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Strategy of Adaptation to Climate Change, Prevention and Minimization of Its Adverse Effects

9.1. Strategy's objectives

Scientific data confirms, that at present, the simple development and implementation of measures on greenhouse gas emission reduction is not sufficient for the prevention of dangerous anthropogenic impact on the climate system.

According to the decisions of CoP UNFCCC and recommendations of the Intergovernmental Panel on Climate Change, adaptation is considered as an important instrument in solving the problem of climatic change in addition to the reduction of greenhouse gas emissions into the atmosphere.

According to the definition of the Intergovernmental Panel on Climate Change adaptation to climate change refers to adjustment of natural and human systems to actual or expected stimuli or their effects, which moderates harm or exploits beneficial opportunities.

National programs and action plans of Tajikistan on environmental hygiene, desertification, ozone layer depletion, flood management and ecological education confirm the high priority of preventative actions and the reduction of natural disasters' negative consequences caused by climate change.

The results of the vulnerability assessment of natural resources, national economy and public health to climate change, confirm that the influence of climatic factors in Tajikistan sometimes is very high, and appropriate adaptation measures could decrease or prevent negative effects of climate change and ensure general preparedness to this phenomenon.

The present stage of the adaptation strategy mainly includes the identification of primary possible adaptation measures that have to be implemented in order to mitigate climate change effects and support sustainable development of the republic. The next stages of strategy development will include expansion, probation and detailing of adaptation measures.

The strategic objective is to develop a set of effective measures for reducing the vulnerability of natural resources, national economy and public health in the conditions of climate change that promote sustainable development of the country.

The main tasks in the implementation of the strategy are:

Implementation of the scientific research programs on climate change, its impacts on natural resources, economy and public health and development of specific adaptation measures;

Improvement of systematic observation and monitoring network for ensuring timely adjustment of adaptation measures;

Improvement of the data collection system and analysis, interpretation and dissemination of the results among the end users;

Enhancing of the system of forecasting, modeling and early warning on natural disasters, especially catastrophic floods and mudflows;

Building institutional and technical capacity on the issues of adaptation;

Training of personnel in the adaptation-related fields, such as, climate and hydrological research, geographical information systems, environmental impact assessment, protection and re-cultivation of lands, rational water use, conservation of ecosystems, agricultural and infrastructure development, health protection;

Implementation of concrete projects on adaptation in priority fields related to natural resources use, economy development and health protection;

9.2. Strategy's priorities and frameworks

The following criteria were used to elaborate the adaptation measures:

The extent of negative effects of climatic factors, extreme weather events and projected climate changes on the subjects;

The risk for people, public health, economic development, food security, infrastructure, cultural heritage, water resources, land resources, biodiversity;

Cost efficiency etc.

Possible adaptation options depend on the type and the intensity of the climate change impact and include:

1. Loss prevention by taking preventive measures on decreasing the vulnerability of the object under the impact of climate change.
2. Acceptance of the loss and minimization of its effects in cases when the negative influence considered being acceptable in a short term, because the object can stand it without prejudice in a long term.
3. Sharing the loss in a way that the influence will be distributed on bigger territory or on larger population despite of those who were the prime victims of the natural disaster.
4. Change of the type of activity aimed at adaptation to both negative and positive effects of climate change.
5. Change of location in cases when the preservation of activity considered being more important than preservation of its location and migration to those areas where conditions are more appropriate after a climatic change.
6. Recovery, which is targeted on the recovery of the system. This is not exactly adaptation to climate change, because the system is still vulnerable to further climate change impacts.

There are of course, many cases, when climate change can have a positive effect. In these cases the strategy of adaptation assumes benefiting from the positive opportunities.

In accordance with recommendations of the Intergovernmental Panel on Climate Change, the following types of measures were taken into consideration:

Structural/infrastructure measures;

Legal/juridical changes;

Institutional/administrative/organizational measures;

Financial motivation and subsidies;

Economical tools;

Technological tools;

Regulation measures;

Prevention and minimization of natural disasters related to climate variability;

Training;

Scientific research and personnel training.

