



Simply about climate change



(Your pocket manual of climate change adaptation in Kazakhstan)

2022

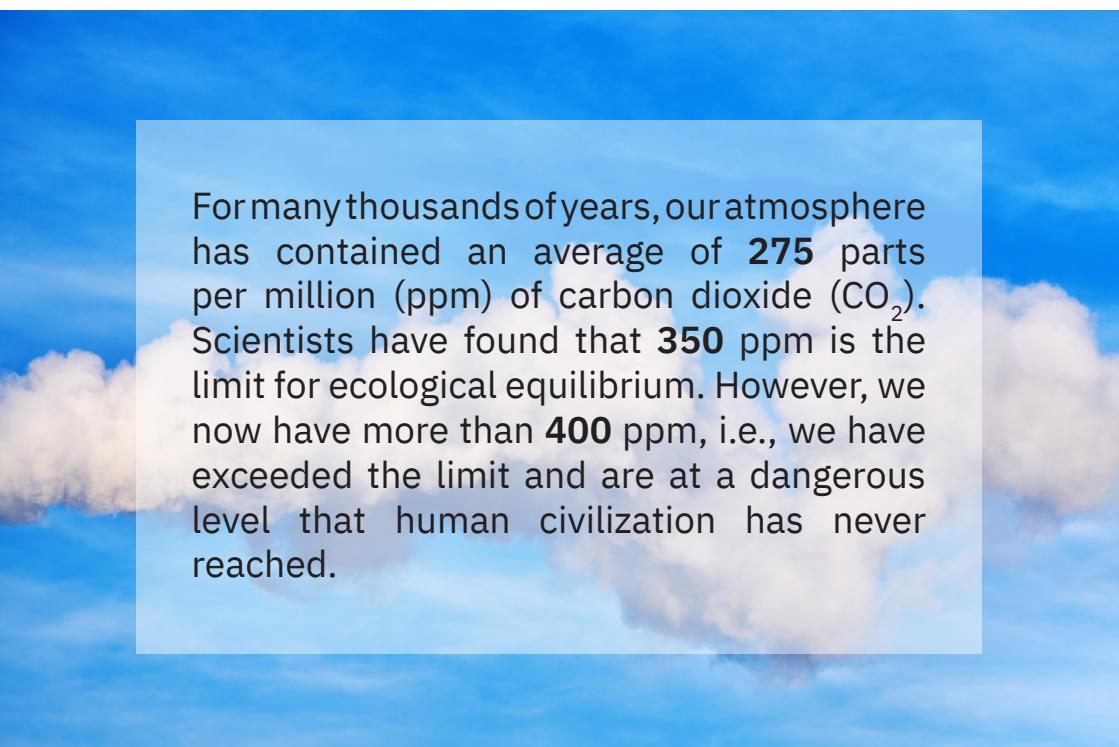


1. What is climate change and why does it happen?

We are a part of nature. Our planet has its amazing and unique natural mechanism for regulating and preserving the climate suited for the life of humans. The global water cycle and flows, biogeochemical cycles, land fertility, and a stable temperature of 15° C have persisted on our planet for many millennia. Our entire life and health, wellbeing and economics depend upon climate.

We know that the climate of the Earth has changed many times throughout history, but as for the changes of today, they are highly dangerous: they happen faster and faster and become irreversible. Intergovernmental Panel on Climate Change (IPCC)¹ has proved that climate changes taking place today are caused by human

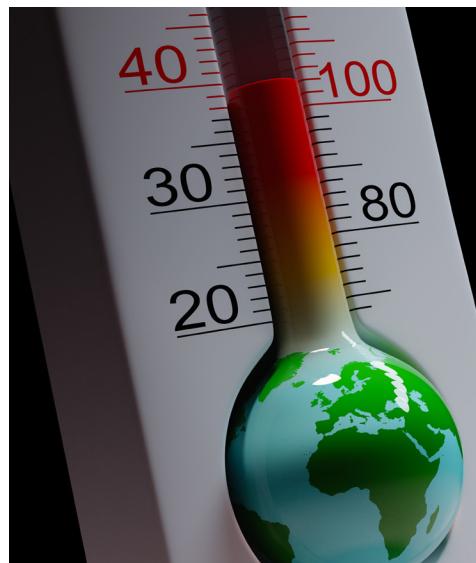
activities. Our use of such fuels as oil, coal, and gas, plowing of lands, deforestation, and irrational use of water resources resulted in significant ecological imbalances and a quick increase in greenhouse gases in the atmosphere. Greenhouse gases trap heat, do not let it escape the atmosphere, and increase global warming.



For many thousands of years, our atmosphere has contained an average of **275** parts per million (ppm) of carbon dioxide (CO_2). Scientists have found that **350** ppm is the limit for ecological equilibrium. However, we now have more than **400** ppm, i.e., we have exceeded the limit and are at a dangerous level that human civilization has never reached.

¹ The IPCC was created on the basis of the Advisory Group on Greenhouse Gases (AGGG), established in 1985 by the International Science Council for (ISC) and the United Nations Environment Programme (UNEP). The International Science Council, the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO). In 1988 it received the status of an expert body of the United Nations. Representatives from 195 countries participate in its work, assessing scientific data on climate change.

As a result of greenhouse gas emissions growth during one and a half centuries, the temperature of the Earth increased approximately 1-1,2°C. One would think it is very little. However, 1 degree is “the average temperature in the hospital all in all”: someone’s was 39°, but grew up to 40°, or instead of 35° became 34°, and that means close to death. Or here is the other example: we know that temperature rising by just 1 degree, from 0° to 1°, turns snow and ice into water, but globally it has resulted in the melting of glaciers, which are depots and regulators of fresh water on our planet. In addition, the temperature change caused a “domino effect”, the chain reaction of numerous failures, ecological imbalances. There started to occur more floods, landslides, and avalanches in some places, while droughts, dust storms, and hurricanes in others.



Until recently, it was thought that the warming of 2°C compared to the pre-industrial period was a safe limit. But the latest surveillance showed that it is essential to set the more ambitious goal: to limit the temperature increase to 1.5 °C. **The warming more than 2°C is the “point of no return” with the irreversible changes:** climate unpredictability, changes in water cycles and natural zones, more frequent floods and droughts, viral diseases,

and other hazards. Biologists also speak of the massive extinction of thousands of plant and animal species, with which we are linked with a lot of inconspicuous but important for our health, wellbeing and living itself, bondages. But their habitat changes faster than they manage to get adapted to these changes.

