunately, climate change confronts societies with a range of uncertainties that scant production as well as sustainability since agriculture and forestry mainly depend on climate. Climate change impacts large geographical areas especially mountain-forest villages where livelihood depend agriculture and forest production. Policy development must allow for responses to be local and to be effective. This study deals with the challenge for agriculture of mountain-forest villages in TRB1 region (Bingol, Elazig, Malatya, and Tunceli provinces), Turkey. Climate change adapted farming systems were try to determine for sustainability through Ministry of Agriculture and Forest's Policies. The extent of support for agriculture and forest to mitigate climate change, to adapt climate change, and to resilience climate change were highlighted as climate change adaptation farming systems of the study result. These climate change adaptation farming systems should define characteristics of future agriculture and forest policies at the level of parcel, farm, region, nation, and international. The combinations of agriculture, forest, and aqua lack shake a leg with sun, wind, rains as game theory for determination of climate change adaptation farming. Optimization of nature, labor, capital, and entrepreneurship for climate change mitigation, adaptation, and resilience requires SMART system where technologies or automation needed. For instance, innovative resource management techniques. Capacity building of climate change adaptation for agriculture, forest, and fishery basis to transfer knowledge outside and collaboration of universities, governments offices, and civil society organization for better research into the changing climate, funding programs, and implementation type farming systems. Farm advisory system that government operate under the Ministry of Agriculture and Forest was established for Climate Change Adaption Farming Systems (CCA-FS) in Elazig province for TRB1 region, Turkey.

##### ICT and Robotic for sustainable agriculture and forestry as CCA-FS

<https://climate-adapt.eea.europa.eu/metadata/projects/ict-and-robotics-for-sustainable-agriculture>

The increasing population of the world coupled with the projected impacts climate change is expected to have on the agricultural sector demands that world food production





increases in terms of volume and precision. ICT and Robotics are strong instruments in propelling high the concept of precision agriculture. Projects such as ICT-AGRI 1&2 were geared towards strengthening research on precision farming and also to develop a common agenda concerning ICT and robotics for a sustainable agriculture in the European community. Those two projects have focused on coordinating European research in ICT and robotics, developed a common research agenda based on shared priorities among participating countries and have supported the development and implementation of new technologies for a competitive, sustainable and environmentally friendly agriculture. The project coordinator of the ICT-AGRI (Niels Götke) was confident that, modern agricultural engineering especially in ICT and Robotics are very important in building a sustainable agriculture that is capable of feeding the increasing population of the world as well as limiting the impacts of the footprints of the production process.

<http://ict-agri.eu/>

Bio economy

<http://ec.europa.eu/research/bioeconomy/index.cfm>

The world is at a stage that demand for agricultural resource are constantly increasing. This however is not fulfilled without serious impact to the environment which environmental advocates are fighting against. The concept of BIOECONOMY tackles this issue by promoting a more innovative and reduced GHG emission economy, thereby satisfying the increasing demands for food security through a sustainable use of renewable biological resources for industrial purposes, while ensuring biodiversity and environmental protection. The concept of Bio-economy has fitted well in the European Commission's agenda of providing jobs, improving economic growth and developing an atmosphere for investment, through its ability to help tackle challenges regarding food and energy requirements, promotes research across social and scientific disciplines within and beyond the borders of the European Union which are in line with the three strategic priorities set out by Commissioner Carlos Moedas.

Project' web site

[https://cordis.europa.eu/guidance/archive\\_en.html](https://cordis.europa.eu/guidance/archive_en.html)

Eastern Mediterranean Climate Centre

<http://www.emcc.mgm.gov.tr/>

The Eastern Mediterranean Climate Centre (EMCC) is a website developed by the Turkish State Meteorological Service (TSMS) to monitor, predict, assess impacts and verify models of countries east of the Mediterranean Sea including Cyprus, Egypt, Greece, Israel, Jordan, Lebanon, Syria and Turkey. It was established in 2009 and has since undertaken several R&D programs and has on an annual bases published reports on the state of the climate especially for the Republic of Turkey. Its R&D are focused on climate analysis, modelling, scenario development, climate indices, downscaling and application of climate information. The TSMS, under which the EMCC operates was founded in 1937 and acts as the only legal organization providing all meteorological information of the Republic of Turkey. Its main objectives are to:

- i. make observations
- ii. provide forecasts
- iii. provide climatological data, archive data, and other information
- iv. communicate these to the public
- v. provide meteorological needs of army and civil aviation

<http://climate-adapt.eea.europa.eu/countries-regions/countries/turkey>





<https://www.era-learn.eu/>

Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bio-economy

<http://ec.europa.eu/programmes/horizon2020/en/h2020-section/food-security-sustainable-agriculture-and-forestry-marine-maritime-and-inland-water>

It is important to invest in research and innovation looking at the unfolding problems with food security, environmental protection and climate change, and rural development. Among the pillars of Europe's socioeconomic activities are agriculture, forestry, fisheries and aquaculture, and bio-based industry. These sectors are important in their impacts on food and feed production, job creation and production of bio-based energy. It is thus important to enhance research and innovation in these sectors owing to problems raised above. Agricultural research has the potential to produce safe and secure food and feed alongside socioeconomic development especially in the region. The Agri-food sector will be able to satisfy demands for reliable supply of safe and nutritious food without negatively impacting the environment if supported with effective research and innovation. The ocean and sea resource of the world which covers about 70 % of the earth's surface undoubtedly provides food, energy and bio-based products to society. Research and innovation is necessary to help develop a sustainable management strategy for this resource in terms of optimising the contribution of the water resource to food and energy, limiting the impact such activity will have to biodiversity. The bio-based industry is very important in this era of controlling the emission of GHG into the atmosphere. Research in this sector will help introduce clean renewable energy source thereby reducing the dependency on fossil fuel. Investment in these sectors will help the European Union achieve the objectives of its programs such as the CAP, Bio-economy Strategy and emission pledge among others.

