NATIONAL CLIMATE VULNERABILITY ASSESSMENT: BELARUS
Climate Forum East (CFE), 2014

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INTRODUCTION

Climate change seriously affects many spheres of human activity in various fields ranging from agriculture to energy. Besides climate change is a serious risk factor for human health caused by such unfavourable weather as heat waves, heavy rains, floods, hurricanes, etc.

According to the instrumental monitoring the average annual temperature is observed to be higher than the norm by 1.1°C for the last 20 years in Belarus. Along with the temperature increase, precipitation has changed slightly for the last 20 years in Belarus. In addition to the mentioned period precipitation irregularity has increased both within the year and during individual years. Precipitation reduction and irregularity in Belarus, especially in combination with high temperature scenario, lead to aridity, which has become more frequent for the last 20 years.

According to meteorologists’ observations, the cases of dangerous hydrometeorological phenomena have also become more frequent because of climate change in the territory of the Republic of Belarus. According to the World Bank experts’ assessment (2005), the annual damage from severe weather in the Republic of Belarus is about 90 million USD.

There are expectations for further increase in average annual temperature by 1.0-2.9°C, according to estimates for the next sixty years in the territory of the Republic of Belarus. However, the average annual increase in precipitation will be negligible and will account for the winter months, when its role, as a source of moisture for vegetation, is not that great.

All these climatic features of a changing climate will certainly have a significant impact on the living conditions of citizens and economic activities in the country. With more frequent severe weather events (floods, storms and squalls and other phenomena), as well as increase in adverse sudden weather changes lead to a huge socio-economic losses which directly affect the effectiveness of such vital sectors as agriculture, forestry, energy (primarily hydropower), water use and water consumption, transportation, construction, housing and utilities and human health.
This report is based on a review of materials of researches being carried out in Belarus in the area of climate change and adaptation to climate change. Official data from Hydrometeorological Centre, National Statistics Committee, Ministry of Forestry, Ministry of Agriculture and Food, Ministry of Health have been used during preparation of this report. In addition, materials from foreign literature have also been used to prepare this report.

Besides, the legislation on climate change issue in Belarus, the measures needed to adapt to climate change, as well as the current level of awareness of climate change issues among the representatives of civil society in Belarus were also analysed to prepare recommendations.

This research is not a scientific report and provides an analysis of the available literature on the impact of climate change on the most vulnerable sectors and health of the population in Belarus, as well as adaptation measures.

On August 27, 2013 within the frames of the project “Climate Forum East”, the meeting with interested non-governmental organisations was held to determine an approach for detecting the most vulnerable areas to climate change. The current situation, as well as to make projections of climate change in Belarus, was discussed at that meeting. Besides, the questions of climate change effects on social and economic systems in the country were also discussed.

The aim of the meeting was to discuss the most vulnerable areas to climate change with interested non-governmental organisations.

During the meeting it was agreed that the most vulnerable regions to climate change in Belarus are agriculture and forestry. This approach for assessment of general country vulnerability to climate change has been developed based on the World Bank assessment of industries dependence on weather conditions. This dependence was determined based on the share of these industries in GDP. A list of weather-dependent industries includes agriculture and forestry (10.4 % of GDP), fuel and energy complex (6.5 %), construction (7.5 %), transport and communications (11.3 %), housing (2.9 %) and utilities (2.9 % of GDP). Furthermore, agriculture and forestry are the most vulnerable sectors in terms of damage caused due to unfavourable weather events.

Agriculture in Belarus is mostly affected by possible climate change. Thus, the most dangerous situation might occur, if there is an increase of poor crops as a result of frequent droughts in numerous territories, growth phase shift and lack of moisture content in spring, deterioration of crops as a result of harmful invasive species, crop loss due to more frequent unfavourable hydrometeorological events.

Forestry is also considered as one of the most vulnerable sectors of the economy, as one can notice a shift of some forest species, the growth of forest diseases and fires in the territory of the Republic of Belarus, as well as losses as a result of timber stock of unfavourable hydrometeorological events.

The issues of climate change effects on human health were also discussed, in particular the impact of heat waves on the human organism.

Thus, it was determined that aspects of climate change effects on agriculture and forestry, as well as on public health, are of special interest for civil society within the frames of this project, as they are the most vulnerable to climate change areas.
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<th>Description</th>
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<td>ATS</td>
<td>Automatic telephone system;</td>
</tr>
<tr>
<td>NPP</td>
<td>Nuclear power plant;</td>
</tr>
<tr>
<td>BRCS</td>
<td>Belarusian Red Cross Society;</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product;</td>
</tr>
<tr>
<td>MVA</td>
<td>Motor vehicle accident;</td>
</tr>
<tr>
<td>EPL</td>
<td>Electric power lines;</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-government organisations;</td>
</tr>
<tr>
<td>NHMS</td>
<td>National Hydrometeorological Service;</td>
</tr>
<tr>
<td>IPCC</td>
<td>International Panel on Climate Change;</td>
</tr>
<tr>
<td>MRMW</td>
<td>Minsk ring motorway;</td>
</tr>
<tr>
<td>MES</td>
<td>Ministry for Emergency Situations;</td>
</tr>
<tr>
<td>OSCE</td>
<td>Organisation for Security and Cooperation in Europe;</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations;</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change;</td>
</tr>
<tr>
<td>CIS</td>
<td>Commonwealth of Independent States;</td>
</tr>
<tr>
<td>ES</td>
<td>Emergency situations;</td>
</tr>
<tr>
<td>SPARE</td>
<td>School Program for Application for Resources and Energy;</td>
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<td>UNEP</td>
<td>United Nations Environment Programme.</td>
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Climate change is quite an obvious fact, which scientists around the world don’t dispute with.

According to meteorological observations in Belarus the average annual temperature has increased by 1.1°C over the last 20 years. The amount of precipitation in the territory of Belarus has changed a little. Climate change in Belarus leads not only to increased aridity, but also to the increase of such extreme adverse events caused by natural factors such as frosts, strong wind, hurricanes and tornadoes, heavy rain, snowfall, extreme fire hazard, which are detrimental to the country’s economy and public health.

Thus, according to estimate of the World Bank experts, the annual damage from severe hydrometeorological events in the Republic of Belarus is about 90 million U.S. dollars. The most vulnerable weather-dependent sectors in Belarus are agriculture - 42% and forestry - 12% of the total damage caused by adverse weather events (Figure 9).

However, the economic damage in various sectors of the economy cannot be compared with the threats to people’s health, wealth and life which are conditioned by adverse weather events. Therefore, modern government policy plays a key role in combating climate change consequences in relation to risk reduction and adaptation to adverse weather events.

This report considers the main trends and estimates of climate change in Belarus as well as the most predictable consequences and adaptation measures for the most vulnerable sectors of the economy as agriculture, forestry and public health. The executive summary of the main consequences of climate change impacts and adaptation measures in the most vulnerable sectors are shown in Table 1 below.
Table 1: Executive summary. Social and economic consequences of climate change in the main vulnerable sectors in the Republic of Belarus

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<th>Sector</th>
<th>Economic consequences</th>
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| • Agriculture | • Decrease/increase in crop yield.  
• Reduction of farming land (erosion as a result of floods, desert advancing as a result of droughts).  
• Reduction of soil fertility as a result of floods.  
• Offset sowing.  
• Increasing uncertainty in the choice of plants species.  
• Overall growth of fires as a result of a prolonged drought.  
• Increased probability of mass pests outbreaks.  
• New parasitic diseases uncharacteristic for certain regions.  
• Lowering of groundwater levels.  
• Weakening plants hardening.  
• Worsening conditions of yield’s growth and its formation.  
• The enlargement of the crop.  
• Increase of the length of the frost-free period.  
• Possible improvement of wintering of winter crops.  
• The maturation acceleration of grain crops, grain legumes as well as harvest time.  
• Longer stubble period. | • The threat to food security.  
• Increased prices as a result of increased demand for agricultural products.  
• Deterioration of living standards.  
• Rise in unemployment levels. | • Considering the agro-climatic conditions when planning agriculture production by country regions.  
• Increase in share of warm-weather, wind-firm and short-rain crops (corn, panic, ambercane etc.).  
• Implementing anti-erosion and soil-protection activities.  
• Development of breeding of new grades and hybrids.  
• Planning and adjusting of terms for sowing and harvesting.  
• Recovery of irrigation system, as well as improvement of water management.  
• Improving of the system for insuring risks from adverse weather events.  
• Development of new measures for protection of agriculture crops from pests considering climatic changes.  
• Increased efficiency of fertilisers use.  
• Development of biological technologies.  
• Increase of awareness of specialists in farming complex on climate change problem. |
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<td>Increase in forest fire loss as a result of fires.</td>
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<td>The threat to biodiversity.</td>
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<td>Improvement of security and protection system for forest range from fires and pests.</td>
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- Increased air pollution as a result of fires.
- Higher prices for forest products (mushrooms, berries).
- Reduced productivity of forest products.
- Change the probability of spring frost harmfulness.
- Increase the probability of spring frost harmfulness.
- Worsening conditions for winter forestry operations.
- Loss of aesthetic value of disturbed landscapes.
- The threat to biodiversity.
- Optimisation of species composition considering the site.
- Increase forest fire resistance, improvement of security and protection system for forest range from fires and pests.
- Introduction of rational methods for cutting and advanced technologies of harvesting.
- Alteration of species composition considering the site.
- Thinning out vegetation areas.
- Creation of fireproof areas through formation of mixed forest species.

In addition, it's important to note:

- Expansion of forestry road network to provide efficient development of forest resources in excessively moisty territories.
- Restoration of damaged lands, unsuitable for use in agriculture, followed by forest planting.
- Introduction of quick-growing species.
- Introduction of rational methods for cutting and advanced technologies of harvesting.
- Alteration of species composition considering the site.
- Thinning out vegetation areas.
- Creation of fireproof areas through formation of mixed forest species.
- Improvement of security and protection system for forest range from fires and pests.
It is very important to note that raising awareness of the public on the consequences and dangers of climate change takes a special place in reducing the risk of climate change. Here not only the state but also public non-governmental organizations, which have quite strong potential and possess great success in working with the population, may play a significant role. Only stakeholder’s methodical and coordinated work can give positive results regarding climate change response.