Scientists give their warning: within the next decades, the extreme natural phenomena caused by climate change threaten to turn our planet into a desert unfit for living. That is why, basically, we have no choice, whether to reduce or not to reduce our destructive impact on the biosphere – we must urgently take measures. The only question is how fast we can do it.





2. Our reply to climate change

In order to prevent climate change, the United Nations Framework Convention on Climate Change (UNFCCC)² was adopted in 1992. There are 197 countries and the European Union that are parties to the convention. Representatives of the parties to the agreement hold formal annual meetings, the Conference of the Parties (COP), to evaluate progress and make decisions. In 2021, the 26th regular meeting (COP26) was held from 1 to 12 November in Glasgow, Scotland. To strengthen global action,

² What is UNFCCC? The Russian text of the convention <https://unfccc.int/ru/peregovornyy-process-i-vstrechi/konvenciya/chto-takoe-ramochnaya-konvensiya-organizacii-obedinennykh-naciy-ob-izmenenii-klimata>

the Kyoto Protocol³ was adopted in 1997 in addition to this convention, and the Paris Agreement on climate⁴ in 2015. To give the brief summary of the essence of the Paris Agreement, all signatory countries pledged to fulfill the following conditions:

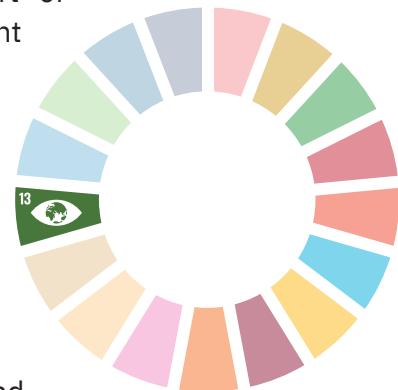
- Not to allow the global temperature to rise above 2°C and try to limit it to within 1.5°C.
- To adopt national commitments, NDCs (nationally determined contributions), in order to reduce greenhouse gas emissions, to restore forests and other natural ecosystems for climate stabilization.
- To phase out the use of coal, oil, and gas for energy production and increase investments into renewable energy and green economy.
- To provide financial and technical assistance to poor and developing countries to help them deal with the impacts of climate change.



³ Kyoto Protocol, 1997, adopted by 192 countries https://www.un.org/ru/documents/decl_conv/conventions/pdf/kyoto.pdf

⁴ The Paris Agreement is an additional agreement to the UNFCCC, adopted by 196 parties in 2015. <https://unfccc.int/ru/peregovorny-process-i-vstrechi/konvenciya/chto-takoe-ramochnaya-konvenciya-organizacii-obedinennykh-naciy-ob-izmenenii-klimata>

The climate goals are also part of the Sustainable Development Goals (SDGs)⁵. These goals address a variety of issues facing humanity, from poverty reduction to access to clean energy and water. Together, all the SDGs make up the 2030 Agenda for Sustainable Development, the UN's plan for peace and prosperity for people and the planet. Goal 13, «Take urgent action to combat climate change and impacts,» is one of the seventeen SDGs.



Kazakhstan has also committed to the SDGs and has ratified the UNFCCC and the Paris Agreement⁶. A Climate Neutrality Doctrine by 2060 and a Roadmap for Climate Change Adaptation are being developed. Climate change issues have been included in the recently adopted Environmental Code of Kazakhstan⁷. It establishes requirements for climate change mitigation and identifies priority areas for adaptation to climate change: agriculture, water and forestry sectors, civil protection (Article 313).

⁵ Sustainable development goals are global humanity goals adopted at UNGA till 2030 <https://www.un.org/sustainabledevelopment/ru/sustainable-development-goals/>

⁶ The law of the Republic of Kazakhstan as of November 4, 2016 № 20-VI 3PK "On ratification of the Paris Agreement" <https://adilet.zan.kz/rus/docs/Z1600000020>

⁷ Environmental Code of the Republic of Kazakhstan <https://adilet.zan.kz/rus/docs/K2100000400>



3. Climate change effects in Kazakhstan

Kazakhstan, like other countries of Central Asia, is included in the group of countries more vulnerable due to climate change. The reason for it is dry environmental conditions and being a landlocked country (and the ocean is the global regulator of temperature). In recent years, there is more and more evidence of climate change: the fluctuations of temperature rise, as well as waves of cold and heat, more droughts occur, the lack of water and related conflicts increase. Glaciers in Kyrgyzstan and Tajikistan, being “water stations” of Central Asia, decrease dramatically. In Tajikistan only, where about 60% of freshwater of Central Asia is stored, their volume reduced by 30% in a few recent decades,

more than 1000 glaciers are almost extinct. Alongside this, droughts and dust storms in this region occur almost with double frequency in the last decades.

In Kazakhstan, the major climate change effects are the growing shortage of water and the intensification of drought. According to forecasts, the shortage of water, including the transboundary aspect, may increase up to 40% by 2030, and this may create serious obstacles for economic and social development and for the preservation of natural systems. Such water deficiency may cause the degradation of lake and river ecosystems, agriculture, fisheries, and tourism.

Aquatic ecosystems in Kazakhstan are particularly vulnerable, so unless timely measures are taken, the tragedy of the Aral Sea may be repeated on Balkhash Lake, in the Ural River delta, and in other ecosystems, the wellbeing of many millions of people living there depends on their condition.

Climate stress factors such as increased drought, changes in river and precipitation regimes and increased frequency of extreme weather events lead to a significant deterioration of land productivity. Already by 2030, wheat yields can be reduced by almost 40%⁸, which threatens food security in the entire Central

⁸ RK President's speech at the international conference, Astana, October 13, 2021 <https://khabar.kz/ru/news/politika/item/136261-k-tokaev-vystupil-na-mezhdunarodnoj-konferentsii-po-dostizheniyu-uglerodnoj-nejtralnosti>



Asian region. This year the rural population in several regions of the country, dependent on livestock, fodder sources and pasture conditions, has already faced abnormal droughts due to climate change. In many villages, people were unprepared: they were left without water and fodder, and a lot of livestock died. At the same time, rising temperatures and changing rainfall patterns can also lead to outbreaks of agricultural pests and diseases.

The impacts of climate change are already affecting the well-being of many social groups. These changes affect people's health, the availability of water for drinking and sanitation, heating systems, and access to energy. Heatwaves and droughts can increase the death rate, especially among vulnerable groups such as children and the elderly. One of the most vulnerable groups is rural women, who traditionally take care of the family and household.

