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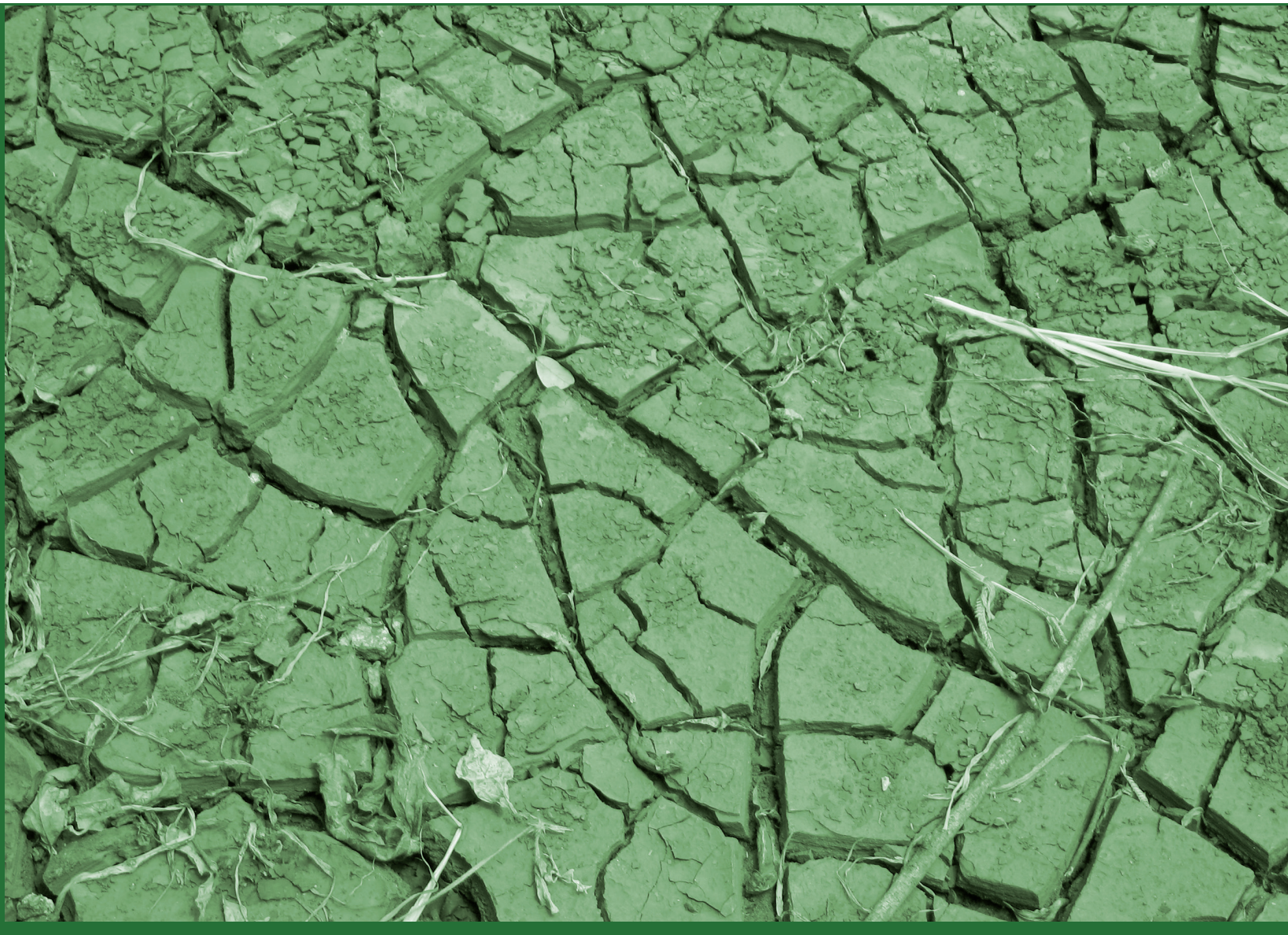

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NATIONAL HUMAN DEVELOPMENT REPORT 2012

Tajikistan: Poverty in the Context of Climate Change

DUSHANBE - 2012

Dear Reader,

For several years already, a series of National Human Development Reports have been prepared and published at the initiative and with the support of the UNDP in close cooperation with ministries and agencies of the Republic of Tajikistan, and civil society and international organizations active in the country.

Every year the report addresses the most important aspects of the country's social and economic development in the context of sustainable human development. This latest National Human Development Reports focuses on the theme "Tajikistan: Poverty in the Context of Climate Change".

Climate changes will inevitably affect population welfare and sustainable development. It is therefore necessary to consider climate change as one of the key long-term factors affecting human safety and security.

In formulating policies for environment, poverty alleviation and the country's sustainable socio-economic development, one must take into account climate change and its impact on the economy, environment and population, particularly the most vulnerable social groups.

The strategic goal of linking policies for tackling poverty with climate policies is to ensure the secure and sustainable development of Tajikistan, while helping the most vulnerable populations to adapt to climate changes.

This informative and timely report makes a positive contribution to stakeholders' discussion on climate change and its implications for the Tajik state, society and economy. Given Tajikistan's strategic landmarks, this report may effectively assist in the development and implementation of joint policies on climate change and poverty alleviation, as well as in the elaboration of national, regional and sectoral programs and action plans.

I would like to note especially that the National Human Development Report "Tajikistan: Poverty in the Context of Climate Change" has been prepared in close collaboration with the Report Development Team and the Team for Developing the Strategy for Improving the Livelihoods of the Population of Tajikistan for 2013-2015, providing an example of concurrence in the development of national policies of strategic importance.

Sincerely,
Sh. Rahimzoda
Minister of Economic Development and Trade
of the Republic of Tajikistan

Dushanbe, December 2012

Dear Reader!

As one of the most important global challenges, climate change is a comprehensive, cross-sectoral problem embracing environmental, economic and social aspects of sustainable development in all countries, including the Republic of Tajikistan.

While climate change is a global phenomenon, its negative impacts will be felt more severely by poor people and countries. They are even more vulnerable because they rely heavily on natural resources and have limited opportunities. Experience shows that the best way to overcome climate change impact on the poor is to integrate mainstream adaptation measures into development planning processes. This is essential for achieving the Millennium Development Goals, including the universal goal of halving extreme poverty by 2015 and maintaining this progress beyond then.

The focal themes of the Rio+20 Summit on Sustainable Development addressed achieving sustainable development in the context of poverty eradication. Adapting to climate change impacts has therefore gone beyond both sectoral and country approaches: the issues themselves have now become global.

Climate change effects manifest themselves at all system levels: global, regional, sub-regional, national and local. Given Tajikistan's location, exceptional diversity of climate patterns, economic structure, demographic problems and geopolitical interests, there is the need to form, well in advance, a comprehensive and weighted state approach to climate problems and cross-sectoral issues, on the basis of integrated scientific analysis of environmental, economic and social factors.

The Government of the Republic of Tajikistan has pronounced poverty reduction and livelihood improvement as one of the most important priorities of its economic policy, and the implementation of these strategies systematically reduces the poverty rate in the country from year to year.

This Human Development Report, 'Tajikistan: Poverty in the Context of Climate Change' is a system of views on the objectives, principles, contents and ways of implementing Tajikistan's climate policy both within the country and internationally, in part related to climate change impacts. Given Tajikistan's strategic landmarks, this Report forms the basis for formulating and implementing the country's climate policy.

The Report's analysis of climate change factors, scenarios and impacts on different sectors of the country's economy considers their impact on the HDI and other human development indices, including poverty. It also includes proposed measures and tools, including the use of practices and approaches which have proved efficient, to allow better development of interlinked and interdependent policies and programs on climate change adaptation in the context of tackling poverty.

An important feature of this Report is its indicial assessment of human development in the country. While the Global Reports allow comparative assessment of countries using the Human Development Index calculations, the disaggregation of this index at a regional level within a specific country allows a closer look at key aspects of human development in oblasts and districts. Such an approach is increasingly attracting the attention of national governments. First of all, this stems from the understanding that an individual cannot be just an 'average' person. An individual's life, health and income depends on the quality of social and other services provided in a specific place where he/she lives. The Human Development Index value in Tajikistan has been increasing in recent years; however, adjusted for inequality, its recalculation suggests that poverty reduction and welfare improvement remain important.

The Report contains a relevant analysis and proposes long-term recommendations. We hope that the Government and relevant institutions of Tajikistan, all stakeholders and development partners will continue to develop and implement policies and programs aimed at achieving the Millennium Development Goals. I assure you that the UNDP in Tajikistan will support all national efforts in this area.

Another very important aspect I'd like to draw your attention to is that, for the first time ever, the efficient coordination of implementing teams was achieved with the MEDT's support. National experts assisted in the development of two documents of the highest importance for Tajikistan: the Mid-term Strategy for Improving the Livelihoods of the Population of Tajikistan for 2013-2015 and this Report.

UNDP extends its gratitude to the Coordinator of this initiative, the MEDT of the RT, as well as national experts and international consultants, editors and members of expert panels, and representatives of local and international organizations for their assistance in the preparation of this National Report.

I am confident that the Report 'Poverty in the Context of Climate Change' will contribute to the implementation of activities aimed at ensuring the sustainable development of the Republic of Tajikistan.

Alexander Zuev
UN Resident Coordinator and
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Dushanbe, December 2012

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TABLE OF CONTENTS

List of Acronyms **7**

Basic Facts about the Country **8**

Glossary **9**

List of boxes, tables, pictures and diagrams **10**

Summary **13**

Foreword **16**

Introduction **17**

Chapter 1. Climate Change and Human Development **18**
1.1 Climate Change: Concepts, Basic Components, Global Trends, and Scenarios 18
1.2 Approaches to Integrated Environmental and Economic Assessments 23
1.3 Poverty in Tajikistan 32
1.3.1 Poverty and its Definitions 32
1.3.2 Dynamics, Trends, and Causes 34
1.3.3 Review of the Existing National Environmental Policy for PRS Implementation 36
1.4 Climate Change Effects and Their Impact on Poverty 38
1.4.1 Overview of Natural and Climate Characteristics of the RT and Their Trends in the XXI Century 38
1.4.2 Key Climate Change Drivers 39
1.5 Environmental Monitoring in the Context of Adaptation to Climate Change in the RT 40
1.6 Dynamics of Human Development Index in the RT 44

Chapter 2. Economic Aspects of Climate Change **46**
2.1 Assessment of Climate Change Impact on the Economic Structure 46
2.1.1 Climate Change and Water Resources in Tajikistan 46
2.1.2 Climate Change Impact on Agriculture and Food Security in the RT 49
2.1.3 Climate Change Impact on Power Engineering in Tajikistan 53
2.1.4 Climate Change and Disaster Risks in the RT 54
2.2 Assessment of Climate Change Impact on Employment 55
2.3 Growth Models and Dynamics of Changes in Environmental and Economic Indices in the RT 59

Chapter 3. Social Aspects of Climate Change Impacts in Tajikistan **61**
3.1 Access to Potable Water and Sanitation 61
3.2 Disaster Risks 63
3.3 Energy Poverty 65
3.4. Human Poverty and Health in Tajikistan, Climate Change-Induced Risks 68
3.5. Poverty and Access to Education in Tajikistan, Climate Change-Induced Risks 70
3.6. Strategies for Social Sector Adaptation to Climate Change 72

Chapter 4. Regions and Climate Change **74**
4.1. Dynamics of Changes to the Human Development Index in the Regions of the RT 74
4.2. Territories as Impact Points of Climate Change 77
4.3. Migration Processes Associated with Climate Change 80
4.4. Cartographic Assessment of Tajikistan Region's Vulnerability to Climate Change 82
4.5. Local Governance in Tajikistan and the Climate Change Adaptation System 83
4.6. The Strategy of contribution to adaptation of climate change in a high level regional disparities 84

Conclusions and recommendations **86**

Annexes **89**

Sources **96**

LIST OF ACRONYMS

ADB	Asian Development Bank
CA	Central Asia
CDM	Clean Development Mechanism
CESD	Committee on Emergency and State Defense of the Republic of Tajikistan
CH_4	Methane
CIS	Commonwealth of Independent States
CO_2	Carbon dioxide
CS	Conference of Stakeholders
EBRD	European Bank for Reconstruction and Development
ECDP	Ecological Clean Domestic Product
ESD	Education for Sustainable Development
FCCC	Framework Convention on Climate Change
GBAO	Gorno-Badakhshanskaya Autonomous Oblast
GDP	Gross Domestic Product
GNI	Gross National Income
GHG	Greenhouse Gases
HDI	Human Development Index
HEI	Higher Educational Institution
HPP	Hydro Power Plant
IDCC	Interdepartmental Coordination Council on Drinking Water and Water Supply
IHDI	Inequality-adjusted Human Development Index
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
MCD	Mechanism of Clean Development
MDG	Millennium Development Goal
MM	Mass Media
NAP	National Action Plan
NGO	Non-Governmental Organization
PPCR	Pilot Program for Climate Resilience
PPP	Purchasing power parity
RECCA	Regional Environmental Centre for Central Asia
RES	Renewable Energy Sources
RRS	Rayons of Republican Subordination
RT	Republic of Tajikistan
SNiP	Construction Norms and Regulations
SUE «KMK»	State Unitary Enterprise»“Kojagii Manzili komunali»
UNDP	United Nations Development Program
WHO	World Health Organization
WPI	Water Pollution Index
WRUS	Water Resources Utilization System
WUA	Water Users Association

BASIC FACTS ABOUT THE COUNTRY

Form of government: Presidential Republic

Head of state: Emomali Rakhmon

Capital: Dushanbe

Independence Day: September 9

Area: 142.6 thousand square km

Population: 7,800,500 people (as of January 1, 2012)

Religion: Islam

Ethnic composition: Tajik, Uzbek, Kirgiz, Russian, Turkmen, Tatar, etc.

National currency: Tajik Somoni

Human Development Index (HDI): 0.607 (2011)

Inequality-adjusted Human Development Index (IHDI): 0,500 (2011)

Gender Inequality Index: 0.347 (2011)

Life expectancy at birth: 72.5 years (2011-preliminary data)

Education coverage: 87.4% (2011- rated data)

Adult literacy: 99.8% (2010)

GDP per capita: TJS 3,901.0 (USD 846) (2011)

Inflation rate: 9.3% (2011)

Consumer Price Index, 2011 relative to 2010, %: 112.5% (2011)

Exports: USD 1,257.3 million (2011)

Imports: USD 3,206.0 million (2011)

Economic growth: 7.4% (2011)

Average total monthly income: TJS 225.62 (USD 48.93) (2011)

Birth rate: 29.1 births per 1,000 people (2011)

Minimum pension: TJS 80 (USD 17.35) in 2011. TJS 200 (USD 42.24) since September 1, 2012

Minimum monthly salary: TJS 80 (USD 17.35) in 2011. TJS 200 (USD 42.24) since September 1, 2012

Average monthly salary: TJS 442.13 (USD 95.9) (2011)

GLOSSARIES

ADAPTATION - initiatives and measures towards reducing the vulnerability of natural and man-made systems to actual or anticipated climate change effects. There are several types of adaptation, including anticipatory and reactive adaptation, adaptation of public and private stakeholders, autonomous and planned adaptation. Examples include: the construction of river or coastal protective dams, the replacement of heat-sensitive plants with more heat-resistant ones, etc.

ADAPTATION CAPACITY - the capability of a system to adapt to climate change, including adaptation to climate change and extreme weather conditions, in order to reduce the latter's potential damages, as well as the capacity to use favourable opportunities and capabilities to combat the effects of climate change.

ANTHROPOGENIC - a result or a product of human activities.

CLIMATE CHANGE - changing the state of climate, which can be identified (for example, by statistical tests) by changes in the mean values and/or variability of its properties, and which persists over a long period, usually several decades or more. Climate change can take place due to natural internal processes or external effects as well steady anthropogenic changes in the structure of the atmosphere or land use.

KYOTO MECHANISMS (or Mechanisms of flexibility) - economic mechanisms based on market principles, which can be used by the parties to the Kyoto Protocol to mitigate the potential economic effects of the requirements to reduce greenhouse gas emissions. These are: joint Implementation mechanism (Article 6), Clean Development Mechanism (Article 12) and emissions trading (Article 17).

KYOTO PROTOCOL - was adopted at the third session of the Conference of Parties (CP) of the UNFCCC in 1997 in Kyoto. It contained legal obligations in addition to those of the UNFCCC. Countries included in Annex B of the Protocol (most member-states of the Organization for Economic Cooperation and Development and countries with transition economies) agreed to reduce their anthropogenic greenhouse gas emissions (carbon dioxide, methane, nitrous oxide, hydro fluorocarbons, perfluorocarbons and sulfur hexafluoride) at least by 5% below than the level of 1990 during the period from 2008 to 2012. The Kyoto Protocol entered into force on 16 February 2005.

CLEAN DEVELOPMENT MECHANISM (CDM) - defined in the Article 12 of Kyoto Protocol, the CDM aimed to achieve the following two goals: 1) providing assistance to the parties not included in Annex I, to ensure sustainable development and support for achieving the goal of the Convention; and 2) providing assistance to the Parties included in Annex I, to ensure adherence to quantitative commitments they have taken to restrict and reduce remissions. The units of certified emission reduction lead to limitation or reduction of greenhouse gas emissions and are received as a result of implementation of projects that meet CDM criteria in countries not included in Annex I. These units can be purchased once they are certified by operational bodies designated by the Conference of Parties / Meeting of Parties and investors (government or industry) from Parties included in Annex B. A part of the proceeds from certified types of project activities is used to cover administrative costs and assist developing country Parties vulnerable to adverse effects of climate change with the repayment of costs associated with adaptation.

GREENHOUSE EFFECT - Atmospheric radiation is emitted in all directions, including towards the Earth's surface. Greenhouse gases effectively absorb the thermal infrared radiation emitted back from the Earth's surface. As a result of this, greenhouse gases absorb the heat contained in the «surface-troposphere» system. This process is called the greenhouse effect.

MIRIGATION - overcoming the causes of climate change through activities leading to a reduction in the emission of greenhouse gases or removing them from the atmosphere: for instance, through carbon sequestration by trees and soil.

EMISSIONS TRADING - a market approach towards achievement of environmental goals. It allows those stakeholders who reduce greenhouse gas emissions below the required level to use or transfer the excess in reduction by compensating for emissions from another source inside or outside the country. As a rule, trade can take place between companies at the national or international level.

CARBON DIOXIDE (CO_2) - gas of natural origin as well as the by-product of the combustion of fossil fuels from: natural fields of hydrocarbon such as oil, gas and coal, the combustion of bio-fuel, changes in land use and other industrial processes. It is a primary anthropogenic greenhouse gas which affects the radiation capacity of the Earth. This is a standard gas, against which other greenhouse gases are measured: therefore, its capacity of global warming is equal to 1.

VULNERABILITY - the level to which the present system is susceptible to, and unable to resist the unfavourable effects of climate change , including changeable climate and extreme climatic events.

LIST OF BOXES

Box 1 Why is the climate changing?
Box 2. Social and economic costs of global climate changes
Box 3. There are three groups of countries
Box 4. UN Framework Convention on Climate Change
Box 5. Primary sources of emissions
Box 6. Policies and possible measures to combat climate change
Box 7. Forecast of events till 2050
Box 8. IPCC Assessment of Climate Change Impacts in Asia
Box 9. The green economy in the context of sustainable development
Box 10. Gender-sensitive poverty assessments
Box 11. The Republic of Tajikistan ratified the UN Framework Convention on Climate Change
Box 12. Upgrading of the hydro meteorological service
Box 13. Environmental monitoring system of the Republic of Tajikistan
Box 14. New approach to measuring Human Development
Box 15. Conceptual aspects of the impact of climate change on agriculture
Box 16. Consolidation of actions
Box 17. Conceptual aspects of climate change impact on power engineering
Box 18. Conceptual aspects of impact of climate change on the increased disaster risks.
Box 19. Gender aspects of employment
Box 20. Conceptual aspects of climate change impact on employment
Box 21. Green jobs
Box 22. Development of legal frameworks
Box 23. Management of water resources (gender)
Box 24. Floods and avalanches, the most frequently occurring natural disasters in the country
Box 25 The types of natural disasters
Box 26. Correlation of HDI and energy
Box 27. Power Supply of the Republic of Tajikistan
Box 28. The EBRD project in energy sector of Tajikistan
Box 29. International assessment of Tajikistan's public health
Box 30. The potential impact of climate change on morbidity in the Republic of Tajikistan
Box 31. The Impact of climate change on human health is diverse.
Box 32. Some international trends in education sphere
Box 33. Example of energy efficiency activities and the use of renewable sources in the building
Box 34. The programme framework in sphere of vocational education and training
Box 35. What is Green Pack?
Box 36. Tajikistan in the context of climate change
Box 37. Setting of the regional indexes HDI – income index
Box 38. Parameter of the regional HDI – Life expectancy index by regions of the Republic of Tajikistan
Box 39. Parameter of the regional indexes HDR – Education index
Box 40. Increase in air temperature in the regional section
Box 41. "Green" roofs
Box 42. Example of the influence of climate on the living conditions of the rural population of the Republic
Box 43. Gender aspects of vulnerability
Box 44. Examples of differences between urban and rural areas in living conditions and social development
Box 45. Ecological migrants
Box 46. Project research of the relationship between migration and climate change in Tajikistan
Box 47. Climate change scenarios
Box 48. Methodological frame mapping vulnerability assessments of regions
Box 49. The ADB project on providing sustainability for communities in the Pyanj river basin
Box 50. The Hukumat district executive office is fulfilling the following duties
Box 51. The UN research on management

LIST OF TABLES

Table 4. Classification of countries according to global CO_2 emissions
Table 5. Cost of combating climate change
Table 6. Possible economic impacts depending on different degrees of climate warming
Table 7. Economic costs of climate warming
Table 8. Changes in the headcount of the poor population in Tajikistan
Table 9. Maximum permissible concentration in air
Table 10. Some water quality standards
Table 11. Climate change impact on energy
Table 12. Individual environmental impacts of climate change and examples of the main forecasted consequences breakdown by sectors
Table 13. Examples of possible climate-related issues under the responsibility of the ministries of the Republic
Table 14. HDI in sectional of aggregated territorial - administrative entities of the Republic of Tajikistan
Table 15. The dynamics of gross regional product per capita in the regions of Tajikistan (in TJS)
Table 16. The distribution of cities of Republican and regional subordination by number of inhabitants

LIST OF ILLUSTRATIONS

Illustration 1. River flow of Tajikistan in annual average and the share of glacial supply
Illustration 2. Institutional capacity for natural resource management
Illustration 3. Map of increasing average annual air temperatures for 50 years in the RT
Illustration 4. Vulnerability of households

LIST OF DIAGRAMS

Diagram 1. Ratio of fuel combustion-induced specific GHG emissions to GDP per capita
Diagram 2. Calculations based on the PAGE 2002 model
Diagram 3. Projected impacts of climate change
Diagram 4. Poverty indicators of female- and male-headed households, %
Diagram 5. Percentage of the population below the absolute poverty line
Diagram 6. HDI in Tajikistan (traditional calculation method)
Diagram 7. HDI in Tajikistan (improved calculation method)
Diagram 8. Forecasts of average seasonal flows of Amudarya and Sirdarya
Diagram 9. Probability of increase in climatically unfavourable situations
Diagram 10. Labour market parameters of the country
Diagram 11. Number of natural disasters and their casualties in the RT for 1997 -2011 years
Diagram 12. Electricity production and consumption in Tajikistan
Diagram 13. Annual average temperature and infant mortality
Diagram 14. The incidence of typhoid in cold and hot years
Diagram 15. Proportion of myocardial infarction and annual average temperature
Diagram 16. The GDP growth and emissions of greenhouse gases considering the absorption
Diagram 17. HDR regions of the Republic of Tajikistan
Diagram 18. Gross regional product per capita in the regions of Tajikistan (in Somoni)
Diagram 19. The value of the integral index of the regions of the Republic of Tajikistan (2010 results)

SUMMARY

Chapter 1. Climate Change and Human Development. Currently, the term "climate change" is typically used to refer to changes in modern climate. Climate change is caused by dynamic processes on Earth as well as external forces, such as variations in sunlight intensity, and human activities.

Climate change effects are manifesting themselves already now, *inter alia*, through the increased frequency and intensity of hazardous weather events and the increased incidence of communicable diseases. They induce significant economic losses and threaten the ecosystem's stability, human health and life.

If humanity will does not take relevant preventive measures, continuing climate changes could cause even more dangerous effects in future.

Global trends and tendencies of climate change show that the fact of global warming is not in any doubt. Meteorological observations show that over the past 100 years, the Earth's average surface temperature has risen by 0.74^0C, and the rate of warming is continuously increasing.

Different programs are currently undertaking large-scale surveys to soundly improve climate forecasting.

Climate change poses a danger to all countries, and developing countries are most vulnerable.

Efficient policy measures to tackle climate-related problems are those that contribute to development, reduce vulnerability and ensure the financing of the shift towards low-carbon economic growth.

To keep control over the achievement of the sustainable human development goals, manage this process and to evaluate efficiency of the funds used as well as the progress toward meeting the goals set, it is required to develop relevant criteria and indicators, i.e. indicators of sustainable development, assessments of the economic impacts of climate change including the so-called "integrated environmental and economic assessments" of climate change that link natural and physical processes with the economic market principles.

Just like in other countries, climate change in Tajikistan is considered a growing threat to the environment. According the World Bank report (2009), Tajikistan is the most climate-vulnerable country in the region and is least able to adapt. This is due to agriculture's high dependence on rainfall during the irrigation season, high levels of environmental degradation, land erosion, deforestation rates and deteriorating social infrastructure. Climate change may have a grave impact on both the ecosystem's condition and the population's livelihood.

Over the last two decades, the country has experienced a sharp increase in the intensity and frequency of climate change-induced extreme weather events. At the same time, the unpredictability of precipitation frequency and intensity directly impacts vulnerable sectors of the national economy and threatens food security.

To some extent, the current national environmental policy includes measures intended to tackle poverty through adaptation to climate change; however, clearer priorities and targets for spending to address the costs of climate change should be developed.

Environmental monitoring should be substantially improved to make efficient decisions related to poverty alleviation, particularly in the context of climate change.

The current understanding of human development through the prism of poverty makes it possible to assess climate change from the perspective of access to hydro carbon resources, cooking fuel and clean water and agriculture's ability to adapt to structural changes.

Human poverty is a process rather than a condition. In order to survive, a poor person uses all available resources in advance. Currently, there are four acknowledged concepts to identify poverty: absolute, relative, deprivation and subjective concepts. Choosing between them depends onwhat aims the poverty line definition is using

The Government of the Republic of Tajikistan has declared poverty reduction to be one of its most important economic policy priorities. Analysis shows that the implementation of the government's strategies systematically reduces the poverty rate in the country from year to year. The available and published data (at the overall rate of absolute poverty by income level and extreme poverty on the basis of USD 2.15 and USD 1.08 PPP per day) show that the poverty rate has decreased from 83% in 1999 to 41% in 2007. Extreme poverty (pauperism) has decreased twofold, from 36% in 1999 to 18% in 2003 and to 13.9% in 2009.

There are different factors affecting the poverty rate in Tajikistan, including lack of access to the sea, remoteness from the markets of high-income countries, regional instability, illicit drug trafficking, the menace of terrorism and some internal factors such as low competiveness, high population growth rates, environmental degradation and depletion of accumulated human and physical capital.

The primary causes of poverty in the country can be defined as: a high unemployment rate, low access to quality education, degradation of over 90% of land resources and low access to electric power, drinking water and sanitation.

SUMMARY

The Poverty Reduction Strategy for 2010-2012 identified the following areas as the primary policy domains related to poverty reduction: 1) public administration improvement, 2) contribution to sustainable economic growth and economic diversification, and 3) human capacity development.

Chapter 2. Economic Aspects of Climate Change. According to the World Bank report (2009), Tajikistan is the most climate-vulnerable country in the region and least able to adapt. Climate change may have a grave impact on both the ecosystem's condition and the population's livelihood. Agriculture, power engineering and transport are the most vulnerable sectors; however, all economic sectors may experience substantial negative impacts.

The effect of climate change on water resources is particularly critical in Central Asia. In this region, water resources are crucial for a wide range of issues related to national and regional security, as they are consumed by all sectors of the regional economy. Any changes affecting Central Asia's water resources imply a high multiplicative aftereffect on various social and economic aspects of these countries' development. The situation is aggravated by increasing water consumption, which is connected with population growth and intensive development of the regional economies. The calculations show that by 2050, the runoff in the basins of the Amu Darya and Syr Darya will have decreased by 10-15% and by 6-10% respectively.

The intensive melting of glaciers in Tajikistan caused by global warming may result in a catastrophic drop in water content in many Central Asia's rivers. Climate change causes glaciers to shrink; over the twentieth century, the largest glacier in Tajikistan, the Fedchenko Glacier, has retreated one kilometre, losing 11 km^2 in area and 2 km^3 in volume of ice. Due to increased air temperature, the glaciated area of Tajikistan and water reserves in glaciers may decrease by 15-20%, which amounts to 80-100 km^3 compared to the present.

The high proportion of the population depending on natural resources (with over 66% of people engaged in agriculture), high food vulnerability (with two thirds of the agricultural production depending on irrigation and 55% of territories under cereal crops depending on precipitation in the irrigation season) and high level of gross agricultural output losses caused by disasters (annual losses attributable to climate events are estimated at one third of all losses) indicate the importance of programs for agriculture adaptation to climate change. Thus, climate change will inevitably cause overall environmental deterioration in rural areas through mass agricultural land degradation, deteriorated soil quality and decreased natural soil fertility. The implementation of emerging favourable opportunities will therefore require significant efforts and vast investments to rehabilitate and protect lands. Large-scale erosion, desertification, soil compaction and salinization and other negative processes are explicit factors in the agrarian sector's response to climate changes.

The country's energy sector already experiences difficulties in coping with loads during the peak power consumption periods in the cold winter months, as well as during the higher temperatures of the summer when periods of extreme heat impose a high load on the transmission lines and it needs urgent upgrading and capacity enhancement. Also, adverse weather events weaken the networks' ability to function properly, particularly with regard to to obsolete and poorly used capacities, which per se reduce the generation of power and industrial products as well as households' access to heat and electricity.

Disaster risk mitigation is an absolute priority for Tajikistan, where damages caused by natural disasters amount to 4.8% of GDP, primarily affecting the poor population. However, adaptation to climate change is not incorporated into the legislation on disasters and natural calamities.

The latest IPCC review (2007) shows it will be not rising temperatures that will affect employment in the short- and long-term run; rather, employment will be threatened by extreme weather events such as drought, cyclones and/or flooding. Employee movement to the districts less exposed to environmental risks, or away from deteriorated regions towards those with better living conditions, might become another effect of climate change. One should particularly note the problem of the so-called "climate" migration (i.e. climate change-induced migration of the population) which is a specific variety of environmental migration, i.e. people flows induced by environmental factors.

Adverse natural climate conditions significantly restrain the country's transport sector. In plain and piedmont areas, high temperatures in the summer months cause loss of road strength properties and deformation of road pavements. Storm rainfalls and mud floods covering a significant territory wash out tens of kilometres of roadbeds and damage many facilities. Altogether, over 500 km of roads are annually exposed to adverse natural events, among which climatic factors play the main role.

The sectoral approach to the problems under consideration is also applied in **Chapter 3 "Social Aspects of Climate Change Impacts in Tajikistan"** that tries to highlight possible climate change impacts on social and ecological processes, taking into account gender as a factor. This chapter shows possible impacts and specifies major risks resulting in adverse social phenomena (limited

access to drinking water, increased frequency of natural disasters and energy poverty, deteriorated health and education). The chapter's recommendations specify areas of activities that require urgent attention and development of adaptation and mitigation measures, i.e. consolidating efforts to integrate assessment and adaptation endeavors of different agencies. It is important to take account of the explicit links between climate change, disaster risk reduction and gender approaches to development.

Chapter 4 "Regions and Climate Change" is focused on the analysis of regional processes in Tajikistan in the context of climate change and makes an attempt to map regions (at the oblast level) taking account of: analysis of the regional development and management trends; assessment of the institutional and human capacity to incorporate climate change adaptation into the regional development programs and policies; review of the problems of social and economic heterogeneity of the Republic's regions; and mapping. The report asserts that actions on the ground are essential to meet internationally-agreed national commitments to address climate change. However, most international climate change mechanisms are meant for national governments and do not specify clearly how local authorities and stakeholders can participate in tackling this problem. The conducted review shows that the regional vulnerability to climate change may become a contributor to the Republic's social and economic instability. Incomplete regional programs that fail to prevent dangerous climate change, and a lack of integration with sectoral climate change mitigation and adaptation programmes may slow down progress towards regional social and economic development and loss mitigation. To ensure sustainable economic growth in Tajikistan, the authors believe that the report's positive impact on income, employment and health, as well as regional social projection for development is important. Therefore regional human development indices were assessed, allowing an identification of vulnerability "points" that can be aggravated, inter alia, by climate change impacts, a different pace of adaptation and the establishment of the relevant institutional base.

FOREWORD

In recent decades, economists started paying increasing attention to measuring economic development in human terms. This fact is highlighted in all programmatic and analytical documents of the UN and World Bank organizations, with the UN Development Programme (UNDP) publishing, since 1990, special Global Human Development Reports. Techniques and human development indicators proposed by the UNDP allow comparative analysis of the progress achieved in this field by both individual countries and groups of countries, and allow a view of their economic and social policies from this perspective.

The attractiveness and popularity of the human development concept – now, the concept of sustainable human development – have grown to such an extent that, since 1994, more than 100 countries to date, including Tajikistan, have been publishing their annual National Human Development Reports. The fundamental provisions of these reports form the conceptual framework of other government programmatic documents.

The human development concept is multidimensional and provides a lot of opportunities for use in various aspects of human and social life. In particular, UNDP's annual Human Development Reports and national reports of different countries are evidence of this.

The reports analyzed different aspects such as: vital needs, various measurements of human security, opportunities of social development via reduced military expenses, new cooperation dimensions, extreme poverty alleviation, employment, globalization impacts, consumption models, links between human development and criteria of environmentally sustainable development, etc. The current vision of progressive social development puts a person at the centre not only of the cultural sphere of social life, as it was traditionally done, but also of the circular flow of production relations. It is based on the recognition that a human being is both a starting and end point of social and economic development. Measurement of this development in human, or social, terms becomes its dominant theme, and material and tangible capacity becomes a condition of this development.