<table>
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<th>Sector</th>
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</table>
| Human health    | • Population decline, including working-age population.  
• Reduction in tax revenues as a result of rising population unemployment and mortality.  
• Increased expenditures on sick leave and compensations.  
• Increase in visits for rendering medical services.                                                                                                                                                                                                                                                                                                                                                               | • Increase in the number of emergencies (floods, storms, squalls, forest fires, etc.).  
• The increased length of the hot period (heat waves);  
• Increased number of pests and pathogens;  
• Increased number of acute enteric infections;  
• Deterioration of water and food quality;  
• Increased stress load on a human body.                                                                                                                                                                                                                                                                                                                                                                            | • Implementation of advance technologies for monitoring and predicting of emergency situations.  
• Further improvement of state system for prevention and recovery of emergency situations to provide efficient protection of population from natural emergency situations.  
• Development of national system of environment monitoring;  
• Formation of ecological services market, introduction of ecological audit and insurance.  
• Improvement of regulatory basis of ecological safety, including system of payment for use of natural resources and adequate compensation of damage caused to natural environment.  
• Implementation of activities on prevention of fires and loss of lives caused thereby.  
• Introduction of technical solutions, organisational forms and methods of fire prevention and supervisory activities.  
• Media management by responsible state authorities, including popularisation of climate change problem and consequences of climatic changes.  
• Improvement of awareness level of medical professionals as to risks related to climate change.  
• Incorporation of climatic risks into educational programs of medical institutions.  
• Improvement of population literacy rate as to safety assurance and rules of conduct in emergency situations.  
• Reduce concentration of contaminants in atmospheric air and drains into water resources through tightening of current regulations and standards.  
• Revision of current construction norms and regulations. |

It is very important to note that raising awareness of the public on the consequences and dangers of climate change takes a special place in reducing the risk of climate change. Here not only the state but also public non-governmental organizations, which have quite strong potential and possess great success in working with the population, may play a significant role. Only stakeholder’s methodical and coordinated work can give positive results regarding climate change response.
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1 Climate Change in the Republic of Belarus

1.1 BRIEF CLIMATE DESCRIPTION AND METEOROLOGICAL CHARACTERISTICS

Belarus is located in the moderate climatic zones in the Northern hemisphere on a downland, practically in the centre of Europe. These conditions define the climatic characteristics in Belarus. One of the main climate forcing trends is the influence of the Atlantic Ocean. Western air masses bring cloudy and rainy weather in summer. However in winter one can notice significant warming. Influence of the ocean weakens to the east while climate continentality strengthens.

Belarus is a part of Atlantic-continental forest and forest-steppe zone. In this region the climate is characterised by the influence of air masses from the Atlantic Ocean and gradually transforms to continental climate. Climate in Belarus is transitional from marine to continental one, moderately continentlal. Based on the degree of transformation, the territory can be divided into 4 sub-regions. Belarus is situated in the south-western sub-region. This is a sub-region of mixed forest.

The temperature scenario in Belarus is characterised by positive average annual air temperature, which gradually increases in the southern and south-western direction. The average annual air temperature in the northeast of Vitebsk region represents 4.5°C, in the extreme south-west of Brest region exceeds 7°C. The average temperature of the warmest month (July) in Belarus is 17.8°C, and of the coldest month (January) – 6.7°C. The highest temperature during observations was +34 °C, the lowest temperature observed was -34 ... -42°C.

As for precipitation, Belarus belongs to area with sufficient moisture. Annual precipitation depends on the terrain and is mostly 600-650 mm in the lowlands of the republic and 650-700 mm in the plains and hills. The maximum annual precipitation marked for the entire observation period at most stations is within 850-1000 mm. Minimum annual precipitation is 350-450 mm. In the warm season (from April to October) 70% of annual precipitation fall mainly in liquid form. The total number of days with precipitation (0.1 mm and more) varies from 145 in the southeast to 195 on the western hills. The total duration of rainfall is 1000-1500 hours per year.

Wind pattern in the republic depends on the general circulation of the atmosphere. In winter there are winds of the south-western quarter, in summer - winds of the north-western quarter. Average annual wind speed in open areas is 4 m/s, in the lower forms of relief - about 3 m/s. Strong winds of up to 10-15 m/s annually might be expected in single areas, every 5 years up to 15-20 m/s.¹

In Belarus there are more than 20 extreme weather events which due to greater intensity or duration can disrupt production activities, cause significant harm to industries, lead to human victims. Such adverse weather phenomena include:

1. meteorological: high winds, squalls, tornadoes, fog, heavy hail, lightning, heavy rainfall, snowfall, blizzards, extreme fire danger, etc.
2. agro-meteorological: drought, frost, low and high temperature, etc.
3. hydrological: floods, low and high water levels, early freeze-up.


1.2 CLIMATE CHANGE: TRENDS

Air temperature

According to instrumental observations over the last 20 years, the average temperature in the territory of Belarus is above normal by 1.1°C (Figure 1). As a result of climate change in the south of the country, a new Polessye warmer agroclimatic region with a greater heat supply has appeared which is characterised by the shortest and warmest winters and longer growing season.²

According to the State Climate Cadastral Register, the warmest years for the last twenty years were 1992, 1995, 1999, 2000, 2002, 2007, 2008, 2009, 2010, and 2011. Especially it should be noted the hot summer of 2010, which took the 1st place in the ordered series of observations (from the warmest to the coldest season) since 1945.

In 2012, the average annual air temperature in Belarus generally was above normal by 1.0°C. The autumn season of 2012 was also a peculiarity. Winter, spring and summer air temperature deviations from the norm were also positive.

Summer in 2013 was warm. National average air temperature in the summer season was +18.5 °C, which is 1.7ºC above the norm. Such summer occurs about once per 10 years. That summer was noted for 22 to 55 hot days (temperature +25°C and above), while the standard is 22-48 days. The number of days with a maximum air temperature of +30°C and above in 2013 was from 1 to 11, while from 1 to 6 days with such a temperature are normally recorded.

It should be noted that the temperature increase in the last decade mainly occurs in the first four months of the year. Also summer months have become warmer (positive anomaly was in July +0.7°C, and in August +0.8°C). In 1999, 2000 and 2002 temperatures exceeded the normal average of 2°C, which is close in magnitude to the anomalies of the cold season. Despite the fact that over the last decade, positive temperature anomalies observed during all seasons, winters have become cooler.

It is also important that the temperature in the last decade, particularly in summer and autumn, was much higher than normal. Prior to 1989, the oscillation amplitude of the stable transition at 0°C was 28 days, and after that it has increased to 75 days. The latest date remained unchanged - 91 days.

In recent years, Belarus has sharply increased the number of days with extremely warm end of winter and beginning of spring. Early stable transition at 0°C also contributed to the earlier establishment of high-plastic top of soil and field work. The growing season began 1 decade earlier. Negative anomalies in May increased the risk of late spring frosts that occurred against the backdrop of actively vegetating plants. There have been cases when the temperature of the first decade of May was 3-7°C below the temperature of the third decade of April.

Precipitation
The amount of precipitation in the territory of Belarus for the last twenty years has changed slightly, however, in the mentioned period of warming the unevenness has increased within the year, and in general for individual years.

Uneven rainfall in Belarus, especially in combination with high-temperature scenario, leads to aridity that significantly reduces crop yields.

Over the last 20 years repeatability of drought events became frequent. Half of 23 years (from 1989 to 2012) in the republic there were observed drought conditions over two months or even more during the active growing season of plants. Arid events that influenced the crop, noted in 1992, 1993, 1994, 1995, 1996, 1999, 2000, 2002, 2003, 2004, 2007, 2010, 2011, 2012 years in some regions of the republic. This is twice as often as in previous years.

During the 1989-2012 years along with dry periods there were also moist periods. So in 1998 due to heavy rains, heavy snow and hail, the precipitation level was high during the year, June and July were characterised by particular moisture, when even the average amount of the precipitation within the republic was 1.5 above the norm, which caused flooding in most of the territories in Polessye, damage crops in the

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3 The review of climatic peculiarities and hydrometeorological events in the territory of the Republic of Belarus.
north of the republic, loss of crops and fodder production decline.

Heavy rainfall and associated soil moisture were recorded in the first half of the summer of 1991 and the second half of the summer of 1993, 2006 and in June-July 2009. Economic damage, which occurred in 2009 was a result of heavy rainfall in Minsk and individual territories of Belarus, showed how vulnerable the economy is today, and how the population depends on dangerous hydrometeorological phenomena.

And in 2010, due to heavy rain and heavy snow the rainfall fallen was 729 mm, which amounted to 111% of the climatic norm, and in 2011 583 mm of rainfall fell, which amounted to 89% of the climatic norm. In 2011 there was a lack of precipitation in spring and autumn.

In 2012, 757 mm of rain fell, which amounted to 115% of the climatic norm. Excessive rainfall was observed during all seasons in 2012, but in winter 2012 rainfall was the most prominent. In spring, summer and autumn the precipitation deviations from the norm were slightly reduced4.

4 The review of climatic peculiarities and hydrometeorological hazards in the territory of the Republic of Belarus.

1.3 DANGEROUS HYDROMETEOROLOGICAL PHENOMENA

Negative impact of hazardous and adverse hydrometeorological phenomena for various sectors of the economy and social sphere of life in whole leads to significant economic and social losses and requires constant detailed recordings of all similar hazardous and adverse phenomena.

Strengthening of extreme hydrometeorological events is a specific feature of climate change in Belarus over the past two decades. According to the Republican Hydrometeorological Centre, annually 10 to 30 cases of severe hydrometeorological events in Belarus are registered. This number does not increase, but due to climate change the intensity of such severe weather events amplifies.

Most noted hazards are of local nature. However, phenomena such as rainfall, strong winds, including gusts and tornadoes, heavy rainfall, heavy snow, extreme fire danger, in some years, cover a large part of the territory of Belarus.