Extreme weather events resulting in floods and landslides also pose serious risks to cities, infrastructure, roads, buildings, and bridges. All major cities in Kazakhstan are located on the banks of rivers and are therefore prone to flooding. Urban heat domes exacerbate all the problems related to climate change, affect human health, and increase atmospheric air pollution.

Climate change is not the future generations' problem anymore; it is happening here and now. If we go on with those processes caused by our activities, they may make our planet totally unfit for living. We must realize the danger of climate threats and take all the measures possible to minimize the damages and troubles that they cause. This is CALLED CLIMATE CHANGE ADAPTATION.





4. Climate change adaptation

Adaptation helps to avoid or mitigate climate change impacts and find solutions to live in new climate conditions. IPCC defines adaptation as “the process of adjustment of natural and human systems in response to the actual or expected climate and its effects, seeking to moderate harm or exploit beneficial opportunities” (IPCC, 2001). Simply put, we all on the personal, local, and state levels have to change our habits and behavior due to climate change.

Approaches to adaptation may vary depending on the situation in some particular management unit, region, or country, that is to say, there are no universal solutions. In some cases, it can be saving or accumulating of water, in other cases it is being alert for hazardous natural phenomena. Adaptation measures must be based on scientific data, on being kept informed in a timely manner, education and population involved actively, with practical expertise and new technologies, gender aspects and vulnerable social groups and ecosystems all taken into consideration.

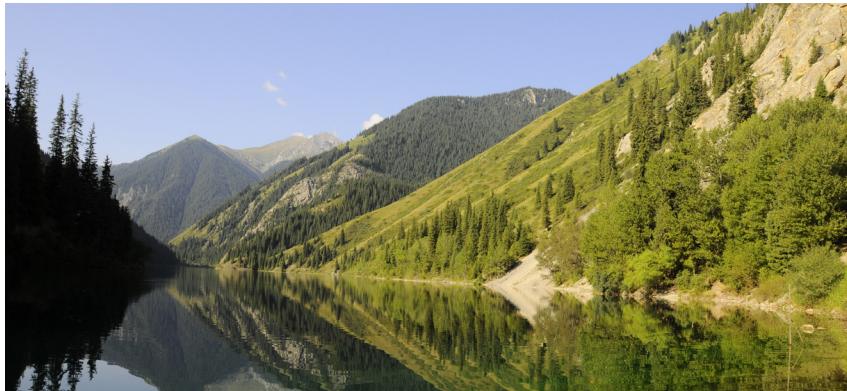
Climate change adaptation is more efficient when it is of strategic character, as well as of preventive and precautionary one. Adaptation measures taken reasonably in advance are, as a rule, 20-30 times cheaper than disaster management. Rough-and-ready adaptation means urgent, forced actions to react to events already taken place; it requires way more means and is of the nature of constant lagging behind.

According to the RK Environmental Code and “Rules of management and implementation of climate change adaptation process” (Order of Minister of Ecology, Geology and Natural Resources)⁹, adaptation measures must be developed and integrated into acting programs both on local and national levels. The Road map of climate change adaptation¹⁰ is developed in Kazakhstan with the UNDP’s support. The map includes strategic activities as well as portfolios of possible measures in priority sectors¹¹.

⁹ Order of Minister of Ecology, Geology and Natural Resources RK as of June 2, 2021 № 170 <https://adilet.zan.kz/rus/docs/V2100022974>

¹⁰ Draft of Road map of Climate Change Adaptation https://docs.google.com/document/d/1ynC1PtZFIbAJxzjQxeY_y-TNFwd2Onp0/edit

¹¹ Agriculture, water and forestry sectors and civil protection (hazardous natural phenomena)



The activities also include plans for oblast akimats unified by regional-and-basin plans according to long-term estimates of water volume change¹². The basin approach, based on the natural integrity of natural ecosystems in Kazakhstan, is particularly important because limited water resources are of strategic importance and require intersectoral and inter-oblast cooperation. The basin approach helps clarify goals and strengthen mutual linkages between oblast and sectoral programs for subsequent coordinated action on climate change adaptation, especially in areas going beyond administrative boundaries (water resources, forest ecosystems, natural emergencies, and others), as well as for nature-based solutions¹³.

¹² Water resources forecast until 2050 <https://drive.google.com/file/d/1jv1eaPmOA4P05bic2USCSJTYfV6DJHRC/view>

¹³ Nature-based solutions are recognized as more sustainable than the conventional and widespread technical measures of the past. For example, the construction of dams and reservoirs, often resulting in negative environmental and social impacts and habitat fragmentation. Any measures that focus too narrowly on climate change mitigation should be evaluated in terms of their overall benefits, environmental and social sustainability (UNEP)

4.1. Strategic activities include the climate-aware adjustment of all existing state, sectoral, territorial and corporate programs and projects. We need to change the whole system of state planning, the order of development, implementation and financing of state and territorial programs, with climate change taken into consideration. For instance, the order of the Ministry of National Economy of Kazakhstan on the development of doctrines (strategies), state programs, comprehensive plans and road maps¹⁴ does not consider climate change factors; it should be supplemented with issues on climate change mitigation and adaptation.

To support adaptation in all sectors, it is necessary to establish a system of adaptation centers with offices in all oblast centers in the premises of existing organizations, including NGOs. Such centers, working on a daily basis, are important for supporting the efforts of state and local authorities to plan, coordinate and monitor adaptation programs.

Changes in the systems of bank financing, insurance and crediting, information systems, education, training and retraining are also recommended at the strategic level. It is necessary to develop and regularly update scientific and methodological knowledge and create special analytical institutions. Following the example of other countries, it is proposed to create economic mechanisms and special funds to finance and support measures to adapt all sectors of the economy to climate change.

¹⁴ Minister of National Economy RK order https://online.zakon.kz/Document/?doc_id=38441660&pos=4;-106#pos=4;-106

4.2. Adaptation in the water sector¹⁵

Programs on supply of people with drinking water and wastewater treatment, reduction of water losses during transportation, modernization and reconstruction of water canals and hydraulic structures are being successfully implemented in Kazakhstan, and basin management is being introduced. In addition to ongoing programs, the Road map offers to draw up the inventory and update the characteristics of all major water sources in our country and take measures to protect, rehabilitate and sustainably use them with the participation of local communities and businesses. The most urgent directions of adaptation in the water sector of Kazakhstan are widespread water conservation and improvement of water management efficiency.