Future development should combine the economic quality of development (efficiency, earning capacity) and social quality (high living standards and life expectancy, education level, etc.) It also should take account of remaining challenges such as poverty and adverse climate change impacts, which require relevant adaptation measures to be developed.

Today, a new quality of economic development is increasingly linked in people's mind with the concept of "human development", which itself is continually enriching itself. In this respect, the UNDP's annual global human development reports have a considerable role to play. Politicians and leaders use these reports increasingly frequently to formulate their political stances and attitudes. In the meantime, the human development concept is recognized by researchers who quite often refer to the UNDP reports in their research papers. In public consultations on national reports, discussions are becoming increasingly professional from year to year as participants use human development terms, indicators and indices.

This being the case, the principles of report preparation remain as follows:

- ***National ownership:*** human development reports are closely connected with the country's experience and development plans.
- ***Participatory preparation:*** report preparation actively involves representatives of the government, non-governmental organizations, academic community, men and women, various ethnic groups, etc.
- ***Independent analysis:*** reports should provide an impartial assessment based on reliable data and analysis.
- ***Qualitative analysis:*** qualitative analysis of human development policies focuses on people and uses qualitative and quantitative data to formulate policy recommendations, and measure and monitor human development progress.
- ***Creative data representation:*** use of visual aids and easy-to-understand language will attract the target audience and conveying key messages of the report.
- ***Maintaining constant feedback:*** this includes awareness raising, marketing, monitoring of results, etc.

INTRODUCTION

In the late twentieth century, the impending problem of protecting humanity against imminent anthropogenic and ecological catastrophe became evident. It was realized that the development of civilization more and more displays features that cannot be considered progressive. These problems are global, and they suggested that the form, types and ways of development should be changed.

Global problems are a complex of modern universal problems manifesting at global, regional and national levels. These include the problem of nuclear war prevention and disarmament; resolution of hunger, pauperism and poverty problems; resolution of ecological problems and the sound use of natural resources; implementation of adequate demographic policies; further cosmic exploration, etc. As main challenges of the twenty first century, these global problems should be solved both globally and at the level of individual countries, as elements of the world community and given their specific capacities.

Currently, the world community's key priorities in terms of global problems are poverty reduction and sustainable development. According to the World Bank,[1] one quarter of the population of developing countries still lives on less than USD 1.25 per day, 1 billion people do not have access to clean drinking water, 1.6 billion live without electricity, 3 billion people are deprived of proper sanitation and a quarter of all children in developing countries suffer from undernourishment.

Climate change has become the main environmental problem facing mankind. It causes a many-fold increase in the frequency of extreme weather events such as drought, flooding and interchanging heatwaves and cold snaps. Its impacts aggravate desertification and erosion processes, result in irreversible changes in ecosystems and biodiversity loss and, finally, affect human life and activities.

Climate change and its resulting environmental changes will affect all aspects of human life: food, water and power sources, the course of diseases and zones of disease exposure as well as production and consumption methods. Climate change will also affect employment.

In future, the vulnerability of the Republic of Tajikistan will be determined by the resolution of the poverty problem and developing sensitivity to climate change impacts. Vulnerability of human security systems and a lack of adaptation to the current climate change can already be observed. To a large extent, this is due to the combination of social and economic factors and the inefficiency of monitoring systems for making informed environmental management decisions, as well as a lack of sound use of natural resources and long-term implementation of environment protection measures.

Poverty makes people more vulnerable. Climate change will have the strongest impact on the poor and those who have limited abilities to adapt to and mitigate adverse impacts. Women and children are most vulnerable to climate change and its impacts, particularly to natural disasters. There is a link between women's roles and positions and resilience to climate change impacts. Women represent a significant share of those engaged in agriculture and directly face the limitation of access to clean water, quality food products and electric power. They are more exposed to the risk of the early termination of education and therefore have limited opportunities to obtain deversing salaries. Adaptation strategies and assistance in their implementation should be focused on women who bear a higher burden of agricultural and houseworks.

UN specialists forecast that unless global environmental risks are mitigated and the deepening of social inequality is stopped, poverty aggravation and regress in global human development rates may become possible. Unlike in rich countries, poor people face climate change as a factor beyond their control, and the political task should therefore be to give them access to a better life in these changing conditions.

The human development concept focuses on disadvantaged people, and development assessment depends in general on how their position changes for better or worse. Today, the new climate change challenge facing humanity creates the threat that environmental degradation, being the result of these changes, will reduce people's opportunities by affecting their incomes and livelihoods as well as health, education and other components of the human development index.

[1] Global Development Report: Development and Climate Change, 2010, http://www.worldbank.org/wdr

CHAPTER 1

Climate change and human development

1.1. CLIMATE CHANGE: CONCEPTS, BASIC COMPONENTS, GLOBAL TRENDS, AND SCENARIOS

There are a lot of definitions of climate, or multiannual weather patterns. The classic definition is as follows:

Climate change is a variation in climate on Earth in general or in some of its regions over time, expressed in statistically reliable deviations of weather patterns from multiannual values over periods from decades to millions of years. Such an assessment takes account of changes in both mean values of weather patterns and frequency of extreme weather conditions. Climate change is caused by dynamic processes on Earth as well as external forces, such as variations in sunlight intensity and human activities. Currently, the term "climate change" is typically used to refer to changes in the contemporary climate.

The Framework Convention on Climate Change gives the following definition of climate change:

"Climate change" means a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Climate change is increasingly linked to global warming. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) provided the concurrent views of the academic community, which stated that climate changes are real and caused by human activities (Annex 1.1.). Experts estimate that the average global temperature has risen by 0.51^0C since the industrial era began. This tends to accelerate 0.2^0C per decade on average. Most expert climatologists identify 2^0C as a threshold of climate change, above which risks of catastrophic changes increase sharply. Unless actions to reduce human impact on the climate are taken now, the average global temperature may rise by 5^0C.

BOX 1. **WHY IS THE CLIMATE CHANGING?**

"Climate" refers to the average weather experienced over a long period, typically 30 years. This includes temperature, wind and rainfall patterns, the number of sunny days and other variables that can be measured in some particular place. The Earth's climate is not static and has changed many times in response to a variety of natural causes.

The term **"climate change"** usually refers to changes that have been observed from the early 1900s. First of all, these global climate changes are likely to be due to the combination of both natural and human causes:

- **Natural causes:** the Earth's climate changes naturally as a result of interactions between the ocean and the atmosphere, changes in the Earth's orbit, fluctuations in energy received from the sun and volcanic eruptions.
- **Human causes:** The main human influence on global climate is likely to be emissions of greenhouse gases (GHG) such as carbon dioxide (CO2) and methane (CH4).

Source: Climate Change, its Consequences on Employment and Trade Union Action. UNEP/International Labour Foundation for Sustainable Development, 2008, http://www.sustainlabour.org

BOX 2. **SOCIAL AND ECONOMIC COSTS OF GLOBAL CLIMATE CHANGES:**

• Damage to health:

1. *Direct damages:* - death of people because of flooding, storms, typhoons, hurricanes that may increase in number with climate warming; - increased incidence and mortality from coronary heart disease, diseases of the respiratory system, nervous system, kidneys, etc. on hot days, the number of which may increase in the summer months.

2. *Indirect damages:* - increased number of infections and infestations associated with increased precipitation, increased swamp areas and changed areas of feral herd infections; - increased number of intestinal infections due to the dysfunction of water, sanitation and engineering facilities; - increased mortality and incidence due to air pollution with suspended particles and other hazardous elements as a result of forest fires.

• Damage to agriculture:

- soil fertility loss due to water erosion, soil compaction, desertification, mineral starvation, salinization, saturation, and pollution; - altered soil structure, decreased overall land productivity; - deficient water resources in dry areas and, vice versa, increased floods and high waters in water-abundant areas; - unprecedented spread of agricultural pests and microorganisms, inter alia, in those regions where they were never observed before.

• Damage to forests:

- forest fires; - emergence of new pests and anomalous spread of traditional pests; - biodiversity losses.

• Other damages:

- natural disasters, unprecedented in their scale, resulting in human victims and major destruction of infrastructure facilities and economic losses; - protection against extreme temperature differentials that will require the creation of huge reserves of energy carriers; - permafrost melting that will destroy buildings, industrial enterprises and damage utility networks; - smoke contamination of large territories because of peat fires and forest fires; - altered moisture rotation over land and reflecting capacity of the Earth's surface; - disturbance of the ecological balance of biosphere in general, etc.

Source: Materials of the World Climate Change Conference in Moscow, September 2003

Climate changes are caused by changes in the Earth's atmosphere, processes in other parts of Earth such as oceans and glaciers, as well as the effects accompanying human activities. External processes that contribute to forming the climate are:

- variations in solar radiation and Earth's orbit;
- changes in sizes and relative positions of the oceans and the continents;
- changes in the solar luminosity;
- changes in the Earth's orbital parameters;
- changes in the atmospheric transmittance and composition caused by changes in Earth's volcanic activity;
- changes in the greenhouse gas (GHG) (CO_2 and CH_4) concentrations in the atmosphere;
- changes in the reflecting capacity of the Earth's surface;
- changes in the quantity of warmth in the ocean depths.

Climate changes on Earth. Weather is defined as the daily state of the atmosphere. Weather is a chaotic non-linear dynamic system. Climate is an averaged state of weather and is predictable. Climate includes such indicators as average temperature, amount of precipitation, number of sunny days and other variables that can be measured in a particular place. There are also processes on Earth that can affect the climate.

Glaciation. Glaciers are considered among the most sensitive indicators of climate change. They substantially grow during climate cooling (the so-called "Little Ice Ages") and shrink during climate warming. Glaciers grow and shrink due to both natural variability and external factors. In the last century, glaciers could not regenerate ice sufficiently in the winter months to compensate for ice losses in the summer months.

The most significant climatic processes, taking place over several recent millions of years, are various cycles of Ice Ages caused by variations in the Earth's orbit. Changes in the condition of the continental ices and sea level fluctuations within 130 meters are key climate change effects in most regions.

World ocean variability. Over decades, climate changes may be caused by the interaction of the atmosphere and the world ocean. Many climate fluctuations, including the best known El-Nino southern oscillation and North Atlantic and Arctic oscillations, take place partially due to the ability of the world ocean to accumulate heat energy and the displacement of this energy to various parts of the ocean.

Over longer time scales, circulation in the oceans plays a key role in redistributing heat and may significantly affect the climate.

Climate memory. More generally, the variability of the climate system is a form of hysteresis, which means that the current climate is a result not only of particular factors but also of climate history. For instance, during a decade lakes partially dry, plants die and deserts advance. In a year following the drought, these conditions result in less abundant rains. Thus, climate change is a self-regulating process, as the environment responds in a certain way to external forces and, while changing, it can also affect the climate.

Non-climatic factors and their impact on climate change include:

Greenhouse gases. Greenhouse gases are considered the main cause of global warming. Greenhouse gases are also important in understanding the Earth's climate history. Surveys show that the greenhouse effect, resulting from the atmosphere warmed by heat energy restrained by greenhouse gases, is a key process that regulates the Earth's temperature.

Lithosphere plate tectonics. Over long periods of time, the motions of tectonic plates shift continents, form oceans and create and destroy mountain ranges, creating the surface on which the climate exists. Recent surveys show that the tectonic movements have aggravated conditions of the last Ice Age: about three million years ago the North and South American plates collided, forming the Isthmus of Panama and shutting off direct mixing between the Atlantic and Pacific Oceans.

Changes in solar output through several recent centuries. The sun is the predominant source of heat in the climate system. Solar energy, transformed into heat on the Earth's surface, is an essential element that forms the Earth's climate. Over long time scales, the Sun has become brighter and emits more energy. This slow development also affects the Earth's atmosphere. It is assumed that at the early stages of the Earth's history, the Sun was too cold for the water on the Earth's surface to be fluid, which resulted in the so-called "Faint Young Sun Paradox".

Changes in solar output are also observed on shorter time scales: the 11-year solar cycle and longer modulations. However, the 11-year solar cycle of appearance and disappearance of sunspots is not clearly traced in the climatology data. Changes in solar output are considered an important contributor to the Little Ice Age and some warming observed between 1900 and 1950. The cyclical nature of the solar output is not yet fully understood; it differs from the slow change that is happening within the sun as it ages and evolves.

Orbital variations. In terms of affecting the climate, variations in the Earth's orbit are similar to fluctuations in solar output, since minor orbital deviations result in the redistribution of sunlight reaching the Earth's surface. Such orbital variations are called Milankovitch cycles, which can be projected to high precision since they are caused by the physical interaction of the Earth, its satellite the Moon and other planets. It is assumed that orbital variations are the main causes of the interchange of glacial and inter-glacial cycles of the last Ice Age. Smaller changes, such as the periodical advance and retreat of the Sahara, are also a result of changes in the Earth's orbit.

Volcanism. One strong volcanic eruption can affect the climate, causing cooling for a period of a few years. Gigantic eruptions, which form large igneous provinces, occur a few times every hundred million years, but they affect the climate for millions of years and cause mass extinctions. Initially it was supposed that cooling is caused by the released volcanic dust, since it prevents sunlight from reaching the Earth's surface. However, measurements show that most dust settles on the Earth's surface during six months.

Volcanoes are also a part of the geochemical carbon cycle. Over very long geological time periods, carbon dioxide was released from the Earth's crust and mantle, counteracting CO2 extracted from the atmosphere and bound by sedimentary rocks and other geological CO2 sinks. However, the US Geological Survey estimates that volcanic emissions are at a much lower level than the emissions caused by the human activities, which generate 100-300 times the amount of carbon dioxide.

Volcanic eruptions, glaciations, continental drifts and the shift of the Earth's poles are forceful natural processes affecting the Earth's climate. On the scale of millennia, the slow movement from one Ice Age to another will probably determine the climate.

Human influences on climate change. Anthropogenic factors are human activities that affect the climate. In some cases, the causal relationship is direct and non-ambiguous, such as the impact of irrigation on temperature and humidity; in other cases, this relationship is less obvious. Various hypotheses of human influences on the climate have been discussed for many years. For instance, the "rain follows the plow" theory was popular throughout the American West and Australia at the end of the 19th century.

Today, the main problems are the increase in CO_2 levels in the atmosphere due to the emissions from fossil fuel combustion, aerosols in the atmosphere affecting its cooling and cement manufacture. Other factors, including land use, ozone depletion, livestock breeding and deforestation also affect the climate.

Fuel combustion. Having started to increase during the industrial revolution in the 1850s and gradually speeding up, human consumption of fuel caused CO_2 concentration in the atmosphere to increase from ~280 ppm to 380 ppm. At such a growth rate, the concentration projected for the end of the 21st century will exceed 560 ppm. It is known that CO2 levels in the atmosphere are higher now than for the last 750,000 years. Together with increasing methane levels, these changes mean a temperature rise by 1.4-5.6°C between 1990 and 2040.

Aerosols. It is assumed that anthropogenic aerosols, particularly sulphates, released during fuel combustion affect atmospheric cooling. It is supposed that this property is a cause of the relative plateau on the temperature chart in the middle of the twentieth century.

Cement manufacture. Cement manufacture is an intensive source of CO_2 emissions. Carbon dioxide is formed when calcium carbonate ($CaCO_3$) is heated to receive calcium cement oxide (CaO, or quicklime). Cement manufacture causes approximately 5% of the CO_2 emissions from industrial processes (energy and industrial sectors). When cement stiffens, the same amount of CO_2 is absorbed from the atmosphere in the counter reaction $CaO+CO_2=CaCO_3$. Therefore, cement production and consumption changes only local CO_2 concentration in the atmosphere, with the average value remaining unchanged.

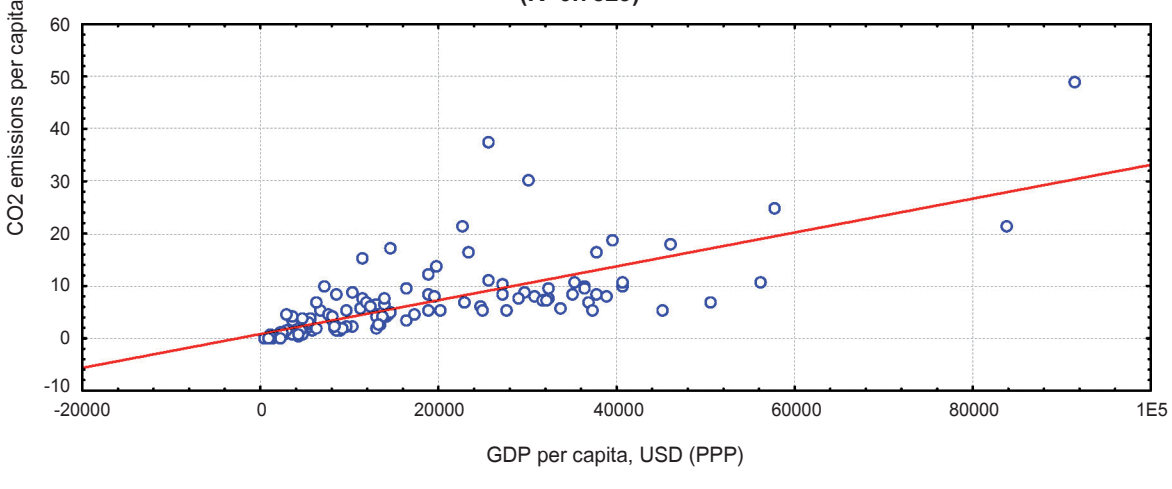
Land use. Land use has a significant impact on the climate. Irrigation, deforestation and agriculture change the environment drastically. For instance, irrigation changes the water balance. Land use can change the albedo of a particular territory, since it changes the properties of the underlying terrain and therefore the amount of the absorbed solar radiation. For example, there are grounds to believe that over the period between 700 BCE and early CE, the climate of Greece and other Mediterranean countries changed in response to large-scale deforestation, as wood was used for construction, shipbuilding and fuel. The climate became hotter and dryer and, today, the tree species used for shipbuilding do not grow on this territory any more. The 2007 survey of the Jet Propulsion Laboratory states that the average temperature in California has risen by 2°C over the last 50 years, and in cities this rise has been much higher. This is primarily the consequence of human-induced change in the landscape.

Livestock. The 2006 UN report 'Livestock's long shadow' states that livestock is responsible for 18% of global greenhouse gas emissions. This includes changes in land use such as deforestation for pastures. In the tropical Amazon rainforests, 70% of forests are cut for pastures; this was the main reason why the UN Food and Agriculture Organization included land use as part of livestock influence in its agricultural report for 2006. In addition to CO_2 emissions, livestock accounts for 65% of nitrous oxide emissions and 37% of methane emissions of anthropogenic origin.

Global trends and tendencies. Per-capita GHG emissions in countries with high GDP per capita are substantially higher than in poorer countries. This is due to the abundant energy-intensive types of activities, such as vehicular traffic, air conditioning and energy generation from fossil fuels.

At the same time, countries are very different from each other in terms of the amount of emissions that accelerate the accumulation of greenhouse gases in the atmosphere.

Diagram 1.
Ratio of fuel combustion-induced specific GHG emissions to GDP per capita (as of 2008, when the latest survey of CO2 emissions was conducted) (R=0.7329)



BOX 3. **THERE ARE THREE GROUPS OF COUNTRIES:**

- Developed countries with high GDP per capita and relatively high carbon dioxide emissions per capita.

Table 1.
5 developed countries ranking first in terms of CO_2 emissions

#	Country	GHG emissions per capita	
		2008	Changes over 2000-2008
1.	Luxembourg	21.5	+2.62
2.	Australia	18.6	+1.36
3.	USA	18.0	-1.6
4.	Canada	16.3	1.1
5.	Finland	10.6	+0.56

- States falling behind in terms of economic development for different reasons. These countries include also countries of the former socialist bloc.

Table 2.
5 CIS countries ranking first in terms of CO_2 emissions

#	Country	GHG emissions per capita	
		2008	Changes over 2000-2008
1.	Kazakhstan	15.1	+6.53
2.	Russia	12.0	+1.42
3.	Turkmenistan	9.7	+1.81
4.	Ukraine	7.0	+0.47
5.	Belarus	6.5	+1.2
6.	Tajikistan	0.47	+0.11

- Countries with high living standards and high levels of emissions

Table 3
5 oil-exporting countries ranking first in terms of CO_2 emissions

#	Country	GHG emissions per capita	
		2008	Changes over 2000-2008
1.	Qatar	49.0	-9.7
2.	Kuwait	30.1	-0.3
3.	Arab emirates	25.0	-12.0
4.	Bahrain	21.4	-7.9
5.	Oman	17.3	+7.6

Calculations made on the basis of World Development Indicators

1.2. APPROACHES TO INTEGRATED ENVIRONMENTAL AND ECONOMIC ASSESSMENTS

Climate change is the most important problem facing our generation and can ultimately derail all the efforts on combating poverty and significantly restrict development opportunities for future generations.

Currently, efforts are focused on the achievement of development goals by 2015, as formulated in the Millennium Declaration. In general, progress has been achieved. The share of the population in developing countries living on less than USD 1 per day fell from 47% in 1990 to 24% in 2010. Over the same period, infant mortality rates have reduced from 106 to 83 deaths per 1,000 live births, and life expectancy has increased by three years. Economic growth is increasingly conditioned by three factors: population growth, consumption growth and carbon-intensive production. Therefore economic growth has environmental costs, the scale of which depends on the level of countries' economic development. Although environmental achievements in general are higher in developed countries and, more than ever, these countries' governments respond to the need of people to live in clean and healthy environment, the scale of GHG emissions is especially significant in these countries.

No single country can manage this problem alone. The principle of "common but differentiated responsibility" is a cornerstone of the Kyoto protocol.

Currently, 32.1 g/t of CO_2 are emitted to the atmosphere. To avoid detrimental climate changes, emissions should remain within the volume of 14.5 g/t of CO_2, the amount of the global carbon budget. If greenhouse gas emissions to the atmosphere are twice as much, the carbon budget might be misbalanced by 2032.

Table 4.
Classification of countries according to global CO_2 emissions

Country	Share in global CO_2 emissions
China	22
USA	17
India	5
Russia	5
Japan	4
Germany	2
Canada	2
Iran	2
Great Britain	2
South Korea	2
Other countries	37

Calculations made on the basis of the World development indicators

BOX 4. **UN FRAMEWORK CONVENTION ON CLIMATE CHANGE**

The ultimate objective of the Convention is to achieve stabilization of greenhouse gas concentrations (carbon dioxide, methane, nitrous oxide, fluorine-containing hydrocarbons, perfluorinated hydrocarbons, sulphur hexafluoride) in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

All Parties to the Framework Convention must develop their national programs to prevent climate change. They also should conduct an inventory of greenhouse gas emissions by sources and opportunities of greenhouse gas sinks, e.g. by forests.

Commitments of the parties are specified in the Kyoto Protocol to the UN Framework Convention on Climate Change that was adopted in 1997. The Kyoto Protocol is the first international document which uses the market mechanism to tackle global environmental problems:

- The Protocol establishes the international regime of "emissions trading" that allows industrialized countries to buy and sell their emissions quotas. If a country does not fully spend its quota, it may assign or sell its "free" part to another country;

- As a result of the implementation of the "joint project implementation" mechanism, developed and transition countries can jointly implement projects aimed to reduce greenhouse gas emissions to the atmosphere on the territory of one of the countries and then "split" the received emissions reductions;

- Industrialized countries will be able to finance emissions reduction projects in developing countries and receive emissions permits via the "clean development mechanism", the primary objective of which is to facilitate achievement of sustainable development in developing countries.

The latest climate-related negotiations are focused on the future of the Kyoto Protocol, which expires in 2012. The primary responsibility for resolving climate change rests with developed countries, which have financial resources and technological opportunities to launch and activate the process of substantially reducing the volumes of greenhouse gas emissions. This being the case, developing countries should have an opportunity to move towards low-carbon economy flexibly and smoothly.

BOX 5. **PRIMARY SOURCES OF EMISSIONS**

Sector	Source according to IPCC	Gas
Agriculture	Agricultural areas direct and indirect emissions)	Nitrous oxide (N_2O)
Agriculture	Intestinal fermentation of domestic animals	Methane (CH_4)
Agriculture	Emissions from dung and compost	Methane (CH_4)
Agriculture	Rice-growing	Methane (CH_4)
Power engineering	Housing and utilities	Carbon dioxide (CO_2)
Power engineering	Industry and construction	Carbon dioxide (CO_2)
Power engineering	Mobile transport	Carbon dioxide (CO_2)
Power engineering	Other sectors: agriculture	Carbon dioxide (CO_2)
Industrial processes	Aluminum production	PFC_s
Industrial processes	Aluminum production	Carbon dioxide (CO_2)

BOX 6. **POLICIES AND POSSIBLE MEASURES TO COMBAT CLIMATE CHANGE**

Gas	Policies and measures
CO_2	Shifting towards alternative fuel (containing less carbon, e.g. natural gas); enhancing industry and transport's energy efficiency through performance of international agreements; enhancing households' energy efficiency (e.g. improved thermal insulation of houses); active use of renewable energy; use of economic instruments (increasing electric power prices/energy taxes, fuel tax, cancelling or reducing subsidies for fossil fuel).
CH_4	Improving organic waste treatment methods, reducing waste burial on landfills through waste generation prevention and increased processing; using landfill gas as an energy source; reducing methane emissions from coal mines.
Halogen containing gases	Using new technologies in production of halogen containing carbo-hydrates.
N_2O	Improving organic waste treatment methods; reducing use of mineral fertilizers; using best available technologies in some industrial processes (e.g. in the production of nitric acid).

Source: Environment Protection Management Guide, UNDP Regional Bureanm Bratislava, Slovak Republic, 2003

Table 5.
Cost of combating climate change

Additional investment and financial flows in 2030

Reduction of emissions	
Sector	**Global (billion USD)**
Agriculture	35
Buildings and facilities	51
R&D in Power-Engineering	35-45
Power supply and infrastructure	(-) 67
Forestry	21
Industry	36
Transport	88
Waste	0.9

Global: USD 200-210 billion (0.92% of the projected global investment and 0.26% of global GDP in 2030)

Developing countries: USD 76-77 billion (0.86% of the projected global investment and 0.29% of global GDP in 2030)

Adaptation in separate sectors		
Sector	**Global (billion USD)**	**Share of developing countries**
Agriculture, forestry and fishery	14	50%
Coastal areas	11	40%
Human health	5	100%
Infrastructure	8-130	25%
Water supply	11	80%

Global: overall needs identified in this survey amount to 0.2-0.8% of global investment flows, or 0.06-0.21% of projected GDP in 2030.

Developing countries: USD 28 to 67 billion in 2030

Source: UNFCCC. Joel Smith (2007). "Preliminary Estimates of Additional Investment and Financial Flows Needed for Adaptation in 2030"

BOX 7. FORECAST OF EVENTS TILL 2050

"Forecasts suggest that continuing failure to reduce the grave environmental risks and deepening social inequalities threatens to slow decades of sustained progress by the world's poor majority - and even to reverse the global convergence in human development."

Modern environmental threats

- dependence on fossil fuel
- mortality caused by atmosphere pollution
- water pollution
- mortality caused by indoor air pollution
- natural disasters
- climate change

Source: Sustainability and Equity: A Better Future for All. Global Report. 2011

Table 6.
Possible economic impacts depending on different degrees of climate warming

Tempe-rature rise	Water	Food	Health	Land	Environment	Abrupt large-scale impacts
1°C	Small glaciers in the Andes disappear completely, threatening water supplies for 50 million people	Modest increases in cereal yields in temperate regions	At least 300,000 people die each year from climate-related diseases (diarrhea, malaria, and malnutrition). Reduction in winter mortality in higher latitudes (Northern Europe, USA)	Permafrost thawing damages buildings and roads in parts of Canada and Russia	At least 10% of land species facing extinction. 80% of coral reefs bleaching, including the Great Barrier Reef	Atlantic thermohaline circulation starts to weaken
2°C	Potentially 20 - 30% decrease in water availability in some vulnerable regions, e.g. Southern Africa and Mediterranean	Sharp declines in crop yield in tropical regions	40-60 million people are exposed to malaria in Africa	Up to 10 million people affected by coastal flooding each year	15-40% of land species facing extinction. High risk of extinction of Arctic species, including the polar bear	Potential for Greenland ice sheet to begin melting irreversibly, accelerating sea level rise and committing the world to an eventual 7 m sea level rise. Rising risk of abrupt changes to atmospheric circulations, such as the monsoon. Rising risk of collapse of West Antarctic Ice Sheet. Rising risk of collapse of Atlantic Thermohaline Circulation
3°C	In Southern Europe, serious droughts occur. 1-4 billion people suffer water shortages, while 1 – 5 billion gain water, which may increase flood risk	150-550 million additional people are at risk of hunger	1 to 3 million people die from malnutrition	Up to 170 million people affected by coastal flooding each year	20-50% of land species facing extinction. For instance, 25-60% of mammals, 30-40% of birds and 15-70% of butterflies In South Africa. Collapse of Amazon rainforests (according to model calculations)	
4°C	Potentially 30 – 50% decrease in water availability in Southern Africa and Mediterranean	Agricultural yields decline by 15 – 35% in Africa, and entire regions out of production (e.g. parts of Australia)	Up to 80 million people exposed to malaria in Africa	Up to 300 million people affected by coastal flooding each year	Loss of around half of the Arctic tundra. Around half of all protected areas cannot fulfill objectives	
5°C	Possible disappearance of large glaciers in Himalayas, affecting one-quarter of China's population and hundreds of millions in India	Continued increase in ocean acidity seriously disrupting marine ecosystems and fish stocks		Sea level rise threatens small islands, low-lying coastal areas (Florida) and major world cities such as New York, London, and Tokyo		
Over 5°C	The Earth's average temperature will rise by even more than 5 or 6°C if emissions continue to grow. This growth will be amplified by warming-induced release of carbon dioxide from soils and methane from permafrost. This level of global temperature rise is likely to lead to major disruptions and large-scale movements of population. Such "socially contingent" effects could be catastrophic, but are very hard to capture with current models as temperatures would be so far outside human experience.					

Source: The Economics of Climate Change. The Stern Review. Nicholas Stern. Cabinet Office – HM Treasury, 2006, UK.

As in the rest of the world, HDI has risen strongly in Tajikistan. However, climate change poses the question of what the future holds. How might HDI values change, for example, by 2050? And how severely might environmental and inequality constraints affect further progress? The 2011 Global Report provides forecasts on the basis of three development scenarios: 1) a base case scenario which assumes limited changes in inequality, environmental threats and risks, 2) an environmental challenge scenario, and 3) an environmental disaster scenario.[2]

The case base scenario anticipates a global HDI for 2050 that is 19 percent higher than today's. The second, environment scenario envisions environmental challenges such as an increased climate change impact on agricultural production and increased inequality and insecurity, such as intensified environmental risks at the household and regional levels (in terms of intensified indoor solid fuel use, water safety and sanitation as well as air pollution). This model anticipates a global HDI in 2050 that is 8% lower than in the base case scenario and 12% lower for South Asia and Sub-Saharan Africa. Under the environmental disaster scenario, most early 21st century gains will have eroded by 2050 as biophysical and human systems are stressed by overuse of fossil fuels and falling water tables, glacial melting, progressive deforestation and soil degradation, dramatic declines in biodiversity, greater frequency of extreme weather events, peaking production of oil and gas, increased civil conflict and other chellenges. Under this scenario the global HDI is projected to be some 15% below the base case scenario by 2050.

Developed and developing countries must take adequate measures to halt or reverse the above-mentioned trends, otherwise the environmental disaster scenario will lead to a turning point before 2050 in developing countries: their convergence with rich countries in HDI achievements for recent decades will begin to reverse. The main finding of these projections suggests that, in many cases, the most disadvantaged people bear and will continue to bear the repercussions of environmental deterioration, even if they contribute little to the problem. Low and middle HDI countries have contributed the least to global climate change, but they have experienced the greatest loss in rainfall and the greatest increase in its variability, with implications for agricultural production and livelihoods.

Large-scale surveys are currently being conducted under the World Climate Research Programme and International Geosphere-Biosphere Programme. This holds out the hope of dramatically improving climate forecasting in the near future[3], all the more so because it is spurred by increasing public interest in the climate change problem.

Because of the substantial uncertainty of climate forecasting noted above, the range of estimates of potential economic implications of climate warming remains rather broad.

Values of economic costs of climate change are dispersed; however, qualitative valuations of different authors concur. Table 7 provides the corresponding estimates of economic costs for the most important regions of Earth.

[2] The 2011 Global Report compares three scenarios through 2050 produced by the University of Denver's Frederick S. Pardee Center. 2011 Human Development Report. Sustainability and Equity: A Better Future for All.

[3] Fomin B.A., Zhitnitsky E.A. General Problems of Post-Industrial Era (Compendium). Moscow Public Science Foundation, the Institute of World Economy and International Relations, Russian Academy of Sciences. Moscow 1999.

Table 7.
Economic costs of climate warming to be borne by the most important regions in case if CO_2 doubles, USD billion and % of GNP

Country/region	Fankhauser S.*		Tol R.S.J.**	
	USD billion per year	% of GNP	USD billion per year	% of GNP
Europe	63,6	1,4	-	-
USA	61,0	1,3	-	-
Russia and countries of the former USSR	18,2	0,7	-7,9	-0,3
China	16,7	4,7	18,0	5,2
South Asia	-	-	53,5	8,6
Africa	-	-	30,3	8,7
Latin America	-	-	31,0	4,3
Middle East	-	-	1,3	4,1
Total:	269,6	1,4	315,7	1,9

Source: http://www.archipelag.ru/agenda/geoklimat/economic-aspect/climate/

* Fankhauser S. Valuing Climate Change: The Economics of the Greenhouse. London, 1995;
** Tol R.S.J. The Damage Costs of Climate Change: Towards More Comprehensive Calculations // Environmental and Resource Economics. 1995. V.5, pp. 353-374

As one can see from Table 7, different forecasts give substantially different data (particularly for the former USSR). Anticipated economic losses are on the order of 1% of GNP for the global economy in general. It should also be noted that the rise in the average global temperature by 5°C will increase anticipated economic costs almost twofold.

In 2005-2006, an international team of authors prepared a Report[4] under the guidance of Sir Nicholas Stern, Head of the Government Economic Service and Adviser to the Government of Great Britain on the economy and development. They proposed one of the original models of integrated greenhouse effect assessment, taking account of international measures on the stabilization of greenhouse gas concentrations. The model was called PAGE 2002 (Policy Analysis of the Greenhouse Effect 2002). It calculated aggregate impacts on the global economy, as well as the economy of individual countries and regions, depending on different climate change scenarios envisioning various levels of greenhouse gas concentrations.