Measures are targeted on national, local, sectoral, institutional, and individual levels.

9.3. Sustainable use of natural resources and the promotion of their adaptation to climate changes

Water resources

The vulnerability assessment shows that in the mid-term the water resources of Tajikistan within the river basins of Vakhsh, Kafarnigan, Kyzylsu, Zeravshan and others are likely to decrease. In some regions this tendency can be catastrophic. The possible decrease of stream flow in summertime can reach a critical level.

During the last 50 years, global warming has caused glaciers to retreat all over the mountainous regions of Tajikistan. Glacier retreat affects stream flow in the rivers that get their water from glaciers and snow stocks. It is likely that a temperature rise of 2°C would reduce the ice cover by 20% in comparison with today's area.

Therefore, an extraordinary process is taking place, which requires systematic observation needed for the long-term forecasting of stream flow. This process requires:

- Routine observation of the representative glaciers;
- Space monitoring of glaciers dynamics;
- Annual observation of snow in mountain regions in the period from January till May and use of observation's results in forecasting.

There are about 35 periodically surging glaciers that are potentially dangerous because of the formation of glacial lakes and their outbursts. Therefore a complex of measures, including glacier research and application of advanced methodologies, to forecast a catastrophic movement of these glaciers is needed.

The main purpose of scientific support in the field of rational water use and protection is determined by the distinctive role of Tajikistan in the supply of water to the Aral Sea. The priority actions on rational water use and promotion adaptation of water resources are:

- Improvement of the system of hydrological observation;
- Development of computerized database to effectively handle and distribute hydrological information;
- Research on the influence of climatic factors on flood formation;
- Development of computer-aided models of hydrological forecasting;
- Development of new schemes of land-reclamation in the conditions of climate change;
- Development of measures in the field of water resources protection, water and energy saving in the conditions of climate change;
- Improvement of payment system related to water resource use;
- Development of new, and improvement of existing technical and economical tools on water resource use at national and regional levels.

Land resources

The area of agricultural lands in Tajikistan is very limited; therefore its protection and rational use play an important role. The welfare and living standards of more than 70% of Tajikistan's population directly depends on the condition of lands, which in turn largely dependent on the climatic factors.

The vulnerability assessment shows that climate change (droughts, high spring and summer temperatures, heavy rainfalls, water resources shortage) could trigger erosion and give rise to desert expansion. This would probably have an adverse impact on the agricultural sector of Tajikistan.

In this regard, the following measures of adaptation and minimization of adverse impacts of climate change are identified:

- Zoning of territory depending on the extent and type of influence of climatic factors on the condition of lands taking into account its vulnerability to the different forms of erosion;
- Setting a selection of soil protection measures for specific landscapes according to the influence of climatic and anthropogenic factors;
- Conducting land-reclamation measures, which include crop rotation, soil protection and limiting the ploughing of steep lands that will help to conserve the humus in the soils under the expected conditions of climate change;
- Combatting swamping and salinization of soils, including the cleaning and rehabilitation of drain constructions, collectors and pumping stations;
- Forest rehabilitation measures in the regions prone to drought and wind erosion. This will promote sand consolidation, reduction of desertification and minimizing the influence of other climatic factors.

Pasturelands

The condition of natural pastures and hayfields in Tajikistan is determined by two key factors: anthropogenic pressure (overgrazing, forest cuttings) and climate impact (droughts, extreme high and low temperatures, hailstones etc).

The vulnerability assessment shows that climate impacts in some years appear to be severe, when pasture productivity reduces by 3 times thus considerably affecting animal husbandry in Tajikistan.

To minimize adverse consequences of climate change now and in the future, the main recommendations on adaptation of pasturelands to climate change are:

- Systematic monitoring of pasturelands and forecasting their conditions based on climate models;
- Development of a computer-based model "Climate - Pasture Productivity" for different climatic and ecological zones of the republic;
- Setting optimal dates and grazing norms, taking into account differentiation by types and productivity conditions of the pastures;
- Regulation and optimization of pastureland use;
- Selection aimed at drought- and disease-resistance in the current conditions of climate change;
- Expanding irrigated pasturelands for using them in dry years;
- Creation of additional fodder stocks.