At the same time, **water-saving** measures are an obvious and priority task for climate change adaptation. Water-saving at all levels and in all sectors can provide significant, up to 50% savings of all currently used water resources! For this purpose, it is proposed to increase water saving requirements and integrate this task into all existing policies of state and local bodies, enterprises, organizations, and the private sector. We need to take measures to protect watersheds and river deltas to preserve water sources and natural ecosystems as well. It is also important to improve education and public awareness on water conservation and preservation of aquatic ecosystems.

Another urgent task of the water sector is to solve problems of fragmented **water management**. Only holistic (integrated) management and coordination of all sectoral and territorial programs in each basin, being an indivisible natural complex,

¹⁵ Water sector adaptation proposals https://docs.google.com/document/d/1ynC1PtZFIbAJxzjQxeY_y-TNFwd2Onp0/edit?rtpof=true

will allow preserving basin ecosystems, which are the basis for economic activity and social wellbeing. Catastrophic consequences of the Aral Sea desiccation show how important special measures are, especially for preservation of vulnerable aquatic ecosystems, such as Lake Balkhash, deltas of the Ural, and others. Successful world experience shows that it is necessary to create full-scale basin management systems with their authority and technical capabilities to plan, coordinate, support and control water and land use considering climate change.

At the basin level, the Road map offers, among other things, the following activities:

- Determination/refinement of common basin objectives and, on their basis, adjustment of objectives, norms and limits for all individual water users within the basin, taking into account forecasts of water resources, other climatic factors, as well as their monitoring and control;
- Strengthening of existing public basin councils for planning and coordination of adaptation measures at the basin level with the involvement of all water and land users and other stakeholders and integration of measures on adaptation and conservation of basin ecosystems into sectoral, administrative-territorial and production programs.

The basin approach is also the basis for transboundary cooperation, the establishment of joint basin councils with neighboring countries, legal, economic and other mechanisms to improve the efficiency of water, land and energy resources use for the benefit of all parties.

In addition to these measures, the Road Map specifies the regulatory framework reforming, wastewater discharges reduction, the establishment of water collection and storage systems, and other adaptation measures.

Case study: accumulation of rainwater and surface water (FAO)¹⁶

Simple systems of rainwater and surface water accumulation allow to collect and store water for its use in households or irrigation. Unsophisticated earthen dams can be used to build small and shallow reservoirs.

Such small reservoirs are especially important in dry periods and when water supplies are unstable. At the same time, natural lakes and wetlands can also be supported by them to increase their capacity to store and conserve water. They can also support the energy production of small and micro hydropower plants and contribute to effective flood control. Reservoir water can be used for ecological purposes to preserve ecosystems during periods of reduced flow or high temperatures. Water storage will be effective in smoothing out fluctuations in water demand and rainfall variability.

Water conservation costs depend on the scale of the project. For example, building small reservoirs with a 10-meter earthen dam can cost between \$100 and \$500. Larger reservoirs can be more expensive because of the requirements for their design, construction and management, as well as the distribution infrastructure associated with them. All water storage systems require maintenance to avoid or reduce losses and contamination. We must also consider that open tanks lose an average of 20% of their water through evaporation.

¹⁶ Technologies for climate change adaptation, FAO, 2014 <https://www.adb.org/sites/default/files/publication/149400/technologies-climate-change-adaptation.pdf>



4.3. Agriculture adaptation offers¹⁷

Kazakhstan is located in the risk farming area. The main problem of modern agriculture is the reduction of land fertility and humus resources. Changes in temperature and precipitation, droughts and reduction of water resources are already largely considered in the State Program of Agricultural Sector Development until 2021, as well as in the National Project for 2021-2025¹⁸. Measures being implemented in this sector include improving the efficiency of irrigated agriculture, crop diversification, modernization of drip irrigation and infrastructure with due consideration of changes in river flows, transition to organic farming and more efficient soil management, prevention of overgrazing, and pasture management. It is also planned to develop gardening, fisheries, as well as to conduct climatic zoning of the country's territory, considering changes in conditions for crop growing.

In addition to the Road map projects in progress, there were recommended the following measures:

¹⁷ Proposals for adaptation in agriculture until 2025 https://docs.google.com/document/d/17cU5b-YmAorMrKPgIN_fqls4nzd7mfIH/edit?rtpof=true

¹⁸ Agricultural sector development program until 2021 <https://admin.primeminister.kz/assets/media/prilozhenie-k-natsproekt-apk.pdf>

- development of a targeted program to preserve and restore soil fertility and to prevent desertification as the basis of the country's food security;
- watering of pastures and building of a network of watering places using RES, as well as the introduction of modern methods and technologies to improve productivity and carrying capacity of pastures;
- creation of forest strips and protective green spaces for flood control and moisture accumulation for food production;
- prevention of land pollution by production and consumption waste;
- construction of an organic fertilizer plant;
- planning import-export of food and industrial goods, taking into account their “water and climate footprint”¹⁹;
- others.

A strategic direction under conditions of increasing water scarcity and droughts that are more frequent is crop diversification with rejection or replacement of water-intensive products with less water-intensive but more productive crops, increasing the share of drought- and disease-resistant cultivars adapted to climatic changes.

¹⁹ **Water footprint** is the amount of water used in the production of goods or services. The water footprint can be calculated for an individual, a product, or a service, as well as for an enterprise, a region, or an entire country <https://www.waterfootprintassessmenttool.org/national-explorer/>

For example, if we have cultivated wheat in our area and want to continue harvesting as much as before, we need to switch to more drought-resistant cultivars. But if, according to climate forecasts, nothing will grow in the area without irrigation, it is advisable to replace wheat with vegetables or switch to irrigated agriculture. In the case of a significant decrease in water resources, one should also think about how to use this land as pasture or for other needs.

An important area of the agricultural sector adaptation is the development and wide dissemination among farmers of climate-resilient technologies, such as greenhouses with modern water- and energy-saving technologies, allowing less dependence on weather conditions, frost or drought. International organizations and projects (UNDP, EU, World Bank, ADB, CAREC, etc.) have created various databases with detailed descriptions of effective and accessible technologies for agriculture and other sectors, with translation into national languages and reference materials, including training videos on YouTube channels²⁰.

²⁰ Database on technologies for adaptation to climate change in water-energy and food production, created at the initiative of Central Asian NGOs with the support of CAREC <https://tech4eco.org/technologies>

Technology case study: laser land leveling (FAO)

An important approach to increasing yields is to level the ground before planting.