According to the findings of the base case modeling for the late twenty first century (with 5-6°C global warming), economic losses are estimated at 5 to 10% of global GDP, with the lower limit taking account of only direct market impacts of climate change. When considering non-market impacts, the estimate increases to 11% of GDP on average, and even to 14% of GDP under the worst-case climate change scenario that takes account of feedback factors. In this case, the cost to the least developed countries, with weak economies particularly vulnerable to climate change, will be up to 25% of GDP. Merging the three types of potential climate change-induced economic losses, the Report's authors concluded that in the worst-case scenario, living standards of the population (or per capita consumption of goods and services) could fall 20% from current levels by the end of the century. Calculations done with the PAGE 2002 model showed that, without proactive measures to limit and reduce greenhouse gas emissions and to adapt the economy to unavoidable changes, climate change could create significant material costs for the global economy and humanity in general.

The accuracy of these calculations and the reliability of the resulting economic estimates remain disputed. As such, the Stern Report points out that the derived estimates are based on probability and, to a large extent, are conditional. It does not claim to be the world's foremost authority. This is in no way a forecast of anticipated economic losses, but an attempt to comprehensively assess the scale of impacts of climate change and its global economic, environmental and social implications. As such, it definitely deserves attention, and all the more so because it is the first project of its kind in the world.

A detailed study of regional implications of climate change, using different economic models, shows that grave impacts upon the global economy, human life and environment should be expected even if the level of warming is modest.

[4] The Economics of Climate Change. The Stern Review. Nicholas Stern. Cabinet Office – HM Treasury, 2006, UK.

Diagram 2.
Calculations based on the PAGE 2002 model.
Average GDP per capita losses under three scenarios of economic and climate impacts

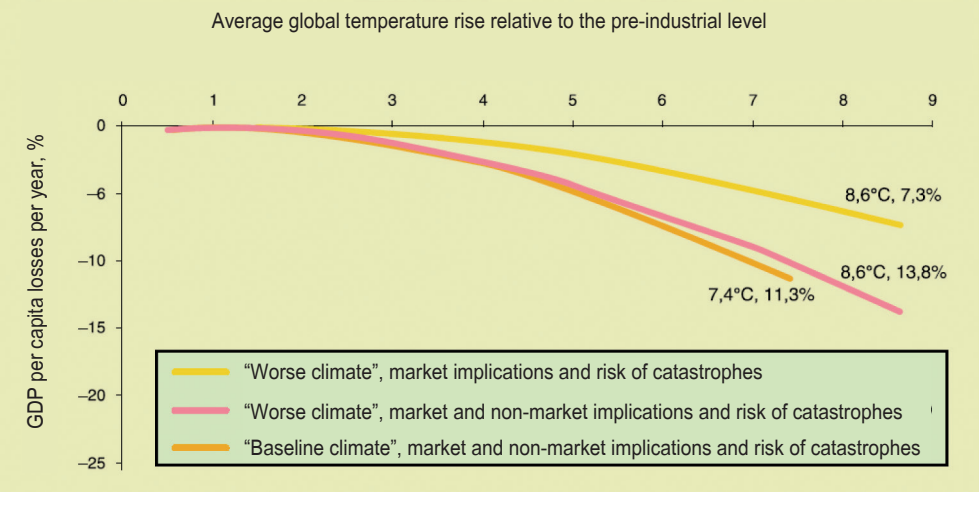
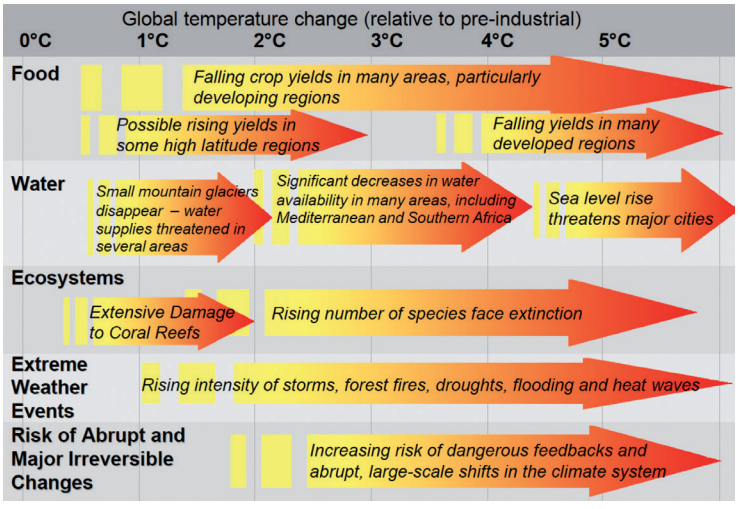


Diagram 3.
Projected Impacts of Climate Change



Source: The Economics of Climate Change. The Stern Review. Nicholas Stern. Cabinet Office – HM Treasury, 2006, UK.

BOX 8. **IPCC ASSESSMENT OF CLIMATE CHANGE IMPACTS IN ASIA:**

- By the 2050s, freshwater availability in Central, South, East and South-East Asia, particularly in large river basins, is projected to decrease.
- Coastal areas, especially heavily populated megadelta regions in South, East and South-East Asia, will be at greatest risk due to increased flooding from the sea and, in some megadeltas, flooding from the rivers.
- Climate change is projected to compound the pressures on natural resources and the environment associated with rapid urbanization, industrialization and economic development.
- Endemic morbidity and mortality due to diarrheal disease primarily associated with floods and droughts are expected to rise in East, South and South-East Asia due to projected changes in the hydrological cycle.

Source: Fourth Synthesis Report of the Intergovernmental Panel on Climate Change (IPCC). Geneva, Switzerland, 2007.

Climate change and developing countries. Developing countries' priority tasks for the short-term are poverty reduction and sustainable development, with climate change complicating rather than facilitating fulfillment of these tasks. Climate change endangers all countries, but developing countries are most vulnerable in this regard. Existing estimates show that they will bear approximately 75–80% of climate change-induced costs. Warming by merely 2°C relative to the pre-industrial temperature levels –this seems to be the minimum temperature rise – could result in an annual GDP decrease of 4–5% in African and South Asian countries. Most developing countries do not have sufficient financial and technical resources to manage increasing climate change risks. Their incomes and welfare depend to a large extent directly on natural resources severely affected by climate conditions. Also, most of them are located in tropical and subtropical regions that already experience impacts of extreme climate variations. On its own, economic growth will hardly be rapid and steady enough to resist climate change-induced threats, especially if it remains a carbon-intensive process which accelerates global warming. Therefore, a choice between economic growth and climate change should not be a backbone of climate policies. In practice, reasonable policies to tackle climate-related problems will include measures that contribute to development, reduce vulnerability and ensure financing of the shift towards low-carbon economic growth.

To continue to achieve sustainable human development goals, manage this process and to evaluate the efficiency of the funds used as well as the progress toward meeting the goals set, it is required to develop relevant criteria and indicators of sustainable development, assessing the economic impacts of climate change including the latter's so-called "integrated environmental and economic assessments" that link natural and physical processes with market principles (Annex 1.2.).

Climate change impacts in Asia. The retreat of glaciers in Asia and the Himalayas over the next two or three decades may increase the frequency of flooding and mudflows and affect water resources. Climate change will also decrease freshwater availability in the basins of major rivers. Amid the population growth and increasing demand for decent living conditions, all this could negatively affect lives of over one billion people by 2050. Coastal areas, especially heavily populated megadelta regions, will be at greatest risk due to increased flooding from the sea and rivers. By the middle of the twenty first century, crop yields are projected to increase by up to 20% in East and South-East Asia and to decrease by 30% in Central and South Asia. Endemic morbidity and mortality due to diarrheal disease are expected to rise. Increased coastal water temperatures will contribute to the epidemics and increased toxicity of cholera viruses in South Asia.

In order to summarize data on climate change in Central Asia, one of the Eurasian Development Bank's surveys[5] used data of the Tyndall Centre (University of East England). Calculations related to changes in temperature and precipitation by the end of the twenty first century (2071 to 2100) were based on two greenhouse gas concentration scenarios, A2 and B2, and four global climate models (Australia's CSIRO2, Canada's CGCM2, the United Kingdom's HAD3 and the United States' PCM). These models have been approved by the Intergovernmental Panel on Climate Change.

The models and greenhouse gas concentration scenarios anticipate that average annual and seasonal temperatures will rise throughout Central Asia by the end of the twenty first century. Precipitation is expected to decrease during summer and increase during winter, while modeling of mid-seasons tends to vary. Under scenario A2, by the end of the twenty first century the average annual air temperature in Tajikistan will vary within 3.4-7°C as compared with the baseline period (1960–1990). Average annual precipitation will increase in Tajikistan by 18% on average.

Climate trends in Tajikistan. The second threat is temperature increases, which seriously threaten glaciers and water resources. Surface air temperatures rise in most regions at high altitudes. Over the 65-year period of observations, the highest temperature rise was recorded in Dangara (by 1.2°C) and Dushanbe (by 1.0°C). In the mountainous areas, a temperature increase of 1.0-1.2°C has been observed in Khovaling, Fayzabad and Ishkashim. The number of days with temperatures reaching 40°C and more has also increased.

Climate change and its impacts, such as extreme temperatures and some anomalous abundant rainfall and natural disasters, is projected to seriously affect various infrastructures such as roads, construction, irrigation, etc. In turn, this will limit access to various services, opportunities and tools that poor people rely on for their incomes and livelihoods.

Drought intensity and frequency are likely to increase. The IPCC's data (2007) show that "the projected decrease in precipitation in Central Asia will be accompanied by an increase in the frequency of very dry spring, summer and autumn seasons. Changes in seasonality and amount of water flows from river systems are likely to occur due to climate change. Changes in runoff of river basins could have a significant effect on the power output of hydropower generating countries like Tajikistan, which is the third-highest producer in the world."[6]

Over the last two decades, the country has experienced sharp increases in the intensity and frequency of climate change-induced extreme events. At the same time, the unpredictability of precipitation frequency and intensity has a direct impact on the vulnerable sectors of the national economy and threatens food security, especially in rural areas. It is expected that major natural hazards will increase in the light of climate change, and that the country will witness dramatic fluctuations in the hydrological cycle, especially because of glacier melting and flash floods. These adverse environmental and climate events are likely to adversely impact the development of hydropower engineering, access to potable water, irrigation, food security and rural livelihoods.[7]

There is a need to enhance Tajikistan's preparedness to climate change-induced natural disasters, through the continuous improvement and enhancement of the climate risk management system. Although over half of the Central Asia's water resources are formed in Tajikistan, there is a severe water deficit in some areas, where livestock breeding incurs serious losses for farmers due to droughts and lack of rainfall.

Experts of the State Hydro Meteorology Agency believe that high speed of global warming directly affects water resources and land degradation. According to them, the average warming rate in the zone of irrigated agriculture has been, since the 1950s, 0.25 grades per decade, which is two-fold higher than global warming rates. This means that in the Republic, the number of days with high temperatures will increase and the number of days with low temperatures will decrease.

Experts estimate that given expected climate changes, the evaporation rate and the evapotranspiration of hydrophilous vegetation will increase in Tajikistan by 5-14% and by 10-20% respectively.

[5] S.R. Ibatullin, V.A. Yasinsky, A.P. Mironenkov. The Impact of Climate Change on Water Resources in Central Asia. Sector report. Eurasian Development Bank, 2009.
[6] Impacts, Adaptation and Vulnerability. IPCC Fourth Assessment Report, 2007.
[7] PPCR Joint Mission Report, October 2009.

The GFDL (US Geophysical Fluid Dynamics Laboratory) and CCCM (Canadian Climate Centre) models have created projections of water resource deficits for irrigated farming in the RT. By 2020, they anticipate losses of 0.87 and 1.31km3 in compare toin 1990 and 0.61 and 0.91km3 in 2000.

With the current temperature expected to increase by 2-2.30C by 2050, plants' biological need for water will also increase.

Assessment of the vulnerability of water resources of the Tajikistan's rivers shows that if CO_2 concentration in the atmosphere increases twofold, water resources are expected to reduce by 20-30%. The probability of high waters will also lessen. Most precipitation will be liquid, in the form of rain, winter snow accumulation will decrease and river turbidity will increase. The latter will increase already-high rates of sedimentation in water reservoirs.

Water resources in the basin of the Amu Darya are likely to reduce by 10%-15% by 2050. Snow reserves in the mountains and glacial zones will shrink, and climate may become more extreme. The frequency of annual mudflows, floods and mountain lake bursts may increase 19% by 2030. Frequency, hardness and scale of droughts will increase, thereby accelerating the desertification processes; the Aral crisis will become more strained, and riparian woodlands, coastal and water ecosystems of the Amu Darya delta will become endangered. The increased duration of hot periods will increase energy consumption.

Potential benefits include the possibility to use lands for different crops two or more times, better conditions for livestock wintering, more areas for cultivation of late crops, etc.

Risk factors include the possible reduction of irrigation due to the water resources deficit, increased soil salinization, increased duration of adverse weather factors, increased areas with spreading plant diseases, weeds and pests, decreased pasture productivity, increased heat loads on animals' organism and lost crops in both irrigated and rain-fed areas. As climate aridness grows, decrease in surface water resources will tend to prevail. Owing to the decrease in water levels in rivers and irrigation systems, water tables in main water intakes, inlet chambers and head ponds of pump stations will also fall. This in turn will limit the size of the managing territories where gravity irrigation is possible and increase energy consumption for pump irrigation. Additionally, rivers will become particulate collectors and their water quality will deteriorate.

BOX 9. **THE GREEN ECONOMY IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT**

In the context of sustainable development and poverty eradication, the green economy should contribute to meeting the key goals of poverty eradication, food security, sound water use, universal access to modern energy services, sustainable cities, management of oceans and improving resilience and disaster preparedness. Public health, human resource development and sustained, inclusive and equitable growth that generates employment, inter alia, for the youth, should also be supported. This support must be based on the Rio principles, particularly those of common but differentiated responsibility, to provide opportunities for all citizens and countries.

The green economy should protect and enhance the natural resources base, increase resource efficiency, promote sustainable consumption and production patterns and move the world toward low-carbon development.

At the same time, the green economy is not intended as a rigid set of rules but rather as a decision-making framework to foster integrated consideration of the three pillars of sustainable development in all relevant domains.

Green economic policies and measures can offer win-win opportunities to improve the integration of economic development with environmental sustainability to all countries, regardless of the structure of their economy and their level of development.

Developing countries are facing great challenges in eradicating poverty and sustaining growth, and a transition to a green economy will require structural adjustments that may involve additional costs. Therefore the support of the international community is necessary.

The transition to a green economy should be an opportunity for all countries and a threat to none. Therefore, international efforts to help countries build a green economy in the context of sustainable development and poverty eradication must not:

- create new trade barriers;
- impose new conditionalities on aid and finance;
- widen technology gaps or exacerbate technological dependence of developing countries on developed countries;
- restrict the policy space for countries to pursue their own paths to sustainable development.

Source: Rio+20 Conference Materials

1.3. POVERTY IN TAJIKISTAN

1.3.1. POVERTY AND ITS DEFINITIONS

The current understanding of human development is seen through the prism of poverty. This makes it possible to assess climate change from the perspective of access to hydrocarbon resources, cooking fuel, clean water and the ability to adapt to structural changes in agricultural production. The 2001 Global Report notes that, in developing countries, at least six people in 10 experience one environmental deprivation[8], and four in 10 experience two or more. Most notably, these deprivations are especially acute among multidimensionally poor people, more than nine in 10 of whom experience at least one.[9] From the perspective of climate change and its impact on developing countries, assessing these deprivations is one of key tasks in determining human development trends. Most poor people suffer overlapping deprivations: the 2001 Global Report shows that "8 in 10 multidimensionally poor people have two or more deprivations, and nearly 1 in 3 (29%) is deprived in all three."[10] All developing countries experience the highest deprivations in access to cooking fuel and water, and shares of the population with environmental deprivations rise with the Multidimensional Poverty Index (MPI).

The MPI, first introduced in the 2010 Global Report and estimated in the 2011 Report for 109 developing and poor countries, provides a closer look at these deprivations to see where they are most acute. The MPI gives an opportunity to measure serious deficits in health, education and living standards, looking at both the number of deprived people and the intensity and prevalence of environmental deprivations.

One of the key modern problems, poverty, is caused by income inequality. Economic inequality is an inevitable side-effect of social life, since people differ from each other in their personality and living conditions. However, high levels of economic inequality, caused by imperfect distribution mechanisms or discrimination, create unequal access to resources. As a result, different groups of population have different opportunities. "The 20th century's growth in consumption, unprecedented in its scale and diversity, has been badly distributed, leaving a backlog of shortfalls and gaping inequalities."[11] Extreme inequalities may arise when economic growth benefits are consumed by a wealthy minority while living standards of the majority decrease.

From the perspective of human development, poverty is a multidimensional phenomenon. In addition to a lack of income, people may also suffer deprivations if they suffer from: a shortened lifespan, frequent illness, illiteracy, a lack of personal security and a lack of opportunities to participate in decision-making on issues which are crucial for them.

Human poverty is a process rather than a condition. In order to survive, a poor person uses all available resources in advance. A dynamic, chronic and hereditary phenomenon, poverty is also caused by structural inequalities and discrimination on the basis of class, race, sex, etc. both within and between countries.

Currently, the world practice has four acknowledged concepts to identify poverty: absolute, relative, deprivation and subjective.

1. **The absolute poverty concept** measures consumption and is adopted as a basic working concept in most transition economies. The first definition of poverty, **absolute poverty**, was developed in England in the late nineteenth century. It was prevalent in both academia and social policy in the first half of the twentieth century. Absolute poverty is expressed by the inability of households to use their monetary income to meet their basic needs such as food, clothing, and shelter. A person is considered absolutely poor if his or her income level falls below some minimum level. This minimum level is called the "poverty line". The absolute poverty concept is based on a minimum list of basic needs (cost of living) and the amount of resources required to meet those needs. However, using the poverty line as an indicator has one substantial disadvantage: it does not take account of the number of households which are just above the line. It also should be noted that the poverty line does not measure when poverty and inequality increase but the number of poor people below it decreases.

2. **Relative poverty** is a European poverty measurement standard. Most European countries primarily measure poverty as social exclusion. In this concept, people are considered poor if they fall significantly below the prevailing standard of living in a given social context. In practice, this concept is determined by a proportion of average or median disposable personal income. The relative poverty threshold for the USA is estimated at 40% of the median income; for many European countries and the international Luxembourg Income Study it is 50%. In Scandinavian countries, with their developed social assistance systems, the poverty threshold is at 60% of the median per-capita income. In general, if the poverty threshold is defined at 50% of the median disposable personal income, about 115 million people in Western Europe, North America, Japan, Australia and New-Zealand – 13% of the total population of these countries – fall under the category of poor.

Unlike the absolute poverty concept, the relative poverty concept asserts the unchanging nature of this social phenomenon. While the absolute poverty threshold can be overcome through the adequate government policies, the relative poverty threshold exists at all times. In this case relative poverty concept is a component of inequality concept.

[8] Deprivation - (lat. deprivatio — loss, privation) – a state of mind when people feel that satisfaction of their needs is insufficient.
[9] 2011 Human Development Report. Sustainability and Equity: A Better Future for All.
[10] 2011 Human Development Report. Sustainability and Equity: A Better Future for All.
[11] UNDP, 1998a: 1.

3. With **deprivation poverty**, people are considered poor if their consumption does not meet the standard in a given societal context and if they do not have access to a particular set of goods and services. This means that poverty is determined not only by insufficient income or low consumption of essential goods and services but also by poor nutrition, lack of access to education and health services, lack of adequate housing facilities, etc.

4. With **subjective poverty**, people are considered poor if they perceive themselves as poor. There are many approaches to determine the subjective poverty rate, making it possible to learn how many people perceive themselves or their friends as poor. The subjective absolute poverty line can be identified on the basis of public opinion and compared with the population's income.

The above concepts do not exclude but rather complement each other; at the same time, they have their advantages and disadvantages. Choosing between them depends on what the poverty line definition is used for. However, before finding quantitative indicators of the poverty rate, it is necessary to give a measurable definition of poverty itself.

Most empirical studies are based on welfare indicators expressed using a scale and compared with preliminary minimum levels. In most cases, scale indicators are household incomes and expenditures, though these are not the only indicators of living standards. In practice, the selection of quantitative welfare indicators is problematic. Theoretically, the best one is actual consumption of an individual. Ideally, this individual's consumption will cover both consumption of food, other goods and services, including social services. However, in practice income and expenditure indicators are often used for measuring consumption levels, as these indicators are easier to determine directly. Also, they define poverty in monetary terms. However, these indicators have limitations. The monetary definition does not take account of the conditions under which money is received or the time spent to earn money. It does not consider living conditions, work, access to necessary consumer goods, free time budget, etc. This problem often emerges when considering gender problems. Theoretically, some of these aspects of living quality could be expressed in monetary terms, but the result would not be correct and the calculations would be complicated.

There are divergent views as to what poverty depends on – either on low income or on low expenditures – and which should be used as a poverty rate indicator. This fundamental difference is rarely expressed clearly, and results can be quite different depending on what exactly is measured, for two main reasons:

- First, a household can have an income below the poverty line, but the expenditures of this household may be above the poverty level if the family resorts to borrowing or savings. Vice versa, if its income is above the poverty line, it does not mean that a household will necessarily reach the required minimum level of consumption;
- Second, incomes and expenditures may give different results due to limitations and household choices. Actual consumption level can reflect the various preferences of consumers.

In practice, there are also discrepancies due to the different quality of income and expenditure data. Income data are often non-reliable due to the partial concealment of incomes, especially those which were not taxed. Expenditure data have their own problems, and these are most frequently connected with the irregularity of expenditures, especially on expensive items. Similarly, there is a distinction between direct and proxy poverty indicators. Proxy measurements (income) allow the assessment of resources and consumption opportunities, while direct measurements (expenditures) apply to how households live in practice and are connected with a notion of their deterioration.

Poverty measurement means identifying the poverty rate or the share of the population with an income below the poverty line, the level of material insecurity of poor households as well as the level of stratification of poor households by income. The poverty measurement process itself is based on household surveys (representative sample surveys are carried out at the national and regional levels) and are rated by income and consumption (depending on which poverty indicator is of interest).

The human development concept considers poverty as a multidimensional phenomenon, the essence of which is not restricted solely to poverty by income or consumption. If human development implies the broadening of human opportunities to live a decent and healthy life, poverty in this case is lack or considerable limitation of those opportunities. Looking at poverty as a multidimensional phenomenon, authors of the human development concept have developed a special indicator that reflects different aspects of people's deprivations in three basic dimensions: health (through longevity), education and living conditions. This is called the Population Poverty Index, calculated separately for high-income countries (PPI-2) and for developing countries (PPI-1). Today this indicator is defining as Multidimensional Poverty Index (MPI).

The share of the population living on less than USD 1 or 2 per day is often used to compare countries. Using this indicator to assess national poverty rates is problematic, but its use for constructing dynamic time series may be promising.

Government poverty reduction policy[12], with the commitment of most countries documented in the Millennium Declaration, should be implemented in two primary areas:

- Economic regulation of the population's incomes;
- Support to poor households and elimination of the causes of poverty.

[12] Disaster reduction as a tool of MDG achievement – Collection of the informative and methodological materials for parliamentarians, Geneva, Switzerland, 2010

The Report of the UNDP Regional Bureau for Europe and the Commonwealth of Independent States[13] (1998) identified three crucial tasks of government policies to eradicate poverty in this region:

- Maintain economic growth rate at the level of at least 5% per year;
- Maintain GNP share for social security within 10-15%, provided that these resources are directed towards the needs of the poorest population;
- Maintain volumes of public expenditures for education and health at the level of 10% of GNP, while at the same time providing opportunities to the private sector to provide services of continuing education.

Having adopted the United Nations Organization Millennium Declaration in 2000, leaders of rich and poor countries promised to join their efforts to meet eight goals, the first being extreme poverty and hunger eradication. This goal is expressed in two targets to be met by 2015:

- First, halve the proportion of the world population living on less than USD 1 a day;
- Second, halve the proportion of the world population suffering from hunger. Today, over 1.2 billion people, or one fifth of the world population live in extreme poverty.

In general, the goals formulated in the Millennium Declaration are aimed at enhancing human capacity through the resolution of problems connected not only with low incomes and widespread hunger but also with gender inequality, a deteriorated environment and lack of education, health protection and clean water supply services.

The 2003 Human Development Report entitled "Millennium Development Goals: A compact among nations to end human poverty" notes that today, the world has many more resources and technologies than ever before to combat poverty. The task is to search the ways to maximally efficiently use these resources and technologies for the benefits of the poorest.[14]

1.3.2. DYNAMICS, TRENDS, AND CAUSES

Recent surveys showed that the most disadvantaged populations carry a "double burden" of climate change, when they must also cope with its direct threats.[15] From this perspective, the Multidimensional Poverty Index allows a deeper measurement of climate change-induced deficits in health, education and living standards. According to the 2011 Global Report, Multidimensional Poverty Index for the Republic of Tajikistan is estimated at 0.068. The headcount of the population living in multidimensional poverty, vulnerable to poverty and in severe poverty was estimated at 17.1%, 23% and 3.1% of the country's population respectively. The headcount living below the international poverty line, i.e. on less than USD 1.25 PPP per day, was estimated at 21.5%. At the same time, the percentage of the population living below the national poverty line set by the national authorities is estimated at 47.2%.[16]

The Government of the Republic of Tajikistan has pronounced poverty reduction to be one of the highest priorities of its internal economic policy. The analysis of numerous papers on poverty in Tajikistan shows that the implementation of government strategies and socio-economic development programmes systematically reduces the poverty rate in the country from year to year.

The poverty rate in Tajikistan was measured under the Living Standards Surveys conducted in 1999, 2003, 2007 and 2009. The surveys were conducted by the State Statistics Agency jointly with the World Bank, UNICEF and other donor organizations. The Tajikistan Living Standards Surveys were carried out on the basis of two methods: 1) on the basis of international poverty standards (USD 2.15 per day) depending on purchasing power parity, and 2) through the assessment of households' basic needs.

It should be noted that, regardless of the selected poverty rate measurement methodology, the poverty rate tends to decrease. The available and published data (at the overall rate of absolute poverty by income level and extreme poverty on the basis of USD 2.15 and USD 1.08 PPP per day) show that the poverty rate has decreased from 83% in 1999 to 41% in 2007.[17] Extreme poverty (pauperism) has decreased twofold: from 36% in 1999 to 18% in 2003 and 13.9% in 2009.[18]

Table 8.
Changes in the headcount of the poor population in Tajikistan (at purchasing power parity of USD 2.15 per day as the poverty line) for 1999, 2003, 2007 and 2009 (%)

	Total	Urban area	Rural area
1999	83,0	73,0	84,0
2003	63,5	59,1	65,1
2007	40,9	40,3	41,1
2009*	39,6	30,3	43,4
2011	42**		

* In 2009 the LSS sample and methodology changed

** Address of the President of the Republic of Tajikistan Mr. Emomali Rakhmon to the Majlisi Oli of the Republic of Tajikistan, 20.04.2012

Source: Findings of the Tajikistan Living Standards Surveys for 1999, 2003, 2007 and 2009

[13] Report of the UNDP Regional Bureau for Europe and the Commonwealth of Independent States (1998)
[14] Human Development Report. 2003.
[15] Poverty and Environment Initiative (PEI) in Tajikistan. UNDP-UNEP. http://www.unpei.org/PDF/TajikistanPEI-flyer-Eng.pdf and: http://www.youtube.com/watch?v=WH94UGZiDyM
[16] Sustainability and Equity: A Better Future for All. Global Report. 2011.
[17] Findings of the Tajikistan Living Standards Surveys for 1999, 2003, 2007 and 2009
[18] Ibid

BOX 10. **GENDER-SENSITIVE POVERTY ASSESSMENTS**

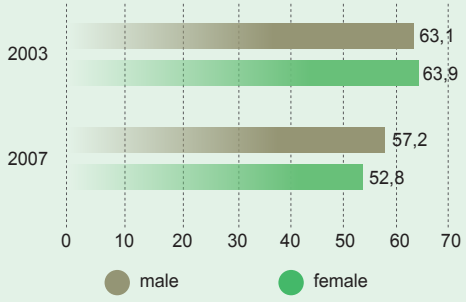
2007 data on the poverty rate by sex of the household head show that the economic situation in female-headed households is seen as less encouraging than in male-headed households (57.2% of poor as compared with 52.8% in male-headed households).

In 2007, female-headed households were at a higher risk of poverty than male-headed households.

Of course, using households as a measurement unit does not reflect the real distribution of incomes between men and women within the household, where distribution of funds and provision of access to resources may have a grave impact on gender inequality. In order to obtain this data, new approaches to information collection and analysis should be developed.

The poverty surveys in Tajikistan took steps to mainstream gender approaches as well as basic principles and methods of gender-responsive policies of poverty alleviation. These surveys showed that both government agencies and the civil sector and business institutions should join efforts to implement poverty reduction policies.

Diagram 4.
Poverty indicators of female - and male-headed households, %*



Source: Tajikistan Living Standards Surveys for 2003 and 2007

There are 9 steps identified at the international level to mainstream gender into poverty reduction strategies:

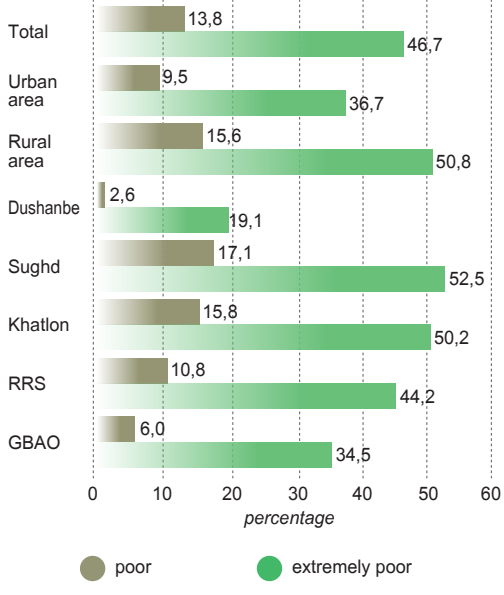
1. Ensuring that gender is addressed across the four dimensions of poverty (opportunities, capacities, security, and power).
2. Documenting the experience of poverty for both women and men for all four dimensions.
3. Conducting gender analysis of the data gathered and integrating findings into poverty diagnosis.
4. Defining the policy implications of gender analysis in the country.
5. Identifying gender-responsive priorities for the poverty reduction strategy.
6. Integrating gender-responsive priorities into the policy responses and priority actions in the poverty reduction strategy.
7. Integrating a gender dimension into the monitoring of strategy's outcomes.
8. Integrating gender into the poverty reduction strategy evaluation strategy.
9. Building institutional capacity for gender-sensitive monitoring and evaluation.

Source: Recommendations of the Organization for Economic Cooperation and Development

The available information shows that poverty in Tajikistan is viewed as a multidimensional phenomenon. When rural populations are asked about poverty, the first thing they mention is a lack of clothes, food, insufficient salaries, low pensions, multiple fees and taxes. Some respondents also indicated lack of lands and livestock. Urban poverty is primarily related to a lack of jobs and salaries in the formal economy, while rural poverty is associated with low incomes, especially in agriculture, and poor access to basic social services (education, health, water supply, etc.).

Although living standards have improved over recent years, poverty remains a widespread phenomenon in Tajikistan. The diagram below shows findings of the latest household survey conducted in the country in 2009, where the population welfare indicator was per-capita consumption and the poverty line was absolute full or extreme (food) poverty.

Diagram 5. Percentage of the population below the absolute poverty line



Source: Findings of the 2009 Tajikistan Living Standards Survey

There are different factors affecting the poverty rate in Tajikistan, including **external factors** such as lack of access to the sea, considerable remoteness from the markets of high-income countries, regional instability, illicit drug trafficking and the terrorism menace. There are also some **internal factors** such as low competiveness, high population growth rates, environmental degradation and depletion of the accumulated human and physical capital, which have a negative impact on the country's development.

The primary poverty causes in the country are:

- **High unemployment rate.** The overall official (recorded) unemployment rate is a bit higher than 2%. However, experts estimate that the real figure might be 9%; taking account of labour migrants, this rate may be 25-30%. Also, the age of the unemployed gives rise to serious concerns. The share of youth (15-29 years) in recorded unemployment is rather high at 60-65%. The average age of the unemployed is 29.6 years.

- **Access to quality education.** In view of insufficient financing of the education sector, the overall condition of infrastructure and material and technical base of educational institutions remains poor, with inadequate teacher training, vocational training, curricula development and refinement and salary increases.

- **Degradation of over 90% of land resources.**

- **Access to electric power, drinking water and sanitation.** Regardless of the increased amount of power generation, access to electrical power remains irregular and the quality of power supply remains poor, especially in the winter months. In Tajikistan, a considerable share of the population experiences difficulties with access to clean drinking water. Only one third of the population has access to chlorinated tap water, 29% uses water from the centralized sources, while the remaining population takes water from watercourses and irrigation ditches. Up to 40% of the consumed water is not potable, and 41% of the population uses poor quality tap water.

Given the existing problems associated with socio-economic development and lessons learnt during the implementation of the previous strategies, the latest government poverty reduction strategy identified the following areas as the primary policy domains:

- **Improve public administration** to enhance transparency, accountability and efficiency of government agencies to combat corruption and create enabling macroeconomic conditions, and an institutional, regulatory and legal environment for development;

- **Contribute to sustainable economic growth and diversify economy** through private sector development and investment attraction, especially in the power-engineering sector, transport infrastructure, cotton sector, etc. Expanding economic freedom, enhancing property rights, developing public-private partnerships may enable achievement of these goals;

- **Develop human capacity** through advocating accessibility of social services for the poor population, improving their quality, facilitating the population's active participation in the process of social partnership development.

It is expected that the focus of the Government and society's efforts on the specified areas will ensure a more efficient use of available internal resources and external aid provided to the Republic of Tajikistan, as well as facilitating the development of all population segments, thus encouraging social development and reducing poverty.