Approximately 80% of all hazards account for the warm season (frosts, squalls, heavy rains, hail).

Analyzing the number of hazard hydrometeorological events over the past 20 years, it should be noted that during this period winds dominated, including gusts, rains, frosts and hail, as well as droughts (Figure 2).

Floods, downpours, heavy snow, fog, heat-waves, droughts, forest fires, ice and accidents annually cause significant economic damage and human losses.

According to the World Meteorological Organisation and the International Bank for Reconstruction and Development the trend toward increasing economic damage and society vulnerability due to the growing impact of natural hazards is observed. Hazardous and adverse hydrometeorological events cause the most part of the damage (more than 50 % of the total damage is caused by natural hazards).

The greatest damage of severe hydrometeorological phenomena as drought, frost, heavy rains, strong winds, hail, etc., apply to agriculture. Strong squally winds damage farm buildings, heavy rains lead to flooding of farmlands, dropping washout and bruise, and lodging. Hail, frost and drought lead to significant damage of agricultural crops.

The greatest danger is brought for forestry from meteorological phenomena such as fires, high winds and associated effects due to the spread of pests and diseases. The average annual damage from fires in Belarus is about 900 thousand USD.
Heavy snow, rains, squally winds hamper movement and work vehicles. Deterioration of weather conditions on the roads increases the number of accidents, and in some cases leads to human victims.

As a result of adverse weather phenomena there are clippings power lines; heat, water, gas and electricity may be disrupted. The above-mentioned consequences are not all examples of the impact of severe weather, influencing economic and social sectors in the Republic of Belarus.

**Insertion 1: Information about the consequences of certain hazardous meteorological events in Belarus**

The greatest damage to the economy is caused by strong winds and squalls. Annually there are observed 2-5 cases of strong wind, and in 2000 there were six cases of strong wind. As a result, agricultural buildings and roofs of the private sector houses are damaged, trees are broken and torn up by the roots, power transmission and communications lines are broken, transformer substations are damaged, settlements are left without power.

Because of the strong wind on November 18-19 in 2004 and August 9 in 2005 there were cases of human victims. It is necessary to mention the latter case. In August 2005, 6218 settlements were damaged, 7,628 km of power transmission lines and 256 ATS were broken, 6024 settlements were left without power. In Minsk there were more than 9000 cases of falling trees, power failures were observed, 122 vehicles were damaged.

July 27, 2004 heavy downpour flooded the basements of buildings, roadways streets and led to falling trees in Minsk.

Invasion of arctic air in January 2006 resulted in a long strong cooling that led to damage of heat and water systems; there were also frostbite cases with human losses.

In May 2000, August - September 2002, and from mid-September to mid-October 2005 an extreme fire danger was observed. There were cases of fires in forests and peatlands. In September 2005 582 fires were recorded, in October - 946, there were cases of fires in residential outbuildings.

In spring 2011, there was an excess of dangerously high water level in the Western Dvina in Verkhnedvinsk, the Svisloch in village Terebuty, the Vikhra in Mstislav, the Pronya in Letyagi village, the Pripyat in Pinsk, Chernichi village and Petrikov town, the Yaselda in village Senin, the Western Bug. The duration of dangerously high water levels ranged from 3 to 86 days. Maximum water level was higher than the average long-term values at 5-130 cm. In the area of hydrological observation points Vikhra-Mstislav, Pinsk - Pripyat and Yaselda- Senin – the water level was approaching the highest values for the entire period of observation, but did not exceed them. As a result of flooding in 2011 the farmland and individual buildings in coastal areas along rivers were flooded, some sections of roads and bridges, commercial facilities and private homes in several districts of Vitebsk, Minsk, Mogilev, Brest and Gomel regions were also affected. The floods consequences are presented in Figure 3.

*Source: Data are provided based on the overviews of the Republican Hydrometeorological data on climatic conditions and hydrometeorological hazards in the Republic of Belarus*
1.4 CLIMATE CHANGE: FORECAST

The long-term estimates of climate change, based on the regionalisation of climate scenario on the results of atmospheric general circulation model HadCM2 (Great Britain), in the territory of Belarus the average temperature of all months will increase by 0.6-1.9°C in the period 1990-2039 and 1.0-2.9°C in the subsequent years of the 21st century, and the average annual rainfall will increase slightly and will account for the winter months, when its role as a source of moisture for the growing season of the current year is not great.\(^5\)\(^6\) Figure 4 shows the predicted values of average monthly temperatures and average monthly precipitation for the territory of Belarus.

As it follows from the model calculations, the temperature in the territory of Belarus will increase to the greatest degree in summer, and especially in winter. This mode is generally favourable for vegetation, but it can significantly affect some agricultural technology cycles, such as winter crops wintering. An increase in precipitation is also expected in summer and winter, both will lack water supply during the active growing season in spring. It is assumed that in the southern regions there will be lack of precipitation, while in the northern regions will be an overabundance of moisture.

Besides, it should be noted that nowadays this forecast of climate change in the territory of Belarus based on atmospheric general circulation model is considered as the most reliable and meets the national peculiarities. Forecasts for climate change effects on adverse weather phenomena were not performed in the republic. However, the analysis of the existing trends of the nature and amount of the weather phenomena over the past 20 years allows making a conclusion that the climate change did not influence the frequency of the adverse weather phenomena, but their intensity has increased.


As a result of climate change in the Republic of Belarus, according to the International Panel on Climate Change (IPCC), some change in species composition (Figure 5) is expected, and total bioefficiency of vegetation, calculated from the regression model CSIRO-Mk3-b2 by SKPI project experts, may be reduced (Figure 6).
1.5 VULNERABLE GROUPS

Climate warming is most dangerous for such vulnerable groups as the elderly, the disabled, children, people with low income and the homeless.

People with chronic diseases also belong to the risk group. These diseases include cardiovascular diseases, respiratory failure, mental and nervous system disorders, blood supply problems, metabolism and endocrine glands disorders, diabetes and malnutrition.

In particular, people of retirement age (60 years old and older, the share of such people in the total population of Belarus is about 24%) are those who suffer most from heat effects. This is a particular concern if consider ageing of population in Belarus (figure 7).

Moreover, exposure to different climate factors in urban areas differs from that in rural ones. For example, effects of heat are more sizable in big cities rather than in rural areas, due to the "heat reserve" accumulated by buildings or coming from urban transport. Considering the tendency towards decrease of rural population in Belarus and increase of urbanisation level observed it involves additional risks related to climate change.

However, some studies indicate a higher mortality rate in rural areas, since the level of population literacy and information support as for the extreme weather phenomena impact and advisable response actions is of great importance.

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[Figure 6. Change in biological net productivity growth in CIS countries by 2100
Belarus is situated in a zone of negative and zero bioefficiency growth. There are given contour changes in the amount of precipitation

Figure 7. Population forecast by age groups
Source: Demographic annual of the Republic of Belarus for 2013

Figure 6. Change in biological net productivity growth in CIS countries by 2100
Belarus is situated in a zone of negative and zero bioefficiency growth. There are given contour changes in the amount of precipitation


9 Ways to improve health security / Discussion paper on "Health care crisis, which took place recently in the WHO - European Region"
2 Climate change impact on individual social and economic sectors of the Republic of Belarus

There is hardly any sector of economy not influenced by hydrometeorological conditions, especially when it comes to dangerous and unfavourable effects. The extent of weather dependence is defined as a total proportion of most weather-dependent sectors in GDP.

Figure 8 depicts the contribution share of the following sectors to GDP.

In the Republic of Belarus weather-dependent sectors compose 41% of the total GDP; these sectors are agricultural and forest sectors (10.4% of the GDP), fuel and energy sector (6.5%), construction sector (7.5%), transport and communications (11.3%), housing services (2.9%) and utility services (2.9% of the GDP).

Agriculture is the most weather-dependent economic sector, for it suffers significant losses – 42% of the total damage of that kind done in Belarus. Figure 9 shows the extent to which adverse weather phenomena impact on different sectors of economy.

It should be noted that along with meteorological vulnerability of economic sectors “socially vulnerable factors” must be considered, such as occupational level in certain economic sector, since climate change and related adverse weather phenomena influence the population welfare. Occupation level relevant to the most vulnerable economic sectors such as agriculture and forestry amounts to 10%, as shown in Figure 10.

As a result of climate change, agriculture may suffer increased risk of bad harvests due to increased frequency and repeatability of droughts within some regions, growth phase shift, and lack of moisture in spring period, deterioration in phytosanitary status due to the spread of phytophagan invasive species, increased frequency of adverse hydrometeorological phenomena and yield losses subsequently.
Forestry is another climate vulnerable sector in Belarus. Today such problems as vegetation area shift, increasing number of forest diseases and fires, hydrological regime changes and others are already typical of some regions. Depletion in supplies as a result of unfavourable meteorological effects is constantly increasing and leads to inevitable felling. The logging industry income is highly affected by shortened period of winter felling since even insignificant soil freezing complicates penetration ability of harvesting technique.

There are some difficulties in estimating the socio-economic damage the climate change does to population health. But it is absolutely undoubted that climate change and related weather effects have a negative impact on people's health due to the increasing number of emergency situations occurred, spread of infections, encephalitis and other infection vectors, deterioration of living conditions based on thermal waves and increased humidity etc. All these risk factors may cause an increase in the death rate.

Not only direct population loss should be considered as a consequence of climate change but also other negative factors which affect indirectly should be taken into consideration. For example, increased unemployment rate caused by reduction in agricultural production which in its return has been provoked by climate changes. The described situation may be the reason for the fall of living standards, mortality, increase in crime and suicide cases, deterioration of relations within a family. Moreover, it can lead to erosion of purchasing power, fall of living standards of the most population, loss of qualified personnel, increased risk of social tension, additional government expenses to support the unemployed, strengthening the tax burden.

Climate change is an obvious fact, that's why it is necessary to develop and implement climate change precaution and adaptation measures in all spheres of human life at the state level.