Ecosystems

In Tajikistan, ecosystems play an important role in sustaining the well being of the population in rural and mountain regions. Climate warming, the increase of carbon dioxide in the atmosphere and other factors greatly influence the ecosystems.

Such an influence is expressed in the extinction of species of flora and fauna, deterioration of biotopes, shifting of phenological parameters of vegetation, degradation of tugai woodlands, winter-spring pastures, etc. The impact of anthropogenic and climate factors lead to intensifying the erosion process, altering the conditions of surface runoff because of changing vegetation, that in turn negatively affect stream flow.

According to authoritative expert assessments, the following adaptation measures for Tajikistan's ecosystems can be underlined:

Enhancing scientific understanding of climate change processes that have an impact on ecosystems, with emphasis on nature protected territories;
Monitoring of ecosystems;
Promotion the reasonable use of natural territories with minimization of anthropogenic pressure, especially in industrial and agricultural areas;
Supply the population with adequate energy resources and substitute wood fuels;
Support the natural corridors of migrating species of animals and birds;
Protection of rare and endangered species of animals, plants and their habitats, including prevention of illegal trade and hunting;
Increase of efficiency, improvement of the systematic monitoring, and expanding of some existing nature protection territories with an emphasis on ecosystems vulnerable to climate change;
Obligatory fulfillment of nature protection laws;
Development of rules and managing principles on the protection and rational use of biological resources.

9.4. Adaptation of economies to climate changes

Water economy

The vulnerability assessment of water resources to climate change shows their reduction in the future, therefore adaptation measures of water economy to climate change and its adverse effects were developed. The negative consequences mainly include: the deficit of water for irrigation, increase of irrigation norms, alteration of ground water dynamics, and the deterioration of water quality.

The adaptation measures are chosen in such a way that it would have to be effective and useful in both the conditions of the present climate as well as considering its possible changes in the future. The necessity of its timely implementation will be increasing in the future. The suggested adaptation measures are divided into three categories: technical, public and agricultural.

Technical:

Computerizing a system of water supply based on geographic information systems (GIS);
Increase of irrigation systems efficiency and application of new technologies and types of irrigation and water conservation;
Rehabilitation and reconstruction of irrigation systems for reduction of water losses due to filtration and evaporation;
Support of water saving technologies in industry, agriculture and water supply;
Switching on increased use of closed drainage systems and secondary use of drainage water for irrigation;
Pumping of some strongly mineralized, toxic and irrigation waters into deep reservoirs in order to avoid its percolation into the river water heads and channels;
Adaptation of irrigation modes to the conditions of climate change, including revision of the terms and norms of irrigation;
Construction of water reservoirs in specific agricultural areas to create guaranteed water reserves in dry years and to reduce the risk of floods and mudflows;

Stabilization and strengthening of river beds, where floods and washout are the norm;
 Decrease of industrial wastewater volume, that will contribute to the reducing of water ecosystems vulnerability;
 Creation and maintenance of transit water-bio-filters for cleaning water from toxic components;
 Rehabilitation of drinking water supply systems and wastewater purification facilities to ensure safe water availability in cities.

Public:

Promotion of principles of rational water use and water conservation in mass media;
 Public and water consumers participation in terms of water management;
 Training of farmers on the principles and technologies on water conservation and rational water use;
 Informing public about the intergovernmental relationships between the Republic of Tajikistan and the states of the Aral Sea basin.

Agricultural:

Measures on expanding protected forests on riverbanks;
 Advancing the selection of drought-resistant and high productive agricultural crops with a low level water consumption.

Hydropower engineering

Hydropower engineering is fundamental for the economy of Tajikistan. The country currently utilizes no more than 5-10% of its huge hydropower potential. The existing reservoirs operate in the mode of hydropower production and land irrigation. They also play an important role in protection from floods, fish industry development, recreation, industrial and public water supply.