1.3.3. REVIEW OF THE EXISTING NATIONAL ENVIRONMENTAL POLICY FOR PRS IMPLEMENTATION

In the context of the Government's efforts to promote sustainable development and reduce poverty, the following initiatives should be mentioned:

- Rio+10 National Sustainable Development Report.
- National Action Plan on Climate Change Mitigation of the RT.
- National Development Strategy of the Republic of Tajikistan until 2015.
- Poverty Reduction Strategies for 2001-2003, 2007-2009 and 2010-2012.
- National Environmental Action Plan.
- Strategy for Transition of the Republic of Tajikistan to Sustainable Development.
- Environment Protection Concept.
- State Environmental Programme for 2009-2019.
- Programme to Improve Drinking Water Supply to the Population of the Republic of Tajikistan for 2008-2020.
- Concept of Hydro Meteorological Safety of the CIS-Member Countries for 2011-2015.
- Programme for Recovery of Hydro Meteorological and Hydrological Stations of the Republic of Tajikistan for 2007-2016.
- State Programme for Glaciers Study and Protection for 2010-2030.

These documents recognize the importance of a stable, healthy and clean environment for successful economic development as well as humanity's dependence on the biosphere's viability. The programmes call for achieving a balance between economic interests and the carrying capacity of the environment (Annex 1.3.).

Key tasks identified include a need to involve all sectors of the society (government, business, non-governmental organizations and the general public) in environment protection and improvement, and informing everyone of the

importance of the sound use of natural resources and the best ways to achieve this.

Over the past decade, Tajikistan has made some steps to reform its environmental policy, legislation and institutions. Although the legal base is well-developed, policy elaboration often lacks prioritization and a consistent approach. Policy is not outcome-oriented, as environment protection is typically viewed as a control on legislation's performance rather than an environmental improvement. The situation is aggravated by inefficient policy and imperfect legislation implementation mechanisms. The development of environmental policy – typically without involving future executives – is linked to the unsystematic resolution of narrow tasks and depends to a large extent on external technical assistance.

The Poverty Reduction Strategy focuses on the need to create jobs. Therefore, measures are aimed at setting relevant legislative and regulatory frameworks for enterprise development and job creation, approving the national job creation programme and developing financial markets. The Poverty Reduction Strategy also addresses the needs of further infrastructure development in various subsectors, particularly in power-engineering, transport, water supply and communications.

As part of the Poverty Reduction Strategy, implementation objectives and a set of indicators for further actions have been elaborated.

The environmental situation requires additional measures be taken to preserve ecosystems, particularly in the context of climate change.

Environment management information systems are not consistent with political and operational requirements. Monitoring is not based on needs, and capacity in the field of information resources is not sufficient. Poor institutional coordination results in duplication, collection of incompatible data and data exchange on a paid basis.

In accordance with the Decree of the Government of the RT, the State Hydro Meteorology Agency coordinates activities aimed at solving climate change-related problems in Tajikistan.

Following the commitments of the Republic of Tajikistan under the UN Framework Convention on Climate Change, the Climate Change Research Centre has been established. The primary objective of the Climate Change Research Centre is to coordinate the implementation of the NAP and UN Framework Convention on Climate Change in the Republic of Tajikistan.

BOX 11. **The Republic of Tajikistan ratified the UN Framework Convention on Climate Change** in 1998. The Committee for Environmental Protection, under the Government of Tajikistan, was identified as the government agency responsible for the implementation of the Convention.

In accordance with the Framework Convention, the republic's commitments include:

- Formulate and take measures on the mitigation of climate change by addressing anthropogenic emissions of greenhouse gases and facilitation of adequate adaptation to climate change;
- Cooperate in the development, application and diffusion of technologies that limit, reduce and prevent greenhouse gas emissions, and assist in the rational use of greenhouse gas sinks and reservoirs, their protection and enhancement;
- Cooperate in the development and adoption of preparatory measures to adapt to climate change impacts;
- Mainstream climate change into social, economic and environmental policies;
- Contribute to international efforts on enhancing systematic observation, capacity and opportunities for scientific research related to the climate system;
- Promote and cooperate in the exchange of information, education, staff training and public awareness related to climate change;
- Communicate information related to the Framework Convention implementation, including the national cadastre of anthropogenic emissions by source and removal of all greenhouse gases by sinks.

The Republic of Tajikistan provided its First National Communication in 2003 and Second National Communication in 2008 to the FCCC Secretariat. The reports outlined key areas of vulnerability mitigation. Now work is focused on the development of the Third National Communication to be submitted in 2014. For this purpose, the following steps are undertaken:

- Inventory of emissions and sinks of greenhouse gases for the baseline year of 2005 and for the period 2004-2009;
- Assessment of potential climate change impacts on natural resources, the national economy and population's health and development of adaptation measures;
- Analysis of GHG emissions reduction.

Actively participating in these negotiations, especially in recent years, Tajikistan has made several official statements at the international conferences:

- COP-15 (Conference of the Parties) – Copenhagen, Denmark: President of the Republic of Tajikistan Emomali Rakhmon calls for the establishment of the International Glacier Preservation Foundation to preserve glaciers;
- COP-16 – Cancun, Mexico: an official delegate of Tajikistan supports the necessity to include 1.50C in the text on long-term joint commitments on emissions reduction;
- COP-17 – Durban, RSA: the Tajik delegation speaks on behalf of the group of developing land-locked mountainous countries including Afghanistan, Armenia, Kyrgyzstan and Tajikistan. The address (report) underlines that climate change creates great challenges for small mountainous countries: glaciers melt at unprecedented rate, and in the next several decades our countries may lose up to 30% of glaciers and glaciers of less than 1 square km will completely disappear.

At the same time, the Government of the Republic of Tajikistan has adopted the Programme for Glaciers Study and Protection for 2010-2030 that covers a variety of problems associated with degradation of glaciers and is ready to closely cooperate with all regional states and international organizations to solve these problems and recover environmental situation in the Aral Sea Basin.

To date, the first version of the Environmental Code of the Republic of Tajikistan has been developed with the support of OSCE and is intended to facilitate the greening of the national economy.

1.4. CLIMATE CHANGE EFFECTS AND THEIR IMPACT ON POVERTY

1.4.1. OVERVIEW OF NATURAL AND CLIMATE CHARACTERISTICS OF THE RT AND TRENDS OF THEIR CHANGE IN THE 21ST CENTURY

Tajikistan occupies an area of 143,100 km^2 and borders Kyrgyzstan to the north (with a border of 630 km), China to the east (430 km), Afghanistan to the south (1,030 km) and Uzbekistan to the north and west (910 km). The prevailing relief is mountainous. Tajikistan's mountain systems occupy 93% of the country's area, with almost half of the territory located at an elevation of over 3,000 m. Located in an active seismic zone running through the south-east of Central Asia, Tajikistan is prone to earthquakes. One third of the country's territory in the west is foothills and steppes (semi-dry grassy plains). Lowlands are located in the river valleys in the south-west and far north, where a strip of the territory runs to the Fergana Valley. Because of the highlands, only 5% of Tajikistan's territory is arable lands.

The climate in the country is continental, with wide diurnal and seasonal variations in temperature and humidity. The complicated structure and high amplitude of the relief form unique local climate types with large temperature differences. The amount of precipitation depends on the position and exposure of mountain slopes and air mass circulation. The average annual precipitation in the hot deserts of Southern Tajikistan and cold alpine deserts of the Eastern Pamirs ranges between 70 and 160 mm, while in Central Tajikistan precipitation may exceed 2,000 mm.

In valleys and plains (up to 500 m), the average July temperature ranges between 230C in the north and 300C in the south, and the average January temperature ranges between -10C in the north and 30C in the south. Precipitation amounts to 150-300 mm per year.

The hottest month is July, and the coldest month is January, but the average annual temperature ranges drastically. In valleys and foothills, it ranges between +6 and +17^{0}C; in alpine areas, e.g. the Western Pamirs, the climate is severe and the average annual temperature here is close to 0^0, while at low altitudes it rises to +6+8^{0}C. The climate is particularly severe in the Eastern Pamirs, where the average annual temperature ranges between -1 and -6^{0}C. The absolute temperature minimum was recorded in the area of Lake Bulunkul (-63^{0}C).

Over the period 1940 through 2000, the value of the average temperature variations in valleys was positive and ranged between 0.3^{0}C (Khujand) and 1.2^{0}C (Dangara). In the uplands (over 2,500 mm above sea level) the annual temperature rises by 0.2 - 04^{0}C, and the temperature decreased only in the alpine basin of Lake Bulunkul (-1.1^{0}C).

High mountains are always covered with snow and ice. The glaciers occupy about 6% of the country's total area. They shrink in response to climate change; over the twentieth century, the largest Fedchenko Glacier has retreated one kilometre in length, 11 km^2 and has lost 2 km^3 of ice.

The country has primarily sierozemic, brown and alpine-humus soils and desert, steppe and alpine-meadow vegetation.

There are over 1,000 lakes in Tajikistan, and 80% of them lie over 3,000 m above sea level. Their total area exceeds 680 km^2, and most of them are located in the Eastern Pamirs. The largest lake is the salt lake Karakul (380 km^2) located in the north-east of the country at an altitude of 3,914 m. The deepest freshwater lake is the 490-m deep Sarez, covering 86.5 km^2 and located in the Western Pamirs at 3,239 m above sea level.

According to the World Bank report (2009), Tajikistan is the most climate-vulnerable country in the region and least able to adapt. This is due to agriculture's high dependence on rainfall during the irrigation season, high levels of environmental degradation, land erosion, deforestation rates and deteriorating social infrastructure. The climatic factor may have a grave impact on both ecosystem condition and levels of the population's safe livelihoods. The rural population, primarily engaged in agriculture, is the most vulnerable. The loss of means of subsistence caused by climate stress, droughts, limited access to water and energy resources and biodiversity loss are among causes of deteriorated living conditions in rural areas.

Water resources. Although Tajikistan has abundant waters and accounts for 50% of the water stocks of the Aral Sea Basin, management of its water resources is poor, which causes transboundary and internal problems with water quantity and quality. Therefore water is the highest environmental priority in Tajikistan.

Access to drinking water and sanitation. Only about 60% of the population has access to treated water that does not always meet sanitary standards. The remaining population uses surface waters that can sometimes be polluted because of the poor treatment of wastewaters and the high number of non-regulated dumps.

Water-related natural disasters. If precipitation exceeds the soil's infiltration capacity, this results in landslides, mudflows and flooding. Tajikistan experiences about 50,000 landslides per year. Since people live in vulnerable places, landslides create hundreds of victims and cause millions of dollars in damage.

Waste and chemical substances. The mining industry and cotton-growing generate large amounts of waste and pollute lands with chemical substances. The mining industry accounts for 77% of all accumulated waste, while cotton growing saturates lands with chemical substances. Hazardous levels of toxic pesticides, herbicides and defoliants exist throughout the country.

Deforestation and desertification. The deforestation process has accelerated over the last decade. Deforestation aggravates soil erosion and desertification and makes slopes more prone to landslides.

Biodiversity. Uncontrolled urbanization, the expansion of agricultural lands and human activities deteriorate the environment and reduce biodiversity. The 1990 civil war also affected biodiversity. Land degradation, deforestation and desertification threaten Tajikistan's rich flora and fauna.

Impact on human health. Affected by climate warming, the republic's health sector might face the increased risk of infections and infestations, including malaria. Change in the hydrological cycle may contribute to decreased water content, increased bogginess and rising water temperatures in rivers, which increases the number of potential malariagenic and choleragenic watercourses, especially in the lower reaches of the Vakhsh, Kafirnigan, Panj, etc. rivers. In hot climate regions, adult and child mortality associated with thermal stress is likely to increase due to the rise in temperatures, which is especially extreme in the summer months.

1.4.2. KEY CLIMATE CHANGE DRIVERS

Anthropogenic influences. Poor people depend largely on natural resources for their livelihoods and are most vulnerable to environmental misbalances, particularly to processes associated with climate, desertification, land and water degradation and the aftermath of natural disasters, including droughts and floods. Poor people in Tajikistan often involuntarily contribute to environmental degradation. Without any alternatives, people cut scarce forest resources for fuel, pollute water sources with domestic waste and wastewaters and breed livestock in amounts exceeding the carrying capacity of scarce land resources.

Lack of employment opportunities is the main reason why people depend on natural resources for their livelihoods. This underpins environmental degradation via human behavior and explains the high dependence of Tajikistan's poor population on environment, particularly on land and water resources.

Impacts on land due increase of population. Of population increase over the last 20 years, Tajikistan's rural and mountainous areas have been experiencing the pressure of an increasing population. Tajikistan's rural areas have faced the highest population growth rate in the CIS, and this creates pressure for subsistence farming on already scarce arable lands, which do not exceed 7% of the country's territory.

Combined with the climatic factors, a high birth rate in mountainous regions, a low employment rate and few economic opportunities except for agriculture, these trends further deteriorate a poor infrastructure and put great pressure on natural resources through the intensive use of arable lands, water and forests. Excessive livestock grazing, rain-fed farming, use of mountain lands for farming and overgrazing have significantly contributed to soil erosion as well as land degradation.

Agriculture. Land degradation impairs living conditions, since agriculture is the main source of food for the poorest people who depend on land for their livelihoods and food (73% of the Tajikistan's population lives in rural areas). According to the World Food Programme, food security is a major concern, with 1,478 million people across the globe in need of food aid. The resolution of the food supply problem depends tremendously on the sound use of land and water resources as well as the proper functioning of the agricultural sector. However, in the context of risky farming associated with climatic factors, it is very difficult for the Tajikistan's to survive from agriculture alone, and land degradation is not the only reason. Other problems in agriculture contribute to the deepening and expansion of poverty among the rural population, such as:

- climate change, including climate change-induced natural disasters;
- incomplete land and water reforms that do not allow the efficient use of land and water resources and limit opportunities for agricultural production;
- gaps in the current management and functioning of key agricultural subsectors that are supposed to ensure food security and human security in general;
- deteriorating infrastructure, particularly in irrigation.

Water supply and sanitation. The importance of water for poverty reduction cannot be underestimated. Irrigation water not only increases crop yields; satisfactory water quality is essential for the good health of the population. Water is also key to ensuring Tajikistan's competitive advantage in two main industries: agriculture and hydropower.

Sewage systems are in constant decline. Ageing pipelines and a lack of maintenance cause serious problems. Settlements experience great difficulties in finding funds for maintenance and repairs, and the central budget provides very scarce financing.

Biodiversity. Combined with overgrazing, poaching and human interference with wildlife, the cutting of trees and shrubs, especially in the context of climate change, also poses a serious threat to biodiversity. Tajikistan has unique natural and recreational resources, beautiful undisturbed ecosystems and rich biodiversity. However, poor environment protection and poverty have a detrimental impact on the environment.

Natural disasters. Obviously, natural disasters are the most obvious manifestations of biodiversity loss and environmental degradation impacts. Because of its geography, Tajikistan is particularly prone to water-related disasters. Steep mountain slopes and unstable soil cover contribute to some 50,000 landslides per year. The slopes and valleys of the Hissar, Karateghin, Vakhsh, Darvaz, Vanch, Yazgulem and Peter the First ranges, as well as the Murgab basin near Lake Sarez, are the regions most prone to landslides and flooding. Along with climatic factors, these flimsy and unstable conditions make lands more sensitive to human-induced damage. Deforestation, cultivation on and overgrazing of slopes, strip mining and road construction exacerbate the instability of mountain areas.

The spread of natural disasters causing accidents among the population living in the risk zone is continuously increasing in recent years. Therefore, environmentally and climate change-induced migration becomes a major problem.[19]

[19] Ecological migration - http://www.osce.org/ru/eea/34464

1.5. ENVIRONMENTAL MONITORING IN THE CONTEXT OF ADAPTATION TO CLIMATE CHANGE IN THE RT

Over the last decade, Tajikistan has managed to preserve the minimum hydro meteorological network and prepare environmental assessments related to biodiversity, climate change and desertification throughout the country.

At the same time, there are some problems, such as:

- Weakened observation and assessment of some environment components of industrial and municipal pollution, including the environmental implications of natural resource use by agriculture and forestry;
- Inadequate environment data and information management and termination of environmental reporting;
- Loss of public interest in environmental problems in general and in the effectiveness of environmental performance by government institutions and businesses in particular.

There remain acute needs in relation to existing resources and capacity, and it is necessary to undertake multiple further actions and activities.

The Hydro Meteorology Agency of the Committee for Environmental Protection under the Government of the Republic of Tajikistan manages 58 meteorological stations, 15 of which are temporarily closed. Only some 25-30 stations provide regular reporting. Several stations are temporarily closed due to lack of specialists and – in the case of remote stations – financing. Meteorological observations are not conducted anymore in a part of Sughd Region and in some parts of Southern and Central Tajikistan. Several stations only carry out automatic observations and recordings of primary data . There are some recorders that keep data on air temperature, pressure, relative humidity, precipitation intensity and sunshine duration; however, this does not solve the problems since these data are processed manually.

Until the 1990s, radiometric observations were conducted at 27 stationary site, now, only at 16 stationary sites. There are no routine measurements of radioactive dust settling on the ground.

The State Agency manages 83 hydrological stations on rivers and lakes. Five of them are located on the transboundary rivers. Other 14 stations (including 3 on the transboundary rivers) do not function primarily due to destruction from the war, a lack of funds for material and technical facilities and equipment replacement, as well as staff reduction.

The average density of the existing stations in the seven major river basins is 0.8 stations per 1,000 km^2. This ratio can be considered optimal on the Shirkent, Zeravshan and Kyzylsu rivers. However, the density in the Syr Darya (0.04), Panj (0.33) and Vakhsh (0.52) basins is lower.

Observations of water level and flow, water temperature, ice thickness, the chemical composition of water, concentration of suspended particulates, streams and fluctuations in lakes and reservoirs are conducted on the network. The volume of observations has reduced at all the functioning stations. For instance, there is only one station conducting observations over surface evaporation. Only 4 out of 53 water level recorders are functioning, and only 43 stations measure water flow.

The State Hydro Meteorology Agency receives data of hydro meteorological observations irregularly. Observations on small rivers 10-25 km long have not been conducted for a long time, which affects the pace of small HPPs construction.

Over 1998-2002, the Aral Sea Water and Environment Management Project has rehabilitated and equipped six hydrological stations on the Tajikistan's rivers. The Asian Development Bank (ADB) assisted the State Hydro Meteorology Agency in the software development and elaboration of the database DB Hydromet. The Swiss Aral Sea Mission assists the State Hydro Meteorology Agency in developing hydrological forecasting methods. Starting from 2012, the PPCR plans to significantly upgrade the monitoring technical base of hydrological and observation stations.

Despite this assistance, needs remain substantial, particularly for monitoring equipment. Both meteorological and hydrological networks have a maximum 53% of the equipment required, and most observation stations use obsolete equipment that reduces data quality and reliability.

BOX 12. **UPGRADING OF THE HYDRO METEOROLOGICAL SERVICE**

Since 2011, with the support of the International Development Association and PPCR (Component C), Tajikhydromet has implemented a Project aimed at the modernization of the hydro meteorological service, rehabilitating meteostations, hydrological stations and enhancing the national hydro meteorological service's capacity.

The PPCR Coordination Group was established to assess the progress of the Pilot Programme for Climate Resilience in Tajikistan and to develop recommendations for improvement of the programme in Tajikistan. The Coordination Group includes permanent members and observers who also can participate in meetings and discussions of the PPCR progress. The Coordination Group's permanent members include 12 high officials from ministries and agencies of the RT, 3 representatives of NGOs, 3 representatives of the WB, ADB, EBRD, 2 representatives of INGOs, and 2 representatives of UNDP.

The Main Geological Department "Tajikgeology" conducts observations over underground waters. It identifies zones of underground waters, their reserves, quality and chemical composition of waters in water beds. The following parameters should be measured: pH, specific conductivity, solids, calcium, magnesium, potassium, sulphates, chlorides, ferrum, NO3-N, total salt content, nitrogen, phosphates and arsenic. However, these data are provided to other government institutions irregularly and are not published.

Air and water quality monitoring. The State Hydro Meteorology Agency manages one air quality observation station in Dushanbe and one in Kurgan-Tyube. The concentration of 5-8 pollutants is measured on a daily basis. Measurements are carried out according to the air quality standards. The table below shows some of these standards.

Tajik standards are stricter but more general than international ones. For instance, western countries have different standards for solids size (SP10, SP2.5), while Tajikistan uses the dust concept that is closer to

the aggregate amount of solid particulates. Also, many international standards envision different external exposure time (e.g. 1 hour, 24 hours, 1 year), while Tajik standards are based on average annual indices.

Table 9.
Maximum permissible concentration in air

Pollutant	Standard (mg/m^3)
Solid particulates	0,15
Nitrogen oxide	0,06
Nitrogen dioxide	0,04
Sulphur dioxide	0,05
Fluorides	0,003
Formaldehyde	0,003
Carbon dioxide	3
Ammonium	0,2

Source: Asian Development Bank. Environmental Profile of Tajikistan. 2000.

At the same time, the air monitoring equipment is also falling into decay, is out-of-date and does not meet modern requirements. Moreover, 17 air quality-monitoring stations were destroyed during the civil war. As a result, air quality observations are not carried out any more in Khujand, Kulyab, Tursunzade, Sarband and Yavan. The Agency estimates the cost of reconstruction of the air quality monitoring network at approximately USD 70,000 per one observation station. The Agency's efforts to receive funds from the state budget or involve cities andtowns in the reconstruction process have not yet been successful.

The State Hydro Meteorology Agency has 108 water sampling points to assess the quality of surface waters. However, in reality, water sampling is carried out at about 40 points only. The modern observation network covers 21 rivers and one lake in four water basins (Vakhsh, Kafirnigan, Zeravshan and Syrhandarya) and measures 20 pollution parameters. By comparison, until the 1990s the pollution of surface waters was observed in 46 rivers, six lakes and one water reservoir, and cthe oncentration of about 40 organic and non-organic pollutants was measured.

Measurements are based on the set water quality standards.

Table 10.
Some water quality standards

Parameter	Limit value
Oxygen	Winter – 4.0 mg/l; Summer – 6.0 mg/l
Ammonium salt	0.5 mg/l
Biochemical consumption of oxygen 5	3.0 mg/l
Nitrate – ion	9.1 mg/l N
Nitrite – ion	0.02 mg/l N
Oil	0.05 mg/l
Ferrum	0.05 mg/l
Cuprum (ion) (Cu)	0.001 mg/l
Zink (Zn)	0.01 mg/l
Phenol	0.001 mg/l
Chlorides (anion)	300.0 mg/l
Sulphates (anion)	100.0 mg/l
Calcium (cation)	180.0 mg/l
Magnesium (cation)	40.0 mg/l
Potassium (cation)	50.0 mg/l
Natrium (cation)	120.0 mg/l
Chrome (Cr)	0.001 mg/l
Solid particulates	1,000.0 mg/l

Source: State Statistics Committee. Environment Protection in Tajikistan: Brief Statistical Handbook. 1990-2000. Dushanbe. 2002 (Russian).

The State Hydro Meteorology Agency submits monthly reports with water quality monitoring data to local committees for environmental protection and State Water Inspectorate.

Industry pollution monitoring. Tajikistan has about 4,000 registered sources of pollution by technical waste. According to the law, all contaminators must carry out observations of their emissions and discharges. Only several enterprises have environmental laboratories, monitoring equipment and trained staff. Environmental authorities have never inspected environment monitoring stations and laboratories at enterprises. However, operations monitoring has been undertaken at some enterprises, because of fines and punishments for violating environmental legislation.

Often, responsibility for monitoring within enterprises is imposed on laboratories for their operations' technological control or product certification. If there is no laboratory, enterprises sign works contracts with the sanitary and epidemiological laboratories of the Ministry of Health

or analytical laboratories of the State Committee for Environmental Protection and Forestry. Judging by the annual reports of the Analytical Control Service of the Former Ministry of Environment Protection, adherence to the environmental legislation is poor in general.

A key task of the analytical laboratories of the Committee for Environmental Protection is to monitor adherence to environmental standards. They inspect the efficiency of gas purification plants and take samples of emissions to the atmosphere, take samples of water from water courses in the vicinity of discharge sources, water courses used for potable water supply and treatment plants, and they also take soil samples from polluted territories. They also measure radiation intensity and examine transport emissions jointly with the Road Traffic Inspectorate,. Also, they check the quality of mineral fertilizers, pesticides and imported chemical substances.

There is an analytical laboratory of the Committee's Analytical Control Service in Dushanbe as well as analytical laboratories of environment protection committees in Gorno-Badakhshanskaya Autonomous Oblast, Khatlon and Sughd oblasts. Rayon subdivisions of the Committee must send samples to the oblast laboratories for analysis.

Under the Environmental Assessment and Monitoring Capacity Building Project (2001-2003), ADB provided mobile monitoring equipment to the Ministry of Environment Protection to carry out rapid analysis of air and water quality. The World Bank provided chemical agents to the Analytical Control Service in 2003 under the Privatization Project and delivered surface and ground water monitoring equipment to local environmental authorities in project areas under the Agricultural Infrastructure Rehabilitation Project (2002-2005).

However, vast needs still remain. For instance, the analytical laboratories of Gorno-Badakhshanskaya Autonomous and Khatlon Oblasts face difficulties in performing their tasks primarily because of insufficient funds, staff, equipment, spare parts and chemical agents. There is an acute need to establish an analytical laboratory in the north of Tajikistan in order to cover remote areas.

A general problem is poor coordination between analytical laboratories and inspectorates. The latter are competent to impose sanctions in case of violations of environmental legislation by enterprises. However, often laboratories and inspectorates elaborate inspection schedules separately, which sometimes results in frequent visits to several enterprises, duplication and the inefficient use of resources. Two analytical laboratories of the State Hydro Meteorology Agency, which constantly measure air and water quality on industrial territories, do not cooperate with each other. Each group of laboratories uses different analytical methods, equipment and formats.

It should be noted that the use and conditions of land resources in Tajikistan are not constantly monitored. Concentrations of toxic chemical substances in soil have not been measured at 25 points throughout the country since the early 1990s.

Biodiversity monitoring is also limited. The Academy of Sciences' institutions perform observations over some species of fauna, flora and microorganisms. Scientific findings are published in the Academy's periodical publications or in separate monographs, e.g. Flora of Tajikistan (2001). The number of wild fowls and birds is measured in the prohibited zones of the hunting sector. Monitoring of fauna and flora species in the protected areas has also lowered.

Forest resources, including mountain forests in the protected areas, are regularly assessed. However, this does not meet the requirements of a comprehensive and continued monitoring. Moreover, forest assessment data published by the Tajik Forest Research Institute differ from data received via remote sensing observations.

Tajik agriculture depends to a large extent on climate conditions and their variations. Over the 20th century, aridity in major agricultural rayons has increased.

The last 10-15 years proved to be the warmest in Tajikistan for the past century. The frequency of summer droughts in Tajik plains has increased most noticeably. Weather conditions were dry in 1996, 1998, 2001, 2002 and to some extent in 2008.

It is very difficult to forecast qualitative climate change impacts for Tajikistan due to the uncertainty of many natural changes. In the Tajik economy, agriculture depends significantly on possible climate changes. Experts estimate that global warming's impact on agriculture will be ambivalent, and negative impacts may be coupled with positive effects. Many climatic scenarios and forecasts underline that climate change will be associated with changes in the frequency of events unfavourable for agriculture. The increased probability of low yields, as a result of the increased frequency of droughts and aridness on the territory of some regions, may also become dangerous.

At the same time, preliminary agriculture adaptation to anticipated global climate and environmental changes is needed.

The State Environmental Programme for 1999-2019 is aimed at: monitoring water, air, lands, sanitary conditions, flora, fauna and protected areas; increasing the number of analytical laboratories; inventorying sources of pollution, data bases, ecological maps and establishing a national environment information system; introducing a comprehensive assessment of ecological conditions and impacts; using remote sounding data for environmental assessment; establishing the regional geographic information system (GOS); and supporting environmental education, training and awareness raising.

BOX 13. **ENVIRONMENTAL MONITORING SYSTEM OF THE REPUBLIC OF TAJIKISTAN**

ORGANIZATIONAL FRAMEWORK

The Committee for Environmental Protection under the Government of the Republic of Tajikistan is responsible, inter alia, for:

- Organization and conduction of systematic hydro meteorological observations and environmental monitoring;
- Coordination of a comprehensive environmental monitoring system;
- Inventory of pollution sources;
- Comprehensive assessment and forecasting of the condition of environment and natural resources and provision of relevant information to government authorities and population;
- Participation in the establishment of environment and natural resources information systems;
- Publication of national reports and messages on the condition of environment and natural resources;
- Development of environmental standards;
- Inventory of protected areas, flora species, surface waters, hazardous waste and forests;
- Participation in the establishment of a system of continuous environmental education, training and awareness-raising.

Responsibilities of other government authorities include:

- Ministry of Land Reclamation and Water Resources – water use monitoring;
- Main Geological Department "Tajikgeology" – ground water monitoring;
- Ministry of Internal Affairs – monitoring of transport emissions (together with the Committee for Environmental Protection);
- State Land Use Committee, Ministry of Agriculture and Academy of Agricultural Sciences – monitoring of land resources;
- Ministry of Health – environmental hygiene monitoring;
- Ministry of Education – environmental education (together with the Committee for Environmental Protection under the Government of the Republic of Tajikistan);
- Statistics Agency under the President of the Republic of Tajikistan – environmental statistics (in cooperation with the above authorities).

1.6. DYNAMICS OF CHANGES IN HUMAN DEVELOPMENT INDEX IN THE RT

The Human Development Index (HDI) combines data on three basic dimensions of human development: income, health and education levels. In general, the quality of the country's economic development and its social projection are assessed through the dynamics of incomes and employment, population health improvement, better access to education and soft infrastructure development.

Among multiple indices used to measure development quality, the HDI has compared countries and been published in the UNDP's annual reports since 1990. The closer index value is to one, the greater the opportunities exist for human development due to better education, longevity and incomes.

The integral HDI may be calculated as an arithmetic (traditional analysis) or geometric (improved analysis) mean of the three indices: longevity, education and income.

The HDI calculation method has changed somewhat over recent years:

- to calculate the income index, the Gross National Income (GNI) per capita at purchasing power parity in USD is used instead of GDP per capita at purchasing power parity;
- to calculate the education index, the index of the expected years of schooling is used instead of the gross enrollment ratio, and the index of mean years of schooling is used instead of the adult literacy rate;
- the longevity index is still estimated based on life expectancy at birth.

The main difference of the new HDI calculation method is that the HDI is now a geometric mean (not a simple arithmetic mean) of the three indices.

In general, the dynamics of human development in the Republic of Tajikistan reflect changes in the quality of the country's economic growth through the HDI based on both the traditional calculation method (Diagram 6) and the improved calculation method (Diagram 7).

BOX 14. **A NEW APPROACH TO MEASURING HUMAN DEVELOPMENT**

The Human Development Index, adjusted to account the inequality, was first introduced in the 2011 Global Human Development report This index aims to provide a better estimation (IHDI) of the development of all segments of society, not only "average" human. The results of calculations showed that not only income distribution, but also assignment of access in the spheres of health and education are important components of the index, all the more data testify on significant inequality in many countries.

The IHDI takes into account not only the average achievements of a country in the spheres of health, education and income, but the way in which they are distributed among its population as well, by "discounting" of average value of each dimension according to its inequality level. While the HDI can be viewed as an indicator of the "potential" human development by equal distribution of achievements, the IHDI reflects the actual level of human development adjusted to the inequalityin distribution of achievements among people in society. IHDI will equal to HDI, when inequlity not exists. The difference between HDI and IHDI scores measures the loss in human development due to inequality. The IHDI of the Republic of Tajikistan in 2011 was 0.500

Diagram 6. HDI in Tajikistan (traditional calculation method)

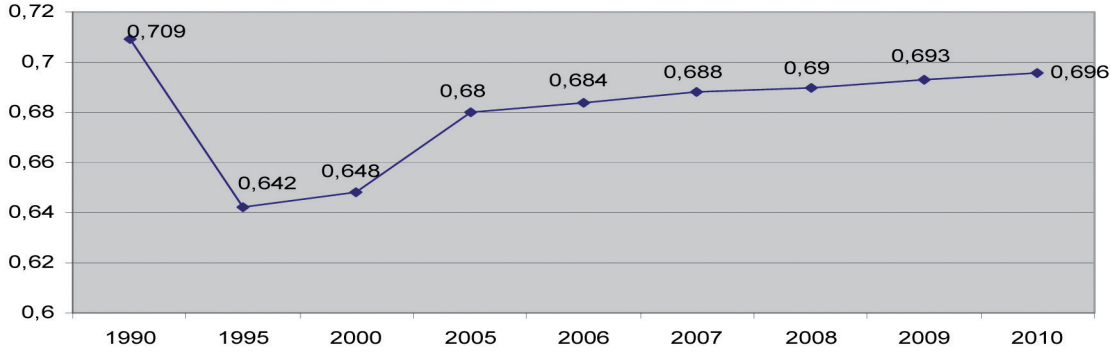
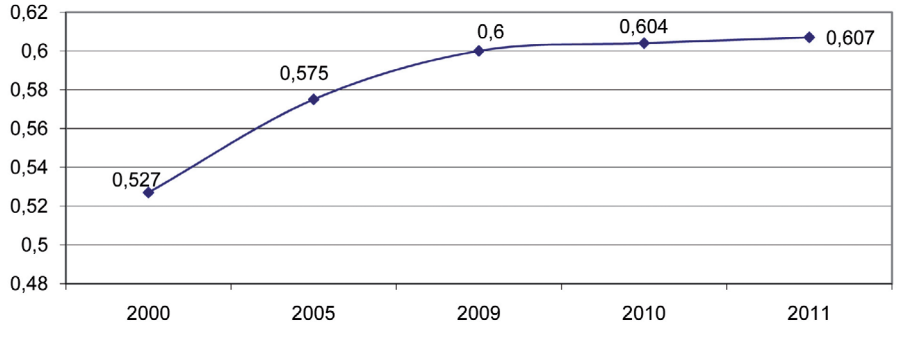


Diagram 7. HDI in Tajikistan (improved calculation method)



The analysis of the HDI components shows that Tajikistan has relatively higher indices of achievements in education and health than the per capita income index. In terms of education and health, Tajikistan is among countries with a high human development index (literacy rate and enrollment ratio exceed, on average, 80%, and life expectancy ranges between 65-75 years). In terms of GNI per capita, Tajikistan, however, falls under the category of countries with a low human development index (below USD 2,000 at PPP).

Therefore, although the increase in the HDI value in recent years was primarily due to higher rates of income growth, income still remains low compared with health and education indices, indicating a need to significantly increase economic activity in the country.

