



İqtisadi Tədqiqatlar Mərkəzi

Research-Report

**Concerning global climate change impact on agrarian
sector**

(On an example of Ganja-Gazakh economic region)

Baku - 2010

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ABBREVIATIONS

| | |
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| OSCE | Organization for Security and Cooperation in Europe |
| USA | United States of America |
| OJSC | Open Joint-Stock Company |
| IFI | International financial institutions |
| UN | United Nations |
| WB | World Bank |
| PC | Public Company |
| PGC | Public Group Company |
| WTO | World Trade Organization |
| SSC | State Statistical Committee |
| PU | Production Union |
| MED | Ministry of Economic Development |
| ERC | Economic Research Centre |
| VAT | Value Added Tax |
| MENR | Ministry of Ecology and Natural Resources |
| MMM | Mass Media Means |
| MA | Ministry of Agriculture |
| GNP | Gross national product |
| NGO | Non-governmental organization |
| CJSC | Close joint-stock company |
| NFAE | National Fund of Assistance to Entrepreneurs |
| JSC | Joint-Stock Company |
| CASE | Civil activity on security and environment |

Summary

The research report introduced to your consideration was drawn up by the economic experts within the framework of the project “Management of social-economic threats and risk caused by the climate change” implemented by ERC under the Small Grants on Security and Civil Activity on Environment executed by OSCE Baku office and financed by “Statoil” and the Austrian Government. The ERC experts conducted surveys amongst the farmers and peasants carrying out their activity in Ganja-Gazakh region to appreciate the impact of the climate change on the agriculture and the processing industry within the mentioned project and the local entrepreneurs were instructed to prevent the expected losses. In addition, in the course of this research, the ERC experts conducted the indirect economic impacts of the climate change on the agrarian sector (productivity, competitive ability, profitability) and social impacts (employment, revenues and losses, poverty and migration) and overall impacts (structure of consumption market, trade turnover, import structure, level of prices, growth of GNP). At the same time, the object of research encompassed the assessment of the impacts of the climate change on the economic policy directed by the state (sustainable economic development, decreasing of poverty, development of regions, providing of population with reliable foodstuffs and food security programs).

To conduct trainings in connection with computing the additional expenses arisen from losses caused to the agriculture by the climate changes in Ganja-Gazakh region and using the methodology of the risk management amongst the local entrepreneurs and informing the community as regards the climate changes, there were organized workshops, round-tables in the central and regional TV channels joined by the agrarian economies in Ganja-Gazakh region and the managers of the processing enterprises.

The presented research combines matters combined in 3 units (legal, agrarian and economic). The first unit implies making of examination of laws and normative documents regulating the environment relating to the climate changes in the Republic of Azerbaijan, the second unit envisages the fulfilment of the expert assessment on the agrarian sector and finally, the third unit considers the conducting of surveys amongst the farmers and the agricultural producers. These surveys are appended to this research.

Introduction

There were made any researches concerning the estimation of the impact of the global climate changes on the economy of Azerbaijan neither by any working group nor academic circles. Despite series arrangements made in this direction, we observed difficulties in its substantiation based on scientific researches and their results.

As the conducted observations and researches indicate, the global climate changes are exerting considerable impact on execution of several state programs and plans of Azerbaijan. Amongst them we can indicate the “National Program concerning the sustainable social-economic development from ecological point of view”, “the State Program on the sustainable economic development and reducing of poverty within 2008-2015”, “The Complex Actions Plan during

2006-2010 concerning the amelioration of ecological state in Azerbaijan Republic”, “the State Program on providing the population with foodstuffs in the Republic of Azerbaijan”. As the initial researches implemented by the Economic Researches Centre¹ prove, the seasonal precipitations and floods in Gazakh-Ganja region are increasing, the duration of the continuous heats and droughts is increased, the geographical territory of the desertisation process is enlarged, the verdures are decreased, the cases of drying of trees are increased and the salinization of soils got intensive. Inter alia, the ground water was levelled up, needs in water gained momentum, the sowing time was delayed and hastened on some plants, in the wake of prices of vegetables and foodstuffs, including livestock products (meat and dairy products) got up in comparison with the past years, in July of the current year, the annual inflation of foodstuffs reached 0,5% versus July of the last year (at the time, the corresponding index was 1,5%), the productivity exponent in the fields of cattle-breeding and plant-growing farms went down, therewith the expenses of the processing industry resting upon the agrarian production base were increased and the indices of competitive edge were reduced.

1. Short climate feature of the region

The population of Ganja-Gazakh economic region is 1,1 million. The economic region includes Gazakh, Tovuz, Agstafa, Gadabay, Goranboy, Ganja, Shamkir, Naftalan, Dashkasan and Samukh cities. Amongst them, Ganja and Naftalan are cities subordinated to the republic. The district is divided into 4 zones: 1) the Gandja-Gazakh disposed plain (irrigated soil). 2) the submontane zone (seed-growing, cattle-breeding (low humidity level)). 3) Middle mountainous zone (dray-farming land). 4) Highland zone (higher than 200 meters) (summer pasture in mountains). Wine-making is developed in Dashkasan, Shamkir and Tovuz districts. In this economic district, the summer pasture in mountains is in Gadabay and Dashkasan districts and winter hut in Jeyranchol.