The research proved that big hydropower plants are more susceptible to the influence of climatic factors and changes in water level than small stations. Key factors of vulnerability are extreme floods, mudflows, landslides, severe climatic conditions and reservoir sedimentation.

The adaptation measures for the sustainability of the hydropower sector in the conditions of climate change are determined as follows:

Updating of stream flow characteristics and its extreme values using the most modern scientific data and methods;
 Updating and modernization of hydropower systems designs in terms of the capacity and stability of reservoirs;
 Optimizing the mode of exploitation, and reducing the sedimentation processes;
 Design and construction of special protection structures for all hydropower systems, electricity transmission lines and substations;
 Computer-based monitoring of all hydropower systems;
 Construction of new hydropower systems and reservoirs, which could provide needed regulation of stream flow fluctuations as well as reducing the negative impact of sedimentation within existing reservoirs.

Agriculture

The vulnerability assessment shows that agricultural production mostly depends on climatic conditions and its variations. The crops grown in Tajikistan are based on irrigated and rain-feed agriculture. The territory of the irrigated lands and the state of rain-feed lands might worsen in the case of a water resource shortage and climate change. Widespread desertification requires a total reform of the whole system of agricultural production in the conditions of climate change. Moreover, the impact of extreme weather events in some cases is catastrophic and can be responsible for 30-40% of all losses in agriculture.

Due to the alarming results of the vulnerability assessment of agriculture, in this strategy the following common adaptation measures have been determined as follows:

- Modernization of logistical base in agriculture;
- Development of scientific and technical support of agricultural sector, including long-term forecasting;
- Conducting a series of agro-technical and land-reclamation measures to improve sowing areas;
- Rationalization of crop rotation combined with agricultural machinery application, appropriate use of chemical and biological methods against insects;
- Measures on the prevention of salinization and swamping, as well as water and wind erosions;
- Securing the financial sustainability of households and insurance in agriculture.

The increase in a level of adaptation for the cotton industry to the climate change requires:

- Creation and introducing of fast growing, heat and disease-resistant sorts of cotton;
- Prediction and timely prevention of harmful insects episodes and cotton diseases;
- Introduction of effective cotton sorts rotation in cotton growing zones, where it is vulnerable to climate change;
- Increase of cotton irrigation efficiency based on water saving technologies, that will assist in protection of soil from erosion.

The increase in a level of adaptation for the grain industry to the climate change requires:

- Creation and introducing local sorts of cereals, which are sustainable to unfavorable climate conditions;
- Selection of new drought and diseases-resistant sorts of cereals along with the support of private seed-growing;
- Maintenance of guaranteed grain stocks;
- Increase efficiency of cereal crops protection regarding diseases and insects, and forecasting the chance of their occurrence depending on climate conditions.

The increase in a level of adaptation for the cattle breeding industry to the climate change requires:

- Strengthening of forage reserves;
- Expanding of pasturelands, allowed for private use with an increased level of control;
- In addition to state veterinary services, to promote the development of private veterinary services and to implement a set of measures on disease reduction.

Transport infrastructure

Transport infrastructure plays an important role in the economic development of the country. In Tajikistan, climate impact on the condition of roads is significant and

contributes to the destruction of roads and bridges. Floods, avalanches, severe climate conditions (cold winter and hot summer) also destroy the roads.

Priority tasks of transport infrastructure adaptation to climate change are the creation of new standard norms during the stages of designing, construction and maintenance of the roads depending on climate conditions.

National plans of road construction should be implemented with consideration of the environmental and climatic impacts. While making decisions on road construction it is necessary to consider the factor of climate variability in different mountain regions.