In 2011, the Republic of Tajikistan was ranked 127, with a 0.607 HDI value. In terms of gender inequality, the Republic of Tajikistan was ranked 68, with a 0.347 value.

CHAPTER 2

Economic aspects of climate change

2.1 ASSESSMENT OF CLIMATE CHANGE IMPACT ON THE ECONOMIC STRUCTURE

2.1.1. CLIMATE CHANGE AND WATER RESOURCES IN TAJIKISTAN

Water is the basis for any kind of socio-economic activity. The availability and quality of water resources play a significant role in the health of the environment, public welfare and creating a prosperous economy.

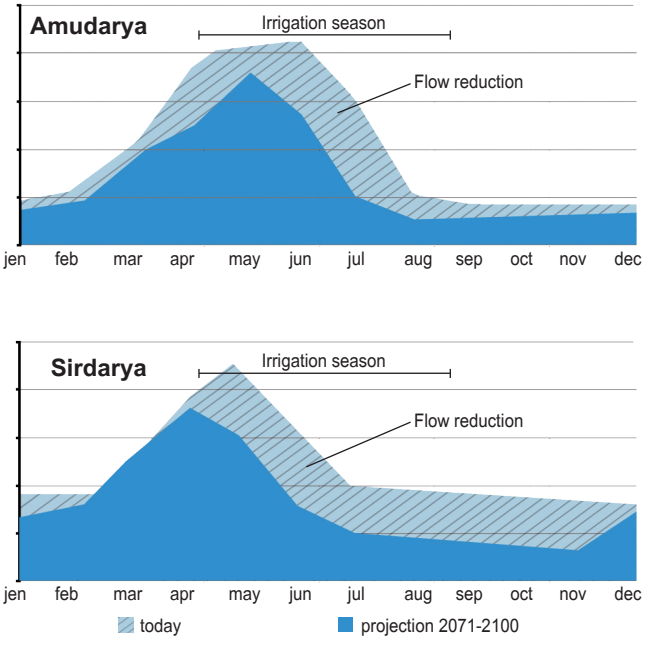
One of the consequences of climate change is a shortage of drinking water. The situation in regions suffering from drought (i.e. Central Asia, the Mediterranean, South Africa, Australia, etc.) is worsening due to a decrease in the level of precipitation. Due to drought and other effects of climate change, the annual economic losses in water supply of these regions is estimated to be approximately $ 50 billion[20].

According to UN data, during the last 100 years the rate of water consumption increased twice as fast as the world's population. There is a chronic water shortage in Middle East, North Africa and South Asia. Based on the UN's prognosis, by 2025 1.8 billion people will live in countries and regions where water resources will be extremely scarce, and two-thirds of the world's population may have an inadequate supply of water.

Intense climate warming can be observed across Central Asia. All of the climatic scenarios for the region that take into account climate change imply a decrease in available water resources. Available data indicate that, by 2050, the volume of river runoff in the Amudarya basin will decline by 10-15% and in Sirdarya by 6-10%[21]. Water resources in Central Asia are used by all sectors of the regional economy and determine various aspects of national and regional security.

The main consumer of water in the region remains irrigated agriculture, which accounts for about one third of gross domestic product and employs more than two-third of the region's population. More than 90 % of the resources of the basin of Aral Sea are spent for irrigation purposes.

Diagram 8
Forecasts of average seasonal flows of Amudarya and Sirdarya



Source: Analysis of activities on adaptation to climate change in Central Asia: needs, recommendations, practices. Almaty, 2011.

[20] Climate change and its consequences in the short- and long-term period by different scenarios. IPCC Report, 2007.

[21] S. R. Ibatullin, V. A. Yasinskiy, A. P. Mironenkov. Impact of climate change on water resources in Central Asia. Sectoral review. European Bank for Reconstruction and Development, 2009.

It should be noted that water resources play a critical role in the energy security of Central Asia. Hydropower generates 27.3 % of the region's total electricity consumption. The present figure is more than 90% for Tajikistan and Kyrgyzstan, which shows the dependence of these countries' economies on the availability and schedule of usage of water resources. Therefore, any changes that affect the water resources of Central Asia have a high multiplier effect on impacts to the region's different socio-economic sectors. The situation is exacerbated by an increase in water consumption, which is related to the population growth and rapid development of the region's economies. The estimated reduction in runoff in the near future resulting from climate change makes the present issue even more acute.

Glacier melting will create additional risks for sustainable development and regional food security. The high mountains of Tajikistan are constantly covered with snow and ice, and glaciers cover about 6% of the total area of the country. As a result of climate change they are declining; during 20th century the largest glacier of the country - Fedchenko - reduced by 1 km in length, by 11 km2 in area and lost the volume of 2 km3 of ice. Their intensive departure threatens to create short-term flooding, and in the long term to reduce the water supply in Central Asia, as glaciers and permanent snow cover feed supply more than 13 km2 of water per year to the rivers of the Aral Sea.

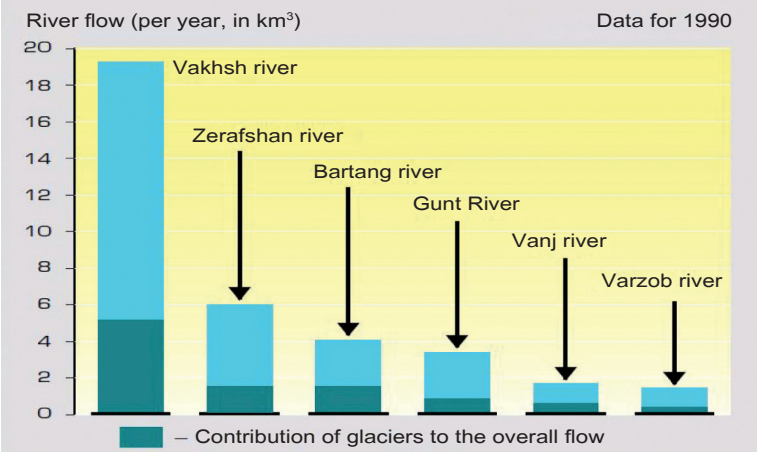
Warming in the highland regions of Pamir, Tien Shan, Gissar-Alay and other mountainous system is in line with regional and global trends. The glacial reserves concentrated in the mountainous regions of Central Asia and Kazakhstan are considered multi-year reserves and a major source of fresh water. By producing melting water during the hottest period of the year, they make up the deficit of irrigated water when demand peaks and the reserves of seasonal snow run out. However, the ice reserves are unstable. At present, specialists on glaciers report the widespread departure of glaciers: small glaciers disappear, and the big ones fall to pieces.

The annual melting of glaciers in Tajikistan provides an average of 10-20% of river volume, and during dry and hot years the contribution of glaciers to some rivers during the summer may reach 70% (see Diagram 1). Water plays a significant role for agriculture, hydropower and other related sectors of the economy of Tajikistan. Moreover, this country's water resources are mainly consumed by downstream states.

An assessment of the impact of global climate change on the glaciers of Pamir-Alai showed that, during the whole period of observation starting from 1930 (first instrumental measurement), the overall area of the country's glaciers shrank by about one third. Over the twentieth century, Tajikistan's glaciers reduced by an average of 20-30%, the glaciers of Afghanistan (on the left bank of the Pyanj river) by 50-70%. In recent years the pulsating glaciers also have become active, due to temperatures rises. The area of glaciers in Tajikistan may shrink another 15-20% compared to the present, and water resources in glaciers may shrink by 80-100 km^3.[22] During the current century the area of snow cover of the country may decrease by 20% and the volume of ice cover by 25-30%. In the initial period, melting glaciers will increase the flow of some rivers and partly offset the decrease in flow of others, but it will eventually cause a catastrophic decline of water in many rivers.

[22] Renat Perelet, Climate change in Central Asia, 2008

Illustration 1.
River flow of Tajikistan in annual average and the share of glacial supply



Source: S.R.Ibatullin, V.A. Yasinskiy, A.P. Mironenkov. Impact of climate change to water resources in Central Asia. Sectoral review. European Bank for Reconstruction and Development, 2009.

Computer models of climate change envisage the possibility of a more than 30% reduction in Tajikistan's water resources[23]. According to the recent report of the Asian Development Bank (ADB), climate change most likely will threaten economic activity, public welfare and the environment of Tajikistan. «In Tajikistan, rising temperatures and changes in rainfall have already led to decrease in small glaciers.» «In the medium and long terms, many rivers are expected to face significant water inflow». The ADB warns that, due to the expected climate changes, Tajikistan is located in a high risk area. «About 95% of the country's territory is vulnerable in terms of environmental degradation, including the risk of floods, landslides, soil salinization, erosion of soil and water resources as well as the emergence of deserts».

The authors of another ADB report, «Republic of Tajikistan: capacity strengthening towards resistance to climate change», calls for urgent measures to support the Government of Tajikistan to prepare the country to meet climatic challenges. Otherwise, a projected 2 0C rise in temperatures by by 2050 will lead to melting glaciers and early snow-melting, which will change the seasonality of water flow and destabilize water reserves for agricultural needs and the generation and consumption of hydropower.

Water supply plays an integral role for the most critical development issues of Central Asia because of population growth, the dry climate, the large water consumption related to the cultivation of water-intensive crops (cotton and rice) as well as the transboundary nature of regional water resources. During the Soviet era, a large part of the water resources of the Sirdarya and Amudarya Rivers feeding the Aral Sea was used to irrigation farmlands that produced a Central Asian monoculture - cotton. Likewise, the shrinking of the Aral Sea other serious issues can be traced to the Soviet heritage, such as flooding and underflooding of lands, soil salinization and waterlog, and a decline in agricultural productivity across the region. Since the 1960s, the water quality in Central Asia has declined as a result of a heavy discharge of contaminated drainage water into the Aral Sea,.

Melting mountain glaciers, the shrinking Aral Sea and the severe energy crisis in Tajikistan in the winter of 2007/2008 indicate the remarkably close tie between climatic changes and water supply issues, energy security and the development of Central Asia. Experts have been long discussing the potentially serious conflicts due to scarce water resources in the region. Over the next several decades, non-climatic factors such as inherited problems and continuing unstable models of consumption will become key factors creating a shortage of water resources in Central Asian states. Floods are not only due to an increase in precipitation; they are the results of the combined effects of significant precipitation and inadequate models of land use and water resources management. Generally, the changes in freshwater systems related to climate are insignificant compared to factors such as pollution, the imperfect regulation of river flows, wetland drainage, river flow reduction and the decrease in the level of underground waters (predominantly as a result of their extraction for irrigation). The most important conditions for Central Asia's stable development are to take measures towards reducing the irrational use of water and energy as well as to promote consistent agricultural management. It is also important to improve the business and investment climate to attract foreign and local investment in the modernization of the electrical power industry and, especially, in the development of renewable energy technologies.

Price liberalization is an integral part of reform. Since this inevitably entails a rise in power and water supply prices (and an especially heavy burden on water-intensive sectors such as irrigation), it is necessary to pay protect the most vulnerable populations from the effects of climate change. Ideally, development and poverty reduction programmes that are elaborated and implemented in Central Asia - usually with the support of the international community - should reflect this tie between efforts on climate change mitigation and overcoming poverty.

Access to clean water for household needs such as hydration, cooking and personal hygiene, as well as access to basic and effective sanitation services is essential for keeping the population healthy and ensuring environmental sustainability. Ensuring access to a safe water supply and sanitation catalyzes many aspects of human development. This is clearly formulated in the Millennium Development Goals, one of which to reduce by half the proportion of people that do not have permanent access to safe drinking water and basic sanitation. With the view to supporting the objectives of the Millennium Development Goals, the UN General Assembly declared in July 2010 that access to safe and clean drinking water as well as sanitation is a human right, which is significant for creating a decent life for all people and exercising all other human rights. However, there is a shortage of clean water, and it is poor people who first of all continue to suffer from water pollution, its shortage and a lack of adequate sanitation services. In 2008, approximately 460 million people in Asia-Pacific region did not have access to safe water resources, while 1.8 billion people did not have access to sufficient sanitation.[24]

Currently, two sub-regions, the East and North-East of Asia and North and Central Asia lead the Asia-Pacific region in providing access to safe drinking water for 90% of their population, With the exception of Mongolia and Tajikistan, where the present figure in 2008 was 76% and 70% respectively, the states of these two sub-regions are

[23] Asian Development Bank Report «Problems of climate change and migration of population in Asian-Pacific region», 2012.

[24] Economic and Social Commission for Asia and the Pacific (ESCAP), the United Nations. Trends and progress in the field of environment and development: emerging and unresolved issues in water resources management. 2011.

on track to reduce by half the number of people who do not have access to safe water and achieve the Millenium Development Goals[25].

The Aral crisis can be seen as a systematic catastrophe caused by incompetent and nature-depleting administrative planning for the development of Central Asian economies, the 'best' demonstration of which was the 'cotton monopoly', underestimating and neglecting its long term negative environmental effects. An orientation to producing water-consuming agricultural crops (first of all cotton and rice) led to the extremely water-intensive nature of agricultural production: irrigated agriculture consumes the vast majority of water in the region. Under the conditions of arid climate, water scarcity and imperfections of irrigation infrastructure, this has led to an almost full depletion of water resources. In recent years, only 4-8 km^3 of water was received in total, and in some years the water flowing into the sea (from the Sirdarya and Amudarya Rivers) does not reach the sea at all. Meanwhile, 33-35 km^3 is required in order to maintain the Aral Sea's level.

Under a sound system of use and distribution of products of reclaimed lands, much less water and land resources are required than is currently used. This maintains and increases the level of final consumption of products of agricultural origin.

Moving from the end to the beginning of the built natural and productive chain of water resources, it is possible to eliminate water loss in reclamation systems. At present, more than half of the water used for irrigation does not reach the fields and instead evaporates, leaks etc. The water loss for the Aral region is 30-40 km^3 per year. For proper use of the water reserves, the cardinal reconstruction of operational irrigation systems and advanced irrigation technologies are required. Currently, more over 90% of canals have an ordinary earth surface.

2.1.2. CLIMATE CHANGE IMPACT ON AGRICULTURE AND FOOD SECURITY IN THE RT

BOX 15. **CONCEPTUAL ASPECTS OF THE IMPACT OF CLIMATE CHANGE ON AGRICULTURE**

Climate change can affect agriculture in many ways. In some regions with a moderate climate, crop yields can increase with a slight rise in temperature and decrease with significant changes in temperature. At the same time, according to forecasts, crop yields will decrease in tropical and sub-tropical regions. According to scientists from the Massachusetts Institute of Technology, an increase in precipitation associated with global warming increases the level of underground waters much more than previously thought. A negative effect of this will be a sharp rise in the water table, which will negatively affect agriculture (particularly in Far East and South East Asia) and increase the risk of landslides. Empirical studies show that the closer a country is to the equator, the more likely its agriculture will suffer from warming.

The IPCC states that a consequence of warming will be the possible damage to reduced soil moisture, an increase in number of plant pests and diseases of plants and animals, and also stressful effects of heat. In addition, soil erosion may rise in some regions due to increased rainfall, while the number of droughts will increase in other regions.

The Report of the UN Secretary-General Ban Ki-moon on the state of agricultural sector mentions that main crop yields may decline by 50% in some countries because of global climate change, and by 2020 the number of people suffering from hunger may rise by almost 50 million. By 2080, agricultural production in developing countries may decline by 9-21%[26].

Positive effects are also possible for agriculture. The period favourable for plant growth will increase. Moreover, yields are expected to increase with a rise in CO_2 concentration, due to the known stimulatory effect of carbon dioxide on plant photosynthesis. In laboratory experiments, doubling CO_2 concentration can increase yields of rice, soybeans and other crops. Under optimistic scenario, the impact of climate change on global production will be almost insignificant, and some negative effects in some regions will be offset by the growth in food production in others.

Access to quality water resources is vital for Central Asia, where agriculture is a central contributor to economic growth, because adequate water supply is an indispensable condition for food security, and a source of livelihood for rural communities that produce food for the region, whose numbers continue to grow[27]. Even if the situation does not change, it will take more water to produce additional food for the consumption needs of rapidly growing population. According to the forecasts, by 2030 the annual demand for water in the Asia-Pacific region will rise by 55% compared to 2005[28]. Food production is limited by the decline in labour productivity in agriculture, the need to use land for different purposes as a result of increased urbanization and industrialization, the production of bio-fuels, global warming and the scarcity of water resources.

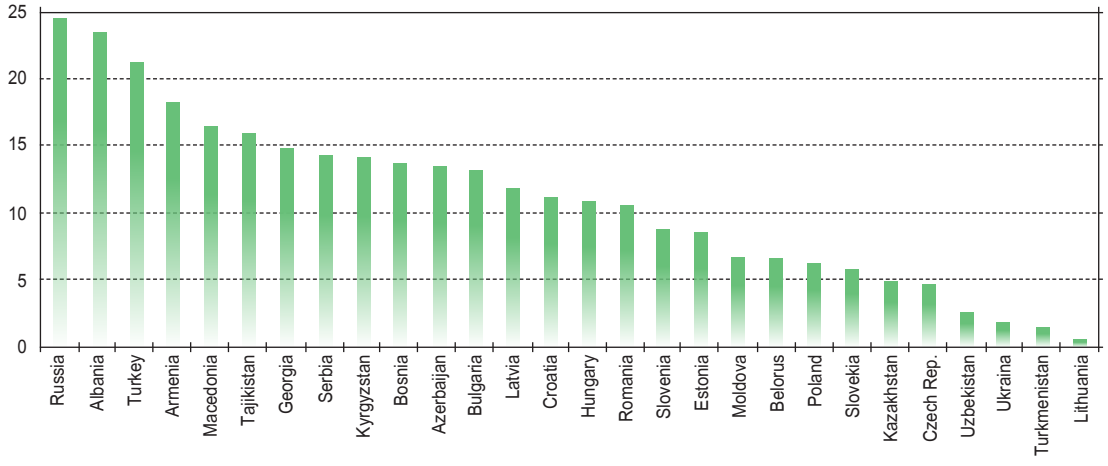
[25] Economic and Social Commission for Asia and the Pacific (ESCAP), the United Nations. Trends and progress in the field of environment and development: emerging and unresolved issues in water resources management. 2011.

[26] Report of the UN Secretary General Ban Ki-moon on the state of agricultural sector

[27] McKinsey & Company. 2009: Charting Our Water Future: Economic Frameworks to Inform Decision-Making. 2030 Water Resources Group. http://www.2030waterresourcesgroup.com/ water_full/ Charting_Our_Water_Future_Final.pdf?

[28] United Nations Human Settlements Programme, The State of Asian Cities 2010/11, Regional Office for Asia and the Pacific. http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=3078

Diagram 9.
Probability of increase in climatically unfavourable situations



Source: Baettig et al. (2007). Remark: The index combines the number of additional years with hot, dry and wet weather; the number of summer periods with hot, dry and wet weather and the number of winters with warm, dry and wet weather projected for the period of 2070-2100 against the period of 1961-1990.

High population growth in the region, together with an increase in water pollution and greater deficit of water resources, will cause a growing imbalance between demand growth and an uncertain supply, and not only in the food and water resource sectors. Since the demand for irrigation water in arid and semi-arid areas of Asia is growing, it is expected that the melting of snow and glaciers as well as the raising of snow boundaries may also have a negative impact on agricultural value chains in South and Central Asia.

Higher temperatures also cause glacier retreat and less rainfall in the winter season that is stored in the form of snow. This complicates the hydrological regime and increases the likelihood of increasing the number of winter floods in Central Asia. Though the water inflow increases in water basins in the short term in summer months at the expense of melting glaciers, the forecasts of water availability in the summer period in the long-term is deplorable, particularly in Central Asian states, where irrigation activities are required[29].

This index, which reflects the magnitude of future climatic changes in relation to the current variability of natural conditions (Baettig et al. 2007), shows that among the countries of Europe and Central Asia, the largest increase in climatically unfavorable situations are expected in Russia, Albania, Turkey and Armenia, and to a lesser extent in Macedonia and Tajikistan.

In general, the region is expected to suffer a decrease in the number of days with frost from 14 to 30 over the next 20-40 years, while increasing the number of hot days from 22 to 37 in the same period[30]. Possible changes in climatic conditions will affect agriculture in Tajikistan, which will face the problem of degraded soil quality and a reduction in its natural fertility. Under the present insufficient funding for the maintenance of soil fertility and compliance with environmental requirements, this will lead to the depletion of natural capacity and a lack of sustainability of agricultural production in the long term.

The high dependence of the population on natural resources (over 66% of the population engages in agriculture), high food vulnerability (two thirds of agricultural production depends on irrigation, 55% of the area planted with cereals depends on rainfall during irrigation season), food shortages (according to WFP more than 1.4 million people suffers), a high level of loss in gross agricultural products as a consequence of natural disasters (annual losses due to climatic phenomena constitute one third of total losses) indicate the importance of adaptation programmes in agriculture.

The National Reports, practical adaptation projects and vulnerability assessments conducted by various organizations show growing negative impacts of climate change on agriculture that are reflected in: drought, the accelerated process of soil degradation and erosion, a reduction in the yield of natural grasslands, the loss of crops in non-irrigated farming areas, the reduction of water resources for irrigation and watering, the reduction of

[29] Climate change adaptation in countries of Europe and Central Asia. World Bank Paper. 2009 (http://qo.worldbank.org/7OOClE7AU0).
[30] In the same place

moisture reserves in soil, frequent adverse natural hydro meteorological phenomena, and so on. All these lead to a reduction in farmers' incomes and an aggravation of poverty[31].

Land degradation. Land degradation inflicts great damage and occurs in agricultural areas due to the heavy degradation of agro-ecosystems, soil erosion, 'over-ploughing' of some areas, the destruction of ecological balance, the economic inefficiency of processing of poor soils, etc.

Possible changes in climatic conditions will mean agriculture will face the deterioration of soil quality and a reduction in natural fertility. The absence or insufficiency of funding for the maintenance of soil fertility and compliance with environmental requirements will lead to the depletion of natural capacity and aggravate the issue of sustainable agricultural production in the long term.

Currently, there are no regular assessments of soil condition which could be used as environmental indicators for agriculture. Meanwhile, the importance of processes such as soil erosion for agriculture is extremely high. Negative environmental processes have become one of the main causes for the decline of agricultural lands. Soil degradation is taking place as a result of their irrational use: a sharp reduction of measures directed towards saving valuable lands from water and wind erosion, flooding, waterlogging and other processes.

Thus, due to changes in climatic conditions, there will inevitably be an overall deterioration of the environment in rural settlements, in the form of massive degradation of agricultural lands, the deterioration of soil quality and reduction of natural fertility. To take advantage of emerging opportunities, considerable efforts and large investments are required to restore soil quality and implement conservation measures. At the same time, agriculture consumes 90% of water. The high level of bedding of ground water, erosion and salinization reduces the productivity of soil, and 60% of irrigated lands are exposed to erosion. This is a big issue for the country, in which only 5% of the overall territory is arable land, and agricultural production accounts for about a quarter of GDP.

Climate change and the general environmental conditions of agriculture pose new requirements for the sector's institutional structure. In these conditions, the farming sector can play a progressive role in the new environment - it is more flexible and adaptable compared with the remaining traditional, less reform-oriented large farms. An extremely effective adaptive measure is agroforestry, since the wide planting of shelterbelts in agricultural areas are particularly vulnerable to climate variability, increased aridity and frequent droughts. This is a typical 'win-win' event, economically and environmentally. Agroforestry's impact on soil, water regime, and its effect on regional and global climate as a form carbon sequestration should be noted.

Climate change and general climatic conditions are emerging as new challenges to the institutional structure of the agricultural sector. The farming sector may play a certain progressive role in new conditions, as it is more flexible and the possibility of its adaptation is far greater in comparison with the traditional, poorly-reforming large agricultural enterprises.

An extremely effective adaptive activity is agroforestry, wide planting of forest strips in farming territories, especially susceptible to climate change, increased aridity and frequent droughts. This is a typical step of «double-win» - economic as well as environmental. It should be noted the local role of agroforestry - impact on soil, water regime, microclimate in regions as well as global - linking carbon.

The following economic benefits, among others, of forest plantations should be highlighted: the increased fertility and yield of agriculture, increasing its economic efficiency, a rise in the cost of land of agricultural enterprises, etc. Environmental benefits are the following: a decrease in water and windy erosion of soil, the regulation of water conditions of soil, the reduction of intensity in droughts because of the creation of favourable microclimates for agricultural crops and support for biodiversity conservation, etc.

Climate change adaptation envisages an intensification, re-distribution and concentration of the technological capacity of agriculture, which allows offsetting the reduction of land resources at the expense of increasing the final product, i.e. at the expense of the reduction of huge losses of potential crops during the process of their transformation and movement to consumers. Even without considering climate change, such an approach is not only economically justified but is important from an environmental perspective. At present, despite the severe exposure of some lands to erosion, a significant reduction in their natural fertility, they continue to be worked partially based on outdated soil-deteriorating technology. Especially dangerous is the use of such land under cultivation, as it leads to the deterioration of the humus's fertile soil horizon, its wash and blow. There is already a risk of going over the 'ecological threshold' of fertility decline, which starts to cause the degradation of many valuable lands and the loss of their entire fertility. This problem is particularly relevant for the regions where there is a probability of increasing aridity, such as Khatlon and Yavan districts. In particular, it is an issue for regions where the possibility of the climate's increasing aridity is high, such as Khatlon region and Yavan district.

[31] Recommendations of Public Organisation of Youth Ecological Centre of Tajikistan

Under such circumstances, it is necessary stop using up to 10% of these regions' present territory as arable land and sow them with perennials, use them for meadows, etc. Even more lands need conservation as pasture land areas. This enables the conservation valuable agricultural lands for future generations, protecting them from the destructing effects of erosion and technology, while rapidly recovering their fertility. Such measures are already being carried out by some countries., For example, taking out lands from turnover in the US had a great environmental impact. In the 1970s and early 1980s, its agriculture faced a dangerous ecological situation as a result of extensive erosion. In response, the government developed a special federal programme of land conservation, in which more than 10% of degraded lands were taken out from agricultural turnover. This allowed a significant decrease in the intensity of soil erosion. In order to involve farmers in the land conservation programme, the US government used a wide range of economic measures in the form of subsidies, price supports, credit, etc.

BOX 16. **CONSOLIDATION OF ACTIONS**

It is important that the Government, through a comprehensive national policy and targeted investments, provide favourable conditions for the improvement of food security and sustainable agriculture at the local and national levels. Civil society can contribute to the overall picture with its practical experience, focusing on issues of the poor, practical participation and its remarkable research capacity. Finally, entrepreneurs recognizing the complexity of the global environmental and economic challenges should cooperate with these stakeholders and profit by using their scale, resources, investment and technology for the targeted development of sustainable agriculture.

In general, activities can be concentrated on the following areas:

- Investments in agricultural productivity, particularly for small farmers:
  - increase investment in agricultural research and development, as well as agricultural institutions, the exchange of experience and infrastructure development such as roads, ports, storage and irrigation facilities;
  - direct investment in rural development to the areas of education (especially for girls), health care and water purification;
  - ensure a sequential and predictable compliance with human rights, labour, environmental and efficient management standards.

- Improve the quality of and access to nutritious food products:
  - integrate nutrition into all areas - agriculture, value chain, social protection, health and education;
  - take into account the nutritional value of food at all stages starting from the producer to the consumer, which includes production, processing, marketing, procurement, preparation and consumption;
  - ensure year-round access to various foods needed for quality nutrition, and emphasize providing universal access to nutritious food.

- Protecting and improving the environment during a simultaneous rise in agricultural productivity:
  - implementation of policies promoting integrated management of food, energy, water and land resources, taking into account all these elements;
  - implementation of policies to prioritize the programmes of diversification of agricultural production as a means of maintaining soil fertility, water resources and biodiversity.

- Support for technological innovations that are acceptable and affordable to poor farmers:
  - creation of legal conditions that attract investment in technology and promote sustainable agricultural development;
  - Assistance in scaling up effective pilot projects and technologies that will improve food security and sustainable agricultural development.

- development of sustainable food systems:
  - Support to the development of standards and guidelines for sustainable development, corporate transparency and accountability for sustainable agriculture;
  - Promotion of best practices;
  - Encourage all companies to include food security and sustainable agriculture as priority areas in their business activities.

- Using the criteria to ensure gender equality and the rights of children:
  - Development of initiatives by government, private sector or joint efforts aimed at women's and children's participation, where possible, that allow them to overcome, while not enforcingm existing inequalities.

Source: the Rio+20 Conference

2.1.3. CLIMATE CHANGE IMPACT ON POWER ENGINEERING IN TAJIKISTAN

BOX 17. **CONCEPTUAL ASPECTS OF CLIMATE CHANGE IMPACT ON POWER ENGINEERING**

Moreover, adverse weather conditions weaken the ability of networks to function normally, especially worn and poorly operated facilities. This is already leading to a decline in electricity production and industrial products, and a reduction in access of households to heat and electricity.

Table 11.
Climate change impact on energy

Climate change factor	→	Sectoral risks	→	Final impact
Rising temperature		Lack of water resources for hydropower needs		Threats to energy security
Change in humidity level		Potential /possible damage to various objects and infrastructure		Possible dependency on extracted fuel /carbon dioxide (coal, mazut)
Frequency and intensity of the role of climate change in case of natural disasters		Change in structure of power consumption		Possible dependency on extracted fuel /carbon dioxide (coal, mazut)

Source: Climate change adaptation capacity in the Republic of Tajikistan: analytical and institutional assessment. UNDP. 2011.

Extreme weather effects are closely linked to water balance, changes in snow cover, melting glaciers and rising sea levels. Changes in river flow may negatively affect the production of electric power in countries like Tajikistan. Consequences observed in the deltas and estuaries are further aggravated due to dams, which prevent the transfer of sediments. This leads to the lowering of deltaic regions and enforces the consequences of rising sea levels.

Population growth in the region creates a heavy burden on the ecological systems, which provide water used in food, for food production and other vital services. Since water scarcity is a natural restriction for steady economic growth in many parts of the region, it is time to give toppriority to the process of economic development, which has lagged far behind in recognizing the inextricable link between water, energy and food security.

Hydropower is highly dependent on water and consequently precipitation and the initial stages of resource management. Unlike other regions of the world, the potential capacity of hydropower development in the Asia-Pacific region is relatively wide: in 2008, the figure of installed capacities accounted for more than 295,764 MW[32]. It is expected that the cumulative installed capacity of hydroelectric power plants in Asia-Pacific region will grow annually by a total of 6.92% and by the end of 2013 will reach 434,388 MW. In certain cases, the current technology leads to a decline of the amount of water available in the beginning of the cycle and affects the quality of water at the end of cycle due to clogging. Large hydro technical facilities have a large effect on agriculture and food production, because of their impact on the quantity and quality of water available at the beginning and end of the production cycle.

Water is not only used for hydropower generation; it is also used in all types of energy production. In order to extract coal, oil, natural gas and uranium, water is required. Heat-generating power facilities require water to produce steam. Silicon solar batteries use water in their work. Power is needed to intake groundwater, with lifting and delivery as well as desalination and the purification of sewage. Energy production is the largest industrial water user, and an increase in the production of energy requires wide access to fresh water. According to the forecasts, by 2030 the demand for energy in the Asia-Pacific region will grow by nearly 70%[33].

[32] PRLOG. 2009: Asia-Pacific Hydro Power Market Analysis and Forecasts to 2013. http://www.prlog.org/ 10198289-asia-pacific-hydro-power-market-analysis-and-forecasts-to-2013.html

[33] Institute of Energy Economics, Asia/World Energy Outlook 2007. http://eneken.ieej.or.jp/en/data/pdf/405.pdf

To ensure energy security in the region, it is required to have sufficient amount of water, which, in turn, depends on the growth of low-cost energy. Henceforth, water and energy resources should not be considered separately from each other. Even in power plants operating with fossil fuel and nuclear power plants, cooling facilities require huge amount of water. Extracting minerals and the transportation of industrial and food products are also water-consuming processes.

Taking into account this inseparable linkage between water, energy and food security, an approach based on the concept of providing sustainable and equal growth opportunities for all can combine all three aspects to implement relevant strategies and policies.

In order to ensure water, energy and food security in the Asia-Pacific region under conditions of the growth in demand of food and energy carriers, and an uncertain water supply, an integrated approach is required, one which unifies sustainable water use and an intensification of labour productivity in agriculture. An economic strategy can be implemented that builds on the principles of integrated water resources management (IWRM). IWRM is a holistic approach that promotes sustainability by taking into account the quality and quantity of surface and ground water, the interaction between water, environment and land resources, and also the relationship with social and economic development. Therefore, the opinions of the government and stakeholders, human living conditions and the environmental aspects of natural water systems are taken into account. Because of its complexity, IWRM needs a streamlined and interdisciplinary planning process, which includes knowledge in areas such as law, engineering, ecology, limnology, finance, social economics, politics, ethnology, history, psychology, the science of nature and many other areas. Given the impact of extreme weather conditions along with inefficient economic activities in the region, the lack of political will and insufficient capital investments, the Asia-Pacific region will face an era of water scarcity that threaten the prospects of socio-economic development, unless significant efforts are made towards effective and integrated water resources management. However, eco-efficiency and efficient water use can be achieved following the principles of IWRM, which is based on the concept of comprehensive sustainable water use. The strategies and action plans of water use that meet the requirements of IWRM are designed to solve the issues and meet the needs related to three aspects of sustainability: environment, society and economy.

2.1.4. CLIMATE CHANGE AND DISASTER RISKS IN THE RT

BOX 18. **CONCEPTUAL ASPECTS OF IMPACT OF CLIMATE CHANGE ON THE INCREASED DISASTER RISKS**

85% of the population under threat from earthquakes, cyclones, floods and droughts lives in developing countries. The huge damage from disasters is a significant constraint to achieving Millennium Development Goals, especially the first goal of reducing poverty by half by 2015. The amount of direct losses resulting from disasters rose from $ 75.5 billion in the 1960s to nearly a trillion dollars in the last decade (Munich Re 2002, CRED 2009). Even these huge numbers do not include the long-term damage to people and communities bearing the brunt of disasters, as a result of which people will lose their lives, livelihoods will be destroyed and development prospects will be lost.

Disasters threaten the food security of the most vulnerable segment of populations in the world. Disaster risk reduction is critical in ensuring one of the fundamental human rights: the right to be free from hunger. If we do not start to use disaster risk reduction as a means for adaptation to climate change, we will not responsibly regulate economic growth or stop environmental degradation, and disasters will cause yet more threats to people's lives and their livelihoods as never before.