The Ganja-Gazakh district is famous by the cotton-growing, grain-growing, wine-making, dry subtropics fruits. Mingachevir and Shamkir water basins play great part in irrigation of this district. The Ganja-Gazakh economic district is located in the western region of the republic, near to the Small Caucasus. Jeyranchol located in the centre of the Kur subsidence is also included to this economic district. This district has favourable economic position. The economic transport relations of Azerbaijan with Georgia and Turkey are implemented through this district. The Ganja-Gazakh district is one of districts with high density of population. The average density of population is 100-120 persons per 1 m². There are sufficient labour means. The Ganja-Gazakh economic district is one of the main agricultural districts. The share of this economic district in production of gross agricultural products is 13-14%. The plant growing is developing more than the cattle-breeding in the regions of this economic district. 27-28% of wine products produced in the republic falls into the share of this economic district. The share of this economic district in potato production in Azerbaijan is 80-85%. Potato is growing mainly in mountainous and submontane districts, i.e. in Gadabay, Dashkasan, Shamkir and Tovuz. This region produces 14-15% of the animal products of the republic.

¹ The project of Economic Research Centre “Management of social-economic threats and risks, arisen as a result of climate changes” within the framework of Small Grants Program of Civic Activity on Security and Environment supported by “Statoil” and Austrian Government and executed by OSCE Baku Office.

2. Current state of agrarian sector

As per the information published by the State Statistical Committee, within 9 months of 2010 the gross national product was increased in the non-petrol sector in 5,2% and 2,7% in the petroleum sector. The increment of growth in agrarian field including to the non-petroleum sector is behind the general rate of growth. It is related to the natural calamities taken place in Azerbaijan. Because of natural calamities, the agricultural products were exposed to harm approximately 5-15%, with the result that the rate of growth of agrarian sector was delayed.

Mr. Samir Sharifov, the minister of finance indicated that during 9 months of 2010, due to heavy rains fallen in Shaki city, Astara, Masalli, Yardimli, Lerik and Dashkasan districts accompanied by the high wind, 10,1 million manat was allocated from the Reserve Fund of the state budget aiming at preventing the damages caused to the houses, social and infrastructure objects: “the agricultural goods and foodstuff was considerably damaged in many countries of the region due to the climate changes and various natural calamities within 2010. Correspondingly, some countries were forced to impose blockade on the grain exportation with the result that there was observed a growth in prices for grain and many foodstuffs”.

The following schedule reflects in detail the course of harvest of the plant-growing products within the mentioned period.

As it is seen from the information contained in the schedule, excluding the production of some crop products, namely water-melon and green tea leaves, the production indices on other agricultural goods in line with the results of 9 months of 2010 were decreased in comparison with the same period of 2009. As the observations and researches prove, the negative influences originating from the global climate changes have played considerable part in occurring of these tendencies. Thus, the hot environment dominated within the last time has broken the normal working regime of farmers and peasants engaging in husbandry and cattle-raising. So, the fact of weather temperature was over 40⁰C in the sowing areas, especially in the villages located near to Kur and in Jeyranchol didn't enable the workers to carry out the necessary agronomic works as the fight against the pests and the irrigation works timely and in duly manner. The sultry weather condition delaying the gathering, packaging and harvest of the ripe fruits – potato, tomato, cucumber, picking of potato, wine and other fruits caused them to go bad. The working regime of peasants and farmers was changed in comparison with the previous years, i.e. it is reduced to 5 hours in a day from 12-14 hours (4 hours in morning and 4 hours in evening). The reducing of the working time, delaying the fulfilment of many important works and arrangements, besides causing harm to the plants and goods under growing, prolonged the gathering time of the mellow fruits and the quality loss of these goods in the fields.

Irrelevance and indisposition of the available agricultural equipment, successive maintenance and capital repair of machines under the summer heat, occurrence of intervals through heating up of engines and other factors delaying the works to be carried out urgently exerted negative impact on the labour productivity.

The majority of the harvesting machines in the region are produced in Russia (with the mark of “Niva”). As their productivity coefficient is lower and they lack the refrigerating plants in cabins according to the weather conditions caused corresponding problems is use the equipment under the hot environment. While grain harvesting, the weather temperature is over 40⁰C, i.e. the

unbearable heats changed the working schedule of combine operators, prolonged the duration of harvesting and caused the product loss. Due to the same reasons, the grain reaping in several villages of Shamkir, Tovuz and Gazakh districts was not conducted timely, as we observed very serious loss of products in the mentioned areas, the fields were not harvested, with the result that these areas were given to the disposal of animals. The hot environment (over 40 °C) as a result of the global climate change increased the cases of sunstrokes amongst the peasants working in the fields.