The measures on promoting sustainability of the transport sector to climate change have been determined as follows:

- Improvement of existing and development of new standards in the transport sector taking into account vertical zonation and climate characteristics;
- Classification of road and climate indicators depending on land surfaces;
- Differentiation of regional requirements to the paving characteristics according to the altitude and vertical zonation of the climate;
- Research of microclimate specifics in the off road side for justification of technical norms;
- Justification of road strength properties taking into account the climate factors;
- Research on the impact dynamics of the unfavorable natural phenomenon on mountain roads with the purpose of construction of additional protecting structures and strengthening mountain slopes;
- Monitoring of dangerous geological phenomenon on the roads and consideration of extreme weather events in the process of road construction and exploitation.

9.5. Preparation, prevention and minimizing the risks of natural disasters

The vulnerability assessment shows that natural disasters, including catastrophic floods, mudflows and landslides caused by climatic factors are a major reason of human and financial losses on an annual basis.

The main tasks in the conditions of climate change are the development of adaptation measures to minimize the risk of natural disasters for the population and economy:

- Improvement and rehabilitation of the existing hydrometeorological network with the development of advanced forecasting and early warning systems, flood management and other extreme weather events (with the upgrading density of stations up to 1/1,000 sq.km);
- Modernization of the system of gathering, processing, analysis, interpretation and distribution of the information, including the development of dynamic databases, geographic information systems and computer-based models of formation and influence of floods and other extreme weather events;
- Development and implementation of a set of measures on natural disasters management, with special emphasis on local public awareness and local authorities participation;
- Improvement of forecasting and early warning systems, including expanding in the areas of accuracy, high reliability of forecasts on floods and other extreme weather events;
- Planning, designing and implementation of pilot projects, aimed at creation, strengthening and development of resources and structures.

Planning of technical and non technical measures of protection from floods;
Improvement of preparedness of population and appropriate governmental departments in the event of natural disasters and providing rescue equipment;
Reduction of flood impact risk, especially in the areas with undeveloped infrastructure and populated by poor groups of people. Allocation of residential and business premises in safe areas is an important measure in this program.

9.6. Adaptation measures for enhancing public health in the conditions of climate change

The vulnerability assessment stated that the climate plays an important role in the dynamics of morbidity and mortality. The change of climate, especially temperature, causes a misbalance not only on different hierarchical levels of the biosystem but also between those levels. Only adaptive measures to the negative influence of the external environment will allow the improvement of health and an increase in life expectancy of Tajikistan's population (fig. 9.1).

Common adaptation measures can be directed to:

Increase socio-economical and sanitation-educational levels of the population;
Arrange seminars and round tables on "Climate change and public health" for the representatives of all categories of society, ministry officials and decision makers;
Develop an educational program on "Climate change and public health" for medical students;
Develop an unified computer database on climate change related to the state of public health on a regional and nationwide level;
Establish an interdepartmental scientific-information center "Man and Climate" (fig. 9.2) that will allow the monitoring of factual changes in health related to climate conditions and also develop targeted measures of adaptation;
Improve nature protection legislation, public health protection laws and its implementation control; introduce effective legislative, administrative and technical measures for control and monitoring;
Develop and improve individual and popular methods of research in terms of adaptation and develop integral indicators, characterizing adaptation to the conditions of climate change;
Increase the sustainability of the human body through consumption of medication that promotes adaptation (preferably herbs).

The vulnerability assessment shows that an increase of the mean annual temperature by 2-3°C would cause an increase in the number of days favorable for the reproduction of malaria mosquitoes (*Anopheles*).

Adaptation measures on reduction of malaria must include:

Illness prevention
Reduction of illnesses and mortality
Reduction of infection
Malaria elimination

Measures for the prevention of malaria should include:

Introduction of *Gambusia* to reservoirs and rice fields containing malaria
Insecticide treatment
Purification of irrigation channels and drainage systems
Marsh drainage
Use of individual mosquitoes nets