Capacity Building in the Field of Climate Change in Turkey Grant Scheme (CCGS) especially focusing on the Project; Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries were completed by searching preview programs as follows;

<http://mdgfund.org/program/enhancingcapacityturkeyadaptclimatechange>

<http://www.wri.org/our-work/project/world-resources-report/decision-making-and-climate-change-uncertainty-setting>

<https://www.globalpolicy.org/social-and-economic-policy/the-environment/climate-change.html>

<http://www.wri.org/>

<http://www.chikyu.ac.jp/iccap/finalreport.htm>

<http://www.chikyu.ac.jp/iccap/finalreport.htm>

<http://www.lse.ac.uk/GranthamInstitute/>

<http://iklim.ormansu.gov.tr/Eng/>

<http://kurakliyonetimi.ormansu.gov.tr/>

<http://ribamap.ormansu.gov.tr/index>

<http://taskinyonetimi.ormansu.gov.tr/taskinyonetimi/AnaSayfa.aspx?sflang=tr>

<http://kurakliyonetimi.ormansu.gov.tr/kurakliyonetimi/AnaSayfa.aspx?sflang=tr>

<http://documents.worldbank.org/curated/en/119151504231238468/Turkey->

[Resilience-Inclusion-and-Growth-Development-Policy-Financing-Project](#)

<https://www.ipcc.ch/>





<https://www.ipcc.ch/links/links.shtml>  
<https://public.wmo.int/en/our-mandate/climate>  
<http://www.un.org/en/index.html>  
<http://www2.unccd.int/>  
<http://www.ipcc-data.org/>  
<https://www.epa.gov/newsreleases/epa-kicks-website-updates>  
<http://www.mfe.govt.nz/climate-change/>  
<http://www.chikyu.ac.jp/iccip/finalreport.htm>  
<http://miljodirektoratet.no/no/Nyheter/Nyheter/2014/Januar-2014/Klimakunnskap-i-dessertformat/>  
<https://www.youtube.com/watch?v=BZdz0sRHCDs>  
<http://www.de-ipcc.de/index.php>  
<http://ilmasto-opas.fi/en/ilmastonmuutos/videot-ja-visualisoinnit/-/artikkeli/178e8529-faff-4f28-a2eb-f9c322eefe54/ipcc5-infografiikat-osa-1-luonnontieteellinen-tausta.html>

<http://ilmasto-opas.fi/en/kunnat>  
The mitigation, adaptation, land use and construction, traffic planning, technical services (Energy supply, Waste management, Traffic and streets, Forests and parks, Water supply and sewerage) were selected. Education and culture, Social services, health care, environmental health care were chosen as solution.

Education and culture <http://ilmasto-opas.fi/en/kunnat/opetus-ja-kulttuuri/-/artikkeli/1ae15020-98e2-41f2-8cee-e47c9f8d0b57/opetus-ja-kulttuuri.html> , Exercises  
Culture Tourism and recreation education

Social services Health care Environmental health care  
<http://ilmasto-opas.fi/en/kunnat/sosiaali-ja-terveys/-/artikkeli/c53ba377-9581-4139-8488-7f5e9bc04bb6/sosiaali-ja-terveys.html>

Environmental protection  
<http://ilmasto-opas.fi/en/kunnat/ymparisto/-/artikkeli/24b874d5-6d1f-4b3a-b176-a23de911d3af/ymparistonsuojelu.html>

Solution  
<http://ilmasto-opas.fi/en/ilmastonmuutos>

Climate friendly food  
Future in bio energy  
Built environment  
Short cut to impacts

The movement for Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries were described from the searches as follows;

Capacity building organizational development

Capacity building resources use

Capacity building presentation of TRB1 region (Training, networking, tools and services (technology need assessment), publications, seminars, and workshop, etc.)

Evaluate





(<http://ilmasto-opas.fi/en/ilmastonmuutos/videot-ja-visualisoinnit/-/artikkeli/b4df9633-7e1f-4389-9dd0-a0539588f211/visualisoinnit.html#vaikutusartikkelit> )  
<https://www.canada.ca/en/services/environment/weather/climatechange/climate-action.html>

International organizations

<https://www.ipcc.ch/links/links.shtml>

Impact of climate change on water life

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/en/db5282f2-d94d-4d05-9e61-04ee40896157/ilmastonmuutos-vaikuttaa-vesiemme-kalalajistoon.html>

Impact of climate change on agriculture

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/328b539b-a12c-4e64-9755-1ae822ec98e1>

Impact of climate change transportation

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/en/11c9a295-4934-492b-afad-33ad270c75ad/maantieliikenne.html>

Impact of climate change on water use

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/a0596a76-eb8b-45e7-ab51-9bc6149f7312/veden-maara.html>

Impact of climate change on tourism

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/0d5181d3-8190-4e90-a7af-f0f46b77a10b>

Impact of climate change on agriculture and horticulture

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/67bff61b-86d4-44ce-8407-754892eab440/puutarhatalous.html>

Impact of climate change on industry

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/79840ec2-4723-442b-a6b3-5a2ebc46f6da/teollisuus.html>

Impact of climate change on biodiversity

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/3cf501d5-3ee3-4672-9a0d-936a7ae88e22>

Impact of climate change on transportation rail road

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/ae2068f4-7cd3-49bd-8f6f-1e1c83eb35e2>

Impact of climate change on water resources

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/df8aa940-bfba-417a-ab28-350779abc995>

Impact of climate change on forests

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/en/d31e0c24-81f6-4479-9ef5-28a3d237921a/metsat.html>

Impact of climate change on health







<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/eb624dfa-8652-4787-ac82-c8e6bfd97f6b>

Impact of climate change on winter tourism

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/487fccbe-e084-4bb6-88b5-afd7a5469b85>

Impact of climate change on fishery

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/en/685bf62a-2bc8-4435-b972-6439dc6d73b5/miten-ilmastonmuutos-muuttaa-kalanviljelya-suomessa.html>

Impact of climate change on forest and carbon balance

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/34335d0b-495f-44c6-8d3f-5e528df49713>

Impact of climate change on social economic life

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/cb44047f-3177-453f-8b1a-086b1b6da042>

Impact of climate change on energy

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/12eead4d-e79b-4a1b-b618-8e1e0336a1d7>

Impact of climate change on Livestock

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/85bdb195-39c4-4633-a2c9-f26c23e07022/porotalous.html>

Impact of climate change on social economic structure

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/98d25017-430a-405b-80f3-ddefcc534d75>