The information concerning the production of animal products in comparison with the last year is given below:

So, in terms of value, as of October 01, 2010, the crop production was 9,2% lower than the level of the last year, the animal products 6,2 % higher, with the result that the gross agricultural products was reduced to 3,4%.

**Diagram 1. The growth dynamics of the agriculture
(Comparison with the same period of the last year in percentage terms during
the first 9 months of 2010)**

3. Resume of regulatory framework of Azerbaijan Republic concerning the climate change

The regulatory framework of conservancy of nature and climate changes in Azerbaijan Republic encompasses mainly the legal documents drawn up in connection with joining the Republic of Azerbaijan to the international treaties and conventions. This legal framework being first of all of the response follows from the necessity to conform to the international environment, but not the natural initiate caused as a result of problems faced by the country.

The Republic of Azerbaijan has ratified up to present 15 international conventions in the field of the environmental safety.

In 1995, the United Nations Framework Convention on the Climate Change has been ratified. As the analysis of the content of the state's legal-normative documents conducted in the course of researches conducted within the framework of the goals of the project proves that despite the Republic of Azerbaijan has ratified the United Nations Framework Convention on Climate change in 1995, there was not adopted any law in this connection. The activity in this direction is implementing within the framework of the separate national programs. These programs are encompassing the documents such as, "state program on using the energy sources as alternative and renewal energy resources" and "the national program of restoration and extension of forests".

In 1997, in order to provide the fulfilment of the obligations proceeding from the Convention based on the decree issued by the President of Azerbaijan Republic, there was established the State Commission on climate change and in 2005, there was appointed the national coordinator of the Convention (the Ministry of Ecology and Natural resources) and there was established working group encompassing the experts of the related organizations.

In connection with execution of obligations and duties processing from the Convention, there was established the Global Ecology Fund (GEF) and "the First National Information of Azerbaijan Republic" supported by the United Nations Development Program; all these documents were submitted to the Secretariat of the Convention.

The Convention linked Kyoto Protocol has been ratified in the Republic of Azerbaijan in 2010. The Republic of Azerbaijan didn't undertake any concrete quantitative obligations on the Kyoto Protocol and only participates in the Clean Development Mechanism of the mentioned Protocol. The Republic of Azerbaijan has ratified the Vienna Convention for the Protection of Ozone Layer and other corresponding documents linked to this protocol in 1996.

In this framework, the quantity of ozone depleting substances (ODS) used within a year in the country was specified and there was executed the Ozone Strategy in the Republic of Azerbaijan implying the reducing the use of these substances by stages. In line with the Strategy, by the financial support provided by the Global Ecological Fund in Azerbaijan there were carried out reconstruction works in the enterprises using the ODS (Baku "Chinar Refrigerators" and Sumgait Compressors Plant) and there was decided to sue alternative not ozone depleting substances in these enterprises.

The Republic of Azerbaijan has ratified the Convention on Long-Range Transboundary Air Pollution (CLRTAP) in 2002. The other international conventions joined and ratified by Azerbaijan Republic includes the "Convention on the Transboundary Effects of Industrial Accidents" (2004), "the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and Their Disposal" (2001), "the United Nations Convention to Combat Desertification in Those Countries Experiencing serious Drought and/or Desertification, Particularly in Africa" (1998), the Stockholm Convention on Persistent Organic Pollution (2003), the United Nations Convention on the Protection and Use of Transboundary Watercourses and International Lakes (2000), the Protocol on Water and Health of this Convention (ratified on October 22, 2002 and came into force in 2005), "the International Convention for the Prevention of Pollution from Ships (MARPOL)" (in 2004 together with 5 APPENDIXES), the International Convention on the Biological Diversity (2000), The UNESCO International Convention "on Wetlands of International Importance, especially as Waterfowl Habitats" (the Ramsar Convention) and the protocol on amendments made to it (2000), the Convention On International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention, 1998), the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (1998), the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1999) and the Espoo Convention on Environmental Impact Assessment in a Transboundary Context (1999).

Despite the legislative acts of the Republic encompasses the VARIOUS direction concerning the conservancy of nature, the influence exerted by the climate change on the economy, especially on the agriculture, the legislative documents aiming at study and preventing these impacts are not comprehensive and in a level enabling to create some platform.