2.1 CLIMATE CHANGE IMPACT ON AGRICULTURAL INDUSTRY

According to the National Statistics Committee of the Republic of Belarus agricultural territory occupies 8817.3 thousand ha which is 42.5% of the total Belarusian territory. There are 0.9 ha of arable areas and 0.6 ha of farm fields per capita in Belarus. Population employment in agriculture and forestry amounts to 10% (Figure 10).

Agricultural industry in Belarus mostly specialises in cultivation of barley, rye, wheat, potatoes and fodder crops which are the typical crops of middle latitudes. Belarusian land comprises 16% of the world flax plantings which is 20% of the same in European continent. Rape cultivation has become a frequent practice due to the vital orientation towards renewable energy sources.

As for animal husbandry cattle breeding for milk and meat production as well as pig and poultry breeding are the most popular directions.

Agriculture comprises 8-9% in the GDP structure. A top-priority task in Belarusian socio-economic policy is further agricultural production growth.

Belarus is considered an area of risk farming due to specific climatic conditions as drained peat-bog soils which occupy 36.2% of total agricultural land of the country being the most susceptible to erosion processes. Over the past 20 years 488 thousand ha became unfit for agricultural processes due to a low productive capacity.

Most dangerous weather phenomena for agriculture in Belarus are as follows: drought and rainy periods, high and low temperatures, droughts, frosts, thaw, shell ice, adverse summer and autumn phenomena, heavy rains, thunder and lightning, tornadoes, squalls and “dual-winters” typical of the last decade.
The negative consequences of climate change impact on Belarusian agriculture can be described as follows:

- loss of farmland (erosion caused by floods, desertification as a result of droughts);
- soil fertility decrease due to floods;
- uncertainties regarding planting terms and plant species selection;
- droughts and unpredictable rainfall, evaporation growth;
- reduction in yield due to the increasing frequency, intensity and duration of droughts in some regions and increasing frequency, intensity and duration of extreme precipitations, floods and cases of waterlogged soil in other regions;
- overall growth of fire danger in forests and peat swamps, increasing possibility of parasites propagation;
- drawdown of underground water level;
- decreasing level of plant hardening, increasing damage probability as a result of damping-off, temperature fluctuations (cold spell), different fungal diseases caused by warm winters;
- deterioration of vegetation and yield formation conditions of such crops as medium and late varieties of potatoes, flax, vegetables (cabbage), aftergrass as a consequence of increasing number of dry days of high temperatures (> 25ºC) in the second half of summer period;
- parasitic diseases not typical of the region.

Besides, it is important to consider social aspect of climate change impact on agriculture, because approximately 10% of the population is engaged in agricultural sector. Moreover, tax proceeds to local budget decrease as a consequence of increasing unemployment rate which may deteriorate the economic state of some regions.

Along with negative consequences of climate change for agriculture, the increase in vegetation period duration will favour an increase in crop yield level of the majority of crops. But at the same time according to the research on climatic impact on certain crop cultivation carried out by Belarusian scientists, the increase in crop productivity can be observed in some regions while a significant decrease in the same will apply to the others.10

According to the above said research the expected climate change will cause increase in the yield of major crops, such as winter and spring crops, potatoes and maize for silo in the Northern region, and decrease in the same crops in the West, especially in Grodno region.

Due to climate change the yield of fibre flax may rise in the Eastern, Northern and Central parts and fall in Brest region. Thus, it can lead to crops production reorientation in some regions of the country.

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10 Loginskov V.F. Climate change on global and regional levels: Reasons and consequences. - TetraSistems. - 2008, p. 476

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Insertion 2: Date on some hazardous hydrometeorological phenomena impact on agriculture in the Republic of Belarus

Since 2000 25 frost cases occurred during the vegetation period in May – June and September have been observed. As a result in 2000 huge amount of grain crops were destroyed, fruit trees and bushes suffered losses. Frost of 2002 also caused severe damage.

Frosts of 2004 affected almost the whole territory of Belarus and damaged a number of crops such as corn, root crops, rape, clover and flax. Spring crops, cereals and corn in the West of Vitebsk region appeared not resistant enough to frosts and died.

Heavy rains observed on 6-10 July 2003 caused soil water-logging over large areas, in some farms lodging of grains, grasses and flax amounted to 30-80% of the total land. Hail damages crops to a significant extent. Heavy hailstorm happened on 14th July 2000 in Vitebsk region damaged cars, broke glasses and roofing slates of the houses.

Extremely intensive drought was one of 2002, when dry weather attended high temperatures. As a result there were no seedlings, plants turned yellow, leaves curled, tuber growth of potatoes and beets stopped, pastures dried, a number of forest fires took place, soil preparation for autumn sowing was hampered, root crops yield decreased, forage production suffered losses.

Drought of 2007 had a negative impact on crop yields mostly as per grain crops and flax. Plant inhibition was observed, leaves turned yellow and dried, plant dried in light soils, grain crops lost their productive sprouts, a huge part of crops died. According to the Ministry of Agriculture and Food damage and loss of agricultural crops in Gomel region affected 57.4 thousand ha which is 30 % of the total territory due to the drought lasted for a month.

Source: Republican Hydrometeorological data on climatic conditions and hydrometeorological hazards in the Republic of Belarus
However, there are a number of positive consequences of the expected climate change as for agriculture in Belarus:

- expansion of crop production;
- improvement of animal husbandry production;
- increased duration of non-frost period;
- possible improvement of winter crops overwintering conditions;
- reduction in cost for stabling caused by increased temperatures in winter and early spring periods; winter period reduction by 10-15 days in all;
- early spring approach and early timing set for spring crops sowing;
- accelerated ripening of grain crops and leguminous plants and early harvest time;
- increased duration of harvest time.

On the grounds that agricultural production depends on weather conditions to a significant extent it is necessary to develop and adopt measures aimed at agriculture productive efficiency and its resistance to unfavourable weather conditions. Climate change poses a threat to food supply security since as a result of unfavourable weather conditions croppage reduces, farm buildings get destroyed, livestock losses become practice. The losses agriculture suffers in Belarus due to the unfavourable weather conditions are estimated at $ 42 million per year on average.

2.1.1 Recommendations on climate change adaptation. Agriculture

There is no certain position adhered to in researches devoted to possible global warming impact on Belarusian agriculture. The matter is that the latest research on this subject shows that insignificant favourable consequences for the yield of some crops are possible in case of a slight increase in temperature (1-2°C). But these favourable consequences will turn into losses in case of further temperature rise. Most researches prove that danger comes not only from climate change, but is mostly connected with increasing frequency and intensity of extreme weather conditions (droughts, floods hurricane). The

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**Practical examples: Campaign against dry grass incineration**

As the spring comes and snow cover disappears, the time of cleanups and voluntary Saturday work takes place in urban and countryside areas – near holiday houses, at dachas, home grounds. Meanwhile, incineration of agricultural refuse and dried grass is not only the neglect of fire safety requirements and environmental legislation but, moreover, burning of dried vegetation leads to extra emissions of greenhouse gases into the atmosphere, which in its return aggravates climate change impact.

Belarusian legislation prohibits any burning of dry vegetation and administrative liability is prescribed by the law. In case environmental misconduct on a massive scale takes place criminal liability is provided for. Nevertheless, unauthorised burning of dry vegetation can be observed around the country. Such law violation sometimes leads to the inflammation of houses and farm buildings, life losses. As a result, animals, birds and insects die, species composition gets depleted, soil deteriorates. Grass incineration may cause large-scale forest or peatland fires.

Belarusian public organisations such as ecological association “Green Network”, NGO “Ecohouse”, agency “Environmental Solutions Center”, international NGO “Ecopartnership”, regional ecological association “Nerush” and the Belarusian Red Cross Society with the support of the Ministry of Natural Resources and Environmental Protection and Ministry of Emergency Situations of the Republic of Belarus have been conducting an annual information campaign aimed at elimination of dry vegetation and waste burning. As a part of such campaigns informational posters are published and delivered, a number of actions are held jointly with the local population.

This is one of good examples of collaboration between public organisations and state authorities for the purpose of effective settlement of ecological problems.

*Source: http://ecoidea.by/projects/pal*
latter will definitely affect agricultural production and food supply security.

Considering various consequences of climate change impact on agriculture the adaptive measures can be as follows:

- consideration of agroclimatic conditions while planning agriculture production over the country regions;
- increase in the share of the cultivated crops resistant to warmth, drought and wind (corn, millet, sorghum etc.);
- delivery of erosion preventive and soil protective activities;
- breeding of varieties and hybrids;
- regional planning and control of sowing and harvesting time based on agricultural climatic conditions;
- deluge system restoration, improved water management;
- development of a system insuring against the risk of unfavourable weather conditions;
- elaboration of protective measures against vectors impacting agricultural crops;
- improving fertilizer usage effectiveness;
- biotechnology development;
- agroindustrial workers' awareness activities as for climate change problems.

2.2 CLIMATE CHANGE IMPACT ON FORESTRY

Forests in Belarus are temperate and include such forest forming species as pine, spruce, oak, birch, black alder, aspen. Forest cover comprises 39 % of the total territory.

Belarusian Government exercises exclusive ownership for all forests in the country and Timber Fund estimates more than 9.4 million ha of forest cover. Standing forest reserve amounts to 1.5 billion m³. Forest cover increases by more than 30.3 million m³ each year. There is 0.86 ha of wooded land and 170 cubic meters of timber resources per capita.

Over the past 60 years forest cover increased twice and reached its peak if consider 100-year period (1901 – 37.6%). Such positive trend is stipulated by organisations engaged in forestry as well as by natural increase in timber stand (figure 11).

Despite significant forest resources in Belarus, the share of forestry in GDP structure is not too big and amounts to 1%. Nevertheless, on the grounds that government support for forestry has increased over the last years the role of forestry as economic sector may be expected to increase as well.

Climate change impacts on forest health either directly or indirectly (by means of groundwater level change, fires, propagation of parasites and worsening of diseases) and introduces structural and composition changes.

There are several main factors causing forest loss (figure 12). Mostly, forest loss occurs due
to unfavourable weather conditions and fires. Then comes an increase in humidity level which is followed by propagation of forest pests (figure 13).