Climate Action Plan of EU

<https://ec.europa.eu/clima/>

Paris agreement

[https://www.youtube.com/watch?v=5Tf5Hxa\\_dKs&rel=0](https://www.youtube.com/watch?v=5Tf5Hxa_dKs&rel=0)

<http://ilmasto-opas.fi/en/ilmastonmuutos/videot-ja-visualisoinnit/-/artikkeli/b4df9633-7e1f-4389-9dd0-a0539588f211/visualisoinnit.html#vaikutusartikkelit>  
<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/ea1d7fc1-5a5a-457f-bd42-984e594685ba/vaikutukset.html>

Questionnaire of the survey was described by searching following web sites;

Socio - economic impact of climate change

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/98d25017-430a-405b-80f3-ddefcc534d75>

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/cb44047f-3177-453f-8b1a-086b1b6da042>

Gender related impacts of climate changes

Reindeer husbandry

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/85bdb195-39c4-4633-a2c9-f26c23e07022/porotalous.html>

Energy need and national emergency supply in a change of climate





<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/12eead4d-e79b-4a1b-b618-8e1e0336a1d7>

Direct health effect of climate change

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/0b9d5f8d-3562-4e1a-a5cf-9b1be3f550c9/suorat-terveysvaikutukset.html>

Forestry

<http://ilmasto-opas.fi/en/ilmastonmuutos/vaikutukset/-/artikkeli/en/d31e0c24-81f6-4479-9ef5-28a3d237921a/metsat.html>

Climate variability and changes effect agriculture, human and nature. The regional environment problem occur, Need of farm land development, irrigation and drainage, cropping system, farm management, water balance and water circulation,

How is that in the past, present and future

Awareness raising on mainstreaming climate change in the national development framework as well international development framework. Questioner of climate change and adaptation

Capacity Building of TRB1 Region Knowledge Platform (Government institutions, Universities, Ministries, Village governorate) The Platform of TRB1 Region for Climate Change Adaptation and Resilience. TRB1 Region Sustainable Development Knowledge Platform

Institutional Organizations

Regional Capacity Development and Institutional Strengthening (Policies, Plans, and Institutions)

Governance

The Role of People and Media

Economic status of growth

Industrialization

Rural infrastructure

Social

Health, population and development

Education

Gender development

Participation of sustainability

Sustainable environment and ecology

Forest and biodiversity

Sustainable land

Chemicals and waste management

Meeting international obligations

Emergency contact person of the Village (Village Governorates)

**Food security and sustainable agriculture**

Challenges and future directions

Water security and water resources. Water supply and sanitation

Energy security

Climate change and climate resilient development

Disaster management and climate risk reduction

Sustainable cities and low carbon development





Transportation and infrastructure  
Creation of jobs including green jobs for poverty eradication action  
Gainful employment for sustainable development  
Green development, green economy, and green jobs  
Village resource management

#### Promoting pilot adaptation project

Integrate Information System of TRB1 region Climate Change Adaptation into all agencies of the world

Introducing CC National Adaptation Strategy and Action Plan to the target groups such as Government Institutions, Universities, Municipalities, Village Administrations, and farmers by Awareness Raising Group of the project.

#### Capacity Development Program of Climate Change Adaptation

P Politics  
E Economics  
S Social  
T Technological  
E Environmental  
L Legal

Purpose project management and associated tools should be uppermost in your thoughts from the start to the end of a project. Regardless of the project management approach you use, it can be enhanced with the use of the tools in this section. When to use it The service improvement project guide in section one of this handbook provides an indication of the various stages these tools would be relevant for. The stages are as follows:

1. Start out
  4. Design and plan
  2. Define and scope
  5. Pilot and implement
  3. Measure and understand
  6. Sustain and share
- How to use it The tools can supplement your existing project approach or be used with the project approach detailed in section one of this handbook.

The specific details for each of the tools and techniques can be found in the relevant sub-sections:

- Politics (Awareness raising on climate change adaptation of agriculture, forest, and fishery)
- Economics (Crop + Livestock + Forest products + Fishery) Portfolio
- Social (Social acceptability)
- Technics (Need assessment of technology for climate adaptation of mountain forest villages)
- Ecology (Ecosystem of Circular Economy at TRB1 region)
- Legal (Law release)





#### 4.2.5. Climate Change Adaptation Technologies

##### **TRB1 region strategy action plans in adaptation to climate change**

TRB1 Region Action plans should be developed and implemented within the scope of strategies developed with the participation of all stakeholders for adaptation to climate change. All efforts to be carried out in this context will make significant contributions to the adaptation of the TRB1 region to climate change. Thus, the action plans and the sectors to be implemented within the scope of the strategies developed in the TRB1 region are;

1. Action plans to be implemented in agriculture and forestry sector
2. Action plans to be implemented in the energy sector
3. Action plans to be implemented in transport sector
4. Action plans for industrialization and industry
5. Action plans to be implemented in waste collection and utilization
6. Action plans to be implemented in the building and construction sector
7. Action plans to be implemented in the effective usage of financial sources and creation of new sources
8. Action plans to be implemented in training and capacity building
9. Action plans to be implemented in the assessment of the adaptation process to climate change of the region
10. Action plans to be implemented in the health sector

##### **Action Plans to be Implemented in Agriculture and Forestry Sector**

1. Action plans for drought risk analysis of the region should be prepared.
2. Short, medium and long-term action plans should be prepared to ensure sustainable water supply by identifying the water resources of the region.
3. Short, medium and long term action plans should be prepared in order to sustain agriculture in the region and to meet the agricultural water demand.
4. Research and Development studies should be accelerated for adaptation of the region to climate change in agricultural and forestry and “Research Institutes” should be established to conduct scientific research in this area.
5. The necessary legal arrangements should be made for the development of Institutional Capacity in the Region.
6. Action plans should be prepared to reduce greenhouse gas emissions in the region.
7. Risk maps should be prepared for disasters such as possible desertification, erosion, floods, floods, droughts etc. and short, medium and long term action plans should be prepared against these risks.
8. Short, medium and long-term action plans should be prepared to protect existing forests in the region and to create new forest areas.
9. Drought-resistant Product Testing Center should be established in order to determine the cultivation of drought-resistant cereals and suitable cereals for use in the region.
10. Action plans should be prepared for the improvement of water transport networks in the region that increase water consumption or have completed their economic life.
11. Action plans should be prepared in order to establish agricultural basins in the region.
12. Action plans should be prepared for new crop planting techniques and modern irrigation systems to be applied in the region.