4. Global climate change Impact on agrarian sector

4.1. Impacts of hail and heavy rains on the agriculture

Recently, we observe the sharp change in the weather condition in Ganja-Gazakh region due to the global climate change. The sharp change of the weather condition is accompanied by getting warmer, falling of pelting and uninterrupted rains and falling of ice bits and hails. In Ganja-Gazakh region, it was hailing within 5-10 days in previous years. But, the length of hail fallen presently in connection with the global climate change is 5-6 cm, i.e. within the scope of the chicken egg. The greater volume of the ice bits caused serious damages to the houses,

economies, plants in the fields and animals in the region. The hail fallen in Goygol, Dashkasan and Gadabay districts, destroying and breaking the roofs of many dwelling houses and windows and destroyed completely the sprouts of potato and vegetables. The fallen hail exerted serious impact on the common pastures and the grasses in the hayfields. It broke the young branches of the fruits and berry trees, caused serious damages to the fruit growing. The hail, destroying the sprouts of the annual plants put forth from the soil and prolonging the vegetation development, reduced the productivity indices. The hail fallen in Sabirkand and Duyerli villages of Shamkir district and in Ashagi Ayibli village of Tovuz district, destroying the organs of the early potato plants on the surface of soil prevented the next phase of development of these plants. The sharp change of the weather conditions in the region, reducing the air temperature to 12-15 °C, the humidity reaching 70-80% created favourable conditions for spreading of pests and diseases being serious danger for the agricultural plants in the region. Thus, namely the weather condition in Ganja-Gazakh region enabled the spreading of the fungous diseases - the late blight in early potato and yellow rust diseases in the grain fields. The yellow rust disease disseminated approximately in 30 % of grain fields, reducing the productivity of wheat and barley in 25% decreased the quality of grain sharply and in many cases spoiled it at all. This case of sharply decreasing of the productivity and quality for peasants engaging in husbandry exposed them to many losses and made problems of shortcoming in livestock, sheep and chicken in their farms. The peasants hoping for amelioration of their social condition by gaining profits through engaging in husbandry being helpless before the changed climate conditions faced with many problems in taking the required steps, as a result of which they were exposed to the material loss. As the Jeyranchol plain is of dry climate here there is a warm and dry wind. The number of windy days within a year reaches 30. The dry climate is very harmful for the agriculture. In these cases, the air temperature reaches 40 °C and leads the reducing of humidity in 10% that causes fire. We need in irrigation to fight against the hot and dry winds.

The global climate change has caused recently the downpour rains in Ganja-Gazakh region. The intensive rains has augmented the water level in the mountainous rivers and because of global heating, the dissolution of ice and snow on the summits of Kapaz and Goshgar mountains, caused the abundance of water that washed and spoiled the plants and the upper surface of soil, as well as the humus layer and exerted negative impact on the soil fertility.

4.2. Global climate change impact on soil resources

Some part of the soils pertaining to Ganja-Gazakh economic district is located in Jeyranchol submontane region. The land lots belonging to Jeyranchol winter huts were exposed to very serious erosion and some part of which was spoiled completely. As these areas were remained neglected within a long term, the soil structure was modified and run the deterioration. The inhabitants are engaging mainly in livestock breeding in Jeyranchol. There are tens flocks of sheep and thousands livestock hibernate in Jeyranchol winter hub. The farmers and herdsmen increase the number of livestock and sheep on annually basis. But there are not undertaken any arrangements, to raise the productivity in the pasture areas. The green cover of these soil fields with the weak humus layer is not strong. There were not carried out any feeding works in these soils. The farmers and entrepreneurs consider that animal manure excreted by livestock while grazing in the field (organic substances) to be sufficient as organic fertilizers. Therefore, they didn't provide the pasture fields with mineral and organic substances that lead the exhausting of the feeding components in the soil.

4.3. Global change Impact on degradation, erosion and desertisation of soils

The observations conducted in the region and surveys held amongst the farmers enable us to deduce an inference that the global climate change aggravates the degradation of soils, erosion and desertisation process.

Seeding of grain in the majority part of available lands (60%) aiming at development of grain-growing made impossible the application of the per-shift sowing. Some farmers and peasants in Gazakh-Ganja region set afire the straw each year after the harvest in the grain fields. The hot environment causes drying of plants in the fields and dissemination of fire from the straw fields towards the other areas. Even, in many other cases, the wildfires caused serious damages to the forestry.

The burning of fields on annual basis caused the mineral and organic substances being important for plants in the humus layer of soil to be exhausted. Burning of fields causes the reducing or killing of bacterium necessary for soil and plants. The soil's humus layer and bacterium provide the fertility of lands being very important for the plants' normal development. As the carried out surveys prove, non fertilization of soil, and on the other hand, burning of the plants residues caused the weakening of lands, changing of their structure and reducing of the stickiness. Namely for this reason, the productivity of plants available in the mentioned fields is reducing year by year.

And the activity of some "businessmen" increasing the number of sheep and livestock in some pasture fields aiming at receiving more revenues caused the eating of plants completely by animals and destroying of the grass cover of soil. This type of economic activity and fervent weather, water deficient during the season, absent of rainfall drained the verdant cover preserving the lands fertility and in some fields the plants were burnt and destroyed. The soils particles on the upper surface of the fields deprived from the grass coat being spent in vain via the hard gales. As this process was not prevented, the soil degradation became more dangerous.