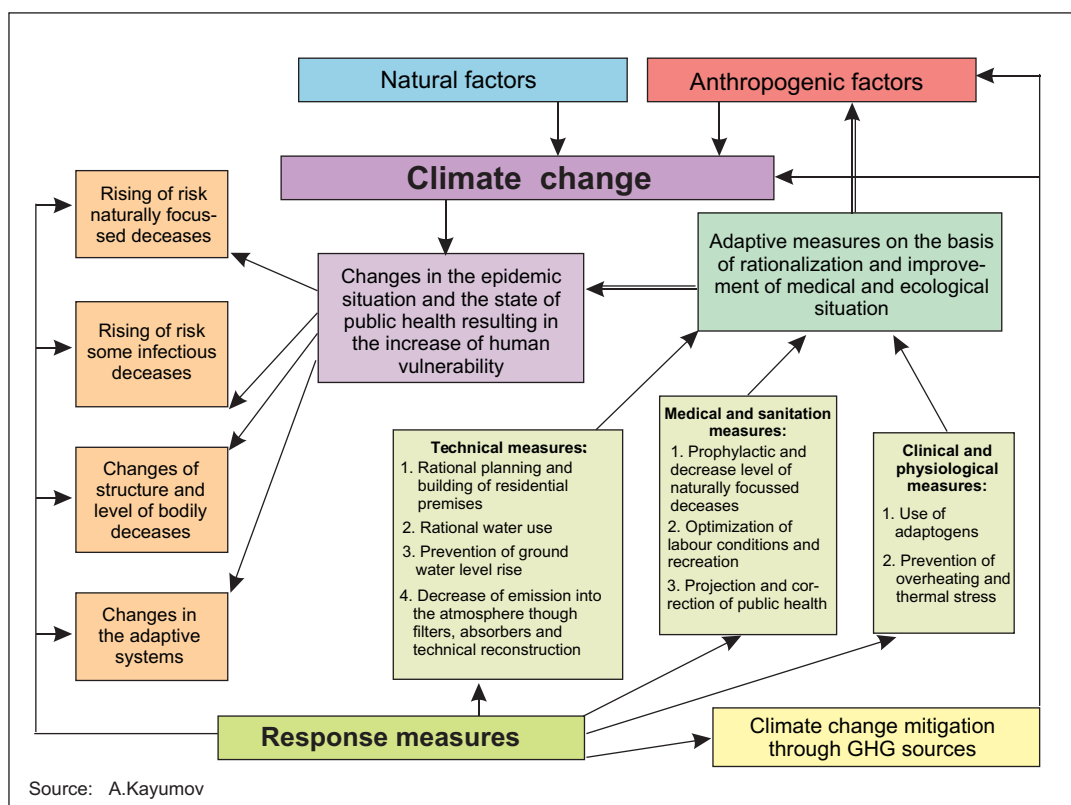


Fig. 9.1.