13. Action plans should be prepared for the use of technological systems in agricultural activities in the region.
14. The establishment of producer training centers in different parts of the region should be planned.

#### **Action Plans to be Implemented in Energy Sector**

1. Action plans for the use of renewable energy resources should be prepared in the region.
2. New action plans should be prepared to increase the energy efficiency of public and private sectors and residences in the region.
3. Action plans should be prepared for the implementation of Energy Identity Certificate in existing buildings in the region.

#### **Action Plans to be Implemented in Transportation Sector**

1. Action plans should be prepared to revise the region's transport network.
2. Action plans should be prepared for the use of environmentally friendly fuels and clean vehicle technologies in transportation vehicles in the region.
3. Action plans should be prepared for the use of railway and airway in the area, freight and passenger transport, metro, light rail systems and bicycle use in urban transport.
4. Action plans should be prepared to reduce exhaust gas emissions in the region.

#### **Action Plans to be Implemented in Industrial Sector**

1. Action plans should be prepared to ensure the use of renewable energy in industrial areas in the region.
2. New action plans should be prepared for the R & D studies and technology transfer that industrialists in the region need.
3. Action plans should be prepared in the region to increase energy efficiency.
4. Action plans should be prepared for the utilization of industrial wastes of the region.

#### **Action Plans to be Implemented in The Collection and Utilisation of Waste**

1. New action plans should be prepared to reduce the amount of waste in the region.
2. Action plans should be prepared in order to create waste storage areas in the region and to dispose-off waste in the region by recycling them into the economy.
3. Action plans for the use of gases from waste storage facilities established in the region should be prepared.
4. **“Waste Incineration Plants”** should be installed to incinerate some wastes.
5. Action plans for the establishment of **“Waste Segregation Facilities”** in the region should be prepared.
6. Action plans should be prepared for the conversion of organic wastes in mountain and forest villages in the region to compost products.







### **Action Plans to be Implemented in The Buildings and Construction Sector**

1. Action plans should be prepared for the construction of green buildings and the use of heat-insulated environmentally friendly materials that will increase energy efficiency in the buildings to be constructed in the region.
2. Action plans for the use of renewable energy sources should be prepared in the buildings in the region.
3. Action plans should be prepared to reduce greenhouse gas emissions of buildings in the region.
4. Action plans should be prepared to encourage the use of wood materials in the construction sector in the region.
5. Action plans should be prepared to make the roofs of the buildings in the region in the form of a green roof or solar panel.
6. Action plans should be prepared for the establishment of Rainwater Storage Areas under the structures in the region or at certain points.
7. Action plans for the use of Smart Home Systems should be prepared for the structures in the region.

### **Action Plans to be Implemented in The Effective Usage of Financial Sources and Creation of New Sources**

1. New action plans should be prepared for the effective use of the region's existing financing resources within the framework of priorities.
2. Action plans should be prepared in order for the region to benefit more from international funds especially in adaptation to climate change.
3. Action plans should be prepared for the provision of resources needed for the transfer of green environment, good agricultural practices and environmentally friendly technologies in the region.

### **Action Plans to be Implemented in Training and Capacity Building**

1. New action plans should be prepared to raise public awareness and create training programs in the region.
2. Action plans should be prepared to create a comprehensive and functional information and awareness mechanism with the participation of all stakeholders in the region.
3. Action plans should be prepared for the participation and support of the public, private sector, universities and non-governmental organizations in the region to change the consumption patterns in an environmentally friendly manner.
4. Adaptation to Climate Change and Capacity Building Research Institute should be established in order to conduct scientific research on climate change in the region.





### **Action Plans to be Implemented in The Assessment of Adaptation Process to Climate Change in TRB1 Region**

1. The establishment of “**Climate Change Adaptation Coordination Council**” should be planned in the region.
2. The establishment of a “**Monitoring and Evaluation Unit**” should be planned to follow the implementation of the action plans for adaptation of the region to climate change.
3. An action plan for the adaptation of the “**Climate Change Adaptation Database**” should be prepared for the accurate and fast evaluation of the data obtained in the region.
4. Action plan should be prepared to create “**Climate Change Observation Points**” at different locations in the region.

### **Action Plans to be Implemented in Health Sector**

1. Action plans should be prepared to identify potential health risks that may arise due to climate change and to draw health risk maps.
2. Action plans should be prepared for monitoring and evaluation of drinking water resources and food grown in the region from the point of climate change in the region.
3. Capacity building action plans should be prepared to combat the risks of climate change in the region's health system infrastructure.
4. Action plans should be prepared to combat animal diseases and plant pests in the region.
5. Action plans should be prepared in order to educate the health personnel working in the region and to raise awareness of the citizens by using written and visual media regarding the impacts of the climate change in the region on possible human health and the precautions to be taken.

### **5. Some Implementable Best Practices for Climate Change Adaptation in TRB1 Region**

The TRB1 regional strategic targets within the scope of basic principles are listed as follows:

- To integrate policies and measures for mitigating and adapting to climate change into national development plans, consistent with the UNFCCC principle of “common but differentiated responsibilities” and its special circumstances
- To contribute to the global greenhouse gas emission mitigation policies and measures, within its own capacity, by limiting the rate of growth of national greenhouse gas emissions, without disrupting its development program aligned with sustainable development principles,
- To increase national preparedness and capacity in order to avoid the adverse impacts of global climate change and to adapt to these impacts; to share emerging experiences and knowledge from such efforts with other regions and neighboring countries; and to develop bilateral and multilateral joint research projects for mitigation and adaptation,
- To comply with the design and implementation of global strategic objectives of mitigation, adaptation, technology transfer and finance that accounts for responsibilities of the parties, and to take active role in international activities,





- To develop local research and development and innovation capacities towards clean production and increasing competitiveness and production in this area by taking into consideration our current technology and development levels.
- To facilitate climate change adaptation and mitigation activities by ensuring efficient and continuous coordination and decision making processes based on transparency; stakeholder participation, and a strong reliance on a science focus.
- To raise public awareness in support of changing consumption patterns in climate-friendly manner through joint efforts of all parties such as the public sector, private sector, universities and NGOs
- To establish an integrated information management system in order to increase the flow and exchange of knowledge in national climate change efforts.