Laser technology increases the accuracy of field leveling. Laser land leveling is the use of lasers mounted on a tripod and used in conjunction with a tractor to level agricultural fields. Leveled land helps control runoff and irrigation uniformity. Laser land leveling has also proven effective in conserving water resources. Studies have shown a 30% increase in crop yields on laser-leveled fields and a 25% water savings (Singh et al. 2009; Lybbert and Sumner 2012). Land leveling is one of the effective techniques in irrigated agriculture. Laser land leveling «promotes better use of variable precipitation», making it particularly useful under the more variable precipitation conditions predicted with climate change.

Laser land leveling usually needs to be performed once every few years only. In addition to the environmental benefits of maintaining soil fertility and water resources, laser leveling has a number of other co-benefits, such as a 2-5 hour reduction in tillage time per hectare (Singh et al., 2009). The use of this technology increases annual farm income by \$200-300 per hectare (Lybbert et al. 2012, 4). A smooth field also improves fertilizer efficiency and can reduce dependence on diesel pumps and fuel (Lybbert and Sumner, 2012; Lybbert et al., 2012). According to Jat et al. (2006, 2), expanding laser land leveling to 2 million hectares of rice and wheat crops «could increase crop yields by up to \$500 million over three years and reduce greenhouse gas emissions by up to 500 million kg of CO₂» (Jat et al. 2006, 2).

The scale of Implementation: Farm level. Laser land leveling can easily be widespread once it is implemented in a region. For example, in India in the state of Uttar Pradesh the number of uses of this technology increased to 925 in 7 years after the introduction of laser land leveling.

4.4. Proposals for natural hazards adaption²¹

The expected increase in the frequency of natural disasters and emergencies requires consideration of climate risks in the civil protection sector. Kazakhstan, along with 187 other countries, has adopted the Sendai Framework for Disaster Risk Reduction 2015-2030²², which also meets the challenges of climate change adaptation. Planning for the prevention and decrease of natural and industry-related hazards significantly reduces the likelihood of disaster risks and losses. The legal and institutional frameworks for risk reduction and management at national and sub-national levels are in place, involving stakeholders, vulnerable social groups, and including regional cooperation through the Centre for Emergency Situations and Disaster Risk Reduction, established in Almaty in 2016 by Kazakhstan, Kyrgyzstan and Afghanistan²³.

In addition to the state programs being implemented, the Road map for Climate Change Adaptation proposes the following measures:

- consideration of climate risks in land use planning and the Architectural Code of RK;
- development/updating of Construction standards and regulations, and standards for construction and reconstruction of buildings and structures, taking into account the risks of climate change (for energy and water conservation, seismic resistance, autonomous

²¹ Civil protection sector adaptation proposals https://docs.google.com/document/d/1DtqQYSzWnzJeFGLsc6RGYRYEnPjbC_8/edit

²² Sendai Framework https://www.unisdr.org/files/43291_russiansendaiframeworkfordisasterri.pdf

²³ Centre for Emergency Situations and Disaster Risk Reduction <https://cesdrr.org/>

heating and renewable energy, landscaping and other climate technologies);

- building of nature-based infrastructure for flood prevention, including the expansion and restoration of forests and wetlands;
- limiting economic activity in areas exposed to climate change risks in order to preserve and restore vegetation cover in watersheds with the purpose of reducing hazards from mudflows and floods;
- planning measures during extreme weather events, including measures for access to drinking water, management of hazardous substances;
- involvement of local organizations and NGOs and training in disaster prevention and removing the adverse effects of emergencies in accordance with the law “About Volunteer Activities” of 2016;
- creation of an automated system for warning the population and monitoring hazardous natural phenomena, introduction of automated monitoring stations with rapid warning of the population and businesses, including via SMS and others.

Advance warning of natural hazards of the population and businesses is one of the most important tasks. Reporting systems are developing rapidly around the world. For example, the European Union has adopted special directives (laws) regulating the timing, content and mechanisms for developing and implementing risk assessment plans²⁴, preventing and minimizing possible hazards, and keeping the population and other stakeholders informed as well.

Case study: European Flood Alert System²⁵



Following the calamitous floods in the Elbe and Danube river basins in August 2002, the European Commission (EC) initiated the development and testing of a unified European Flood Alert System (EFAS), which aims to provide early warning and supplement to existing national systems. Developed at the EC's Joint Research Centre, EFAS can provide medium-term flood simulations across Europe with a lead time (which is the period of time between the detection and occurrence of a flood) of 3-10 days. Following its creation, EFAS has successfully issued early warning signals, 3 to 6 days before a flood. Here are some examples: (a) floods in August 2005 in the Northern Alps; (b) floods on the Elbe and Danube due to melting snow in March-April 2006; (c) several flood warnings on rivers in Romania, including in August 2008; (d) floods on the Po River in April 2009. EFAS receives about 70 different digital weather forecasts twice a day from the European Centre for Medium-Range Weather Forecasts (ECMWF), the German Weather Service (DWD) and the Meteorological Consortium (Limited Area Ensemble Forecasting System) (COSMO-LEPS), as well as real-time weather and river flow observations from several European organizations. All these data are entered into a hydrological modeling system (LISFFOOD), which generates 70 forecasts. Statistical comparisons with past

²⁴ The European Council Directive on the assessment and management of flood risks http://ec.europa.eu/environment/water/flood_risk/index.htm

²⁵ European Flood Alert System <http://floods.jrc.ec.europa.eu/>



floods allow EFAS to establish the potential for exceeding critical alert thresholds in the forecast time interval. In this case, electronic flood warning messages and flood probability information are started to be sent to the relevant national hydrological services. These services can check the results on-site and access all alerts via a secure web server. EFAS has two advantages. Firstly, it provides useful information for the preparation and provision of assistance both before and after a flood event, through a community civil protection mechanism coordinated by the Monitoring and Information Centre (MIC) in Brussels. Secondly, a network of 25 national and/or regional hydrological services receives additional medium-term flood information that can help improve preparedness for an upcoming flood event. No fee is charged for participation in EFAS. National and regional hydrological services, involved in operational national/regional flood warning, can cooperate within the system after signing a simple memorandum of understanding, which defines tasks and responsibilities, without specifying the responsibilities of the national hydrological services. Currently, EFAS covers Europe up to 30° E. (including Finland, the Baltic States, and the Republic of Moldova). There is a possibility of further expansion if there is demand from other countries.



An important element of EFAS is the exchange of near-real-time river flow information between hydrological services in close cooperation with the Global Runoff Data Centre (GRDC) in Koblenz, Germany. This data improves the quality of forecasting and allows verification of forecasts for further improvement of the system.