The lands being owned to the state in the region are used as a rule as pastures. These lands are exposed to exploitation as they were ownerless. You can imagine that the entrepreneurs using the pastures are from abroad and they think that they will take profit using the green coat of lands. It was revealed as a result of the carried out observations, these "ownerless" land lots are bearing loads exceeding the norm. In Goy-Gol district, pasturing of 40 heads of animal per hectare cattle area caused the reducing of productivity in production of meat, milk and wool. Besides, the large number of sheep and goats lead to destroying the plant coat of soil under the mentioned pasture areas. These cases were taken place mainly in the summer pastures and the summer pasture of Jeyranchol. As the conducted surveys have proved, the untargeted use of these pastures and haylands caused the soils to be exposed to degradation and erosion. So, preserving the fertility of soil, the green grass coat being bitten by the animals and dried because of hot climate was destructed completely. And it caused the degradation of the mentioned soil areas.

5. Global climate change impact on plant-growing economy

Despite in many villages of Ganja-Gazakh region there was possible to harvest two times in a year, now it is impossible to cope with this mission. As the plants' needs towards the environment

were not met in the development phase, the plants' vegetative organs develop weakly that cause the serious decrease of the productivity. The plants needs in providing with heat, light and nutrient substances are of vital important. The plants' productivity are depending more on these factors. In the various stages of the development, the plant's needs in the environmental conditions are various. In the phase of swelling of a seed, its need in a sufficient humidity and in the phase of sprouting in heat and in the stage of development – in light is growing. But it doesn't mean that the growing needs are endless. The excess quantity of humidity and light causes problem for the normal development of a plant. It is to be noted that the plant regulates the stability of these factors. The seed needs in sufficient heat for development. The vital processes are depending on the temperature. So, the process of photosynthesis, exhaustion of water and nutritious substances, transpiration of water, the flow of nutritious substances from the root towards leaves, seeds and fruits and the movement of the required components from leaves to the root – all these processes are occurred under the circumstances of availability of water and heat. For example, the seeds of the cool-fast plants are developing in 2 - 5 °C. The most optimal temperature for their normal development is between 15-20 °C. Bu the excess warmth (over 25 °C) delays the normal development of seeds and in a temperature more than 30-32, the development is ceased. The cool-fast plants include cabbage, fennel, spinach, onion, pea, bean and other. The development of other heat-liking plants requires the temperature around 15-20 °C; if the temperature is 8-10 °C, their development will be prevented. And the on-land part of the plant is destroyed in the temperature of 0 °C. The seeds of the plants as cucumber, tomato, pepper and egg-plants start to develop in the temperature of 12-15 °C. The optimal temperature required for development of these plants is 20-28 °C, but lower temperature (lower than 15, more than 30) causes the process of development to cease completely.

5.1. Global climate change impact on wine-growing economy

In Ganja-Gazakh region there are growing mainly ordinary and wine kinds. Recently, the vie-growing is developed in Samukh, Shamkir, Tovuz and Gazakh districts. The normal growth and development of the grape are depending on the exterior environment factors, such as the temperature, humidity, light, the nutritious substances and other similar factors. The grapevine is a heat and light liking plant. If the atmospheric temperature is over +10 °C, the leaf-buds start to develop. The growth and development of the berries require higher (25-30) temperature. In the case of extreme higher air temperature, for example, if it reaches 42 °C, the process of growth of cells in the grapevine is ceased and the plant is deprived of the development. The air temperature that the current year reached 40-42 °C or more has exerted severe impact the productivity and the quality of berries. The sugar amount in the berries is expected to be reduced 5-8%. The reducing of the sugar quantity in the wine kinds will impact on the product's net profit margin. The decreasing of the grape's fertility and quality will increase the needs of vine processing enterprises in raw-materials.

The grapevine is more frost-hardy in the period of winter. But, when the shoots are developed in spring, the frost (3-4 °C) may damage the plant. The sprouts of grapevines in the fields provided insufficiently with the sunbeams are growing up weakly, the sprouts became thin, the productivity decreased and the amount of sugar in berries is reduced. As the grapevine is humidity loving plant, its growth and development are depending on humidity of soil and water. In the soils with humidity level of 70-80%, the buds are developed fast, the berries in bunches became large and the productivity is increased. The growth of sprouts is weakened because of drought and leaves became yellow. The plant's need in water became grater during the period when the berry is formed. Taking

into account the growth of the need in sweet water in the region and occurring of problems in meeting of the growing needs, the farmers may be recommended to avoid the “traditional manner” and to use new methods enabling both saving the existing water resources and stimulating the growth of the plant’s productivity. Thus, irrigation of plants based on the traditional rules (i.e. furrow irrigation) causes the growth of the level of ground waters besides the loss of water. And this prevents the normal development increasing the amount of humidity in the roots of plants grown in the arable lands located in the pits. The effectiveness of the irrigating method used and applied by the countries as Ukraine, Russia, Uzbekistan and Moldova besides the leading countries in growing of vine plants is proved a long ago. The subsurface irrigation applied in Uzbekistan has increased the productivity of the raisins considerably, i.e. 4,1 tons per hectare. The irrigation water is spared 34% and the number of irrigation is reduced from 5 to 2.