**Capacity building for climate change adaptation for the TRB1 Region in general; the following practices has been proposed for agriculture, forestry and aquaculture;**

- Dissemination of village crafts (Crafts and toys)
- Vaccination of a perennial plant, which has a natural vegetation and which can be expressed as the most resistant plant to drought. Appropriate vaccination for a Geven plant will be very important for adaptation to climate change on a global scale.
- Initiation of R & D studies to produce plant nutrition environment for hydroponic system
- Establishment of textile workshops as alternative diversified income in adaptation to climate change
- Launching entrepreneurship to build capacity in adaptation to climate change by creating climate change entrepreneurship module.
- Rehabilitation project for adaptation to the Euphrates basin climate change
- Construction of eco-houses and insulation in adaptation to climate change
- Promotion of highly productive goat breeds in adaptation to climate change. For example, the Pakistani goat
- Launching twining programs with successful municipalities and mukhtars for adaptation to climate change
- Implementation of priority catering and sales programs in the transportation vehicles such as THY and YHT for the marketing of local products adapted to climate change
- Organizing fairs for the marketing of local products adapted to climate change, opening stands with participation in fairs and scientific meetings.
- Seasonal monitoring and photographing of agricultural, forest and aquaculture effects of climate change.
- Establishing sectoral life cycle in the regional scale for sustainability
- Capacity building for adaptation to climate change; technology needs analysis program for agriculture, forestry and aquaculture sectors
- Capacity building for adaptation to climate change; Initiation of wildlife tourism production program in the form of in-forest production for agriculture, forestry and aquaculture sectors
- Capacity building for adaptation to climate change; emphasis on the processing of products for the agricultural, forest and aquaculture sectors. For example; wheat bulgur production, production of chickpea, fruit desserts, fruit, churchkhela , meat, jam, etc.
- Capacity building for adaptation to climate change; Designing new handicrafts and technologies for agriculture, forestry and aquaculture sectors





TRB1 Area capacity building in adaptation to climate change and the European Union ministerial action plan for capacity-building at the international level on the basis of policy fields that applied in Turkey for the harmonization of international programs has been determined.

Policy Areas of the European Union;

1. Preparatory Reforms for Membership to the Union
2. Socio-Economic and Regional Development
3. Employment, Social Policies, Education, Promotion of Gender Equality and Human Resources Development
4. Agriculture and Rural Development
5. The project was linked to regional and cross-border cooperation.

According to this;

1. Within the framework of preparatory reforms for membership to the Union, two issues have been stipulated in the following sub-components: Establishing a Civil Society Platform and the put emphasis on organizing of this platform.
  - a. Climate Civil Society Platform has been established on Democracy and Governance.
  - b. The rule of law and fundamental rights, Judiciary and Fundamental Rights were dealt with within the scope of Internal Affairs in the organizations related to climate issues. Climate studies groups will be formed in institutions.
2. R & D program for climate research is foreseen to be initiated as a sector / sub-sector within the scope of Socio-Economic and Regional Development policy area;
  - Environment and climate program - Ministry of Environment and Urbanization
  - Transport – Ministry of Transportation, and Ministry of Agriculture and Forestry;
  - TRB1 Wild Tourism Production Project,
  - Local products such as fish facilities, roasting sales areas and restaurants on TRB1 road,
  - Energy - Renewable energy such as solar, wind and water energy investments made by the Ministry of Energy
  - Competitiveness and Innovation / Ministry of Industry and Technology

Capacity building for adaptation to climate change; for agriculture, forest and aquaculture have been determined as a national capacity building. Activities and the responsible institutions listed below.

- Establishment of the Climate Civil Society Platform
- Organization
- Implementation of the environment and climate program conducted by the Ministry of Environment and Urbanization,
- Conducting TRB1 Wild Tourism Production Project by the Ministry of Agriculture and Forests with the merger of forest roads by the Ministry of Transport and Transportation, Supporting the creation of local products sales areas, fish facilities, roasting restaurants on TRB1 regional roads,
- Energy - The establishment of renewable energy investments by the Ministry of Energy (Solar, wind and water energy) and
- The conduct of climate change R & D activities by the Ministry of Industry and Technology - Competitiveness and Innovation





Pre-evaluation Questionnaire was applied based on the Logical Framework Approach for capacity building in the project area of implementation within the framework of capacity building at the national level according to the environmental and climatic conditions, product, production, farm systems and marketing systems (Comprehension and Analysis)

During fieldwork application process; elucidating, Interview and Video activities were conducted. After the Seminars (Comprehension) and Informative materials, the final evaluation questionnaire Workshop studies were conducted.

Environment and climate friendly renewal of transportation and energy infrastructure (solar, wind, ponds and irrigation),

Developing competitiveness and innovation programs on climate change issues,

Employment, social policies, education, promotion of gender equality and human resources development (university and private administration cooperation) in determined fields,

Adding grants to agricultural system investments adapted to climate and rural development programs,

Extending the scope of support of institutions and organizations such as ORKÖY, Special Administration, Development Agencies, for support from national programs,

The reorganization of ÇATAK program according to climate change and its widespread application,

Carrying out Implementation of Regional Trade Center activities in Regional and Cross-Border Cooperation,

Establishment of Farm Systems Adapted to Climate Change in Treasury Lands Owned by Village Legal Entities and Their Business Model.

Establishment of adaptive farm systems on individual lands;

Accumulation of precipitation water and irrigation; Micro ponds

Project outputs in the scale of TRB1 Region

1. Implementation of farm systems adapted to climate change based on parcels, districts and sub-regions.
2. Implementation of agricultural systems adapted to climate change by districts, sub-regions and regions.
3. Making product processing investments for industrial ecology systems adapted to climate change.
4. Establishment of local products marketing locations for the sale of farm systems, agricultural systems, tourism and industrial ecology products adapted to climate change, and the organization of local product fairs.
5. Initiating the "Wildlife Tourism Production Program" in the region as diversified alternative activities in adaptation to climate change.
6. Establishment of a life cycle for farm systems, agricultural systems, tourism and industrial ecology adapted to climate change.
7. Capacity building for adaptation to climate change; start of regional development with Bio Economy consisting of agricultural, forestry, aquaculture, mining, medicinal and aromatic plants, recycling and renewable energy components.