4.5. Forestry sector climate change adaptation²⁶

Kazakhstan has pledged to restore **at least 1.5 million hectares** of degraded land through afforestation and reforestation by 2030 as part of the Bonn Challenge . Reforestation is one of the key areas for climate change mitigation and adaptation. In addition to carbon sequestration, afforestation supports water regimes, land restoration and biodiversity, and creates possibilities for employment.

The Forestry Committee has modeled climate change mitigation outcomes using the CBM-CFS3 program (the Carbon Budget Model of the Canadian Forest Sector). During the first three years after planting, each hectare of coniferous, soft-wooded broad-leaved or hard-wooded broad-leaved tree species absorbs an average of 3.67 tonnes/year of carbon dioxide per hectare. The 25-year lifespan of commercial forests also provides many adaptive benefits: water retention, timber for construction, and others.

In order to increase forest cover between 2022 and 2030, the government plans to improve the incentive mechanism for private industrial plantations and forest nurseries, as well as the implementation of pilot projects supported by public-private partnerships. In 2020, an action plan was adopted to implement the Head of State's message to the people of Kazakhstan «Kazakhstan in the New Reality: Time for Action». According to the Plan, **it is scheduled to plant more than 2 billion trees in the**

²⁶ Proposals on forestry sector adaptation https://docs.google.com/document/d/1OMWscLU9Tr93Y_a-Hg9MVu1qikGDCBLz/edit

²⁷ **The Bonn Challenge** is a global goal to bring degraded and deforested landscapes into restoration. Sixty-one countries have taken up the Bonn Challenge, committing to restore 210 million hectares of land <https://www.bonnchallenge.org/sites/default/files/resources/files/%5Bnode%3Anid%5D/20010%20-%20Bonn%20Challenge%20Report%20-%20Russian.pdf>



forest fund and 15 million trees in human settlements within five years.

The Road map also proposes the following events:

- restoration and conservation of forest ecosystems, increase of forest cover and forest strips to regulate and warn influxes and flood events;
- development of networks of protected areas and eco-corridors to protect animal and bird migrations and conserve biodiversity;
- restoration of the system of forestry (wildlife) management units in all forest ecosystems of the country for permanent and systematic forest restoration, control and protection, including against fires and pests;

- establishment of an automated remote monitoring system for early detection and prevention of forest fires with the integration into transboundary and international systems, and training of specialists and volunteers to extinguish forest fires;
- arrangement of a central forest pathology service with the functions of forest pathology monitoring in the forests of the republic, planning and control of measures to combat forest pests and diseases;
- forest reclamation and afforestation on the dried seabed of the Aral Sea (Kazakhstani part) in cooperation with Uzbekistan;
- increase of the forest cover in catchment areas in river basins and reforestation in the dispersion zones of river runoff;
- improving green infrastructure: green spaces, green roofs, trees along streets;
- others.

Ecosystem-based adaptation is now seen worldwide as the most effective and reliable method of climate change adaptation²⁸. For example, forests in river basins significantly reduce the force and speed of flash floods. But this requires at least 30% of coverage of the river basin area by forests.

The restoration and preservation of forest ecosystems also requires the creation of special services for the cultivation of seedlings, breeding and seed production.

Case study: In Kazakhstan, a tree nursery has been created, and it has no analogs in the country.

A unique complex of forest nursery and forest seed station is created in Beskaragai district of the East Kazakhstan region. Seedlings will be grown in it for the restoration of ribbon pine forests of Priirtyshie²⁹.

The complex is located near the village of Kara-Murza in the Kanonersky rural district as part of the World Bank's project «Conservation of Forests and Increasing Forest Cover in Kazakhstan». The complex consists of several nursery buildings, greenhouses, an administrative building, a boiler house and a water station. About 1.5 billion tenge was spent on the construction of all the facilities, purchase of modern equipment from Sweden, Finland. «The main objective of this complex is the restoration of the ribbon woods of Priirtyshie which have suffered from fires in 1997-2006. About 130 thousand hectares of forest in the Beskaragai district have been burnt out in recent years. This

²⁸ Ecosystem-based adaptation is «the use of biodiversity and ecosystem functions and services to contribute to the wellbeing of society, including indigenous peoples and local communities, and to help people adapt to the adverse effects of climate change» (UN Convention on Biological Diversity, 2018).

²⁹ <https://www.zakon.kz/4711973-v-vko-otkryvajut-lesopitomnik-kotoromu.html>



territory should be planted with young spruces and pines,» said Murat Dauletov, General Director of the State Forest Nature Reserve (SFNR) «Semei Ormany». «We hope that in a few years we will be able to plant burnt-out territory near Begem. Then, in terms of forest coverage, we will return to the indicators of the Soviet era. Next, we will face the task of greening the cities of Semey and Ust-Kamenogorsk. With the new volumes of industrial reproduction, we will also provide planting material for Pavlodar, where terrible forest fires once raged».

In 2015, SFNR specialists planted more than 19 million seedlings in the area of 4,158 thousand hectares. The rooting rate is very high - 58%. But with the introduction of new technologies for the planting of seedlings with a closed root system, this indicator will almost double to 95%. This will already be a record in the history of reforestation in Kazakhstan. Murat Dauletov demonstrated Swedish equipment worth 595 million tenge (about \$ 1.400 million). Special automated machines will themselves perform the selection, processing of seeds by category, planting seedlings on the cassettes. Three million seedlings will be intended for planting with a closed root system (together with an earthy root ball). It is proved that transplanted trees with «native» soil more easily take root and do not get sick. Also near the greenhouses, there is a huge area for planting five million seedlings for transplanting with an open root system (natural nursery). «The construction of the complex will be a real step for forest reproduction on an industrial scale,» said regional head Danial Akhmetov.

4.6. Your personal adaptation: what can you personally do for climate conservation and adaptation, to save your own life and your family's lives?

Ultimately, climate change is about all of us. Agriculture, utilities, industry, food production and services are all created for our needs. We are both consumers and customers of these activities that are destroying the climate and nature. So each of us can do our part, starting with changing our needs and habits. There are many practical tips on what each of us or our communities can do for mitigation and climate change adaptation. For example, this publication by FAO (Food and Agriculture Organization of the United Nations) advises³⁰:

³⁰ Climate change chevron <https://www.fao.org/3/i5216ru/i5216ru.pdf>

Save water!