Despite the vine is grown in any soil environment, but it develops weakly in the soils with excess acidity and salinity. The plant receives from the soil the mineral substances, such as nitrogen, phosphorus, potassium and so on. Each of these mineral substances is of great importance for the plant. If the plant lacks nitrogen, the growth of the sprout and leaves became weakly and the productivity is reduced. And the phosphorus precipitates the growth of fruits (berries). If the potassium, iron and other elements lack it causes instability of the atmospheric condition and various diseases. The most dangerous diseases for vine are the mildew (a thin whitish coating consisting of minute fungal hyphae, growing on plants or damp organic material such as paper or leather) and oidium (a fungal disease affecting vines, caused by a powdery mildew). The disease is originated from the fungal spores. The disease inflicts damage to the leaves, sprouts, flowers and berries of the plant. The forming of a mould-like cover under leaves proves that the plant is caught by mildew and if it is covered with floury layer it will be an indication of odium disease. The intensive development of mildew disease in plants starts from the blowing period. The rainy and breezy weather namely in this period causes the spreading of the disease quickly. And the odium disease is occurred in the region where the summer is heat and dry; it spreads out very quickly and inflicts severely to the productivity. The carried out surveys and observations prove that the existing weather condition during this year caused acceleration of the both diseases in grapes. The intensive and long-standing raining prevented to fight against the mildew. And failure to fight against the mildew causes the spreading of fungus from plants to leaves, buds and bunches.

To fight against mildew and odium disease we have recourse to Michal (, 70%), ridhomil MS-72, Topsin M-50 and other fungicidal agents. The farmers catch an excuse that these preparations are very expensive and don’t have recourse to them that caused the spreading out of these disease in Ganja-Gazakh region.

5.2. Impact of global climate change on the potato culture

There is a fertile climate condition in Gadabay and Tovuz districts to develop the potato culture. Alike the previous years, recently, especially this year, changing of the climate conditions forced the farmers engaging in producing agricultural goods and peasants to select the very strained working regime and to perform the sowing and seeding works within the framework of very serious schedule. If the term of sowing, which is very important for development of a plant, is delayed because of instability of weather condition, there will be arisen problems in the development of grown plant. The productivity indices are decreasing. Therefore the farmer has to be ready to perform the works simultaneously.

The absent of the potato seed in the region with the higher reproduction, oblige the farmers to use the seeds, which are cheaper and unknown origin. The plants originated from these seeds display lack of self-control in the local weather conditions. If the weather conditions are changed and the humidity reaches 70-80%, it suffers from the potato blight. Besides, the productivity of plants originated from the seeds with unknown origin (8-10 tons per hectare) doesn't enable the cost effectiveness of this area.

6. Global climate change impact on cattle-breeding economy

The surveys held in this region prove that the extreme hot weather in Jeyranchol and Kureteyi districts caused serious problems for the development of the livestock economy. There were occurred some difficulties in pasturing, watering and growing of sheep and lambs for the certain reasons. So, the absent of shady places in these regions caused the problems that these animals were remained under broiling sun within a long term. There are observed the cases of miscarriages in the large-horned animals. As the air temperature was over 42-43 0C, the slime secretion in animals became intensive, the mucus excreted by the diseased animals in the pastures infects the healthy animals that causes the intensification of diseases of animals. The series of factors, such as the cattle is not able to be on pasture in this hot weather condition and unavailability of raping techniques cause lots of problems for peasants, as a result of which the fodder ration is decreased that exerts negative influence on their physical conditions and decreases the productivity seriously and increasing the prime cost. The strained situation arisen in connection with the air condition obliges the peasants to work under broiling sun and to resolve their problems that are accompanied with sunstrokes amongst labourers.

The hot weather in the region caused the serious decreasing of the productivity. The milk production in the healthy cows was decreased 20-25%. Besides, there are arisen serious changes in the physical conditions of cows - weakening and growing thin. The extreme summer heat caused by the global climate change, doubling the works to be performed in this field increased the additional costs. So, if in ordinary manner, the cows had to be bathed once in a month, the hot summer has increased the number of these actions in 3-4 times. Besides, as the extreme hot weather was a favourable condition for spreading of some animal diseases, it necessitated the conducting of disinfecting actions on regularly basis in the farms and stalls. As the large-horned animals are on pasture only within the night, the additional herdsmen are involved to perform this mission. The additional expenses spent to perform all these works caused the product's prime cost to be increased in 8-10 %. The decrease of the productivity in 20-25% and increase of the product's cost-prime in 8-10% caused very serious harm to the farmers' business. As the farmers intending to indemnify the caused losses look for the way out only in the raise of prices for the product they decided to raise the prices of milk in 15-20%.