Requirements for BİNGÖL province Capacity building towards adaptation to climate change in agriculture, forestry and aquaculture:

1. Farm systems adapted to climate change;
  - a. Specialization in Adaklı, Genç, Karlıova, Kığı, Solhan, Yayladere, Yedisu and Merkez districts in the creation of farm systems adapted to the climate with Gross Production Value more than 50 % beekeeping products by using native bee stocks which have high adaptability to climate change
  - b. Specialization in the production of climate systems adapted to climate, in the Adaklı, Genç, Karlıova, Kığı, Solhan, Yayladere, Yedisu and Merkez districts with Gross Production Value of more than 50 % ovine livestock and products by using native sheep and goat stocks which have high adaptability to climate change
  - c. Specialization in Adaklı, Genç, Karlıova, Kığı, Solhan, Yayladere, Yedisu ve Merkez in the creation of farm systems adapted to the climate with Gross Production Value of more than 50 % poultry products by using native bird stocks with high adaptability to climate change (Turkey, Goose, Chicken)
  - d. Specialization in the production of climate systems adapted to climate, in the regions of Adaklı, Genç, Karlıova, Kığı, Solhan, Yayladere, Yedisu ve Merkez with Gross Production Value more than 50 % fruit products using native fruit stocks with high adaptability to climate change
  - e. Specialization in the production of climate systems adapted to climate, in the area of Adaklı, Genç, Karlıova, Kığı, Solhan, Yayladere, Yedisu ve Merkez Gross Production Value with more than 50 % aquaculture products by using domestic aquaculture local stocks with high adaptability to climate change. For this purpose, investing in water harvesting and the start of the program of aquaculture such as carp, crayfish, leeches, frogs, seed beds
2. Agricultural systems adaptation to climate change,
  - a. Specialization in Adaklı, Genç, Karlıova, Kığı, Solhan, Yayladere, Yedisu ve Merkez districts in the creation of agricultural systems adapted to the climate by using local bee stocks, domestic sheep and goat stocks, native poultry, fruits and domestic aquaculture stocks with high adaptability to climate change,
3. Industrial ecology systems adapted to climate change,
  - a. Establishment of an Industrial Ecology-Integrated Fruit Products Processing Facility to serve the province and region in the creation of adaptation-oriented agricultural systems such as domestic bee stocks, native sheep and goat stocks, native bird stocks, native fruit stocks and native aquaculture stocks.
4. Alternative activities in adaptation to climate change (Wildlife Tourism Production Program),
  - a. Establishment of a tourism destination in the form of combining in-forest roads with water resources. As an activity that provides alternative income for adaptation to climate change and reduces the "baksı" of agriculture, forest and aquaculture with Gross Production Value (GSÜD) more than 50% wildlife tourism. Initiation of non-wood production in the forest in the form of wildlife tourism with the integration of forest roads in Bingöl, Elazığ, Malatya and Tunceli provinces,
5. Establishment of life cycle for farm systems, agricultural systems, tourism and industrial ecology adapted to climate change,





- a. Establishment of Industrial Ecology-Recycling Plant-Biogas and Compost Plant to serve the province and region in the creation of climate-adapted agricultural systems by using local bee stocks, native sheep, goats, poultry, fruits, and aquaculture stocks
  - b. For the establishment of the Life Cycle in the creation of farm systems that adapt to the changing climate, with a gross production value of more than 50 % by using fruit stocks with high adaptability to climate change in Adakli, Genç, Karlıova, Kigi, Solhan, Yayladere, Yedisu and Merkez districts
6. Bio Economy is designated as the regional development that consist agriculture, forestry, aquaculture, mining, medicinal and aromatic plants, and recycling and renewable energy components for the purpose of capacity building for adaptation to climate change.
- a. Meat and meat products, milk and milk products, beekeeping products, biogas energy plant, fertilizer industry in the form of plant nutrition, wind energy
  - b. Opening of Local Product Sales and Fairs to serve the region in the creation of agricultural systems adapted to the climate with Gross Production Value of more than 50% fruit by using fruit rootstocks and Gross Production Value of more than 50% sheep by using domestic sheep rootstocks with high adaptability to climate change
  - c. Establishment of the production of fruit and vegetable, milk and dairy products, beekeeping products, solar energy plants, and bio nutrients from mines in the form of plant feeding.

TRB1 Region Capacity building for adaptation to climate change for ELAZIĞ province, agricultural, forest and aquaculture requirements:

1. Farm systems adapted to climate change;
  - a. Specialization in Alacakaya, Arıcak, Baskil, Karakoçan, Keban, Kovancılar, Maden, Merkez, Palu and Sivrice districts in the creation of farm systems adapted to the climate with Gross Production Value more than 50 % beekeeping products by using native bee stocks which have high adaptability to climate change
  - b. Specialization in the production of climate systems adapted to climate, in the regions of Alacakaya, Arıcak, Karakoçan, Kovancılar, Maden and Palu with Gross Production Value of more than 50% ovine livestock and products by using native sheep and goat stocks which have high adaptability to climate change
  - c. Specialization in Alacakaya, Arıcak, Baskil, Karakoçan, Kovancılar, Maden and Palu in the creation of farm systems adapted to the climate with Gross Production Value of more than 50 % poultry products by using native bird stocks with high adaptability to climate change (Turkey, Goose, Chicken)
  - d. Specialization in the production of climate systems adapted to climate, in the regions of Alacakaya, Arıcak, Baskil, Karakoçan, Keban, Kovancılar, Maden, Merkez, Palu and Sivrice, with Gross Production Value more than 50% fruit products using native fruit stocks with high adaptability to climate change
  - e. Specialization in the production of climate systems adapted to climate, in the area of Alacakaya, Arıcak, Baskil, Karakoçan, Keban, Kovancılar, Maden, Merkez, Palu and Sivrice, using domestic aquaculture local stocks with high adaptability to climate change and Gross Production Value with more than 50 % aquaculture





products. For this purpose, investing in water harvesting and the start of the program of aquaculture such as carp, crayfish, leeches, frogs, seed beds