Risk reduction protects investment in development and improving people's well-being despite the threats. For instance, China spent $3.15 billion to reduce the effects of floods, thus preventing damage which, according to experts, could reach $12 billion. (DFID, 2004). Disaster risk reduction: increases the sustainability of community development activities; helps the poorest segments of the world population to improve their well-being and health and enhance their food security by protecting and broadening the livelihoods; and promotes the release of resources by reducing the need for and dependence on foreign aid and resources for recovery

Experts have already identified five priority objectives to ensure the sustainability of development efforts to natural disasters[34]:

1. Mainstreaming disaster risk reduction measures in social and economic development plans and programmes to secure resources invested in development. This requires the transfer of funds, technology and knowledge to the most vulnerable communities through cooperation and partnership between actors of different areas of expertise, along with the involvement of multiple stakeholders at all levels.

[34] Disasters' risk reduction as a tool of MDG achievements. UN. 2011

2. Mainstreaming disaster risk reduction activity as an integral part of poverty reduction strategies and programmes, to help to protect and improve the well-being of the poor and disadvantaged populations, improving their resistance to the impacts of disasters. Moreover, particular attention should be paid to vulnerable, marginalized minorities and social groups.

3. Ensuring the resilience of schools, health institutions and water and sanitation infrastructure to the effects of disasters will maintain access to universal education, primary health care and emergency care. This will also decrease the rate of infant mortality, improve maternal health and protect against obstacles to the eradication of serious diseases such as HIV/AIDS, malaria and tuberculosis.

4. Providing opportunities for women to participate in disaster risk reduction will accelerate the achievement of the MDGs. Governments need to ensure the active participation of women in policy and decision-making processes, especially in regards to the development of local communities, natural resource management, drought prevention, rational water management and natural agriculture.

5. Holding back rapid and poorly-planned urban growth reduces the risk of disasters. The construction of buildings and facilities in urban areas should be based on the results of careful risk assessment so that the rapid socio-economic achievements are not negatively affected by disasters.

Mitigating the risk of natural disasters is an absolute priority for Tajikistan, where their damage costs 4.8 percent of GDP and they have have a particularly negative impact on the poor. Unfortunately, adaptation to climate change is not included in legislation on disasters and natural catastrophes.

Floods in Tajikistan cause huge economic losses annually and often lead to people's deaths. A significant volume of financial and other resources are allocated every year for post-disaster relief, emergency relief, reconstruction and recovery. The risks associated with poorly-organized operations to minimize the consequences of extreme weather events are reflected in the lack of enabling environments for private investments. Under conditions of extreme weather conditions and inadequate disaster risk management, investors do not have a reliable infrastructure for human resources and stable markets. These are important to stimulate investment strategies that will enhance the population's capacity for resilience in extreme weather events, rather than aggravating competition for water resources. Despite the fact that the infrastructure of reduction of flood effects is improving, rapid economic development and the settlement of floodplains means that flooding will bring even more damage.

The implementation of development projects that can resist natural disasters is one of the most cost-effective ways of investment in poverty reduction in any country. Poor citizens become either the victims of floods, earthquakes and other natural disasters or suffer from effects resulting from the destruction of schools, hospitals, housing and livelihoods. However, this kind of regression, and destruction of development achievements can usually be avoided. Through considered investments in disaster risk reduction, the population as well as the state budget can be considerably protected from such damages.

2.2. ASSESSMENT OF CLIMATE CHANGE IMPACT ON EMPLOYMENT

Labor market and employment. The following factors influence the formation of the employment and labour market situation in the Republic of Tajikistan:

- trends in economic growth are not quite accompanied by the creation of new jobs. Under an average annual GDP growth of 7.7% in 2000-2011, the growth of employment was only 2.1%;
- the average annual growth of the labor force is 121.5 thousand people or 2.9%. The task of annual increase of workplaces by at least 100 thousand was putted;[35]
- conservation of population migration: in 2010, the negative balance of resettlement migration was four thousand people, most of whom are able-bodied (80%);
- growing demand of the economy for a qualified labour force, first of all employees who are able to undertake entrepreneurial activity.

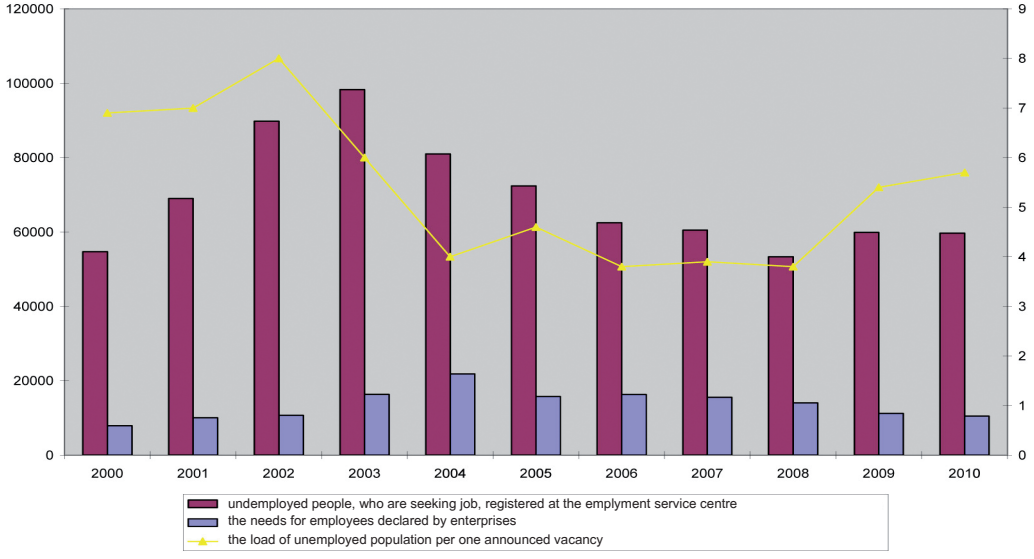
The above factors mean the modern state of employment and development trends of labour market are characterized by the following features:

- high aggregate labor supply and its excess over demand - in 2010, the labor force supply was 59.7 thousand people (unemployed persons seeking work and who are registered with the employment service), while the number of employees requested by enterprises was only 10.5 thousand[36]. The number of unemployed people looking for work and registered is declining and at present accounts for 4.5% of the economically active population;

[35] Address of the President of the Republic of Tajikistan for Parlament of the State, 15 Apriel 2009

[36] Tajikistan: 20 years of the state indepoendence. Statistical collection, pp. 164-165

Diagram 10.
Labour market parameters of the country



- widespread informal employment, which employs about 49% of employed population[38]. In addition, the decreasing trend in reduction of the present area is less remarkable;
- by increasing the size of citizens who leave the domestic labour market because of labour migration abroad - the number of persons working abroad ranges from 400 to 1200 thausands;
- maintaining an imbalance between the structure of training of personnel in the field of higher and secondary special education and the needs of economic sectors for professional staff;
- maintenance of the capacity of 'hidden unemployment', reflected in the high number of employees in enterprises that are not functioning constantly;
- the existence of districts with a high level of tension in the labour market (Gorno-Badakhshan Autonomous Region, major cities, including Dushanbe)[39];
- loss of wages as the market value of labour.

BOX 19. **GENDER ASPECTS OF EMPLOYMENT**

1. The labor market in the country is strictly segregated. Women predominate in agriculture, health, social welfare and education.

Grouping industries by their share of women employed in them: of the 15 groups of employment activities reported by the State Statistical Committee in 2009, the following could be considered 'male' industries: construction (where women make up only 3.7%), transport and communications (7.4%), electricity generation and gas extraction (7.9%), mining (12.4%), real estate (12.9%), public administration and safety (16.2%), delivery other communal services (18.1%), financial services (22,4%), wholesale trade (23.9%), processing industries (30%).

2. In the countryside, women aged 15-49 years spend 32.11 hours per week on domestic work. The difference in time spent on housework between rural and urban women is insignificant. However, the difference of types of housework is significant. Women in the city spend more time on child care and upbringing, shopping in the market, housecleaning, cooking, but in rural areas women spent more time in the activities associated with plots of land, animal care and providing clean drinking water to the household.

Under conditions of further liberalization of the economy, the regulation of labour market and employment should be done predominantly through economic mechanisms, the main features of which are:

- creating new effective workplaces, linked with production activity and created by the private sector.
- support for formation of the rational sectoral and territorial structure of employment, due to development of labour-intensive production with higher value added, particularly in rural areas, cities and districts with mono-sectoral economic structures.
- ensuring a quality equilibrium of demand and supply of the labour market. Demand for a qualified labour force still remains unsatisfactory and will grow under the influence of the processes of structural economic reform.
- development of labour market infrastructure through effective interaction of local bodies of executive power, entrepreneurs and employment service centres.

[38] Labour market situation in the Republic of Tajikistan (findings of the labour force survey June-July 2009), p. 91
[39] Labour market situation in the Republic of Tajikistan (findings of the labour force survey June-July 2009), p. 106

BOX 20. **CONCEPTUAL ASPECTS OF CLIMATE CHANGE IMPACT ON EMPLOYMENT**

The impact of climate change on employment remains one of the most unexplored issues. However, scientists have been attempting to identify many sectors in which reduction of staff is expected due to extreme weather conditions and temperature rises.

Impact on employment in the short and medium term will not be due to rise of temperature, which is expected to be moderate and may even have a positive impact - for example, in terms of increased yields of agricultural crops. The threat to employment will come from extreme weather events such as drought, cyclones and floods. The impact will also be exacerbated by current processes such as a rise in sea level.

If we assume a significant increase in the frequency of heavy rainfalls and their damage to agricultural land, then we can expect a negative impact on employment in the agricultural sector, particularly concerning seasonal workers who are employed during the harvesting and processing of fruit.

An increase in the frequency and magnitude of floods will also affect urban employment, since the collapse of the transport system and industrial and urban infrastructure will adversely affect the ability of workers to get to their workplaces or find another job when enterprises are forced to close down. A vivid example of this situation is the almost complete destruction of New Orleans, US, by Hurricane Katrina, which led to the loss of 40 000 jobs.

Spreading respiratory diseases, and diseases transmitted through water and food, as well as the risk of malnutrition will have a negative impact on employment levels. Such effects on health will decrease the productivity and adaptative capacity of young employees as a consequence of irreplaceable damage to health caused yet in childhood. Growing migration and mortality will exacerbate problems such as the turnover of labour force and the reduction in the number of skilled workers. This arouses a special concern, as the latter's technical knowledge and skills are essential for adaptation to changing labour conditions.

There are two groups of factors that are important for identifying vulnerability to employment impacts for a given country or region[40]:

- Geographical factors: countries and regions located in tropical and sub-tropical zones, as well as close to the northern or southern poles, will first suffer from a rise in temperatures.
- Socio-economic factors: all climatic-sensitive types of activity in any economy (such as agriculture and fishery), as well as the capacity of people's living areas to resist climatic shocks are the key criteria for defining vulnerability of each country.

Up to 60% of population incomes living in rural areas of Asia are directly connected with agricultural production, while the rest is accounted for by salaries received in the same sector. Thus, an increase in the frequency of floods and scarcity of fresh water will have a negative impact on the two income sources.

Development of the Asian region will be accompanied by increased scarcity of fresh water; it is expected that by 2050, more than a billion people will suffer from thirst. Coastal areas, especially heavily populated deltas of large rivers are exposed to high risk of floods and a rise in sea level, which will also lead to growth in morbidity and mortality from endemic diseases such as diarrhea and cholera. This says nothing of the damage to infrastructure sites such as roads and electricity transmission lines, and of economic recession and decrease in the income of workers. A hurricane in Karachi, Pakistan, killed 200 people, mostly poor people living in overcrowded slums. This shows that workers can lose not only jobs, but their lives too (see: http://www.vesti.ru/doc.html?id=358049)

Yet another predictable consequence of climate change may be the movement of jobs to areas that are less susceptible to environmental risks (for instance, far from sea coasts or areas less prone to cyclones). In the context of globalization, it is almost impossible to predict the geography of the mentioned movements - whether they will take place within only one country or will spread globally. Climate changes may cause additional migration due to the deterioration of living conditions in some areas and their improvement in others. Estimates show that migration accounts for roughly 1.5% of the world population (approximately 100 million), which will lead to annual economic losses of several hundred million dollars.

Of particular note is the problem of so-called 'climatic' migration (i.e. migration of people as a result of climate change), which is a specific kind of environmental migration: - flows of people due to environmental causes. In 2010, there were 30 to 50 million environmental migrants, including environmental refugees, and by 2050 their numbers could reach 200-250 million people. This rapid growth will be primarily associated with the effects of climate change, first of all with the more devastating dangerous natural events. With regard to environmental migration from Central Asian states, in the near future they may be due to growing water stress, which involves not only a shortage of volume, but also low quality of water resources.

An assessment of losses from possible migration flows in Central Asia has not yet been done. However, the estimates available for similar living standards and state vulnerability in Asia and Africa predict a loss of less than 5% of GDP for developed countries, particularly for Russia. For poor

[40] Climate change and its impacts on employment and activities of trade unions. UNEP/International labour Fund for sustainable development, 2008, http://www.sustainlabour.org

Table 12.
Individual environmental impacts of climate change and examples of the main forecasted consequences breakdown by sectors

Event and tends	Examples from the main forecasted impacts by sectors		
	Agriculture, forestry and ecosystem	Health of people	Residence area of people and society
Majority areas; warmer and less cold days and nights; warmer and more frequent hot days and nights	Increased productivity in cooler districts; decline in yield in warmer districts; rise in frequency of infestation of insects	Reduction in people's mortality from overcooling	Reduction of needs for energy for heating; growing demand for cooling; worsening air quality in cities; less problems for transport due to less snow and fewer icy roads; unfavourable consequences for winter tourism.
Revealed favourable and/ or unfavourable impacts on employment	+ -	+	- +
Increase in frequency of heavy shower and other atmospheric cataclysms in most areas	Damage to agricultural crops; soil erosion, withdrawal of cultivated lands from turnover due to flooding and washing out	Increased risk of morbidity, injury, infectious, respiratory and skin diseases	Destruction of populated areas, failures in transport, enterprises of trade and communal services as a result of floods; increased load in objects of urban and rural infrastructure; loss of property.
Revealed favourable and/ or unfavourable impacts on employment	-	-	-
Areas subject to increased frequency of droughts	Land degradation; decline in yield and/or damage or morbidity of agricultural crops, mortality of cattle; increased risk of forest fires.	Increased risk in shortage of food and potable water; increased risk of depletion; increased risk of diseases penetrated through food and water.	Water scarcity in populated areas, industry and communal services; decrease of capacity for hydropower generation; and as an option, possible migration of population
Revealed favourable and/ or unfavourable impacts on employment	-	-	-
Increase in intensity of tropical cyclones	Destruction of agricultural crops; windfall of trees; damage to coral reeves	Increased risk of death, injury, spread of diseases penetrated through food and water; post-traumatic stress and health disorders	Large-scale destruction from floods and hurricane winds; refuse from private insurers from taking the risks in vulnerable regions; possible migration of population; loss of property.
Revealed favourable and/ or unfavourable impacts on employment	-	-	-
Increase in the amplitudes of fluctuation of changes in level (excluding tsunami)	Salinization of water for irrigation, deltas of rives and freshwater systems	Increased risk of morbidity and injury of people resulted from floods; deterioration of health conditions caused by migration	Increase in expenditures for coast-protection zones in comparison with expenditures for displacement of land use system; possible migration of population and displacement of infrastructures.
Revealed favourable and/ or unfavourable impacts on employment	-	-	-

Source: IPCC 2007, and for employment related issues - International Labour Foundation for sustainable development ("Sustainlabour"), 2008

countries, taking into account social issues, losses may be much more. By the end of the twenty first century, the loss to India, North Africa and the Middle East may be around 7-8% of GDP under a moderate scenario and 10-13% of GDP under the worst-case scenario, if humanity does not retard the growth of greenhouse gas emissions. In this case the loss is much more than the projected economic growth rate of 3.6%:there will be a rollback to the past, quite rapidly. Countries will become poorer and life will be more and more difficult there, inevitably leading to the migration of millions.

BOX 21. **GREEN JOBS**

Human development is extremely important for achieving broad economic growth, including the creation of strong, sustainable communities, and the improvement of social welfare and the environment. Workers should have the skills and benefit from the transition to the green economy, which has a great capacity for the creation of decent jobs, especially for young people in the field of poverty eradication.

Considerable opportunities for job creation can be provided by promoting: investments in public works to recover and strengthen natural capital, sustainable land management, lessons on water resources and managing environmental agriculture, organic production systems, sustainable forestry management, the rational use of biodiversity for economic purposes, and the creation of new markets related to the use of renewable and non-traditional energy sources.

Moreover, social welfare should be based on reliable and good-quality infrastructure, which creates jobs and contributes to wider integration. Because of this, it is important to expand investments in infrastructure, which contributes to sustainable development.

Building a green economy will depend on creating environmentally clean jobs, and for that the following actions are needed:
a) to enhance knowledge of green job trends and activities as well as integrating relevant data into national economic statistics;
b) to avoid potential deficit of skills and promoting green cards, the programme of job preparation;
c) to enact favourable conditions for the reliable establishment of decent jobs at private enterprises investing in the green economy, including small and medium enterprises.

Source: Rio+20 Conference papers

2.3. GROWTH MODELS AND DYNAMICS OF CHANGES IN ENVIRONMENTAL AND ECONOMIC INDICES

Under current conditions, the paradigms of economic development is undergoing modifications due to the influence of globalization and strong environmental challenges. This require their appropriate reflection in the theory and practice of managing the national economy. Nowadays, it is widely recognized that traditional macroeconomic indicators do not provide a full picture of human development, which highly depends on the quality of environment.

The calculation of environmentally-adjusted macroeconomic indicators allows more reliable statistic data on the status and sustainability of natural resources as a source of economic growth, and shows a positive or negative impact of environmental factors on GDP.

Studies on the evaluation of environmentally adjusted macroeconomic indicators in different countries have yielded striking results that reveal a significant discrepancy between a traditionally-calculated volume of GDP and its calculation, taking into account environmental factors, or ‘green, or environmentally clean GDP.’

In the case of China, the maximum difference between traditionally a calculated and ‘green GDP’ shows an actual decrease in the growth of its development. China's experience shows that including expenditures of conservation and reproduction of natural resources in GDP calcuation, as well as losses from degradation and (or) the deterioration of natural resources helps to avoid illusions in an analysis of prospects for the economic activity of any country.

Environmentally friendly, ‘green’ GDP, which is calculated by subtracting the value of indicators of natural resources and environmental degradation from traditional GDP, enables a forecast of the consequences of interaction of the economy and nature through numerical measurement over a period of time. Despite the tremendous progress in the attempts to calculate the ‘green’ GDP during the last two decades, especially in countries of the European Union, a widely accepted method of calculating environmentally clean GDP has not been yet elaborated. At the same time, the existence of integrated environmental and economic indicators at the macro level is important for decision-makers, because it takes into account environmental factors

in a country's development and displays an ecological development path. An integrated approach to building such an aggregate indicator is consistently tracked in studies conducted in the framework of the UN and the World Bank.

The Statistics Division of the UN Secretariat proposed Environmental-Economic Accounting: a System for Integrated Environmental and Economic Accounting - 1993), aimed at integrating environmental factors into national statistics. This describes the relationship between the natural environment and the economy of a country, disclosed by the indicator of environmentally adjusted net domestic product (EDP). The current indicator is usually calculated in two steps. First, the cost of depletion of natural resources (deforestation, extracting oil, minerals, etc.) is subtracted from the net domestic product. Next, the derived figure is subtracted from the cost of environmental damage resulted from air and water pollution, waste disposal, soil deterioration and groundwater use. According to preliminary estimates of the United Nations Statistical Division, the average value of EDP is about 60-70% of GDP.

In turn, the World Bank calculates the index of 'genuine (domestic) savings', which is also calculated in two steps. First, the value of net domestic savings is determined as the difference between gross domestic savings and the rate of depreciation of produced assets. Second, net domestic savings is increased by the amount of spending on education and decreased by the amount of natural resource depletion and environmental damage from pollution. Estimates revealed that the global average level of 'genuine savings' accounts for 13.6% of GDP, while the gross domestic savings accounts for 22.2% of GDP. For the Republic of Tajikistan, adjusted net savings is 6.2% of GNI (2005-2009).

In general, the current methodology indicates that there is a significant discrepancy between traditional economic indicators and indicators, taking into account environmental factors. This may become a strong argument for decision-makers for environmental adjustment of economic policy.

From a human development prospective, genuine savings are important because they show the necessity of compensating natural capital depletion at the expense of the growth of investment in human and physical capitals. In reality, current policy is implemented through the establishment of special funds, like Foundations of Future Generations (Norway, USA and some oil-producing countries) towards improving the future development of the country, at the expense of fixed allocations from extraction of depleting fuel and energy resources.

A very important indicator is the 'ecological footprint' (EF), which measures a population's food consumption and materials equivalent to the area of biologically fertile soils and sea area needed for production of these resources and absorption of waste, and the energy consumption equivalent to the area needed for absorption of CO2 emissions. Calculations reveal that during 1970-1997, the global EF rose by 50% or 1.5% per year. At the same time, the EF average consumer from the developed world was four times higher than the respective consumer from the developing world. Some surveys discovered that, at present, the pressure of population on the planet is 30% more that the latter's capacity. For the Republic of Tajikistan, the ecological footprint is 0.9 hectare per person in 2012, it was 1.0 - in 2010.[41]

Another important indicator is the index of environmental achievements, which includes 25 indicators in 10 policy categories that are linked with the public health related to ecology, as well as with the viability of the ecosystem. At present time, the present indicator for the Republic of Tajikistan is 38.78 out of 100.[42]

[41] http://www.footprintnetwork.org/images/frends/2012/pdf/2012_tajikistan.pdf
[42] http://epi.yale.edu/epi2012/rankigs

CHAPTER 3

The Social aspects of climate change's impact in Tajikistan

3.1 ACCESS TO POTABLE DRINKING WATER AND SANITATION

Current situation. Currently, around 4.24 million people or 53% of the country's population have access to drinking water, including 93% of the population in cities and towns and close to 49% of the rural population. Only 52 out of 62 cities, districts centers and towns have centralized water supply systems and 28 of them have sewage system. In total, 44% of the urban population and 5% of the rural population have access to safe sanitary facilities. About 20% of the population in rural areas is covered by centralized drinking water supply systems. The remaining part uses water from different sources (springs, wells with manual pumping, irrigation canals, rain water and etc.). The overall capacity of the drinking water supply systems is 1834.59 thousand m^3/day, including Khatlon region - 373.52 thou. m^3/day, Sughd region - 409.82 thous. m^3/day, Regions of Republican Subordination - 176.07 thous. m^3/day, GBAO - 76.07 thous. m^3/day and Dushanbe 867 thou. m^3/day. (Annex 3.1.)[43]

[43] Analytical review "Status and perspectives of integrate management and water resources in the Republic of Tajikistan", 2011

BOX 22. **DEVELOPMENT OF LEGAL FRAMEWORKS**

- The Project "Improving the access to safe drinking water to the population of the Republic of Tajikistan for period 2007-2020 (approved by the Government of the Republic of Tajikistan on December 2, 2006, No. 514) aimed at the provision of safe drinking water to 7,68 million people (including 1,38 million urban and 6,3 million rural people), was developed and is under implementation. The program requires investment equal to Tajik Somoni 3,32 billions (about US $ 1 billion on the approval date of the document) to improve the coverage of potable water by 31%.
- The law of the Republic of Tajikistan "On drinking water and water supply" (29 December 2011) was aimed at meeting the most advanced international standards and principles, as well as involving necessary investment in the water supply sector.
- The UNDP takes part in the «Water Supply and Sanitation Project in Tajikistan» (TajWSS) implemented by the Oxfam Association (Oxfam) in Tajikistan and funded by the Swiss Agency for Development and Cooperation (SDC). The project objectives are to strengthen policy development, reform the administration of the water supply sector at the national level, and to improve overall access to drinking water for rural communities of Tajikistan by introducing appropriate changes in the policy and practice of subsector sustainability development. The project components include developing a strategic dialogue at the national level; the creation of a stakeholder network; capacity building; and establishing a trust fund to support investments in infrastructure of water supply and sanitation and its sustainability. Activities like policy development and strengthening the reform and improvement of legislation in the water supply and sanitation sectors are planned under the first project component. To achieve this particular objective, the Government of the RT, in coordination with the respective agencies in the water supply sector established the Inter-Agency Coordination Consul (IACC) on drinking water and water supply that acts as a consultative and coordination unit for implementing policy dialogue and making recommendations on policy reform. The activities of the IACC are supported by its secretariat, which is responsible for the provision of analytical, legal, organizational and technical support, with the assistance rendered by different partners and donor agencies actively involved in water supply and sanitation sectors.
- Beginning in 2006, the investment allocated by the World Bank for the project was successfully used for the development of municipal infrastructures in eight targeted cities: Kurgan-Tyube, Kulyab, Danghara, Istaravshan, Rusht, Vose, Kanibadam and Vahdat. This included:
  1) Rehabilitation of infrastructures, renovation and replacing the properties of the local SUE 'MCS':
  2) Support to SUE 'MCS' and its local branches to improve the delivery of basic municipal services. The project aimed to increase the number of people with improved access to potable water by 146% in eight targeted towns. On average the water supply period increased by 20% during the day time, and water wastage decreased by 31%.

Additional funding of the World Bank's project for development of municipal infrastructure started in 2012 with a budget of US $11.85 million. The resources under the grant will be directed for increasing investment in water supply, sanitation and solid waste management. Special attention is given to strengthening institutional capacity aimed at the long-term improvement of quality of life.
As a result of the project, over 200,000 urban dwellers in Tajikistan, namely in Kurgan-Tube, Farkhor, Dangara, Kulob and Vose have improved access to clean water and high quality utility services.

The entire water supply and sanitation infrastructure is exhausted by above 70%, and this poses a serious threat to the quality of drinking water and consequently to the population. Water losses in drinking water supply systems on average makes up 50-60%.

Due to electricity shortages and other reasons, drinking water is supplied on schedule to the population mostly in the evening and morning. The water supply systems are in real need of rehabilitation.

In reality, the reform has not affected the drinking water supply and sanitation yet. So far, only the concept of reforming the housing and utility services has been approved. Accordingly, the technical conditions of the systems of water supply and sanitation are not satisfactory.

The priority objective the Millennium Development Goals in Tajikistan is to reduce the proportion of people without sustainable access to safe drinking water and sanitation by 2015. The goal is to increase the level of access to safe drinking water in urban areas by 97% and in rural areas by 74%, improve and bring access to sanitation to 50% of the population in urban area and to 65% of rural areas, taking into consideration the population's growth of about 2 million.

BOX 23. **MANAGEMENT OF WATER RESOURCES (GENDER)**

Women know the real value of the water. Women are the main suppliers, users and managers of water in the household. Water is required for agricultural purposes as well as household needs in rural areas. Since women work in equally conditions with men, they have equal rights, not only in terms of access to water but also for management of water resources.

Hazards in the context of climate change. The impact of climate change on water resources are shown by the following perspectives:

- Melting of glaciers supplies between 10-20% of water to the rivers annually, but in dry and hot years this figure reaches 70%[44].
- The largest glacier in country – Fedchenko located in Pamir mountains – According to monitoring information, the Glacier has decreased by about 44 square kilometers or 6 percent from 1966 to 2000. The Glaciers of the Murghab River Basin decreased by around 30-40% over the past few decades[45].
- Some glaciers, like Skogach and Garmo recede by 10 meters / year, and the glacier Zarafshan by 30 m/year[46].
- According to some forecasts, the availability of water in the Amudarya River (one of the main sources of water) could shrink by 40%[47].
- In the long-term, from 2030-2050 the total size of glaciations of the country may decrease by 15-20% and water reserves in the glaciers by 80-100 cubic km compared to the present.

Climate warming and higher temperatures are already causing a retreat of glaciers and a decrease of precipitation during the winter period, which is normally stored as snow. As a result, the hydrological regime is complicated. The water basins' level of water is established through melting of glaciers in the summer months; if there is a rise of inflow in the short-term, due to the melting of glaciers, the availability of water may became a serious problem in the long-term due to the reduction of water sources. The problem of access to potable and irrigation water for agricultural purposes will get worse. Furthermore, in areas which already have a shortage of water, the poor management of natural resources will increase the possible impact of climate change.

More sustainable water management methods are required over the next decade before the effects of global warming become more intense.

[44] World Bank, 2009, Adaptation to climate changes in Europe and Central Asia
[45] Second national Report, 2008
[46] Central Asia Country Initiatives in Land Management (CACILM). Updated national Framework Programme of Tajikistan, 2009
[47] Central Asia: The history of climate changes. UNDP, 2007

3.2. DISASTER RISKS

A natural phenomenon becomes a disaster only when it has a serious negative impact on the lives and livelihood of people, due to their vulnerability and inability to deal with it. At the same time, natural disasters increase vulnerability, exacerbating poverty and the risk level.

Currently there are more than 50,000 registered landslides areas, 1,200 of which pose a threat to settlements, roads, irrigation facilities and other infrastructure. A total of 142 settlements in 18 districts of Tajikistan (4 districts of the Sughd region, 11 in the Khatlon and 3 in the DRD) are in continuous flooding areas and 490 settlements undergo regular flooding during the irrigation period.

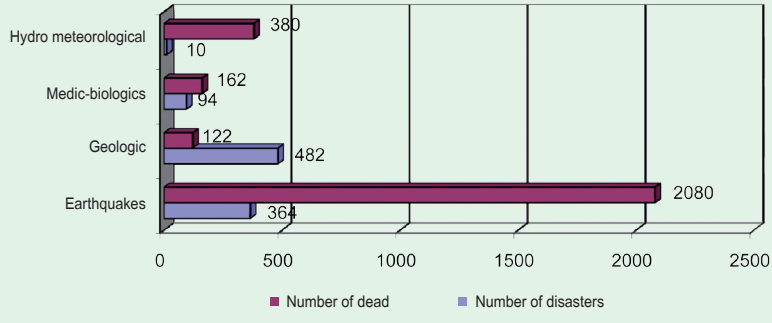
The average annual number of deaths due to natural disasters was three out of one million people for the period 2001-2010. At the same time, the average annual number affected by natural disasters made up 47,642 people out of one million.[48]

[48] Human Development Report 2011. Sustainable development and Equity: A better future for all, pg. 152

BOX 24. **FLOODS AND AVALANCHES, THE MOST FREQUENTLY OCCURRING NATURAL DISASTERS IN THE COUNTRY**

Debris Floods are one of the consequences of heavy rainfalls. They often occur in the foothills and mountain areas of Tajikistan at altitudes of above 2000 meters. In the high mountain areas, floods may occur due to the breakout of glacier lakes. Typically, debris floods are of short duration but cause great damage to settlements and the economy. The greatest numbers of destructive floods were observed in 1969, 1970, 1985, and 1988. During 1961-1990 there was an observed increase in the number of days with destructive mudflows by 50-60%. Powerful mud-floods occurred in 1993, 1998 and 2002, destroying many infrastructures (including the Rogun dam, roads and residences in Khatlon and Sughd regions) and causing huge economic damage.

Diagram 11.
Number of natural disasters and their casualties in the RT for 1997-2011 years



Avalanches are formed during suitable weather conditions mainly on slopes of 30-50°, which have snow coverage of above 30 centimeters. The number of days with avalanches of twice the average annual rate was observed in 1976, 1984 and 1987. An increase of the number of days with avalanches by 50-70% was reported for the period of 1961-1990. (see: Report on monitoring and early worning in Tajikistan, june 2012 - http://www.undp.tj/site/images/Drmp-monitoring)

BOX 25. **THE TYPES OF NATURAL DISASTERS**

The highest number of casualties is caused by natural mudflows due to the breakout of temporary lakes or because of intense rainfall, such as in the village Navdi, Rasht district (1998), Jirgatol district (1999), Dashtak village, Roshtqala district (2002), Vashan and Revad villages, Ayni district (2002), Asht district (village Oshoba, 2007) Khuroson district (Aini jamoat, 2009), Kulob, Shurabad and Muminabad districts in the Khatlon region (2010, 2012).

Tajikistan is threatened by frequent cases of the outbreak of glacial lakes, which occur when the water from melting glaciers floods its banks or breaks its natural dams.

The number of the floods may increase due to aggressive deforestation. The National forest reserves decreased from 1.3 cubic meters per capita in 1990 to 0.9 cubic meters per capita in 2003. The causes of deforestation are tree cutting, heavy grazing and an increased number of insect infestations.

The Committee of Emergency Situations and Civil Defense of the Republic of Tajikistan (CoES) is the agency responsible for the mitigation of risk from natural disasters and hazards. However, the legal framework of the Committee's activities does not correspond to the needs of adaptating to climate change. Though the committee has experience in climate hazards and risk management, as well as training facilities and staff, its potential to mitigate the effect of natural disasters - including its Human Resources - remains very low.

At the same time, there are ongoing activities aimed at establishing a National Platform for Disaster Risk Reduction. (A relevant resolution of the Government of Tajikistan was adopted, regulation has been developed and approved, and the composition of platform has been established: Chairperson - Deputy Prime Minister of the Republic of Tajikistan, Deputy Chairperson – Chairperson of CoES, members - all the deputies of ministers and head of committees).

It is very important to strengthen the institutional capacity of the system for natural resource management, by assessing planning and forecasting the effects of climatic factors.