Recently, the number of shed and large-horned cattle grazed in the pasture areas exceeded the norm in 4 times and reached the critical limit. The food shortage decreases the productivity of livestock, causes serious problems in the physical state of cows and calf, which is accompanied with diseases such as tuberculosis, brucellosis and other severe diseases.

The conducted surveys prove the availability of serious problems in the meat production of the region. So, the extreme hot weather condition has caused serious problems for farmers. We have observed serious growth in weight of calf in the aft-stock, as the preserving conditions were not conforming to the current weather conditions, the revenue received from the weight growth of the animals being in the fat-stock in the hot stables was enough to indemnify the spent expenses. The farmer spending 3,15

manat for each 1 kg weight could sell the product produced by him for 3,15 manat, i.e. for the same price.

Conclusion

As suggested in the researches conducted on Ganja-Gazakh region, there were arisen serious hindrances and embarrassments in fulfilment of the works conducted in agrarian sector, observing the agronomic rules by the impact of the climate change in the region taken place within 2010. As shown in observation conducted in the economy of the firm "Amin" managed by the farmer Nariman Alakbarov, specialized in fruit and vegetables viticulturist agronomist in Garayeri village of Samukh district, the cultivation works in the field of 12 ha have been conducted timely, as a result of which there were grown healthy grapevines owing to the works carried out within a long term. Despite he was able to protect the vineyard against the heavy rain while the cultivation taken place because of global climate change, he couldn't rescue the vine product from the impact of the heavy rains fallen within 5 days in September. So, the main part of grapes became curious and the economy was underwent the losses in the amount of 70 thousand manat.

The same case was observed in Duyarli village of Shamkir district. So, after the rains fallen in July, the vineyard of Ahmadov Ramiz was exposed to mildew disease, whereby the farmer underwent the losses amounting to 9 thousand 500 manat.

The main reason of the decrease of productivity in the economy of the farmer Rasim Nabiyev engaging in production of grain and fruits in Khoylu village of Goranboy district, specialized in agronomist was namely the severe impact of the climate change. So, the farmer stated that this year he has received 8 metric centner grains per 1 ha and it was related to the climate change.

The peasants working in cattle-breeding field are faced with many problems related to the global climate change. So, there was revealed the problems in the provision of the cattle with the succulent fodder in the farm managed by Firudin Hasanaov in Gushchu village of Dashkasan district.

The climate change has caused serious problems in the potato production too. While conversation with a group of peasants in Gushchu village of Dashkasan district there was revealed that firstly the heavy rains fallen in the region within spring season have perished the sprouts of the potato and then the heavy and intensive rains and the damp climate created favourable environment for fungous disease of sprouts grown weakly after rains. If the preventive measures are not applied timely, later the performed works will have no effect, quite contrary the amount of losses was increased more.

The peasants in Sabirkend village of Shamkir district could profit by the arisen situation. So, the farmers and peasants, determining correctly, the optimal cultivating period for potato and cabbage in the conditions of climate change reached the higher productivity. The plant grown of the potato seed planted in the soil in mid-August, 2010 was not exposed to the drought and disease, being developed in healthy environment was productive. The peasants received high quality potato exceeding 30 tons from 1 ha soil cultivated by them. These indices were higher than those reached within the last year. The farmer Zaman Imanov being aware of the fact that the cabbage is very exigent to the weather conditions, water and food components received 35 tons of cabbage from 0,5 ha field. As the market needs in cabbage and potato, the farmers profiting by the higher prices in the market received good revenue.

The carried out observations prove that the negative impact of the climate change in majority of cases were taken place namely because of the fact that farmers were not ready to meet these changes, therefore they underwent the large losses. Despite the farmers organized heir works in accordance with the climate existing within the previous years, this year the climate conditions were sharply changes, long standing heavy rains and the extreme hot weather conditions were taken place.

As the researches made by the World Bank, if the weather temperature under the global climate changes reaches 2 C in 2010 and 2050, the amount to be required for the tailoring measures may be changed between 75-100 billion USD within a year and 10,5 billion of these funds will fall to the lot of our region (Europe and Central Asia). According to the estimations made by Economic Research centre, the adaptation expenses required for climate changes in Azerbaijan may be 68-8-0 million manat.