Ground fires (mainly peat-fires) damage forests foremost and result in 120 tons of dry basis coming off 1 ha. As for crown fires 1 hectare burned presents 35 tons of organic materials calculated with reference to dried basis, and 13 tons of dry matter when it comes to low fires. Figure 15 depicts the dynamics of fires distinguished by type.

Ground fires mostly happen due to inflammation of drained peats appeared as a result of heat waves. Figure 15 indicates the fact that the share of ground fires in the total fires rises in certain years.

It is important to mention that Belarus belongs to a risk zone when it comes to peat fire cases, because the country comprises a great amount of drained peats. In particular, the share of drained peats amounts to 4% of the total forest cover and is constantly increasing due to the process of including inefficient degraded agricultural land in timber area.

Increasing number of droughts caused by climate change as well as increased share of peat bogs in forestry will inevitably lead to economic losses and biodiversity problems.

Moreover, forest fires emit greenhouse gases such as carbon dioxide, methane, nitrous oxide. According to the data given by the National Greenhouse Gas Inventory, about 172 thousand tons of greenhouse gas equal to CO$_2$ is emitted each year due to forest fires in Belarus. The increase in fires will cause additional emission of greenhouse gases and climate warming subsequently.

Vegetation period duration is one of the factors that impact forest productivity. On the
one hand, wintertime warming contributes to the increase in forest products but it must be admitted that woody plants slowly adapt to changing growth conditions. Temperature fluctuations during the vegetation period affect negatively the resistance to external effects.

Moreover, heat supply redistribution of vegetation impacts the spatial spread of tree plantation. In Polesye located in the south of the country a new area with greater heat supply not actually typical of Belarus is already observed2.

Some Belarusian authors note that along with heat supply in Polesye equal to 2480°C (the sum of temperatures above 10°C) continuous spruce propagation is no longer observed. Current distribution limit of spruce shifted 250-300 km to the north and almost extends along the border of the subzone of oak taiga forests. If this trend keeps going, we can expect a gradual boundary shift of spruce to the northeast. Mass reclamation in Polessye has already caused 20-30 km shift to the north as compared to the situation of the sixties (Figure 16).

Besides, the early vegetation caused by climate change dramatically increases the probability of late and harmful spring frosts which can have a significant impact on current stand growth, as well as damage the flowers and fruits of woody plants and forest berries.

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**Insertion 3: Date on some hazardous hydrometeorological phenomena impact on forestry in the Republic of Belarus**

Storm wind of July 1991 was the reason for more than 1 ha of fallen timber in the Mior district of Vitebsk region.

Fire season associated with abnormal heat in 1994 caused 526 fire seats in forests and swamps in Brest region and 156 fire seats at farmlands. In Novogrudok district (Grodno region) 42 hectares of forest were burned. Some other fire seats of a small area were also observed over the rest territories of the republic.

The fire season of 2005 lasted from August to mid-October. It must be admitted that 177 fires were registered in August, 88 of which happened in forests, 49 – on peat bogs, 40 cases of grass and bushes burning. In September 582 fires cases were observed, 140 of which happened in forests, 663 – peat bogs, 143 cases of grass and bushes burning. Moreover a number of fire cases of residential and outbuildings were registered.

*Source: Republican Hydrometeorological Centre data on climatic conditions and hydrometeorological hazards in the Republic of Belarus*
Climate change also increases drought risks during vegetation period, while a further reduction in spruce area can be expected in case the groundwater level keeps lowering.

It is necessary to note that over the past 15-20 years mass spruce forest drying has already been observed. According to the data delivered by the Ministry of Forestry of the Republic of Belarus, more than 100 thousand ha of spruce stand (total timber resources 35 mln cubic m) had drained and had been cut over. That quantity is equal to 12 % of the total spruce stand. The majority of Belarusian scientists consider climate change the main reason for spruce shrinkage.

Even today decrease in deepness and soil freezing period in winter is, and will be in future, a significant obstacle for forestry activity performed on water-logged and wetted territories due to heavy conditions for harvesting technique to approach the area.

Thus, even today climate change impacts negatively on forest ecosystems and in a progress can cause significant economic losses as well as become a real threat for biodiversity.

2.2.1 Recommendations on climate change adaptation. Forestry
On the grounds that forest ecosystems react to climate change rather slowly forest natural habitat will shift not that fast as climate changes. That’s why it’s important to make provision for adaptive measures in advance so that forestry shouldn’t suffer any economic or ecological losses.

Climate change adaptation measures in forestry can imply such activities as:
- optimisation of species composition of tree species with regard to forest conditions;
- alignment of forest age structure due to competent forest management, cleaning cutting;
- delivering activities on reforestation;
- reclamation of disturbed lands unsuitable for agricultural work and subsequent afforestation;
- introduction of fast growing species;
- introduction of efficient logging methods and improved technologies of logging processes;
- development of forest conservation and protection system against fires and pests;
- increasing forest resistance to fire (arrangement of fire resistant regions by mixed forest standing; timely forest management works; clearing the felling site from the forest residue etc.);
- maintenance of reclamation systems or restoration if necessary;
- restoration of drained peat bogs by repeat waterlogging;
- expansion of the forest roads network for the purpose of effective development of forest areas at waterlogged territories;
- biological diversity protection.

2.3 CLIMATE CHANGE IMPACT ON POPULATION HEALTH

In the process of analysing climate change impact on social sector, population health impact assessment is to be emphasised on. Despite the fact that socio-economic damage done to public health is rather a complicated subject to estimate, it is obvious that climate change and related unfavourable weather conditions negatively affect population health. It must be admitted that unfavourable hydrometeorological effects head the list of natural emergencies (Figure 17).

![Figure 17. Natural emergency situations](image-url)
Basing on the expected climate change the main factors that impact population health can be described as follows:

- increasing number of emergency situations (floods, hurricanes, squalls, forest fires etc.);
- increase in heat period (heat wave);
- increasing number of pests and pathogenic organisms;
- increase in acute enteric infections occurred;
- quality deterioration of water and food;
- increase in stress load on the human organism.

**Flood flows** affect not only the health but also the welfare of the population and have become rather a frequent practice in Belarus. In particular, large-scale flood flows are registered in Belarus once in 3 years and even on a more frequent basis as observed (figure 17). Such incidents result in flooded houses, destroyed harvests, increased social tensions associated with posttraumatic stress disorder and population welfare deterioration.

Moreover, increasing spread risk of acute and chronic diseases of food and water borne kind as well as worsening quality of water and lack of tap water due to chemical contaminants are also considered the consequences of flood flow processes.

Long-lasting rainstorms can enlarge the level of germs and microbes contained in water reservoirs and cause water contamination in case storm runoff from farmlands and dumping of pesticides fall into water storages. These persistent organic pollutants are very toxic and can deposit in living organism tissues and remain in environment for a long time travelling long distances. Persistent organic pollutants damage all protective systems of an organism even while affecting in small quantities.

Pesticide application in agriculture is constantly growing in Belarus. For instance, 8,45, 11.7 and 14.1 thousand tons of pesticides were used in 2005, 2007 and 2011 respectively12.

**Deterioration of water quality** (both in water sources and water supply systems) caused by worsened microbial burden will inevitably increase the number of intestinal infections. About 10-16 thousand cases of acute intestinal diseases can be observed each year in Belarus.

Increase in forest fires also have a negative impact on population health since fires, especially long lasting fires, alter atmospheric composition damaging respiratory and blood circulatory systems.

In 2010 American Heart Association published the study on the connection between air pollution and cardiovascular diseases (CVDs) such as ischemic heart diseases, heart failure, ischemic stroke, vessel diseases, cardiac arrhythmia, and premature mortality12. According to the above said research the main air polluting factors are forest fires and emissions from fossil fuels produced in such sectors as energy, industry and transport. Emissions produced by stationary and resilient sources of ambient air contamination amount to 1450 thousand tons each year which is 40-48 kilograms per capita.

Besides, a number of indirect consequences of unfavourable weather conditions must be allowed for. These are the **increase in mosquitoes** (as a result of floods), increased **activity of ticks and other vectors**, increased infectious risk period of such vectors, malfunction of water-and-sewage systems. Moreover, the risk of intestinal diseases is growing.

Thus, according to the information delivered by the Ministry of Health of Republic of Belarus, the incidence of diseases carried by ticks (encephalitis, in particular) has increased over the last years. There were 67 cases of encephalitis officially registered in 2008, 106 cases in 2012, 118 cases in 2013, two of them were of lethal outcome. The number of Lyme disease cases has also increased. There were 632 cases in 2008, 1071 in 2012, 1096 – in 2013.

Medical workers insist on the dependence of major vectors’ (ticks) activity on significant climatic warming. Tick population increased by 37% in 2013 as compared with 2012. First of all, this is associated with late and drastic spring approach. Ticks’ activity extremely increased after warm weather had set in.

Another significant factor of climate change that has a negative impact on population health is **long-lasting periods of abnormal heat (heat waves)**. Environment temperature stipulates deepness and frequency of breathing, blood circulation speed, hematopoietic system nature, oxygen supply of cells and tissues and that is why even short-term temperature rise can cause increased mortality due to the aggravation of various diseases (ischemic heart disease, diabetes, respiratory diseases), accidents, suicides and murders. Moreover, some medicine affects central or local mechanisms of thermal regulation and (or) increase load upon heart and heat exchange. Extreme heat can intensify medication toxicity or weaken it.

It should also be noted that the level of air pollution is rising in case air temperature is increasing (the consequences of air pollution are described above).


13. http://ru.wikipedia.org/wiki/%D0%9B%D0%B5%D1%81%D0%BD%D0%B8%D1%81%D1%8F%D1%8B%F%D0%BE%D0%BD%D0%BE%D1%8B
According to the data delivered by the Ministry of Health of Republic of Belarus, emergency calls increase by 23% in Minsk when abnormal heat sets in.

Air humidity rate also impacts on the state of human organism. Since increased air humidity is typical of Belarusian region throughout a year, comfort level for the human organism gets deteriorated when air temperature rises.