To bring water you use every day to your place and to make it safe for drinking, a large uptake of water from natural resources is required, as well as chemicals for its treatment. It takes a lot of energy to bring it to your house and turn it into hot water, and this unavoidably results in water resources depletion and greenhouse gases emissions. In other words, water saving protects nature and water sources, and saves energy!

Use water rationally:

turn off faucets while brushing your teeth, don't use bathtub, spend less time taking a shower.

Stop water loss:

If you have just one drop per second dripping from your faucet, you lose **more than 11,360 liters of water** in one year! If your toilet is leaking, you are already losing more than 700 liters of water in just one day! Put a drop of food coloring in the cistern, wait a while - if the color appears in the toilet, it means that your toilet is leaking!



Avoid the excessive use of hot water for your washing machine: do the washing when your machine is fully loaded. Let it wash at a lower temperature: **up to 90% of the energy used to wash laundry goes to water heating.** And there's no need to set the temperature high: most detergents are so effective that they can wash your laundry and your dishes clean at low temperatures.

Water-saving appliances: Consider installing water-saving appliances, such as showers, toilets, or faucets with minimal water use. They can help reduce water use by up to 50 percent!

For more information on water, check out The Water Chevron. Here you can find more ideas on how to conserve this valuable resource:

<http://wateruseitwisely.com/100-ways-to-conserve>

Do you know that if hot water is running for five minutes, it uses as much energy as a 60 W light bulb burning for 14 hours!



Grow plant products on your land plot

There are many various and inexpensive greenhouses available today with drip irrigation, rainwater, and energy conservation. Food grown at home does not require much energy to be transported and stored. Plus, it always tastes better and is healthier for you!

https://tech4eco.org/prodovolstviennoie_obiespiechienie

Make compost from food and other waste:

to reduce the amount of trash going to the landfill, and at the same time feed the soil in your yard, garden, or vegetable garden.

Plan your garden wisely: choose native and low maintenance plants that don't require much water and special care.



Use mulch: Mulch is a material made up of decaying leaves, twigs, or tree bark that is placed around plants to enrich and protect the soil from drying out. This will help maintain a moderate soil temperature and retain moisture during dry weather.

Reduce the size of your lawn: Lawns consume 2 to 3 times as much water as other plants, which means you can lose up to 50 percent more water through evaporation, runoff and excessive sprinkling.

Plant trees and care for them: trees regulate climate, water exchange, and absorb carbon dioxide during photosynthesis. Trees also clean the air and keep it cool, reducing the need for air conditioning.



Use less energy:

Most of the energy you use at home and at school goes into heating, air conditioning, and the use of appliances. Less energy, less harm to the environment.

https://tech4eco.org/enierghoobiespiechieniie_i_eniergho_sbieriezhienee

Keep them unplugged:

do you know that some appliances and electronics, when plugged into an outlet, still consume electricity even when they are turned off? Unplug these energy «vampires,» Visit ENERGY STAR, the website for kids, to learn more:

www.energystar.gov/index.cfm?c=kids.kids_index



Pay attention to labels:

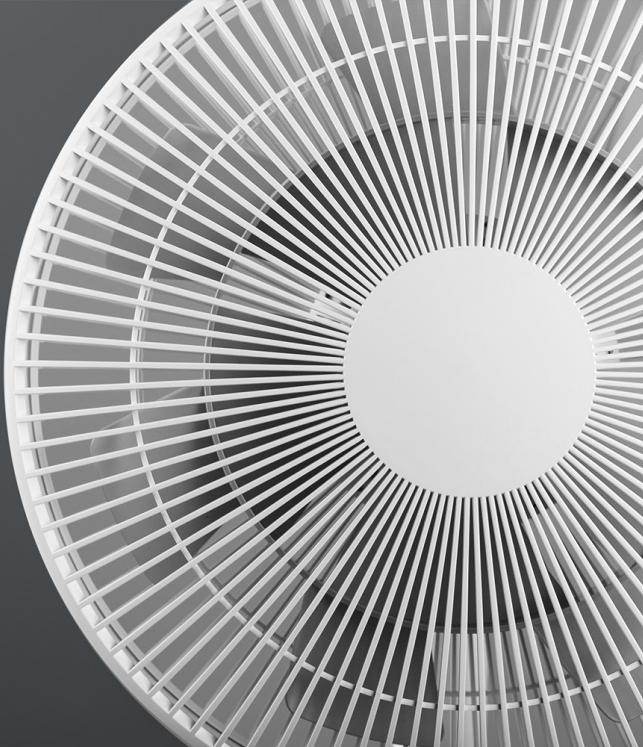
energy-efficient appliances and electronics typically use 10 to 50 percent less energy than conventional models. If you want to buy a TV, computer, or other electronic appliance, look for products with a label with a star (Energy Star) on them.

<https://market.yandex.ru/journal/expertise/kakuju-marki-rovku-iskat-na-ekologichnih-tovarах>



Take smart steps: making a few changes in your home you can go a long way toward reducing your carbon footprint. For instance:

Regularly clean or replace the filters in your heater and air conditioner so they work more efficiently. Inspect your heaters or air conditioners: if they're set too high in the winter or too low in the summer, you're wasting energy.



Keep your vents clean: if your vents are blocked, it will take more energy to blow air into your room.

Use a cooling fan instead of air conditioning, never forget to switch it off when you leave the room, or keep doors and windows closed when it is on.



Use awnings and curtains to protect yourself from the sun or the cold.

Replace single glazing on windows with double glazing.

Replace regular light bulbs with LEDs, which use 60 percent less energy. Also, wipe down light bulbs regularly. Clean bulbs provide 50 percent more light than dirty ones. And remember, natural lighting is more efficient than artificial lighting, plus it's free of charge.



Paint your walls light colors: dark colors absorb light and light colors reflect it. The lighter your walls are painted, the less electric light you will need to light the apartment.

Do the math: an energy audit can help you calculate how much energy your family uses and determine how to reduce that amount.

Here's an example: <http://cent.dn.ua/wp-content/uploads/note-for-pupils.pdf>

Energy saving and transition to clean energy



Choose ecologically friendly energy:

Talk to your family and school about switching to renewable energy. When we get our electricity from renewable sources, like wind and solar, we are protected from power outages and avoid the carbon dioxide emissions that come from burning fossil fuels (coal, oil, and natural gas).