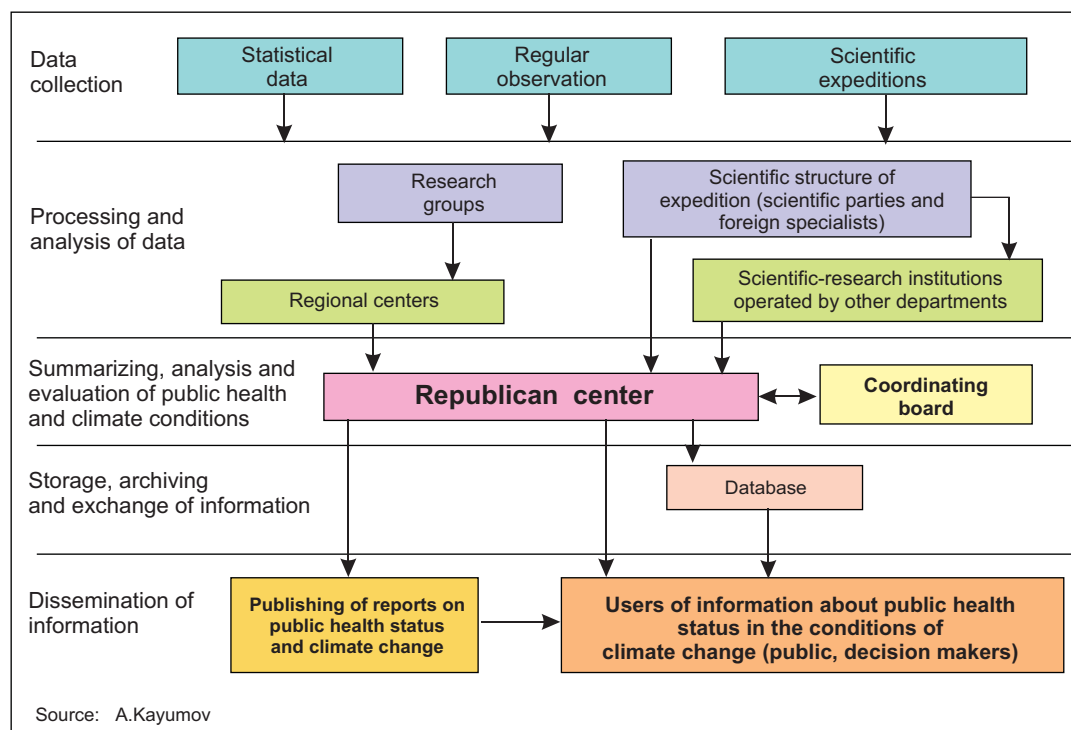


Fig. 9.2.

Besides vector-born diseases, which are dangerous for public health, there are other diseases such as typhoid, salmonellosis, dysentery and others with the inherent spring-summer, summer and summer-spring timing.

Weakening of sanitary control over the water quality in the conditions of climate change can potentially increase the risk of these infections spreading, especially in rural areas, where the population does not have sufficient access to safe drinking water.

Within a set of measures on prevention of intestinal infections it is necessary to consider:

Securing the population with quality drinking water; disinfecting sewers; sanitary cleaning of public transport, urban and rural settlements, industrial and agricultural objects;

Enhancing microbiological, chemical and physical control of ground and surface waters.

More than 60-80% of workdays in July-August in valleys and mountains, especially southern Tajikistan, air temperature exceeds 28°C. Labor in such conditions causes many functional changes in the human body resulting in a high pulse rate and frequent breathing, increase of body dehydration, temperature and thermal stress of human beings that negatively affects working capacity and human health.

For maintenance of working capacity and health protection in the conditions of such a hot climate and to reduce thermal stress in summertime it is necessary to:

Introduce the work schedules that avoid peak daytime temperatures;

Use the premises with regulated microclimate;

Drink regularly;

Consider the possibility of providing additional rest periods during work on a hot day and revise appropriate legislation.

Town planning in Tajikistan was originally carried out without consideration of the hot climate; especially the impact heat can have on public health. As a result, morbidity and mortality increase, especially among children and aged people. Existing residential and public buildings do not fully secure rational use of landscape and microclimate conditions in town planning, which reduces comfort. Urbanization intensifies the problem of exhaust gases, noise, vibration and overheating.

Adaptation measures to reduce thermal stress in respect to town planning are considered as important options in improving health in the conditions of climate warming. To achieve this goal at present and in the outlook it is necessary to consider:

Landscape characteristics and altitude;

Orientation of mountains and valleys towards the cardinal points;

Duration of days within the hot season where overheating occurs;

Amplitude of near surface temperature fluctuations between average maximum and average minimum (day and night time) in summer and winter seasons;

Day and night wind speeds during the summer season.

Thus, with regards to the improvement of urban environments and enhancing comfort it is necessary to develop new architectural typology that secure necessary adaptation potential in a changing climate.

9.7. Immediate adaptive measures in case of climatic catastrophes

In recent years, the number of climatic catastrophes has been increasing, especially floods and droughts. The unpredictability of these events makes them difficult for adaptation.

It is estimated that if medical support could be timely provided at the locality of the incident then mortality could be decreased by 20%.

During the last decade from 1991 to 2000, more than 90% of the victims of natural disasters who died were the result of extreme meteorological and hydrological phenomena.

For the improvement of preparedness and minimization of negative consequences from possible climatic catastrophes, it is necessary to conduct regular training on emergencies, liquidation and development of exact cooperation mechanisms between local and central authorities, rescue services and populace.