Considering complex climate change impact on human health it is important to make provision for climate change intensity. Sudden atmospheric pressure drops disturb breathing process, deprive blood and tissues of oxygen which increases the probability of cardiovascular diseases. Arisen meteorological effects aggravate chronic diseases, impact on health of a person and his mood.

2.3.1 Recommendations for adaptation of population to climate change

Climate change, and in particular the increase of the probability and frequency of adverse weather events which affect health and living standards of the population. Therefore, one of the key elements of the state social policy adaptation to climate change is a system of early warning of unfavourable weather phenomena and risks, as well as protection of the population in emergency situations of natural character.

To protect public and reduce the effects of natural emergencies, the following measures are usually taken:

- long-term activities carried out to prevent and mitigate the consequences;
- activities undertaken prior to a disaster which will help to improve the efficiency of emergency response during the disaster;
- activities carried out immediately before and during the phenomenon in order to protect life and property;
- activities undertaken after a disaster which include the restoration work.

To reduce the effects of natural emergencies and protect the population in Belarus it is necessary to follow the next rules:

- Development of national environmental monitoring system.
- Forming of environmental services, the introduction of environmental audit and insurance.
- Improvement of the regulatory and legal framework of ecological security, including the payments for natural resources use and adequate compensation for the damage caused to environment.
- Implementation of protection measures from fires and deaths as the results of them.
- Implementation of technical solutions, organisational forms and methods of fire prevention and monitoring activities.
- Conducting methodic work by the government agencies when working with the media, including the popularisation of climate change problem and the impacts of climate change.
- Increasing the awareness level of medical workers on risks related to climate change.
- Introduction of climate risks issue into medical institutions programs.
- Improving literacy to ensure safety and the rules of conduct in emergency situations.

In particular, one of the most common ways to reduce mortality caused by heat waves is the introduction of health warning systems of heat on the basis of meteorological observations. While each city needs to create its own system based on specific weather data for this city, as well as the public reaction to the temperature anomalies and the city infrastructure.

The design standards play a significant role, namely, record keeping on climate change in developing the design standard for.

Due to climate change the waste load reduction in the atmosphere and improvement of air quality should be another important area for adaptation to climate change.

Climate change increases the risk of the rising number of fires in forests and peat-bogs, what also exacerbates the environmental quality. It is necessary to implement a set of measures for the prevention of disamenities in forests and peat-bogs and fire cases. Such preventive measures are described in the chapter “Forestry” above.

The expected water quality impairment as a result of climate change has also a negative impact on public health. It is important to emphasise the next measures concerning...
adaptation to climate change: the reduction of pollutants discharged into basins; the improvement of the efficiency of water reclamation; the tightening control over the protection of water-intakes. In addition, the public awareness plays a tremendous role regarding purifying water methods domiciliary, as well as good hygiene, in particular for the rural population.

Practical examples: response to heat wave

The survey on blood pressure during the heat wave

In the summer of 2013 the average temperature in Belarus was above the normal one by 1.7°C and amounted to 18.5°C above zero. The average temperature in July was +18.5°C or 0.7°C above the normal one. The first decade of the month indicated the average temperature which was above traditional showings by 2.3°C. In many cases air heated to +25°C and above in the first decade and in separate days of the second and third decades; the temperature reached +30-33°C on the hottest days. On July 8th - one of the hottest days of 2013 Belarusian Red Cross volunteers measured blood pressure of people belonging to different age groups. It was carried out under the activities of Belarusian Red Cross Society.

Age of the groups studied:
30 – 40 years – 70%;
40 – 50 years – 20 %;
50 – 60 years – 15%;
over 60% – 5%.

The survey revealed abnormalities in the majority of the cases.

Note: Each year circulatory deaths amount to 53% of the total deaths in Belarus, 7% of which occur to the working-age population. Acute myocardial infarction kills about 1% if consider the total amount of deaths.

BRCS’s volunteers from the service of response to emergency situations distributed drinking water in public places and provided first aid during the heat wave in summer 2013. A great attention was taken to elderly residents. Volunteers not only dispensed water to all people suffering from heat in places of mass gathering (bus stations, close to churches, railway stations, at border crossings and in other public places where people were standing for a long time under the burning sun), but also told the public how to adapt to heat.

3 Addressing climate change

3.1 PUBLIC AWARENESS ON CLIMATE CHANGE

Public awareness and access to information, including climate change - is one of the most important conditions for the development of civil society.

It is said in the UN Framework Convention on Climate Change (Article 6 of the Convention) that participating countries, including the Republic of Belarus, have to implement policy aimed at public education and public awareness on climate change and its consequences, to provide access to such information and participate in issues related to climate change and adaptation, and to develop response measures.

There is a system of environmental education regarding public education on environmental protection, executive training, alerting service on issues related to environment. Besides there is co-operation with the environmental NGOs. However, there are some gaps in this direction. In particular, the program introduction of climate change issue into school curricula and educational institutions is often proactive.

It is necessary to note that there has been positive experience in the implementation in Belarus of Norwegian educational School Program for Application for Resources and Energy in the institutions of formal and non-formal education (SPARE).

This program does not address the problem of climate change directly, however it propagates energy and resources conservation and envisages involvement of pupils and teaching staff into the problem of energy conservation. In particular, complex educational platform for Belarusian education system from the elementary school to high education in topic "Energy Conservation and Climate Change" is planned to be developed within the frames of activities under this program till 2015, as well as public organisations and local authorities are planned to be actively involved into awareness on energy and environment16.

- The ratification of the Aarhus Convention by Belarus has helped to provide public access to environmental information and public participation in decision-making process on environmental issues in Belarus. There are two Aarhus centers in Minsk and Grodno. The next activities are carried out in the above-mentioned centers:
  - providing environmental information upon the request of individuals and legal entities;
  - counselling individuals and legal entities on law enforcement of the access to environmental information, public participation in decision-making process and Access to Justice on Environmental Matters;
  - providing educational activities (workshops, seminars, lectures), including climate change issues;
  - business round tables, publications in media, televised and radio address, advertising campaigns, booklets with information about the state of environment, measures for environmental control, the civil rights in accordance with the Aarhus Convention;
  - collection, accumulation, storage and dissemination of environmental information.

Significant step in the development of democratic environmental decision-making process is the creation of Public Environmental Coordination Council in the Ministry of Natural Resources and Environmental Protection in Belarus which includes many public organisations and associations, which functions also include discussion of environmental education. Similar councils have been established at regional levels and Minsk City Committee of Natural Resources and Environmental Protection of the Republic of Belarus.

A wide range of climate change issues in Belarus is supported by government agencies, non-governmental organisations in the form of seminars, round tables and conferences. In particular, the Ministry of Natural Resources and Environmental Protection together with the partnership “Green Alliance” and the experts from the TACIS project “Implementation of the Kyoto Protocol in the CIS” held a workshop on adaptation of agriculture in the Republic of Belarus to climate change.

There are regular articles in scientific periodicals of the National Academy of Science on the impact of climate change on environment. The media also publish the programmes and

16 http://spare-belarus.by/page.php?166
articles devoted to climate change. However, the quality of the information delivered is often focused on low readership (experts, specialists) and has a scientific character. Therefore, it is very important to choose such forms of information that allow attracting more people to climate change issues.

It is difficult to imagine that the topic of climate change is quite unknown to people in Belarus, but public awareness activities should be more focused, better organised and permanent.

Thus, the Republic of Belarus has developed a system of informing the public about environmental state, measures for its protection, including mainly magazines, newspapers, radio and television broadcasts. On the other hand, the content of the information on climate change and the country’s vulnerability to climate change needs to be added with high-quality, reliable and easily accessible data.

3.2 NATIONAL POLICY ON CLIMATE CHANGE AND EMERGENCY PREVENTION

3.2.1 Climate change
Belarus has signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) on the basis of Presidential Decree No. 177 under date of April 10, 2000 and ranks among the list of countries included in Annex I to the UNFCCC. Moreover, Belarus was a party to the Kyoto Protocol, adopted and assumed obligations to reduce greenhouse gas emissions by 2012 in the amount of 5% from the levels in 1990. However, during the period of the Kyoto Protocol 2008-2012 Belarus didn’t manage to ratify the amendment by all parties to the Kyoto Protocol, what did not allow the country to participate in the economic mechanisms under this agreement.

Ministry of Natural Resources and Environmental Protection in the Republic of Belarus is the responsible authority for the implementation of the provisions of the UNFCCC and the obligations of the Republic of Belarus in accordance with the Kyoto Protocol. Ministry of Natural Resources and Environmental Protection organises and coordinates the functioning of the greenhouse gas inventory system, and provides the national communication and the national report on the greenhouse gas inventory of the Republic of Belarus to the Secretariat of the UNFCCC and the Kyoto Protocol, conducts a preliminary examination of projects to reduce greenhouse gas emissions and maintain their registration. The Ministry is also the administrator of the National registry of carbon units.

The State Commission on Climate Change has been established in order to coordinate the work of the implementation of policy to mitigate climate change in Belarus, which coordinates the activities of state administration bodies and other state organisations subordinated to the Government of the Republic of Belarus, regional executive committees and Minsk City Council and other organisations to ensure compliance with the obligations arising from the UNFCCC and the Kyoto Protocol, to participate in the official bodies of the Framework Convention and the Kyoto Protocol, as well as in international cooperation on climate change. The State Commission on Climate Change is responsible for developing strategy in the negotiations on climate change.

The Commission is also deals with laws and regulations for the implementation of the provisions of the Framework Convention and the Kyoto Protocol, selects and examines results of joint implementation projects, sets the volume of carbon units, intended for purchase and (or) transfer (sale) for the given period, considers Inventory Reports on greenhouse gas emissions and national report under the Framework Convention and the Kyoto Protocol to refer them to the Secretariat of the Framework Convention.

Since the accession of Belarus to the UNFCCC and the Kyoto Protocol there is an active process on working on the development of legal documents, creating a legal and institutional framework of the activities in the field of climate change. There has been recently adopted the project concept of Law of the Republic of Belarus on "On climate protection".
• It is necessary to note the following policy documents among the most significant policy documents of public policies aimed at reducing anthropogenic greenhouse gas emissions and minimising the impacts of climate change on the economy and public health:

• State socio-economic development program until 2020, which defines the main directions of the state policy in the field of climate change mitigation and some questions on adaptation to climate change.