2. Agricultural systems adapted to climate change,
  - a. Specialization in Alacakaya, Arıcak, Baskil, Karakoçan, Keban, Kovancılar, Maden, Merkez, Palu and Sivrice districts in the creation of agricultural systems adapted to the climate by using local bee rootstocks, domestic sheep and goat rootstocks, native poultry rootstocks, native fruit rootstocks, domestic aquaculture stocks with high adaptability to climate change,
3. Industrial ecology systems adapted to climate change,
  - a. Establishment of an Industrial Ecology-Integrated Fruit Products Processing Facility to serve the province and region in the creation of adaptation-oriented agricultural systems such as domestic bee stocks, native sheep and goat, birds, fruits, and aquaculture stocks.
  - b. Establishment of Industrial Ecology-Sheep Wool Lanolin production plant which is adapted to climate in one of the Karakoçan, Arıcak, Kovancılar district to serve the whole country with Tunceli, Bingöl, Elazığ and other regional provinces with Gross Production Value (GSÜD) of more than 50 % sheep by using domestic sheep stocks with high adaptability to climate change
4. Alternative activities in adaptation to climate change (Wildlife Tourism Production Program),
  - a. Establishment of a tourism destination in the form of combining in-forest roads with water resources. As an activity that provides alternative income for adaptation to climate change and reduces the "baksı" of agriculture, forestry and aquaculture with Gross Production Value (GSÜD) of more than 50 % wildlife tourism. Initiation of non-wood production in the forest in the form of wildlife tourism with the integration of forest roads in Bingöl, Elazığ, Malatya and Tunceli provinces,
5. Establishment of life cycle for farm systems, agricultural systems, tourism and industrial ecology adapted to climate change,
  - a. Establishing a plant for the Production of Fruit Seedlings Adapting to the Industrial Ecology-Climate to serve the province and region in the creation of agricultural systems adapted to the changing climate with stocks of domestic aquaculture and local bee stocks, native sheep, goat, poultry, and fruit rootstocks which have high adaptability to the climate change
6. Bio Economy is designated as the regional development that consist agriculture, forestry, aquaculture, mining, medicinal and aromatic plants, and recycling and renewable energy components for the purpose of capacity building for adaptation to climate change.
  - a. Establishment of the production of fruit and vegetable, milk and dairy products, beekeeping products, solar energy plants, and bio nutrients from mines in the form of plant feeding.





TRB1 Region Capacity building for adaptation to climate change for MALATYA province, agricultural, forest and aquaculture requirements:

1. Farm systems adapted to climate change;
  - a. Specialization in Kale, Akçadağ, Arapgir, Arguvan, Battalgazi, Darende, Doğanşehir, Doğanyol, Hekimhan, Kuluncak, Pütürge, Yazıhan ve Yeşilyurt districts in the creation of farm systems adapted to the climate with Gross Production Value of more than 50 % beekeeping products by using native bee stocks which have high adaptability to climate change
  - b. Specialization in the production of climate systems adapted to climate, in the regions of Kale, Akçadağ, Arapgir, Arguvan, Battalgazi, Darende, Doğanşehir, Doğanyol, Hekimhan, Kuluncak, Pütürge, Yazıhan ve Yeşilyurt with Gross Production Value of more than 50 % ovine livestock and products by using native sheep and goat stocks which have high adaptability to climate change
  - c. Specialization in Kale, Akçadağ, Arapgir, Arguvan, Battalgazi, Darende, Doğanşehir, Doğanyol, Hekimhan, Kuluncak, Pütürge, Yazıhan ve Yeşilyurt in the creation of farm systems adapted to the climate with Gross Production Value of more than 50 % poultry products by using native bird stocks with high adaptability to climate change (Turkey, Goose, Chicken)
  - d. Specialization in the production of climate systems adapted to climate, in the regions of Kale, Akçadağ, Arapgir, Arguvan, Battalgazi, Darende, Doğanşehir, Doğanyol, Hekimhan, Kuluncak, Pütürge, Yazıhan ve Yeşilyurt with Gross Production Value of more than 50 % fruit products using native fruit stocks with high adaptability to climate change
  - e. Specialization in the production of climate systems adapted to climate, in the area of Kale, Akçadağ, Arapgir, Arguvan, Battalgazi, Darende, Doğanşehir, Doğanyol, Hekimhan, Kuluncak, Pütürge, Yazıhan ve Yeşilyurt by using native domesticated aquaculture stocks with high adaptability to climate change and Gross Production Value with more than 50 % aquaculture products. For this reason, investing in water harvesting and the start of the program of aquaculture such as carp, crayfish, leeches, frogs, seed beds
2. Agricultural systems adapted to climate change,
  - a. Specialization in Kale, Akçadağ, Arapgir, Arguvan, Battalgazi, Darende, Doğanşehir, Doğanyol, Hekimhan, Kuluncak, Pütürge, Yazıhan ve Yeşilyurt districts in the creation of agricultural systems adapted to the climate by using local bee stocks, domestic sheep and goat rootstocks, native poultry rootstocks, native fruit stocks, domestic aquaculture stocks with high adaptability to climate change,
3. Industrial ecology systems adapted to climate change,
  - a. Establishment of an Industrial Ecology-Integrated Fruit Products Processing Facility to serve the province and region in the creation of adaptation-oriented agricultural systems such as domestic bee stocks, native sheep, goats, birds, fruits, and aquaculture rootstocks.
4. Alternative activities in adaptation to climate change (Wildlife Tourism Production Program),
  - a. Establishment of a tourism destination in the form of combining in-forest roads with water resources. As an activity that provides alternative income for adaptation





- to climate change and reduces the "baksı" of agriculture, forest and aquaculture with Gross Production Value of more than 50 % wildlife tourism. Initiation of non-wood production in the forest in the form of wildlife tourism with the integration of forest roads in Bingöl, Elazığ, Malatya and Tunceli provinces,
5. Establishment of life cycle for farm systems, agricultural systems, tourism and industrial ecology adapted to climate change,
    - a. Establishment of Industrial Ecology-Recycling Plant-Biogas and Compost Plant to serve the province and region in the creation of climate-adapted agricultural systems by using local bee stocks, native sheep, goats, poultry, fruits, and aquaculture stocks
  6. Bio Economy is designated as the regional development that consist agriculture, forestry, aquaculture, mining, medicinal and aromatic plants, and recycling and renewable energy components for the purpose of capacity building for adaptation to climate change.
    - a. Fruit and vegetable products, beekeeping products, waste energy and solar industry.