In initial hours after a natural disaster event, the population should be provided with the following information:

1. What to do to be safe.
2. Location of food, water and medical supply distribution centers.
3. Operation of army, fire services, professional rescue personnel and others.

It is important to divide the responsibility of medical personnel accordingly:

Urgent surgery;

Sorting of victims depending on their condition;

Solving epidemiological and hygiene problems for the organization of water supply, temporary living and food supply;

Conducting medical and sanitary assessment (sanitary-epidemiological, sanitary-chemical and sanitary radiation).

9.8. Food security and struggle against the drought consequences

The problems of land degradation and water supply shortage decrease contemporary agriculture's productivity and threaten the food security.

Sufficient supply of food in Tajikistan, especially in rural areas, is strongly linked to environmental conditions and climate impacts.

Adequate nutrition favors normal growth and development of the human body, increases disease resistance and working ability. These factors as well as other social conditions allow wide adaptation possibilities of the human body to the changing climate conditions.

The problem of food security becomes evident when internal supply is insufficient for the needs of the population demands, as a result of climatic and other impacts.

In the 1990s, the food supply in Tajikistan was not sufficient to provide the minimum level of calories and proteins. Accordingly, adaptation possibilities of the human body have decreased and caused the high level of population's vulnerability in a condition of climate warming. The droughts associated with increasing poverty and reduction of agricultural sector's efficiency, extremely intensified the food security problem.

Therefore the strategy determines the following adaptation measures aimed at food security improvement:

Stimulation of economic growth that will contribute to adequate food security;

Elimination of poverty, especially within communities, which are more vulnerable to climate change;

The rural areas, where more than 70% of the country's population reside and provide about 90% of food production, assistance and support are needed in the development of effective and rational methods in agriculture, acceptable for the conditions of climate change and high risk of climatic catastrophes;

Development of private farms with differentiation of agricultural production.

9.9. Reduction of anthropogenic pressures in urban areas

Research shows that the cities of Tajikistan are vulnerable to the impact of meteorological factors (wind mode, atmospheric circulation, dust storms, temperature, solar irradiance). It results in the increase of pollutant concentrations in the atmosphere caused by anthropogenic emissions, the rise of air temperature and its subsequent adverse influence on urban environments and public health.

Projected climate change will likely intensify the impact of meteorological factors, because the feature of urban architectural composition promotes the rise of temperature by 2-3°C in comparison with the countryside.

The lack of sufficient street ventilation leads to the increase of atmospheric pollutant suspension and promotes the formation of heat islands.

In respect to the adaptation of the urban environment to climate change important measures for the improvement of air quality and urban ecology in general are:

Zoning of vulnerable urban territories to facilitate acceptance of adequate and effective adaptation measures and to ensure appropriate urban design and construction in the conditions of climate change;

Environmental impact assessment for large enterprises that have the potential to effect the urban environment and determine how much their operation adds stress on the local environment;

Enhancing of nature protection control on industrial technologies, processes and overall performance of air protection measures on stationary pollution sources;

Minimization of unorganized pollution sources;

Optimization and improvement of urban road surfaces and designs for reduction of fuel consumption and GHG emissions, and construction of by-pass roads to diminish vehicle's pressure in the central part of the cities;

Control on fuel quality and harmful substance concentrations in exhaust gases;

Prohibition of open waste burning in urban areas to reduce emissions of persistent pollutants and greenhouse gases, including solid communal wastes and foliage that contains toxic substances;

Inventory of urban tree plantations and development of measures that enhance their efficiency in terms of air quality;

Increase of public participation when implementing the urban environment improvement measures.

9.10. Costs of measures and potential financial sources

The general estimated cost of strategy implementation is about US\$ 500 million. The potential resources for the funding of adaptation measures could be the projects of international support by Global Environmental Facility programs and Adaptation Fund, investment projects, part of CDM projects, budgetary funding within the approved limits, and non-budgetary sources.

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