RECOMMENDATION PACKET
Of the Economic Research Centre concerning the simplification of the
Adaptation process to the global climate change of the agrarian economies in Ganja-
Gazakh region¹

The conducted researches afford ground for the fact that in most cases, the farmers and peasants working in the agrarian sector are met with various difficulties to find the way out under the global climate change. So, long-standing and heavy rains, extreme hot weather conditions sets many problems in before the agrarian sector, which are of great importance for this field and necessitate to make reasonable steps in direction of application of the preventive measures. The below specified recommendations are addressed to the farmers, managers and accountants carrying out their activity in the agrarian sector, the customers, the purchasers, as well as the heads of the processing enterprises linked to this sector by their activity, finally the related organizations being responsible for the activity of the agrarian sector in order to survive the extreme condition with fewer losses or quite contrary to leave behind it with some benefit to be arisen in the conditions of global climate change.

1. In the macroeconomic level:

- 1.1. To revise the qualification level in the agrarian sector on the economic districts and the policy of arrangement of productive forces, regulating and stimulating of resources have to be implemented appropriately;
- 1.2. The state program on the adaptation of the agrarian sector to the climate change has to be worked out and the adaptation expenses and measures for the near, middle and long terms have to be planned in line with this program;
- 1.3. To indemnify the losses caused by the climate changes, there has to be inserted the paragraph “compensation of losses caused by climate changes” inside the auxiliary section “other measures related to the agriculture” in the composition of the expenses for “safeguarding of agriculture, forests, fishery, hunting and environment” of the state budget of Azerbaijan Republic and there will be allocated funds from the state budget on this paragraph for the next years.

2. Hydrometeorological measures:

- 2.1. Neutralizing the expected negative effects of the climate change to the households and houses, by increasing the measures against the hail in the mountainous areas.
- 2.2. Following the weather forecast in short, medium and long terms, and providing regular information in this field.

3. Economic measures:

- 3.1. Obtaining insurance activities of the seasonal works in agriculture in order to minimize damages which might occur;
- 3.2. Realizing insurance payments and forming reserve funds in order to pay future costs;

¹ The recommendations were worked out within the project of Economic Research Centre (ERC) “Management of social-economic threats and risks, arisen due to the climate changes” within the framework of Small Grants Program of Civic Activity on Security and Environment supported by “Statoil” and Austrian Government and executed by OSCE Baku Office.

- 3.3. Auditing the loss occurring from different reasons and proposing to the related government agencies in time to pay the loss.

4. Using water resources efficiently:

- 4.1. Protecting the existing water resources , regulating the usage of the irrigation system in order to use water resources efficiently, substituting old irrigation systems with new ones, such as drip irrigation, and stimulating investments on this purpose;
- 4.2. Educating households about the drip irrigation system and its benefits;
- 4.3. Creating regulatory norms for minimizing water dissipation.

5. Using soil resources efficiently:

- 5.1. Since little farmers get the most damage during climate change, helping them to come together and unite their lands, organizing educative events for them;
- 5.2. Nourishing the soil on time according to the plants cultivated;
- 5.3. Providing the agricultures households with fertilizers in order to be able to improve the soil.

6. Technical measures:

- 6.1. Giving preference to the technology which provides the cabs with cool and warm seats in summer and winter, considering incessant work of the combine harvesters, mowers, tractors and other agricultural equipment brought to the country by “Agrolizing” SC

7. Protecting the plants:

- 7.1. Educating the farmers about which plants to cultivate and when to do it, according to their characteristics;
- 7.2. Since the changing climate has caused many problems in the struggle with the pests, to take prompt actions beforehand.

8. Protecting animals:

- 8.1. Creating strong food reserve for the animals during the short term favourable weathers, considering the very hot weather and heavy rain during the climate change.
- 8.2. Getting ready to take the animals to the pasture in the evenings, because of the heat during the day, and solving technical problems in regard of this.
- 8.3. Considering how pastures may get overwhelmed, increasing the productivity of the animals, rather than increasing the number.

9. Propagandizing of ecological pure agriculture (PEPA). Taking into account that PEPA is a novelty for Azerbaijan, first of all, we have to start from the propaganda of this activity and testing of the envisaged production means in the pilot economies. The PEPA (the organic farming) is a farming form that is developed by protecting of soil, water and environment. PEPA is an activity based on the healthy product production and biodiversity. The soil becomes fertile with the local resources without any chemical compounds due to the application of PEPA. PEPA protects the soil against erosion and degradation, raises the fertility, safeguards the water and natural units and reduces the emission of hothouse gases.

10. Social/economic forestry (SEF) being an integrative approach implies the use of the interactive profits of the tree planting combined with the husbandry and cattle-breeding. This method combines the agricultural and forestry technologies to establish more various, productive, healthy and sustainable soil working systems. The availability of salty soils in the central region of Azerbaijan, especially in Kur-Araz lowland is a considerable problem of these days. The higher quantity of saltiness of soil became more worsen because of the global climate change. To prevent these problems, the farmers intending to return back the non productive soils for use planting salt-proof trees may be supported. As the experience proves, planting salt-durable trees in the salty soils, the farmers may receive considerable revenues. In this case, they, gaining the construction and wood materials may restore the fertility of the salty soils and the windy erosion will be reduced.