Produce your own energy: Can your home or school use its own renewable energy sources? Talk to them about the possibility of installing solar panels, solar water heaters, solar collectors or wind turbines:

<https://tech4eco.org/technologies>



Move to conscious consumption. Many people don't realize that reducing consumption, reusing and recycling helps with climate change adaptation. You will ask: How? The fact is that every product we buy requires energy and resources to produce, transport, sell and then dispose of it. Reducing consumption, reusing and recycling means you buy and throw away less stuff, and it helps conserve nature and reduce the amount of greenhouse gases we emit into the atmosphere.



Reduce consumption: Think about how many things you have in your home that you never use. What do you think are the things that you shouldn't have bought? Do you really need a new mobile phone? And what is there in your garbage can? Maybe you throw away too much food? Why is it happening? You may considerably reduce amount of things you buy. Can you buy the same food but with less packaging or without packaging at all? And is that package recyclable? If you can, try to borrow or rent things that you need for a short period only.



Reuse:

reuse the things you already have. If you have things you no longer need, give them away to someone who needs them or can use them. Reuse bags, glass jars and other materials, don't throw them away and stop buying new ones.

Recycling: don't forget to send any materials for recycling: bottles, cans, paper, because they can make new products from them. Use containers for different materials so they can be recycled separately.



Buy things made from recycled materials:

choose, if possible, those items that are made from recycled materials. Talk to your school about conscious consumption! Schools can save energy, conserve natural resources, and prevent greenhouse gas emissions by reducing consumption, reusing, and recycling.

Buy and consume eco-friendly products.

Ask your parents and friends to change their buying habits and become more environmentally friendly. There are several certification schemes that ensure that certain environmental principles are followed in the production of items. When buying these products, look for national or international «organic» labels or the Forest Stewardship Council label

<https://ic.fsc.org>



Have less meat. You can find meat-free recipes, which, however, allow you to have the balanced food ration. For instance, once a week you can eat food containing no meat but vegetables or beans, rich in proteins.

Use bags or shopping bags repeatedly instead of disposable plastic bags. This saves energy and reduces waste.

Avoid overpackaged foods. You can reduce your carbon dioxide emissions by 500 pounds if you reduce the amount of trash you throw away by 10 percent.



Buy locally grown and produced food.

Это This will help save fuel and money for your community. For example, you can buy unpackaged foods with a low carbon footprint at your local market.

Buy food that has not been heavily processed, buy raw ingredients and cook yourselves.

Buy fresh foodstuff instead of refrigerated one. Making frozen foods requires ten times as much energy to produce.



Avoid buying such foodstuff that is luxurious but not a necessity. Do not let advertising have influence on you and do not buy things that you don't need.

Buy items in reusable packaging.

Do you know that ready-to-eat foods in the U.S. travel 2,400 km from a farm to your dinner table!



The livestock sector emits more greenhouse gases than transportation. This sector also uses enormous amounts of land, water, and energy. Millions of hectares of rainforest are cut down in order to turn the land into pasture. So think about the journey the food takes to get to your table!

Eco-tourism and travel



Cars, trucks, airplanes, and other types of vehicles account for about one-third of greenhouse gas emissions. Your choice of transportation can have a big impact on reducing emissions.

Walking, biking, scooting, skateboarding, rollerblading, or taking a bus to school and work: the key is to make sure your ride/walk is safe. Ask your school to participate in the Safe Routes program. This program gives advice to students and their families on, for example, how to organize a hike/trip to school led by one or two adults.

Leave your car at home:

make arrangements with your family so that all of its members can do their chores in one trip, so that you don't have to drive them separately. Think about your friends who can give you a lift, and who you yourself can give a lift, and use public transportation if possible.



Be rational in your choice of a new car:

When it is time to buy a new car, help your family choose an economy or electric-powered model. Then you will use less gasoline, reduce emissions and save money.

Drive rationally and convince your parents to do it: different factors influence your car's fuel economy: for example, tire pressure, brake pedal and gas pedal use, sudden acceleration, and an overloaded car boot. **And remember, a well-maintained car emits lesser greenhouse gases!**

Carbon offsets: when you take a plane or other modes of transportation, find out if the company offsets its carbon emissions by, for example, planting trees. This is called a carbon offsets scheme. But remember, you'll need to check to see if that company's scheme is credible.



People all over the world are preparing for the effects of climate change. Children and young people are the most vulnerable social group - try to help them learn more about climate change and how they should respond, for example:

Find out how climate change will affect your area and what extreme events there might be: floods, droughts, or hurricanes. Help them make a contingency plan in case this happens, and how to involve all potential participants. Check out the Red Cross curriculum “Masters of Disaster”:

https://www.unisdr.org/files/2300_20GoodExamplesofGoodPracticeruss1.pdf



Find out more about **climate change impacts on water and food sources**. Ask local authorities what they do to prevent water and food products deficiency. And what else can you do by and for yourselves? Find out about the ways climate and such extreme weathers as intense heat or cold can influence people's health. The ways these phenomena influence those people in your community who are the most vulnerable. Find out the ways you can help them, for example, define higher risk localities, safe havens, and locations of drinking water sources and medical treatment facilities.

Find **out the way climate change may affect houses, buildings, or public spaces**. Simple measures to be taken to diminish potential hazards, for instance, a danger your house may be subject to. What kind of thermal insulation for severe frosts does it have or how is it protected from heatwaves? If you own a patio, garden, or land plot, how can you make this landscape more defensible when climate changes or extreme weathers occur?



Climate change affects natural ecosystems, and changes in ecosystem affect our lives. This is because ecosystems provide us with many «services» that we don't think much about, from clean air, food, and water, to protection from floods and droughts.

Find out what you can do to protect natural ecosystems where you live, how they will be affected by climate change, and what else you can do.

Protect nature, rivers, animals, birds, land fertility, don't pass any violations by!

Keep nature intact, don't upset any natural habitats. Why it is important for you, who and in which way to address, see here:

[**https://www.ecodao.ru/materials/instrukcija-kak-pravilno-napisat-obrashhenie-v-organ-vlasti;**](https://www.ecodao.ru/materials/instrukcija-kak-pravilno-napisat-obrashhenie-v-organ-vlasti;)
[**https://bellona.ru/pravo/**](https://bellona.ru/pravo/)



Assess the situation on the constant basis in relation to potential disasters that climate change may cause. This will allow you to stay alert and act in time to protect yourself and your nearest and dearest.

Raise your voice, get united with others, and call on local authorities and government to take better action to preserve and adapt to climate change!

You are lucky because you have this important information about climate change and its effects in your hands. But there are still many people who do not know this. Please help them so that your family, friends, schools, internet societies, cultural and sport centers get familiar with this information and can be ready for climate change!

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