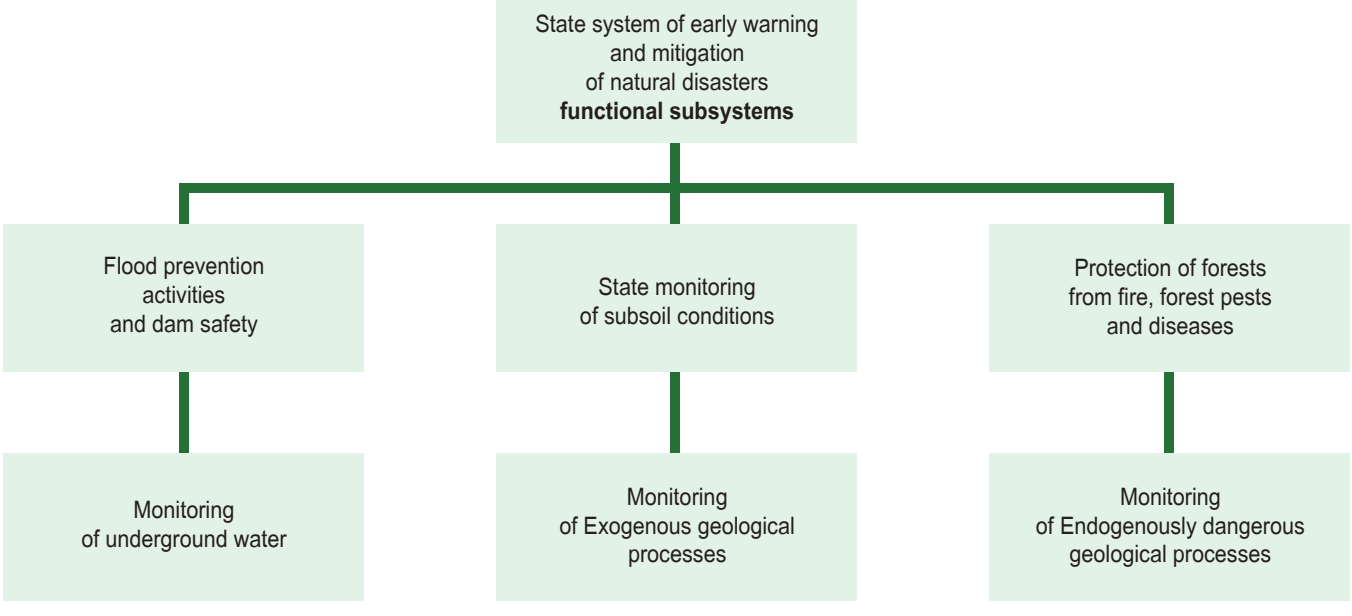
Apart from purely natural factors, human economic factors have an important role in increasing the risk of exposure. Typically 20 - 30% of slopes - are at risk of landslides in Tajikistan. Irrational use of mountain areas by communities, construction in dangerous and restricted areas without geological surveys and reports, road construction, building accommodation on slopes, the building of dams, reservoirs, canals, plowing of slopes, noncompliance of water-use techniques, and insufficient monitoring and planning of these processes lead to increasing disaster hazards. The situation is complicated due to fact that traditional places of settlement in mountainous areas in many cases coincide with areas prone to landslide hazards. Large numbers of people reside in these areas, not small individual farms.

Natural disasters threaten not only the lives of the population, but also their resources and livelihood. Failure to undertake agreed-upon timely mitigation measures to reduce the risks of natural disasters will cause significant social and economic costs. This includes the increased allocation of financial resources to pay for damages, a part of which could be spent on the development of the economy and poverty reduction.

Monitoring of natural resources plays an important role in emergency prediction, prevention and response. The country formed a state system of disaster prevention and emergency response management.

Reducing the vulnerability to natural disasters should be considered a key element of the country's sustainable development. For this purposes, it is important to use methods for the sustainable management of natural resources, including supporting scientific initiatives related to the increased risks of natural disasters due to climate change, and providing more training to the population on the prevention of natural disasters.

Illustration 2.
Institutional capacity for natural resource management



3.3. ENERGY POVERTY

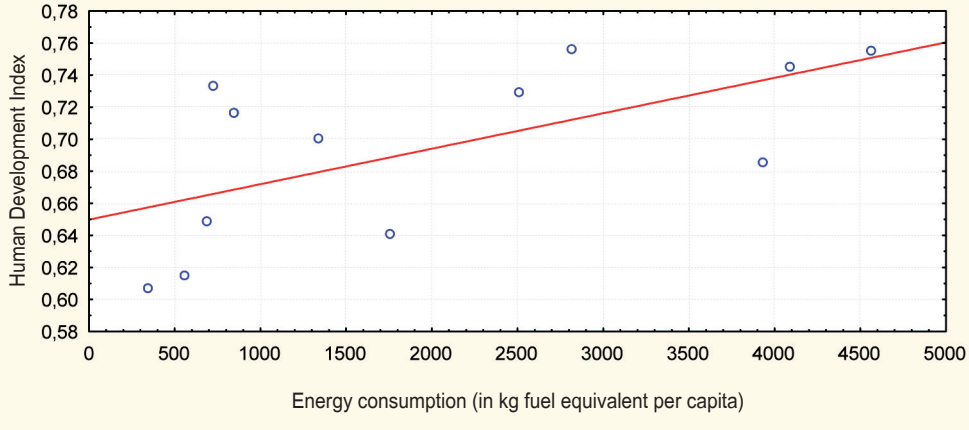
Energy is the most important and determinate element of poverty and development. Power insures that people meet their basic needs in cooking, lighting, use of household equipment, appropriate heating in buildings, the normal functioning of water and sanitation, accessibility of information and communication technologies (telephone, television, radio, e-mail, Internet) and to health, education and transport services. Additionally, energy stimulates production activities and promotes the development of all sectors of the economy. Access to energy services and improving their quality contribute to the safeguarding better living standards for the poor strata of population. Conversely, limited or no access to energy affects the rate of economic development and exacerbates poverty.

Better access to energy is a fundamental element in achieving the MDGs and will assist in:

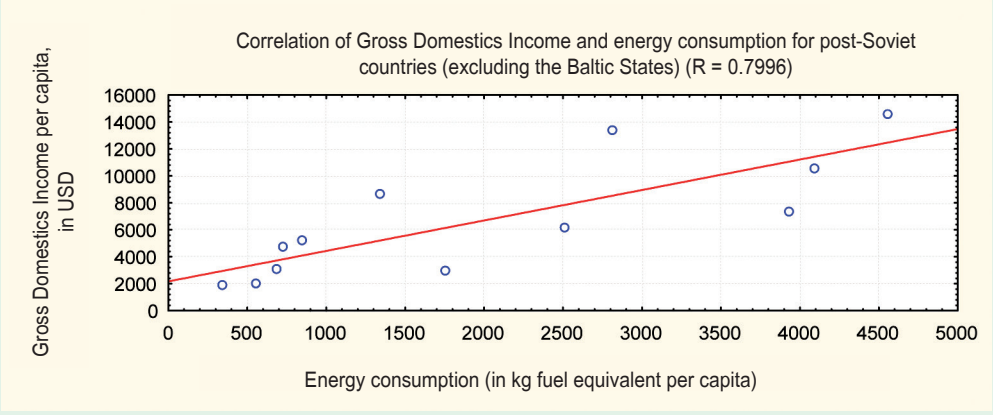
- improving the performance of the health sector. A lack of electricity also involves insufficient heating and increases vulnerability to diseases, especially among children. Furthermore, due to absent or unreliable energy sources, medical centers do not have the appropriate capacity to store vaccines, make use of medical equipment, and sanitize tools. Some centers are closed or only work a few hours per day. It is assumed that this causes a growing trend of home births, which can adversely affect maternal and child health;
- improving education quality. The supply of electricity for only several hours a day and a shortage of heating do not allow children to spend more time in school. Absenteeism in kindergartens and high schools is increasing, while teachers are not able to use modern technology such as computers, playback devices and laboratories;
- creating positive impacts on the lives of women and children. Women and children are main suppliers of household firewood and spend more time preparing heating, cooking meals and getting water and therefore have less time for other activities. Improved access will reduce the cutting of trees and shrubs for food preparation, slowing the decrease of forest cover, which may help to slow down the processes of desertification and promoting the relatively large absorption of carbon dioxide from the atmosphere. Saving the pristine cover of slopes halts the destruction of the soil and reduces the risk of landslides;
- providing opportunity for the stable functioning of enterprises of the real sector of economy, which could contribute to higher employment, provide income from income-generating opportunities and reduce the poverty level.

BOX 26. **CORRELATION OF HDI AND ENERGY**

There is a clear correlation between the energy strategies implemented by various countries and the management of social problems. According to research results, energy consumption has a direct impact on human development indicators. This correlation is confirmed by the estimation in the group of post-Soviet countries (excluding the Baltic States):



A relatively higher correlation is observed for income and consumption:



Estimations based: on Human Development Report 2011-Sustainable Development and Equity: A Better Future for All, pp. 127-129 and World Development Indicators.

Energy poverty, which is defined as «the absence of sufficient choice in accessing adequate, economically affordable, reliable, high-quality, safe and environmentally friendly energy services, necessary to support the development of economic and human capital development» is a growing threat to the Republic of Tajikistan.

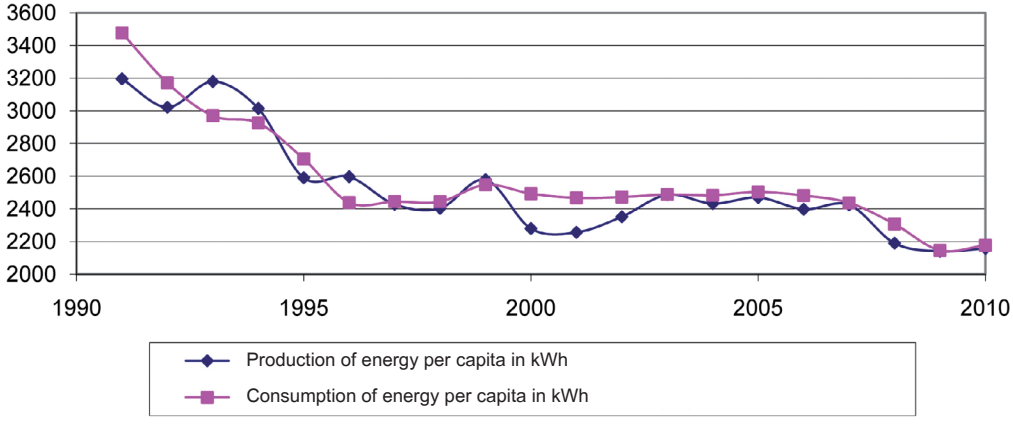
There have been changes in the production and consumption of energy over the past two decades in the Republic of Tajikistan. The country's specific energy intensity of GDP is higher than the world level.

Hydropower is the country's main resource (in terms of water energy reserves, Tajikistan is second largest among CIS countries after Russia). The development of this capacity is a major task.

The reason for the decline of share in energy consumption is due to the continued growth in the country's population without the introduction of new production capacity. But the situation has started changing; in 2009, operationed HPS Sangtuda-1 with a generation capacity of 2.7 billion kWh per year, and putting into service HPS Sangtuda-2 with a generation capacity of 0.9 billion kWh per year is planned for 2012).

There are still problems that impact on poverty, mainly associated with power shortages (about 3 - 4.5 billion kWh) in the winter period. As a consequence, there is a rigorous rationing of electricity supplied to consumers (especially in rural areas), which leads a shortage of water and heating, creating a vicious circle and preserving poverty.

Diagram 12.
Electricity production and consumption in Tajikistan



BOX 27. **POWER SUPPLY OF THE REPUBLIC OF TAJIKISTAN**

Electricity production and consumption in the Republic fluctuates and depends on the duration of periods of water shortage and polyhydramnios in rivers. Thus, electricity production depends on river tributaries to bring water to the reservoir and ensure the effective operation of the cascade hydropower station. In rural areas throughout Tajikistan (except for Gorno Badakhshan) households have electricity for only a few hours a day (supplied by the energy company «Barqi Tojik»). The electricity schedule leads to:

- a decline in the quality of social services and infrastructure;
- the depletion of required resources and relatively greater pressure on the environment (cutting of trees and shrubs for heating). This creates conditions for the development of the processes of desertification and the reduced capacity of the soil and biomass to absorb carbon dioxide from the atmosphere. At the same time, denudation of the slopes increases the risk of floods and soil erosion;
- shortage of drinking and irrigation water due to pumps not functioning.

The rationing of power supply to regions of the country interact with the natural - climatic conditions. Examples include:

- In 2008, during the unusual long and cold winter, the majority of rural areas were cut off from the electricity supply for almost two months. Electricity supply in Dushanbe was reduced to 14 hours per a day. Up to this year, the supply of electricity in rural areas was limited to 6 hours per day.
- In 2011, not only in the winter period but in spring, the electricity supply was also limited.

The hazards in the context of climate changes. Tajikistan has great hydropower potential, which is used only by 4-6%.

Hydropower generates 98% of the Tajikistan's electricity at present. Since hydropower sources in Tajikistan are in the river basins of the country and are fed by water melted from glacial and snow reserves, the sector is highly dependent on hydrology and highly vulnerable to climate change risks.

BOX 28. **THE EBRD PROJECT IN ENERGY SECTOR OF TAJIKISTAN**

EBRD assisted the Republic of Tajikistan in assessing the vulnerability of its hydropower to climate change. It made recommendations for adapting to climate change. To study this adaptation, a grant of PRCR equal to US$ 10 million was allocated. The EBRD is preparing to start the feasibility study of the project for the rehabilitation of Qairoqqum HPS from autumn 2012.

The results of this Phase will be considered during engineering analyses; based on them, the EBRD will prepare a rehabilitation programme, including components to adapt to climate change. Furthermore, the activities under Phase II will strengthen the capacity of the institutions that manage the hydropower facilities in the Republic of Tajikistan to improve disaster risk management. Household energy use and the level of vulnerability to the climate change will be assessed at the community level. Similar analyses will ensure that investments in sustainable energy infrastructure contribute to tackling climate change and energy poverty. The Bank intends to develop experience and create a methodology, through the implementation of advanced pilot activities, which could be provide to climatic-vulnerable countries with hydropower energy sources.

The utility sector is responsible for 10% of greenhouse gas emissions, due to the combustion of fuel in its facilities. Furthermore, it consumes about 40% of the heat and 25% of the electric energy consumed by the whole country. The trend in greenhouse gas emissions from the use of energy resources in the sector will be affected by two mutually antithetical elements: the increased energy needs of the population and service sector as well as the utilization of the enormous reserves of energy savings. The fuel and energy crisis in the country forces to take prompt action and develop long-term measures in economic and technical directions to improve the efficiency of fuel and energy resources in the sector.

The main directions and measures to eliminate the inefficient use of energy resources include:

- Increasing the thermal insulation properties of external walls of operating buildings;
- use of effective types of skylights fills through heat transfer (windows and doors made of plastic, triple glazing, etc.) during construction and rehabilitation;
- Introduction of means for regulating the flow of heat for buildings, depending on outdoor temperature and facade regulation;
- Development and implementation of cost-effective technologies for heat transport for construction and rehabilitation activities.

If the situation of the country's energy infrastructure does not improve, it will lead to a further increase of energy loss and reduction of energy services quality, at the same time as the problem of growth and life quality remains acute. Moreover, every year the demand for energy in housing and transport sectors is growing, which further exacerbates the need for a transition to sustainable energy use in the near future.

3.4. HUMAN POVERTY AND HEALTH IN TAJIKISTAN, CLIMATE CHANGE-INDUCED RISKS

Situation. The health system of the Republic of Tajikistan is key for achieving the Millennium Development Goals, since the sector's activities to improve public health ensure sustainable economic development and development of the country's human resources.

BOX 29. **INTERNATIONAL ASSESSMENT OF TAJIKISTAN'S PUBLIC HEALTH**

The Republic of Tajikistan is in 84th place among 145 countries with a population of above one million in 2012. The index of the health risks is 5.22 points: this is the result of a new ranking of countries on the health of their citizens. Reviewing the situation in former Soviet republics, the conditions are worse in Uzbekistan (85th), Azerbaijan (87th place), Belarus (91 place), Russia (97th place), Ukraine (99t place), Kyrgyzstan (101 place), Turkmenistan (104 place) and Kazakhstan (111 place).

Experts used data from three different sources - the World Health Organization, the United Nations and the World Bank. As a result, there were two main indicators analyzed for every country: the Aggregate Health Index and Health Risk Index.

Source: Bloomberg - The World's Healthiest Countries 2012

The maternal, infant and child mortality rates are the most sensitive indicators of the assessment, as measures of the quality of health services and socio-economic development level of the country. There were 86 maternal mortality cases for 100,000 live births in Tajikistan, during 2010. Almost 80% of maternal deaths were recorded in rural areas. However, one of the key problems is the unsatisfactory status of the medical statistics.

In accordance with the objectives of the MDGs for the Republic of Tajikistan, the expected level of maternal mortality in 2015 should be at the level of 30 deaths per 100,000 live births. If the WHO data is considered as a baseline level, it is necessary to reduce this indicator by at least three times.

Depending on sources, the data vary for infant and child mortality rates. The differences for the indicators of infant and child mortality rates make up almost four times. The relatively high levels of infant and child mortality are observed in rural areas. Success in reducing the infant and child mortality rates is associated with the gradual improvement of health facilities and expanding the immunization coverage. However, the problem remains very acute and requires a complex response.

BOX 30. **THE POTENTIAL IMPACT OF CLIMATE CHANGE ON MORBIDITY IN THE REPUBLIC OF TAJIKISTAN**

According to IPCC projections and a number of international research projects, it is expected that global warming will change the habitat of a number of infectious diseases, which will lead to their increase in some countries and regions, including Tajikistan. This is because countries with the worst social and economic situation, including Tajikistan, will suffer from climate-related diseases first. Points to consider include:

- the increase in the morbidity of intestinal infections, caused by an increase in the number and intensity of extreme weather conditions and average water and air temperature. This will help to maintain and in some cases multiply pathogens in the environment. For example, cholera is linked with the climate and weather conditions. The increase of temperatures and water pollution promotes the growth of phyto- and zooplankton, which is favorable for the long-term survival of vibrio.
- the outbreak of disease is a complex process, and a certain combination of natural factors (air temperature, precipitation, the distribution of seasons) is required for a number of years.

The number of deaths in the country (per one million people) due to pollution include: water pollution – 751; indoor air pollution, 516; outdoor air pollution - 47[49].

[49] Human Development Report 2011. Sustainable development and Equity: A better future for all, pg. 152

BOX 31. **BTHE IMPACT OF CLIMATE CHANGE ON HUMAN HEALTH IS DIVERSE**

- It occurs as a direct effect of an increased number of days with abnormally high and/or low temperatures, the number of floods and indirectly, due to mediated influence of environmental or socio-economic factors (increasing the size of dry lands, reducing the amount of safe drinking water, etc.).

Diagram 13.
Annual average temperature and infant mortality (for 1000 live birth) in Dushanbe city

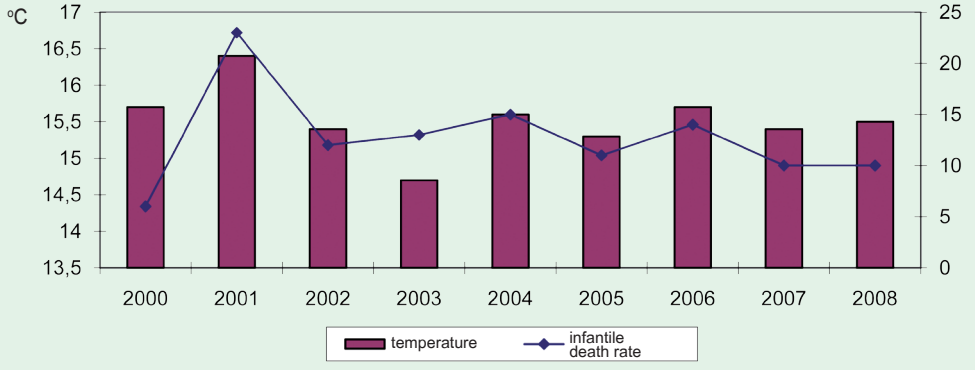
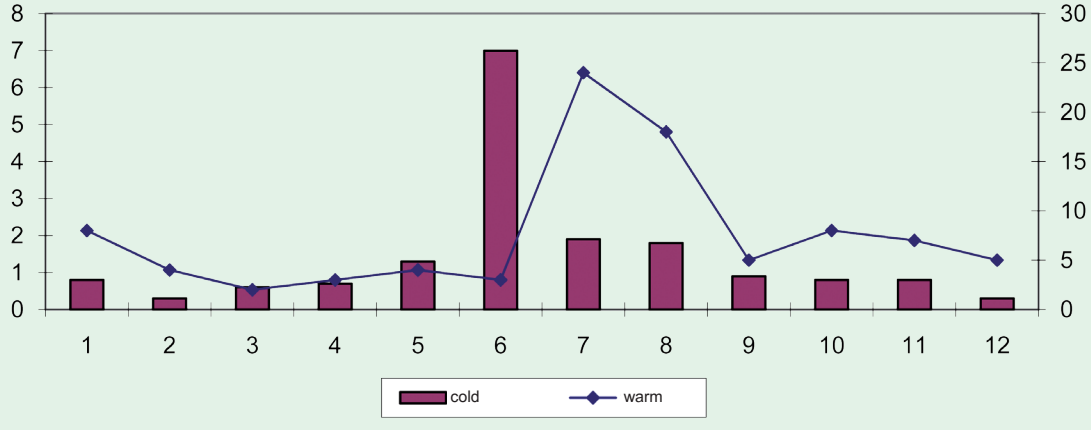
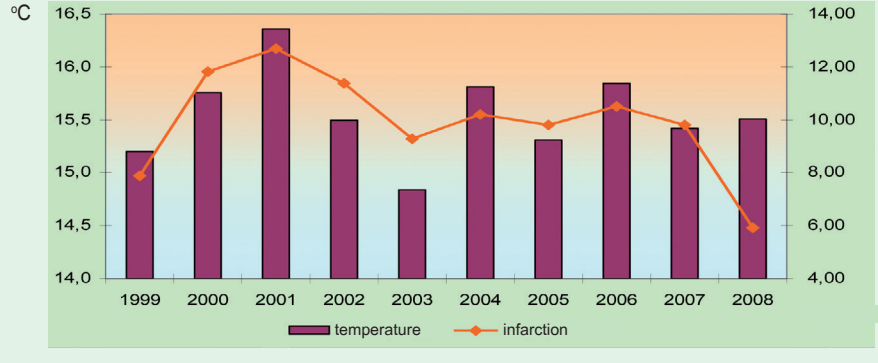


Diagram 14.
The incidence of typhoid in Dushanbe in cold and hot years (2001-2012 and 2007-2008)



- Mortality increases in the days following dust storms - «Afghan weather» - particularly due to cardiovascular and respiratory diseases. The south of the country has the highest number of days with dust storms: an average of 14 days per year. From 1961-1990, the decreasing the number of days with dust storm decreased by 1.5-2 times. However, in the late 1990s, the number of days with dust storms increased.

Diagram 15.
Proportion of myocardial infarction and annual average temperature in Dushanbe city



Climate change is accompanied by an increase in the number of days with extreme high temperature. Stable long hot weather causes an increase in mortality and morbidity due to cardiovascular diseases.

- The most clear and visible effect of climate change is the emission of thermal radiation.
- Another type of effect of abnormal weather conditions is the 'cold wave', clearly proved by the weather temperature in January-February 2008, when the whole country felt extremely cold temperatures for 26 days. The cold wave's effects were observed not only in elderly people but also in children.
- *Climate warming as a risk factor for drinking water quality.* Pathogens are found in drinking water in many regions of the country. Particularly, populations with low per capita income suffer greatly due to a shortage of high-quality water.

The population of the Republic of Tajikistan will gradually age in the next 20-30 years, and global warming could have a negative impact on the growing number of elderly people.

The Earth's ozone layer retards the flow of extreme ultraviolet radiation with wavelengths less than 320 nm, which causes skin cancer, melanoma and cataracts. Climate change leads to a decrease in the layer's thickness, and the number of primary detected cases of skin melanoma has increased by five times in the country over the past 20 years.

3.5. POVERTY AND ACCESS TO EDUCATION IN TAJIKISTAN, CLIMATE CHANGE-INDUCED RISKS

Tajikistan is likely to achieve two out of eight Millennium Development Goals: universal primary education and reducing gender disparities in primary and secondary education. However, challenges remain: incomplete enrollment, especially in the higher grades; shortage of schools and teachers, especially in remote rural areas; the poor quality of education, including the program contents; the quality of textbooks and a shortage of qualified teachers.

BOX 32. **SOME INTERNATIONAL TRENDS IN EDUCATION SPHERE**

European and the North American countries are increasingly expressing concern regarding the deterioration of the education situation and the education crisis. The current global economic crisis had contributed to fact that many countries have persistently raised the need to pay urgent attention to education, including Britain, France, Germany and the United States.

In a study related to the interrelationship between ongoing reforms in the education sector and the growth of GDP, it was stressed that countries such as India, China, Thailand, Spain and South Africa have made great success in education reform and within the next 15 years will be growth centers. Therefore reforms in the education sector will not give immediate results but in 10-15 years.

Source: Deutsche Bank – "The Global Growth Centers", 2005

Accessibility and quality of education depends on energy supply to educational institutions. A stable power supply is an acute problem in rural areas of the country. However, actions have been undertaken to reduce its severity:

- advanced procurement of fuel for heating, maintenance of the heating system, the purchase of generators to supply power to schools with the support of local executive authorities;
- Changing the vacation time within the school year, thereby increasing the duration of winter vacation (for the most part after the first quarter).

BOX 33. **EXAMPLE OF ENERGY EFFICIENCY ACTIVITIES AND THE USE OF RENEWABLE SOURCES IN THE BUILDING**

The country already has a good example of energy-efficient construction practices and the use of renewable energy sources. The Federal Ministry for Economic Cooperation and Development (BMZ), in partnership with the National Social - Investment Fund of Tajikistan (NSIFT) supported the construction of new schools by using renewable energy sources and to ensure energy efficiency in rural areas in Khatlon region. This is important, as the provision of traditional fuels (wood, charcoal and animal dung) is often poor, and efforts are required to create systems that reduce CO_2 emissions. Southern Tajikistan has favorable conditions for the

use of solar energy: winter temperatures are usually below 0 degrees Celsius, the lowest corner of the solstice at noon is 25 degrees and sunshine duration lasts for about 10 – hours/day. Thermal solar facilities are prepared and designed specifically for every school. This experience will provide examples for similar systems elsewhere, which is particularly important for the education and health sectors of the country.

Source: GIZ Regional office for Central Asia: Tajikistan

Considering the willingness of Tajikistan to industrialize and increase the competitiveness of the economy, it is necessary to improve the quality of the labor force with a more precise linkage with the labor market. The education system should respond flexibly to the needs of the country, as well as being integrated into world educational systems. Poverty reduction depends primarily on the solution of problems of employment and unemployment. Accordingly, access to quality education will help to increase the number of qualified professionals.

BOX 34. **THE PROGRAMME FRAMEWORK IN SPHERE OF VOCATIONAL EDUCATION AND TRAINING**

The Government of the Republic of Tajikistan pays attention to the development of vocational education and training. This is reflected in key policy documents - the National Development Strategy of the Republic of Tajikistan for the period up to 2015, the Poverty Reduction Strategy, the National Action Plan for the reform of initial vocational education and training.

At the same time, the program to support reforms of vocational education and training was developed and is implemented in Republic of Tajikistan. This program is active from 2008 - 2014. The program supports partners in Tajikistan (Ministry of Economic Development and Trade, the Ministry of Education and the Ministry of Labor and Social Protection, including some of their subordinate institutions) for this period. The program has four main objectives:

- developing of a legislative and institutional framework conditions for initial vocational education as well as for professional training for adults
- improving the quality of services at the national and regional labor markets, and access to them;
- compliance of the professional education to the demands and contributing to employment and self-employment;
- Provision of equal opportunity to men and women

The program supports the partners in research and analysis of information on the labor market and its needs in service sphere.

Implementation of issues related to the impacts of climate change in the professional education process, the analysis of structural changes in the labor market (and considering the factor assessment of climate-related structural changes) will help to strengthen the adaptive capacity.

Environmental education is integrated into the general education system and is one of its main activities: according to State educational standards, environmental issues, including climate and climate change are used to attract students to research ecology. However, the public education system has not fully implemented the concept of environmental education or highlighted global issues. The preparation of specialists for environment science is carried out unsystematically and there is no system of continuous professional training. The implementation of education for sustainable development and the use of multimedia educational resources like 'GreenPack' is proceeding very slowly.

BOX 35. **WHAT IS GREEN PACK?**

This is a set of educational materials by the Regional Environmental Center for Central and Eastern Europe on environmental protection and sustainable development. It is a universal educational resource for teachers and students (11-15 years age) and is useful for students and for improving the general capacity of a broad audience. Innovative educational technologies and multimedia applications make this resource popular in many countries of Europe and the CIS.

Green Pack is used in 18 countries by more than 20,000 teachers and two million students

In 2010, the Green Pack was adapted for the Central Asian countries by Regional Environmental Centre for Central Asia

Kazakhstan Ministry of Education and Science has accepted this resource and recommended it for use in the country's secondary education system in 2011

Web-page: http://www.rec.org/REC/Programs/Greenpack/

3.6. STRATEGIES FOR SOCIAL SECTOR ADAPTATION TO CLIMATE CHANGE

Climatic changes and their impact are characterized by a complex interaction of environmental, economic, political, social and technological processes.

The decision made by the Government to adapt to and mitigate climate change under conditions of remarkable uncertainty should be implemented. Climate change can affect the area of interest (and responsibility) of almost any department of the country, including the ministries in charge of the social sector of the economy.

The table lists some examples of incomplete climate-related problems, which need further elaboration to integrate the efforts of various agencies.

BOX 36. **TTAJIKISTAN IN THE CONTEXT OF CLIMATE CHANGE:**

The recent past and the present situation – there has been:

- a significant increase in temperature (~ 0.5 ° C);
- shrinking of seasonal snow cover and many glaciers
- a slight increase of heavy precipitation events
- the occurrence of serious long-term droughts downstream
- an increase in the number of strong spring floods and mudflows in the upper and middle parts of the river valleys.

The future:

- the average temperature is likely to rise by 1-3 °C by 2050, and extreme temperatures may increase even more
- the annual precipitation level is likely to increase
- the snowfall season will probably shorten but snowfall will increase
- the intensity of the daily amount of heavy precipitation is likely to increase
- evaporation will increase due to the increase in air temperature.

Source: Richard Jones. Adaptation to climate change in the basin of the Pyanj river, 2012

Table 13.
Examples of possible climate-related powers under the responsibility of the ministries of the Republic

Ministry	Examples of ministerial responsibilities related to climate change
State Hydrometeorology Agency of the Republic of Tajikistan	• Organizing research related to climate and impact of its changes globally and in the country, organizing monitoring of climate and GHG in the Republic of Tajikistan. • Preparation of national assessment reports on climate impacts to the territory of the country. • organizing inter-ministerial coordination in the area of climate
Ministry of Economic Development and Trade of the Republic of Tajikistan	• Economic justification of political and economic decisions related to climate change: for example, factor assessment of economic risks, forecasts of the country's economic development, sectors considering the impact of climate change; • Strategies for sustainable development of the regions, the impact of climate change on the regional economy.
Ministry of Energy and Industry of the Republic of Tajikistan	• The problems of energy saving, monitoring of GHG emissions (FEC provides 80% of GHG emissions)
Ministry of Agriculture of the Republic of Tajikistan	• Changes in the yield of different crops in the new climatic conditions. • Changes in land suitability for use in agriculture. • New infectious diseases and parasites. Displacement of some species by others
Migration service of the Republic of Tajikistan	• Analysis of migration flows, linked to climate changes and relevant impacts on the economy, social services, public health in different regions of the country
Committee of Emergency Situation and Civil Defense under the Government of the Republic of Tajikistan	• climate change due to changes in the nature, frequency and scope of natural disasters
Ministry of Health of the Republic of Tajikistan	• Climate-related threats to health and employment
Ministry of Education of the Republic of Tajikistan	• The preparation of qualified research staff for the purpose of country's sustainable development
Committee of environmental protection under the Government of the Republic of Tajikistan	• Climate effects on the natural resources of the country: aggravation of drinking water shortage in some regions of the country, displacement of some species by others, the occurrence of new type of tree diseases.
Ministry of Finance of the Republic of Tajikistan	• Funding the priority scientific research in the field of climate change.

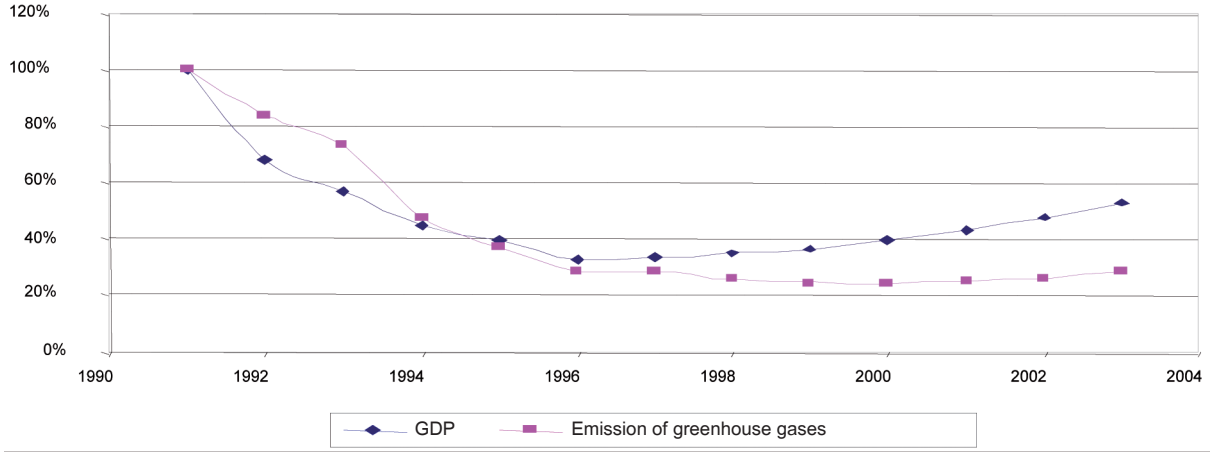
Future dynamics of greenhouse gas emissions in the country will depend significantly on the country's economic development, structural transformations, industrial policy, measures to regulate the energy sector, taxation, innovation and investment policy, environmental regulation and other factors. The most important factor, which determines the dynamics of GHG emissions in the country, is the *growth of the gross domestic product (GDP, changes in the sectoral structure of the industry)*. Assessment of the dynamics of economic development and the reduction of greenhouse gas emissions in 1991-2003 is depicted in below diagram 16.

While GDP decreased, the share of the energy sector increased to 13%. The population's level of energy consumption is worse compared to the period before the 1990s. The use of energy-efficient technologies can reduce the current level of energy utilization in the country. About a third of these saving potentials are in the domestic sector.

The most effective adaptation, protection and mitigating measures to the impact of climate change and its effects should be regulated by state decisions. Given the long-term nature of these measures and their magnitude and depth of impact on many sensitive aspects of society, business and government, their planning, organization and execution should be carried out within the framework of Country's State policy on climate change.