• State program on measures to mitigate climate change by 2013 - 2020, approved by the Council of Ministers (Decree No. 510) in June 21, 2013. The objectives of these programs are to carry out activities aimed at reducing greenhouse gas emissions in order to reduce the rate and magnitude of climate change and adaptation measures for economic sectors to climate change.

Development Strategy of Hydrometeorological Activities of the Commonwealth of Independent States, Strategy provides a coherent set of interrelated tasks and directions for development, activities and stages of their implementation mechanisms for effective solution of endemic problems in the CIS activities NHMS CIS.

Additionally, the country has developed and adopted several policy documents at the national level, which contain new or revised plans and targets related to energy efficiency, increased energy conservation policy and implementation of renewable energy sources.

The development of sectoral program of forestry adaptation to climate change has become an important step in determining the country’s priorities in the field of climate change. Despite the fact that this program has been approved by the Ministry of Forestry in the Republic of Belarus, it has not been approved at the state level.

Individual adaptation measures to climate change include many governmental programs and industry documents, such as the State program of socio-economic development until 2020, State Forestry Development Program for 2011-2015, the instructions for aviation forest air protection and the monitoring status forest program of measures to mitigate climate change for 2013-2020 (measures program on climate change). However, the variation and inconsistency of these measures in various documents do not allow using them successively and makes their use less efficient. Therefore it is necessary to develop a single program of adaptation different sectors of economy and population to climate change. The document has not been developed yet, although it was a part of the measures program on climate change in 2008-2012 and is included in the measures program on climate change in 2013-2020.

3.2.2 Disaster risk reduction

All emergency situations cause great social, economic and ecological damage, i.e. damage to the defensive capacity of the country and safety of the state. In Belarus civil defence has started solving not only defensive, but also social, humanistic and economic issues.

Improvement of civil defence system and population protection system increased after Chernobyl NPP accident.

Emergency situations authorities and divisions which perform activities in the sphere of prevention and management of emergency situations of natural and industry-related nature (hereinafter – emergency situations), civil defence and fire safety provision, as well as other activities in accordance with the legislation of the Republic of Belarus form a part of the national security system of the Republic of Belarus.

• Emergency situations authorities and divisions include:
  • Ministry for Emergency Situations of the Republic of Belarus (central administrative office, excluding departments);
  • territorial bodies for emergency situations;
  • emergency situations divisions.

Ministry for Emergency Situations of the Republic of Belarus (MES) is a republican state administrative body, which performs monitoring and control in the field of prevention and management of emergency situations of natural and industry-related nature and civil defence, provision of fire safety, industrial, nuclear and radiation safety, management of Chernobyl NPP disaster consequences, creation and ensuring of state and mobilisation material reserves integrity.

Territorial bodies for emergency situations are region departments of the Ministry for Emergency Situations of the Republic of Belarus, Minsk City Department of the Ministry for Emergency Situations of the Republic of Belarus, city and district offices for emergency situations. The territorial bodies listed manage subordinate city and district emergency situations offices within their competence in accordance with the legislation of the Republic of Belarus.

• Emergency situations divisions:
  • fire-fighting rescue teams;
  • fire-fighting rescue units;
  • fire-fighting rescue posts;
... educational, scientific and other emergency situations subdivisions created according to the procedure established by the legislation of the Republic of Belarus for performance of tasks assigned to emergency situations authorities and subdivisions.

Belarus has also been maintaining cooperation in the field of emergency situations prevention and management of the consequences thereof, as well as scientific and research activities in establishment of bilateral agreements with rescue offices and other state and public organisations in countries near and far abroad: the Republic of Austria, the Republic of Azerbaijan, the Republic of Armenia, the Socialist Republic of Vietnam, the Islamic Republic of Iran, the Italian Republic, the Republic of Kazakhstan, the State of Qatar, China PR, Republic of Korea, the Kyrgyz Republic, the Republic of Latvia, the Republic of Lithuania, Republic of Moldova, the Republic of Poland, the Russian Federation, Tajikistan, Uzbekistan, Ukraine, the Swiss Confederation, the United Nations.


From 2011 to 2013 MES of Belarus has been presiding in CSTO Steering Group for Emergency Situations.

To warn population of adverse weather phenomena and to facilitate better perception of weather forecasts containing warnings of adverse and hazardous meteorological phenomena, in Belarus from June 2013 special colour codes, including green, yellow, orange and red colours, were introduced. Colour code makes it possible to inform how serious the situation is.

Thus, “green code” means that the weather is not dangerous, and no hazardous and adverse weather phenomena are expected. Yellow code means that the weather is potentially hazardous, “yellow hazard level”, expected adverse weather phenomena (precipitation, thunder and lightning, wind blasts, high and low temperatures etc.) are typical of the territory of the country, but sometimes they may represent hazard for separate kinds of social and economic activities. Orange code means that the weather is hazardous, “orange hazard level”, adverse phenomena are expected in the most territory, hazardous phenomena are widely scattered (squalls, rainfalls, thunder and lightning, hail, heat, frosts, snowfalls, snowstorm etc.), which may negatively affect social and economic activities and lead to great material damage, moreover human losses are possible. Red code means that the weather is very dangerous, “red hazard level”, meteorological phenomena of extreme intensity are expected (heavy rainfalls and snowfalls, heavy hail, very strong wind, extreme fire hazard etc.), which may cause great material damage and human losses.

Using these codes allows to increase the awareness level of the persons responsible for decision-making in the country, as well as of the population on risk of acts of God by providing appropriate information on intensity and degree of potential hazard of the phenomena expected. Meaning of these codes is available for usage both by media and population, assisting thereby to determination of the risk level in different situations.

It should be noted that well operating fires early warning system is available in living and administrative buildings in Belarus. This system forms a part of the state system for emergency situations prevention and management. At present technology system for warning of forest and peat fires is being developed. Nowadays ground detection system of forest fire in the Ministry of Forestry of the Republic of Belarus comprises 478 fire lookout towers and 56 masts. Forest fires early detection and monitoring of surrounding territories of forest fund use 160 video cameras which operate in manual mode.

3.2.3 Environmental legislation

Environmental legislation of Belarus is primarily based on the Constitution. The Constitution of the Republic of Belarus laid foundation for the rights of citizens to a healthy environment and compensation for damages caused by the violation of these rights. Decrees and laws are issued as per the constitution and include environment protection issues.

The fundamental law as for environment protection is the law of the Republic of Belarus “On Environmental Protection.

Currently there are more than 15 legislative acts regulating relations in the field of environmental protection, in particular the Water Code of the Republic of Belarus, the Code of Natural Resources, Laws of the Republic of Belarus On Air Protection Act, On Waste Management Act, On Hydrometeorological activity Act, On Flora Act, On Ozone Layer Protection Act, decrees No. 348 On Compensation charges for environment damages of the President of the Republic of Belarus dd. June 24, 2008,
No. 349 The criteria of classifying economic and other activities as environmental abuses dd. June 24, 2008.

Furthermore, the Republic of Belarus is a party to more than 20 international conventions and agreements on environmental protection issues.

Legal regulations of environmental protection laws are implemented by means of governmental regulations and resolutions of the State administrative body, particularly by the Ministry of Natural Resources and Environmental Protection.

Ministry of Natural Resources and Environmental Protection implements the state policy in the field of environmental protection and rational use of natural resources; works on the improvement and development of legislation as for environmental protection and country ecological security issues; monitors the implementation of environmental legislation and carry out international cooperation in the field of environmental protection.

It’s worth mentioning that ecological legislation of Belarus performs rather a reasonable system but nevertheless it needs further development as any other field does. In particular, further development of ecological policy in the field of environment improvement issues is required.

One of such policy tools is exaggeration of the current regulations and standards. This kind of tools does work and improves environmental conditions, as restrictions and regulations are set in legislation and its violation assumes legal liability.

Another alternative method that can be used for environmental enhancement is to make provision for internal market for emissions of pollutants into the atmosphere, as well as lower tax burden for those entities that reduce emissions of pollutants. These tools provide enterprises with incentive implement environmental measures.

3.2.4 Monitoring of climate change and natural disasters, research and early-warning system

Monitoring of climate status is held by the State Meteorological Service subordinated to the Ministry of Natural Resources and Environment. The State Meteorological Service includes Republican Hydrometeorological Center, Republican Aviation Weather Center and five regional centers of Hydrometeorology and Environmental Monitoring.

The specialists of the State Meteorological Service study the peculiarities of climatic, agro-meteorological and hydrological conditions in Belarus; conduct regular environment monitoring, collect, analyse and generalise climate information, perform short-term and medium-term weather forecasts as for the whole country, certain regions, Minsk, foresee crop yields and hydrological conditions of water reservoirs.

National climate inventory is conducted on an annual basis to ensure the awareness of public authorities, organisations and the public as for the data on climate in Belarus. It comprises analyses of climate variables (temperature, precipitation, humidity, wind velocity), information on the frequency of meteorological phenomena implying adverse weather phenomena, climate assessment and identification of climatic patterns in particular.

- The data delivered by the National climate inventory is used for the following issues:
  - planning economic activities and rational distribution of productive forces considering climate indicators;
  - agroclimatic zoning, distribution of crops, planning agricultural activities;
  - industrial, transport, energy, water and construction of civil engineering, planning and construction of settlements;
  - development of state standards for technical products, clothing, fuel standards and other state and departmental standards;
  - design of recreational facilities, recreation and tourism bioclimatic study;
  - development of protective measures against air pollution and for environmental enhancement;
  - assessment of climate changes including those caused by anthropogenic factors;
  - conducting other state inventories of natural resources;
  - other purposes provided for by law.

National Metrological Service is also a party to the World Meteorological Service and participates in international information sharing as for climate issues.