TRB1 Region Capacity building for adaptation to climate change for TUNCELİ province, agricultural, forest and aquaculture requirements:

1. Farm systems adapted to climate change;
  - a. Specialization in kullanılarak Çemişgezek, Hozat, Mazgirt, Merkez, Nazimiye, Ovacık, Pertek ve Pülümür districts in the creation of farm systems adapted to the climate with Gross Production Value of more than 50 % beekeeping products by using native bee stocks which have high adaptability to climate change
  - b. Specialization in the production of climate systems adapted to climate, in the regions of kullanılarak Çemişgezek, Hozat, Mazgirt, Merkez, Nazimiye, Ovacık, Pertek ve Pülümür with Gross Production Value of more than 50% ovine livestock and products by using native sheep and goat stocks which have high adaptability to climate change
  - c. Specialization in Çemişgezek, Hozat, Mazgirt, Merkez, Nazimiye, Ovacık, Pertek ve Pülümür in the creation of farm systems adapted to the climate with Gross Production Value of more than 50 % poultry products by using native bird stocks with high adaptability to climate change (Turkey, Goose, Chicken)
  - d. Specialization in the production of climate systems adapted to climate, in the regions of Çemişgezek, Merkez ve Pertek with Gross Production Value of more than 50 % fruit products using native fruit stocks with high adaptability to climate change
  - e. Specialization in the production of climate systems adapted to climate, in the area of Çemişgezek, Merkez, Ovacık ve Pertek by using domestic aquaculture local stocks with high adaptability to climate change and Gross Production Value with more than 50 % aquaculture products. For this reason, investing in water harvesting and the start of the program of aquaculture such as carp, crayfish, leeches, frogs, seed beds
  - f. Specialization in Hozat, Mazgirt, Merkez, Nazimiye, Ovacık, Pertek and Pülümür districts in the creation of farm systems adapted to the climate using local onion seed with high adaptation to climate change with Gross production value of more than 50 % garlic.
2. Agricultural systems adapted to climate change,







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- a. Specialization in Çemişgezek, Hozat, Mazgirt, Merkez, Nazimiye, Ovacık, Pertek ve Pülümür districts in the creation of agricultural systems adapted to the climate by using native bee stocks, native sheep, goats, poultry, mountain garlic, fruits, and aquaculture stocks with high adaptability to climate change,
3. Industrial ecology systems adapted to climate change,
  - a. Establishment of Industrial Ecology-Integrated Meat Products Processing Plant to serve the province and region in the creation of adaptation-oriented agricultural systems with high adaptability stock to climate change such as native bee stocks, native sheep, goats, poultry, mountain garlic, fruits, and aquaculture stocks
4. Alternative activities in adaptation to climate change (Wildlife Tourism Production Program),
  - a. Establishment of a tourism destination in the form of combining forest roads with water resources. As an activity that provides alternative income for adaptation to climate change and reduces the "baksı" of agriculture, forestry and aquaculture with Gross Production Value of more than 50 % wildlife tourism. Initiation of non-wood production in the forest in the form of wildlife tourism with the integration of forest roads in Bingöl, Elazığ, Malatya and Tunceli provinces,
5. Establishment of life cycle for farm systems, agricultural systems, tourism and industrial ecology adapted to climate change,
  - a. Establishment of Industrial Ecology-Forest Rejuvenation Return Facility to serve the province and region in the creation of agricultural systems adapted to the climate with high adaptation stocks of domestic aquaculture and native bee, sheep, goat, poultry, mountain garlic, and fruit rootstocks
6. Bio Economy is designated as the regional development that consist agriculture, forestry, aquaculture, mining, medicinal and aromatic plants, and recycling and renewable energy components for the purpose of capacity building for adaptation to climate change.
  - a. Fruit and vegetable products, meat and meat products, beekeeping products, garlic, solar energy plants, plants for the production of bio nutrients from mines.

**Capacity building for climate change adaptation for the TRB1 Region in general; the following practices may be proposed for agriculture, forestry and aquaculture;**

- Dissemination of village crafts (Crafts and toys)
- Vaccination of a perennial plant, which has a natural vegetation and which can be expressed as the most resistant plant to drought. Appropriate vaccination for Geven plant will be very important for adaptation to climate change on a global scale.
- Launching R&D studies and activities for production of plant feeding environment for soilless agriculture in the hydroponic system
- Establishment of textile workshops as alternative diversified income in adaptation to climate change
- Launching entrepreneurship to build capacity in adaptation to climate change by creating climate change entrepreneurship module.
- Rehabilitation project for adaptation to the Euphrates basin climate change





- Construction of eco-houses and insulation in adaptation to climate change
- Promotion of highly productive goat breeds in adaptation to climate change. For example, the Pakistani goat
- Launching twinning programs with successful municipalities and mukhtars for adaptation to climate change
- Implementation of priority catering and sales programs in the transportation vehicles such as THY and YHT for the marketing of local products adapted to climate change
- Organizing fairs for the marketing of local products adapted to climate change, opening stands with participation in fairs and scientific meetings.
- Seasonal monitoring and photographing of agricultural, forest and aquaculture effects of climate change. Evaluation of the Ministry of Agriculture and Forestry in photo contests.
- Establishing sectoral life cycle in the regional scale for sustainability
- Capacity building for adaptation to climate change; launch the technology needs analysis program for agriculture, forestry and aquaculture sectors and implementation with improvement circle application
- Capacity building for adaptation to climate change; Initiation of wildlife tourism production program in the form of in-forest production for agriculture, forestry and aquaculture sectors
- Capacity building for adaptation to climate change; emphasis on the processing of products for the agricultural, forest and aquaculture sectors. For example, production of bulgur from wheat, roasted chickpea from chickpea, fruit desserts, fruit pulp, orchid slab, jam, etc.
- Capacity building for adaptation to climate change; Designing new handicrafts and technologies for agriculture, forestry and aquaculture sectors

## Resources

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