Moreover, specialists of hydrometeorological service are responsible for informing people and public authorities about current and expected weather conditions and also for warning of dangerous weather effects. Information on weather forecasts and unfavourable weather conditions is constantly dispersed by means of mass media and is available on the Internet.
3.3 REGIONAL INITIATIVES AS FOR CLIMATE CHANGE AND DRR

In Belarus international cooperation in the field of climate change is implemented with international organisations and union organisational structures such as the UN Development Program in Belarus, United Nations Environment Programme, UN Economic Commission for Europe, Organisation of Economic Cooperation and Development, Organisation for Security and Cooperation in Europe, Intergovernmental Panel on Climate Change, World Meteorological Organisation, Global Climate Observing System, World Climate Research Programme, CIS Interstate Environmental Council, Committee for Hydrometeorology and Monitoring of the Environment Pollution.

Belarus also takes part in a number of regional climate initiatives. Herein such projects and initiatives can be brought in as:

- “Clima-East”: assistance in impact mitigation of climate change and in adaptation of Eastern Partnership Countries (Belarus, Russia, Ukraine, Armenia, Georgia, Moldova). This project comprises a series of pilot projects that support the development of ecosystem-based approaches to climate change, and also includes a second component which is aimed at developing better policies in the field of climate change, strategies and market mechanisms as for partner countries.

- “INOGATE” project “Technical assistance in Kyoto protocol implementation” (Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, Uzbekistan). The purpose of this project was to increase the awareness of governmental authorities of climate change in general, and mechanisms of the Kyoto Protocol, in particular. Besides, the pursued goal was to develop and implement mitigation and response strategies for climate change issues at the request of the partner countries.

- UNEP and OSCE Initiative “Environment and security” (Eastern Europe: Belarus, Moldova, Ukraine) which implied the sharing of experience and information as for water resources management and risk assessment of floods as well as capacity-building to detect flood cases in due time.

Seventh Framework Programme: Environment including climate change issues and other programmes and initiatives.

The Republic of Belarus has concluded 21 international agreements with 19 states in the field of prevention and control of emergency situations of a nature or man-made kind. The above said countries are the Republic of Austria, the Republic of Azerbaijan, the Republic of Armenia, the Socialist Republic of Vietnam, the Islamic Republic of Iran, the Italian Republic, the Republic of Kazakhstan, the State of Qatar, China P.R., Republic of Korea, the Kyrgyz Republic, the Republic of Latvia, the Republic of Lithuania, Republic of Moldova, the Republic of Poland, the Russian Federation, Tajikistan, Uzbekistan, Ukraine, the Swiss Confederation, the United Nations.

Moreover, the Republic of Belarus is a party to the flagship initiative of Eastern Partnership program for the prevention, preparedness and response to natural and man-made disasters in the countries of the Eastern Partnership (PPRD East). The key partners in this program are also authorities in the field of civil protection and disaster management in Azerbaijan, Armenia, Georgia, Moldova and Ukraine.

3.4 CIVIL SOCIETY AND THE BELARUS RED CROSS SOCIETY

3.4.1 Non-governmental organisations and their role in tackling climate change

Public participation in decision-making, including the environmental issues, is one of the main requirements for sustainable development, good governance and sound decision-making in a country. There are currently more than 70 registered environmental non-governmental organisations in Belarus.

NGOs in Belarus are making a significant contribution to informing the general public about the environmental issues. In addition to non-governmental organisations, public ecologists are actively participating in different events, informational campaigns, defending their interests in court, trying to address the violations of environmental legislation, taking part in working out draft laws, implementing projects on various environmental issues, including climate change projects. We should note that non-governmental organisations have
already positively influenced the process of environmental decision-making.

As noted above, a number of non-governmental organisations in Belarus are trying to tackle climate change. This involves informing and educating the public, carrying out research work in the field of sustainable development, renewable energy and energy efficiency improvement. Analysing the main environmental activities of NGOs, it should be noted that most of their work is focused on energy and resource conservation and developing public awareness about these issues, while climate change issues, possible future scenarios and risks related to climate change, as well as the importance of developing and implementing adaptation measures to climate change have been tackled indirectly.

It must be admitted that successful solution to environmental problems requires improving the interactions and increasing the level of cooperation between the various organisations to involve specialists from different fields and unite efforts for fruitful advocacy and defence of their interests in the field of environmental protection. This issue has been actively claimed and blamed among environmental non-governmental organisations in Belarus.

3.4.2 The role of Belarus Red Cross Society

Belarus Red Cross began to carry out its activities at the end of the XIX century under the Russian Society of care of wounded and sick soldiers. Today Belarus Red Cross Society is a republican public association, which has a membership of approximately 1 mln 119 thou 688 members BRCS (10.4 % of the total population), 21 100 volunteers, where there are 16 282 young people; 282 staff member BRCS, 138 employees of Sisters of Charity Service. BRCS is the only Red Cross national organisation in the Republic of Belarus which assists the state in performing charity activities within the whole territory of the country. Its structure comprises 8 regions Minsk city organisation and Railroad organization of BRCS, 144 district and city organisations, and 17 unit organisations on Belarusian Railroad, 7843 primary organisations of BRCS.

The BRC is engaged into the following strategic areas:

- Dissemination of the Fundamental Principles of the International Red Cross and Red Crescent Movement, as well as dissemination of humanitarian values, which involves education and acknowledgement with Fundamental Principles of the International Red Cross and Red Crescent Movement and standards of international humanitarian law of not only the employees and volunteers of the Belarusian Red Cross Society, but of other population groups as well (the youth, journalists, national security agents, university area, healthcare professionals).

- Preparation for emergency situations and response to emergency situations with the purpose to reduce population vulnerability in emergency situations of natural and industry-related nature.

- Healthcare and homecare which envisage active work of BRCS employees and volunteers in the field of social relevant diseases prevention and maintaining healthy lifestyle, implement programs and projects, such as “The youth against HIV”, “HIV prevention in the worlds of work”, “Preparation for pandemia”, “Support of the State Program “Tuberculosis”, in the Republic of Belarus’ and others.

- BRCS organisation development and capacity building, with the purpose of improvement of the activities legal basics and BRCS capacity building.

As for issue related to climate change, the BRCS provides response to emergencies. Response to heat waves and cold weather may be given as an example. Also within the areas of its activities BRCS works closely with the governmental bodies and public organisations.
In the territory of Belarus at the end of January 2014 there were very strong frosts up to -30˚C with a strong wind. During this period, Belarusian Red Cross helped the most vulnerable people. The response service of the BRCS took part in response to cold weather: city, railroad and each regional organisation.

Mobile heating items, namely, special tents equipped with a generator and a heat gun worked in Minsk and in each regional center. The volunteers could keep warm tea, get a hot meal. Particular attention was paid to the most vulnerable – the homeless.

BRCS's volunteers organised special raids, visited the most probable places of temporary residence of the homeless, dump sites. Volunteers offered warm drinks, clothing, provided first aid.

In addition, BRCS's volunteers carried out round the clock patrolling the Minsk Ring Road and the nearest highways to help drivers to warm up with hot tea, start the engine, if necessary – even to tow the car off.
4 Conclusions and recommendations

The recommendations have been made based on the analysis of legislation on climate change in Belarus, the measures needed for adaptation to climate change, as well as the analysis of the existing level of awareness on climate change among the representatives of civil society in Belarus.

4.1 RECOMMENDATIONS FOR DECISION-MAKERS

To improve environmental legislation, including legislation on climate change and adaptation to climate change. Nowadays some measures for adaptation to climate change include many governmental programs and industry documents. However, the variation and inconsistency of these measures in various documents do not allow using them successively and makes their use less efficient. Development of a single document on adaptation to climate change will coordinate the work of various governmental agencies on climate change.

To improve an emergency early warning system. Particular attention should be given to measures to improve the existing system what will allow to develop warning system in case of hazards in the media and disseminate warnings in an accessible form to all who are in danger. Also it is necessary to give advice on appropriate actions.

To improve the interaction of state bodies on climate change. This will improve the efficiency of governmental agencies on climate change.

To develop cooperation between state bodies and NGOs in order to ensure public participation in decision-making processes, taking into account the interests of the public concerned in environmental issues, including climate change.

Involvement of NGOs in the work of educating the public on the threats of climate change on human health and welfare and adaptation of population to climate change. NGO has good potential to work with different layers of the population, including vulnerable groups. This potential can be used to cover different regions and population groups.

To improve the capacity-building of the Steering Committee under the Ministry of Environment; the involvement of non-governmental organisations, not only the environmental ones. This will improve NGO dialogue with the government, and expand the public concerned.

To include the climate change issue into educational curricula in schools, as well as improve personnel qualification. Currently the topic of climate change in the educational system of Belarus is proactive. Educating young people about the problem of climate change will attract broader population to the implementation of measures to mitigate the effects of climate change such as energy and resource saving, as well as informing the public about the necessity to reduce the risks of climate change.

Media relations with the aim to inform public on climate change. Information delivery should be directed to a wider range easily understandable by citizens.

4.2 RECOMMENDATIONS FOR CIVIL SOCIETIES

To strengthen the cooperation with state sector. NGOs cooperate more with the Ministry of Natural Resources and Environmental Protection regarding climate change. Sometimes they may contact with other governmental agencies: Minsk City Executive Committee, Ministry of Housing, Ministry of Health, State Committee for Standardisation and Department of Energy, Ministry of Construction, Ministry of Agriculture, state media etc. However, the examples of
cooperation with local authorities are not so successful as they might be. It should be noted that the initiative should come from both sides.

To improve cooperation of different NGOs. It will increase the efficiency of the public to influence decision-making processes on environmental issues.

To include the climate change issues into NGOs’ work. Work in this area needs to be extended, as there is currently a small number of non-governmental organisations engaged into climate change issues. Besides, their work is focused on the areas of improving resource and energy conservation.

To improve capacity for advocacy campaigns through their activities. Active participation in the development of legislation that will accommodate the interests and influence public policy of the state of climate change.

To continue the work in the sphere of raising population awareness. NGOs have good potential working in the field of education. To improve the efficiency of this work it is very important to interact with the government agencies and the media.
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