To establish and implement the country's sound climate policy, it is important to learn from the relevant experience of foreign countries, to assess the contradictions that arose between individual countries or groups of countries on climate change issues, to follow closely the changes in the official positions of different countries and be ready to respond quickly to such changes by adjusting domestic positions.

Diagram 16.
The GDP growth and emissions of greenhouse gases considering the absorption (CO_2 equivalent), 1991 = 100%



CHAPTER 4

Regions and climate change

4.1. DYNAMICS OF CHANGES TO THE HUMAN DEVELOPMENT INDEX IN THE REGIONS OF THE RT

Unfortunately, the impact of climate change on the Human Development Index (HDI) and its constituent components in the Republic of Tajikistan is given little consideration. By rejecting it focus on mitigation and adaptation, the HDI's growth can be expected to slow or even decline in selected regions of the country. This will come at the expense of people's health and a reduction in average life expectancy. It is important to understand that the adaptation of the population to climate change will be effective only if it takes into account the specificity of regions of the Republic of Tajikistan.

National Reports of human development indices for the regions of the Republic of Tajikistan were calculated from 2008 onwards. However, these calculations have only been possible on the basis of traditional methods of calculation. Regional calculations through improved methods are not possible, due to the lack of sufficient statistical reports.

In order to ensure the comparability of the index at national regional and district levels, the traditional method of index calculation is applied in the current Report with the introduction of additional parameters.

These parameters are related to: the adjustment of the gross regional product (GRP), or the income index for each region of the country; subvention payments, which are allocated to regional budgets from the center; the recalculation of index income that is not part of purchasing power parity (PPP) for the current year (at district level the PPP is not possible to calculate); and the exchange rate.

The index of education and literacy rates are estimated according to the census or survey of living standards in recent years. The coverage rate is calculated as the ratio of the number of students in all types of educational institutions (schools, primary, secondary and higher education) of population members aged 7-24 years (detailed methodology of calculation of HDI at the regions of the Republic of Tajikistan was presented in the NHDR 2008-2009 "Tajikistan: employment in the context of Human Development").

Regional HDI calculations can separate the factors that contribute to positive regional dynamics. Calculation were made at the level of five administrative territorial units: Dushanbe (the capital), two areas (Sughd and Khatlon), Gorno-Badakhshan Autonomous Region, and the group of cities and RRS. The calculations showed that in 2011, Dushanbe continued to maintain a leading position with an HDI index value of - 0.706.

As the calculations showed, HDI in Badakhshan and RRS have declined in recent years, a fact to be alerted to, especially with further effects ofclimate change. Life expectancy varies from 71.6 years in Badakhshan to 74.3 years in Dushanbe. The adult literacy rate is also high in all regions, with only a small gap in values. Three regions, Dushanbe, Sughd and GBAO have high indicators of coverage in primary, secondary and higher education. In contrast, RRS and Khatlon regions have the lowest education indicators.

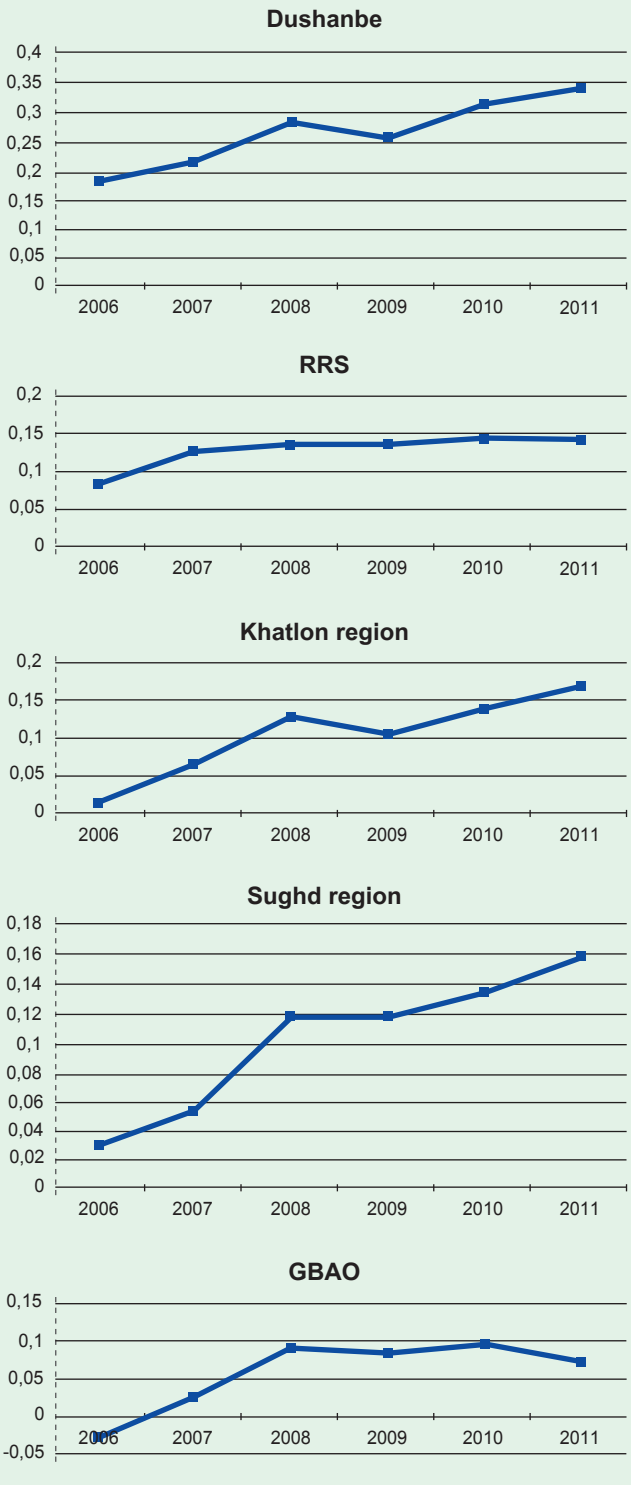
The Republic of Tajikistan's regions' HDI correlated closely with economic growth, while the most differentiated component is the gross regional product per capita.

The diagrams show a significant lag in Tajikistan's regions from the capital Dushanbe, which is supposed to use interbudgetary allocation to implement adaptation policies.

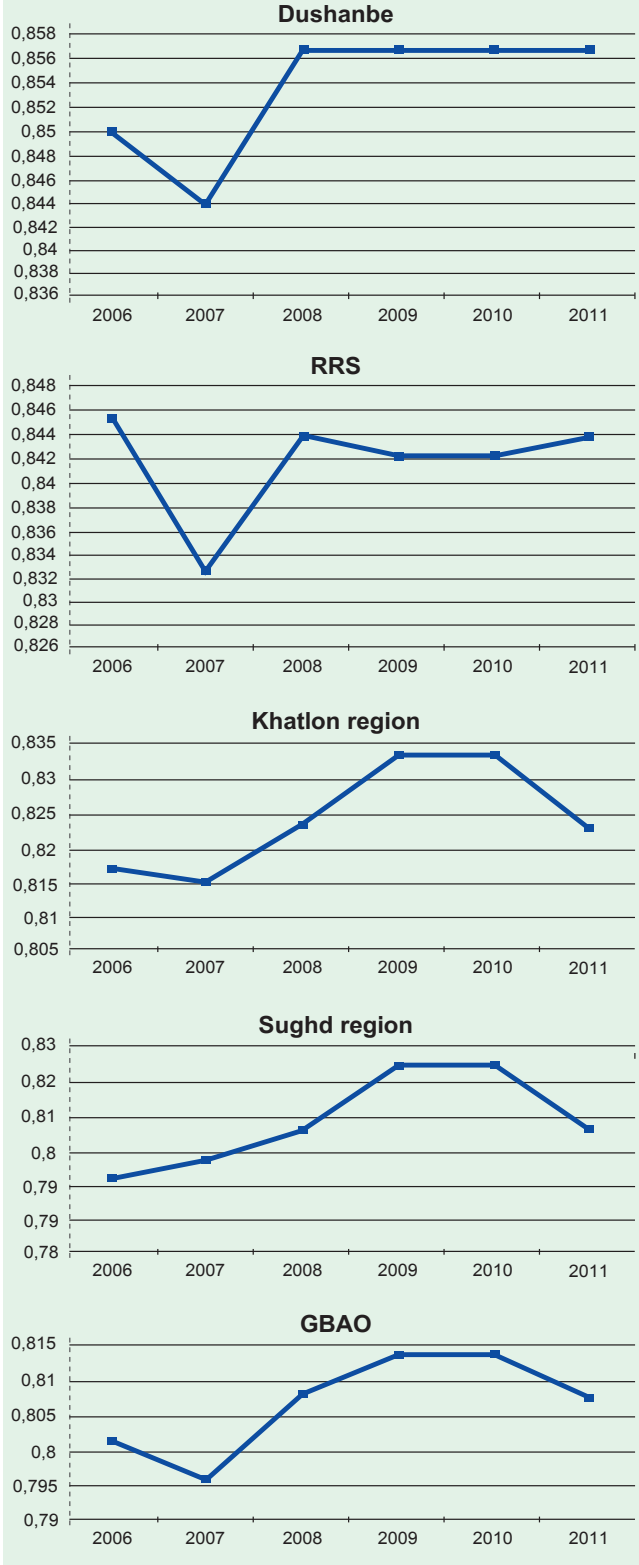
HDI analysis shows that the main emphasis for creating social and economic development at the regional level should be on education and research, improving the quality of life and reducing inequalities.

The impact of climate change on the livelihood of the population in the region depends on the variability of agricultural production and the specificity of human development. This impact also depends on households' production and consumption patterns, access to resources, poverty and the ability to cope with the latter. The Global Report 2011 showed that, taken with biophysical consequences for crops, the impact of climate change on irrigated and rain-fed land in 2050 years will probably be negative.

BOX 37. **SETTING OF THE REGIONAL HDI – INCOME INDEX**



BOX 38. **PARAMETER OF THE REGIONAL HDI – LIFE EXPECTANCY INDEX BY REGIONS OF THE REPUBLIC OF TAJIKISTAN***



* Demographic Annual report of the Republic of Tajikistan. 2011. P.102-104

BOX 39. **PARAMETER OF THE REGIONAL HDI – EDUCATION INDEX (2007)**

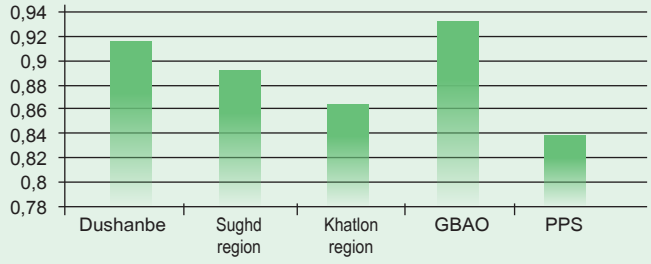


Table 14.
HDI in sectional of aggregated territorial - administrative entities of the Republic of Tajikistan (by traditional method of calculation)

	2006	2007	2008	2009	2010*	2011*
Dushanbe	0,654	0,662	0,688	0,678	0,698	0,706
Sughd region	0,573	0,584	0,607	0,614	0,618	0,621
Khatlon region	0,565	0,583	0,608	0,603	0,613	0,620
GBAO	0,572	0,586	0,612	0,613	0,616	0,607
RRS	0,590	0,600	0,609	0,608	0,609	0,609

* Life expectancy during 2009 year

Diagramme 17
HDI of the regions of the Republic of Tajikistan

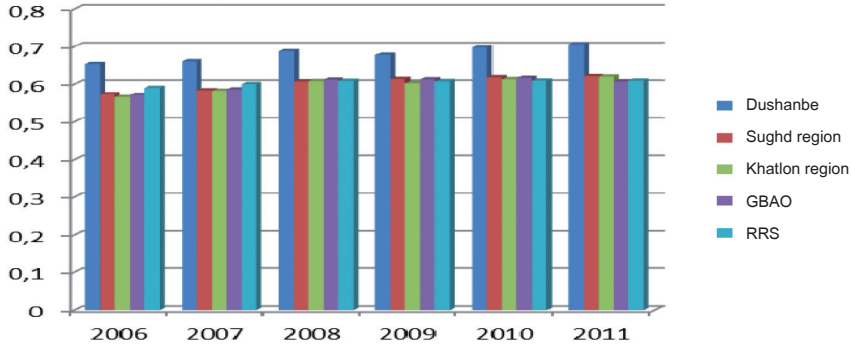
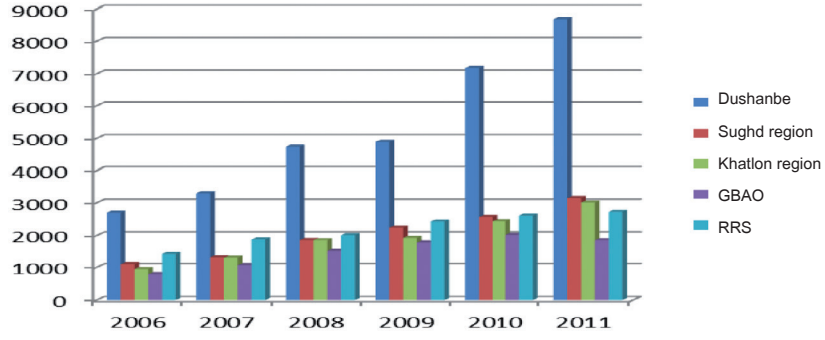


Table 15.
The dynamics of gross regional product per capita in the regions of Tajikistan (in TJS)

	2006	2007	2008	2009	2010	2011
Dushanbe	2691,325	3300,721	4740,362	4888,968	7184,254	8690,259
Sughd region	1097,247	1319,95	1859,663	2250,248	2555,297	3148,735
Sughd regions	946,5468	1305,018	1856,035	1928,265	2426,495	3007,059
GBAO	784,9038	1065,789	1523,962	1782,865	2019,417	1855,825
RRS	1425,565	1878,42	2013,852	2415,47	2602,729	2717,395

Diagramma 18.
Gross regional product per capita in the regions of Tajikistan (in Somoni)



4.2. TERRITORY AS IMPACT 'POINTS' OF CLIMATE CHANGE

The effects of climate change on populations living in urban and rural areas of the country include:

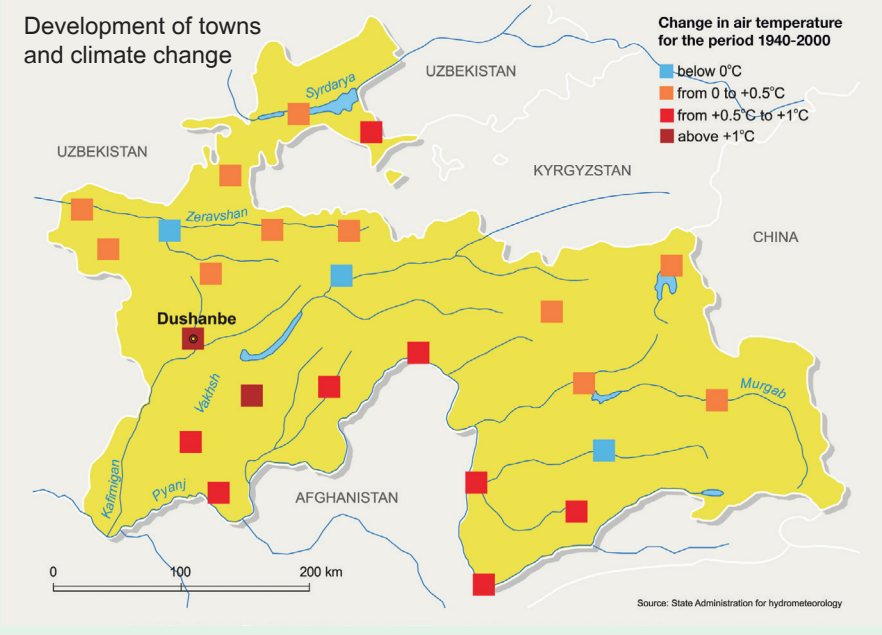
- Air temperature increase;
- Increasing the number of days when the maximum temperature reaches 40°C or more;
- Extreme temperature changes, alternating drought and unusually cold winters with abnormally heavy snowfall.

However, it is not possible to draw accurate conclusions on the scale of regional emissions, as there are no such national estimates.

BOX 40. **INCREASE IN AIR TEMPERATURE IN THE REGIONAL SECTION**

The largest increased annual average temperatures over the last 65 years were observed in Dangara - 1.2 degrees and Dushanbe - 1.0 degree Celsius. In high mountainous areas, observed in Khovaling, Faizabad and Ishkashim regions, the temperature increased 1.0 - 1.2 degrees.

Illustration 3.
Map of increasing average annual air temperatures for 50 years in the Republic of Tajikistan



Source: The Second National Communication Tajikistan under the UNFCCC (2008)

There is no sustainable development without sustainable cities. Progress in achieving the Millennium Development Goals largely depends on cities. In many respects, local settlements define the conditions and prospects for economic development. At present, the structure of the cities of national and regional subordination differs:

- big city (with population more than 250 thousand people) - Dushanbe;
- large city (with a population of 100-250 thousand people) - Khujand;
- middle cities (with a population from 20 to 100 thousand inhabitants) - Vahdat, Isfara, Istarafshan, Kayrakkum, Kanibadam, Kulob, Kurgan-Tube, Nurek, Panjakent Tursunzade, Khorog, Chkalovsk;
- small towns with a population of less than 20,000 people – Roghun, Sarband and Taboshar.

For the period of 1991 – 2010, only one city increased the concentration of its urban population: Dushanbe (Table 4.1). More than 70% of domestic cities are average-sized, comprising a third of the total urban population of the Republic.

Cities are greatly influenced by climate change. The major emitters of greenhouse gases in cities are in the HCS (housing and communal services) sectors, comprising manufacturing and transportation. During its life cycle, buildings consume up to 40% of energy resources and emit 30% of greenhouses gases.

'Heat islands' are usually in the center of a city due to high office buildings, asphalted territory, and a small number of open land, green space and water surfaces. They create an unfavorable environment for employees of many government agencies, banks and other offices located in city centers, if these buildings are not equipped with air conditioners.

Climate change in cities combines with atmospheric air pollution to unfavorably influence population health.

BOX 41. **«GREEN» ROOFS** are becoming more and more popular in cities. By covering building, they can help to fight global warming. Green roofs are multifunctional. For example, they reduce the costs of heating and air conditioning and preserve storm water. Researchers know that green roofs also absorb carbon dioxide, the main greenhouse gas that fosters global warming. They discovered that green roofing an urban area with about one million inhabitants would neutralize more than 55 000 tonnes of carbon. This creates a «similar reduction [to taking] over 10,000 mid-sized off-road vehicles or trucks off the road during one year».

From «Environmental Science & Technology».

Despite the limits that the real economy places on reducing greenhouse gas emissions, the city authorities nevertheless should solve the many challenges they are facing, such as land planning, house construction, waste recycling and improving transportation.

Rural areas and climate change. A significant proportion of the population lives in rural areas. According to the 2010 census, the rural population was 5557.9 thousand people or 73.5% of all residents. 72.3% of the working age population, an absolute majority, live in rural areas. But, in these regions saved a higher demographic burden - specific weight of able-bodied citizens is lower than in urban areas (58.7% against 59.75% in cities). City residents work mainly on non-agricultural enterprises like industry, services, management, etc., but in rural settlements the population is predominantly employed in agricultural activities. In this case, food security is most acute in the Rasht group of districts and Gorno-Badakhshan Autonomous Region.

According to official data, about 70% of the predicted damage from adverse weather and climate conditions will affect agriculture.

Table 16.
The distribution of cities of Republican and regional subordination by number of inhabitants*

	Number of cities	Number of inhabitants		
		1991	2001	2010
Total cities of Republican and regional subordination:	17	100,0	100,0	100,0
- small towns (up to 20 thousand people)	3	3,5	2,5	2,8
- middle cities (from 20 up to 100 thousand people)	12	38,8	39,8	37,8
- large cities (from 100 up to 250 thousand people)	1	12,7	11,6	10,8
- metropolis (up to 250 thousand people)	1	45,0	46,1	48,6

**Culculated on:* *Regions of the Republic of Tajikistan. Stat. Sat - Dushanbe, 2001. pp.14-15; Regions of the Republic of Tajikistan. Stat. Sat - Dushanbe, 2011. pp.16-17*

BOX 42. Example of the influence of climate on the living conditions of the rural population of the Republic. Due to the drought in 2008, the wheat yield has fallen by 30-40%. Since many farmers have not received their planned harvest, they had to sell their cattle *(Oxfam, 2010)*.

The growth of desertification from increasing temperatures will be aggravated the growth of land degradation, due to water erosion caused by an increased number of irrigations (Annex 4.1.) Tree-cutting and pasture-reduction is the main cause of desertification in the country.

In the 1990s, Tajikistan had 15% forest cover, but only 2.9% by 2008. This increased desertification and the risk of natural disasters. This case is more complicated in Pamir, where teresken shrubs are barriers to dust storms. However, the population is destroying these plants on an industrial scale.

BOX 43. **GENDER ASPECTS OF VULNERABILITY**

- Women head nearly half of households suffering from a heavy burden of food insecurity, and a third of households are suffering from moderate food insecurity. These families represent about 20% of total households in the country and have a high level of poverty «(SPUIK?, Tajikistan, 2010).
- In the countryside, many food producers are women, while men are more likely to migrate to search for work. In this regard, initiatives to help farmers master new methods should be planned in such a way that reflects the requirements of women. This conclusion was confirmed by an analysis of the inventory: women are an essential segment of climatically-vulnerable branches of agriculture *(Oxfam, from the results of research in 2010)*.

In general, living conditions in rural settlements remain much less comfortable than in cities. The gap in living conditions between urban and rural areas existed even in the Soviet period. However, in subsequent years, the situation has worsened. Presently, rural settlements are significantly inferior to cities judging by a number of indicators, including the level of amenities, housing stock, the development of transport infrastructure, the quality of education, healthcare and consumer services.

BOX 44. **EXAMPLES OF DIFFERENCES BETWEEN URBAN AND RURAL AREAS IN LIVING CONDITIONS AND SOCIAL DEVELOPMENT:**

- Surveying the economically active segment of the population aged between 15 to 75, the number who have a specialty in urban areas: 38.3 persons out of 100. In rural areas, this figure is two times less: 17.5 people. In the city, there were 19.8 people out of 100 with higher or incomplete higher education, and about 9.1 in the villages. *(Labour market situation in the Republic of Tajikistan from the results of the Labour Force Survey for the period of June - July 2009, page)*
- There are relatively higher levels of infant mortality in the countryside: the infant mortality rate, calculated by the method of Brass, amounted to 54 of every 1000 live births in the village, and 41 in the city. This indicates the relatively low access to rural health facilities *(Surveys of infant, child and maternal mortality in the Republic of Tajikistan in 2010, page 106)*.
- The size of housing provision in rural areas is also lower than in the city. In the latter, at the beginning of 2009, it was on average about 13.5 m2/people, while in rural areas it was on average about 6.7 m2/people. Also, the quality of housing in urban and rural areas is not comparable.
- There remain essential differences in the quality of the water used by urban and rural communities for household water use. Only 38% of rural residents have access to centralized sources of drinking water. Only 0.7% of the rural population has access to centralized sewage, whereas in urban areas, sewer systems cover 30% of the population. There are also significant differences between urban and rural areas in the sanitary cleaning, removal and disinfection of municipal solid and liquid waste.
- Rural inhabitants have limited access to a sustained electricity supply, due to the persistent practice of limiting energy consumption.
- for the periods of 1999, 2003 and 2007, all surveys of poverty levels showed higher rates of poverty in rural than in urban areas.

As a consequence, rural regions are more vulnerable to the consequences of climate change.

Rural areas should become the object of economic activity with the goal of a real reduction in poverty and inequality. This would involve the creation of a more developed industrial and social infrastructure adapted to climate change.

Due to the continuing high burden on nature, action is required to create new jobs and establish the basis for an alternative non-agricultural employment, in particular the development of the industry, the creation of prerequisites and conditions for the ‘green economy’, and the spread of ‘green employment’.

4.3. MIGRATION PROCESSES ASSOCIATED WITH CLIMATE CHANGE

Potential rural inhabitants are forced to move to the city due to the reduction of agricultural production, increasing population density.

Currently, internal migration occurs due to 'ejection' because of limited access to resources and opportunities for the region's labor force. Migration is a key factor creating a growing inbalance in the country's regional development.

The analysis shows a significant disproportionality of regional development, which may be aggravated by climate change. Currently, economic activity is concentrated to a greater extent in the city of Dushanbe and the Sughd region.

Three private indexes showed that, in 2010, a group of Rasht districts and Badakhshan occupies the last place in regional evaluations, with a very low integral index value (Annex 4.2).

Currently, much standard legislative research in the field of migration in Tajikistan has centered on external labor migration. Numerous studies have shown that migration is caused by economic and social factors. However, in certain areas of the country, environmental problems contribute to the high level of migration.

BOX 45. **ECOLOGICAL MIGRANTS**

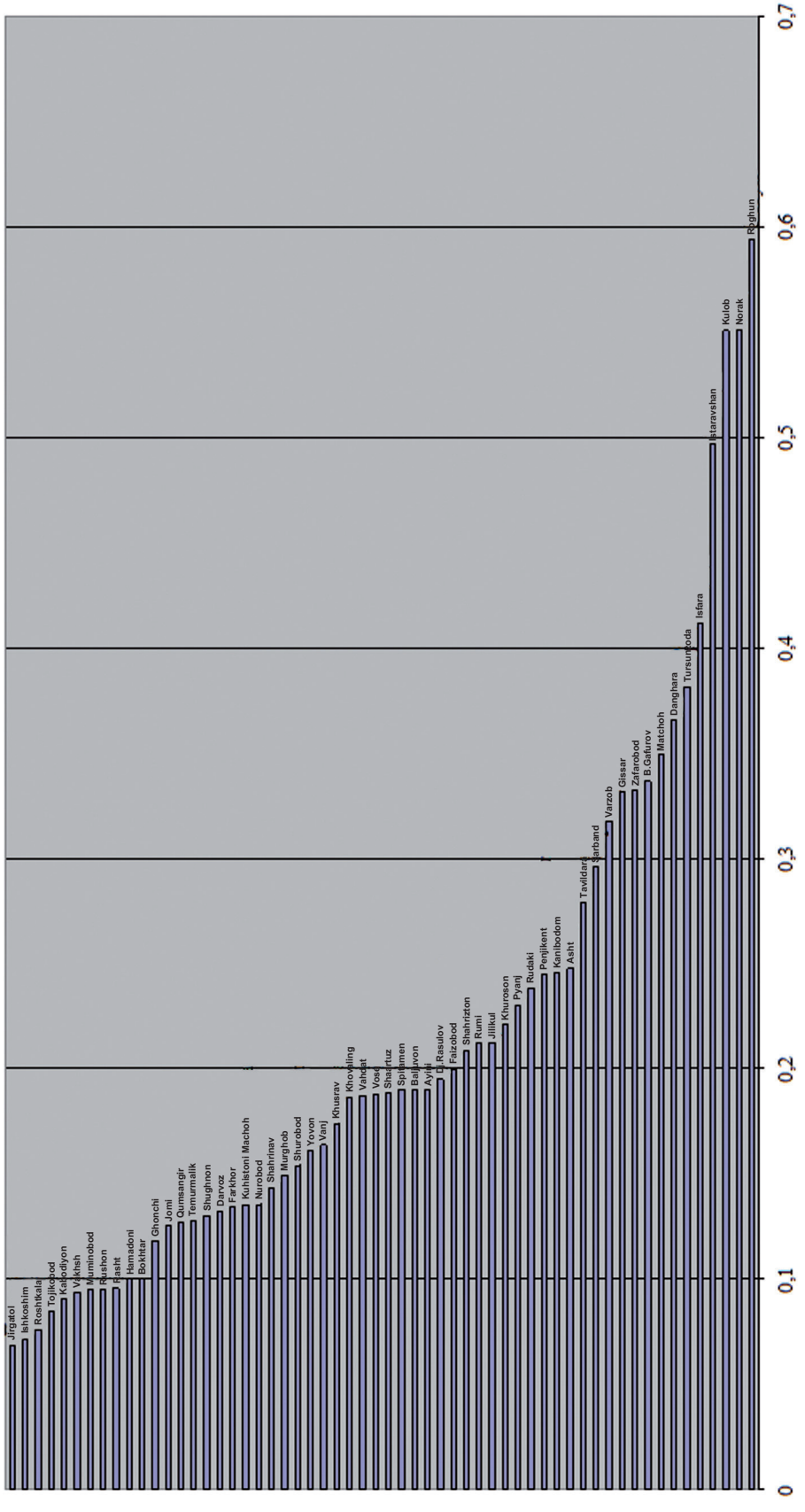
Ecological migrants: people who are living in environmentally-dangerous areas that are subject to planned relocation to prevent loss of life from natural disasters. The reason for relocation includes living in areas susceptible to landslides, avalanches, mudslides, and other natural disasters that pose a threat to lives.

During the period of 2000 to 2010, 6,643 families, a total of over 40,000 people, were relocated from environmentally dangerous areas to safe places of residence in the Republic of Tajikistan. However, there are no complete studies to assess and predict the relationship between migration and climate.

BOX 46. **PROJECT RESEARCH OF THE RELATIONSHIP BETWEEN MIGRATION AND CLIMATE CHANGE IN TAJIKISTAN**

- The European Commission has initiated a large-scale international research project on «Environmental change and forced migration scenarios (EACH-FOR – 2010). According to the results, 6,643 families in total were relocated in the Republic of Tajikistan. However, despite the presence of different kinds of environmental degradation, the population continues to live in these places. The main reasons include: the presence of a migrant worker in the household, the reluctance to leave ancestral land and the lack of sufficient financial resources. The household survey, which indicated the presence of different kinds of environmental degradation, showed that about 62% of residents were migrant workers in Sughd region, about 44% were migrant workers in Khatlon and about 46% were migrant workers in RRS. Results of the same research showed that about 14% of migrants were engaged in unremunerated household work before leaving the country. Environmental degradation can have not only a direct but also indirectly stimulatory effect on internal and external labor migration, by a loss of income for the population which is employed in agriculture related to environmental degradation.
- The project of the International Organization for Migration in Tajikistan studied environmental degradation, migration, internal resettlement and vulnerability of rural communities in the Republic of Tajikistan for the period of 2011-2012. Research included a public opinion survey to represent the population of Tajikistan, as well as exploring quantitative and qualitative methods in the four regions to examine different types of environmental degradation and migration patterns. Environmental migrants relocated in 2005 after a mudflow in the Sarazm and Penjikent district of the Sughd region. Migrants relocated after the flood in 2005 from the villages of Faizabad, Kodara and Andzhirkon of Hamadoni district in the Khatlon region. Environmental migrants have returned to their original residences in the Chorsada, Nurobod districts of RRS, while migrant workers from Jamoat Kulkand, in the Isfara district of the Sughd region, have experienced strong environmental degradation. The research revealed that:
  - The degradation of the environment has an increasing impact on the migratory behavior of the population of Tajikistan. Although the main strategy continues to be temporary labor migration plus agriculture homeland with a high level of participation of women and children, environmental factors are gradually changing this. The latter are becoming increasingly important in household migration decisions, especially in the choice of type of migration - external labor, internal labor, seasonal, internal resettlement, rural-urban or emigration from the country.
  - The form for migration depends on the extent of damage and losses during natural disasters, the probability of recurrence, loss of livelihoods, aid, poverty, remittances, and potential opportunities at the destination. Sometimes affected households use several types of migration in accordance with the circumstances.

Diagramme 19. The value of the integral index of the regions of the Republic of Tajikistan (2010 results)



- Migration levels are highest in areas prone to environmental degradation,. However in situations of extreme impoverishment, for example because of a natural disaster, households cannot finance the costs of external or internal migration. Therefore, in settlements affected by the disaster the level of labor migration is below average, and internal migration is higher than in neighboring villages unaffected by disasters.

As a result of climate change (for example, an unexpected and rapid melting of glaciers) the risk of flooding, mudflows and avalanches increases, particularly during regularly occurring spring thaws.

Drought, floods or extreme weather conditions increase poverty by destroying crops and depriving people of income, promoting even greater migration processes as people have to move to find work.

Climate change can strengthen external and internal migration:

- Loss or reduction of income are factors in external labor migration. Currently, external labor migration is one of the key factors in the development of the country. Remittances are an important part of the income for many households. Due to extreme situations, the flow of migration to Russia probably will increase.
- The scale of population displacement is likely to increase to the extent that, as a result of climate change, people will be forced to leave flooded or arid areas that are unsuitable for living. As a result, migration can cause serious problems that affect health both directl, due to various stresses related to the migration process, and indirectly, due to possible unrest caused by unmanageable movements of people.
- The reasons why people migrate are complex, making it difficult to predict the effects that climate change will have on future migration. At the same time, climate change is likely to become an important driving force that generates future migration.

BOX 47. **CLIMATE CHANGE SCENARIOS**

Walter Kalin, the representative of the UN Secretary-General on the human rights of internally displaced persons, has defined four climate change scenarios, each of them with a different impact on the pace and scale of migration or movement:

- Hydrometeorological disasters, including weather events such as hurricanes, floods and landslides, which can cause unexpected migrations.
- Deterioration of the environment, particularly desertification causing water shortages and soil depletion, which can lead to a gradual migration or displacement.
- authorities of 'high risk' countries declaring areas prone to natural disasters as unsafe, so forcing the displacement of residents of those areas. In this scenario, migration and displacement, occur gradually within the same state.
- Conflicts caused by the struggle for limited and dwindling natural resources, including conflicts related to the lack of food, water and arable land. In such a scenario, unexpected gradual migration and displacement can occur.

A national policy is needed for the treatment of population movements related to environmental factors. National adaptation programs of action still do not include issues of migration, while national policies in the field of migration management still do not not consider environmental factors and climate change.

4.4. CARTOGRAPHICAL ASSESSMENT OF TAJIKISTAN'S REGIONS' VULNERABILITY TO CLIMATE CHANGES

An assessment of the impact of climate change on different sectors of the economy should be sensitive to climate change and the country's ability to adapt. This allows the creation of a new system of indicators to describe regions' vulnerability.

BOX 48. **METHODOLOGICAL FRAME MAPPING VULNERABILITY ASSESSMENTS OF REGIONS**

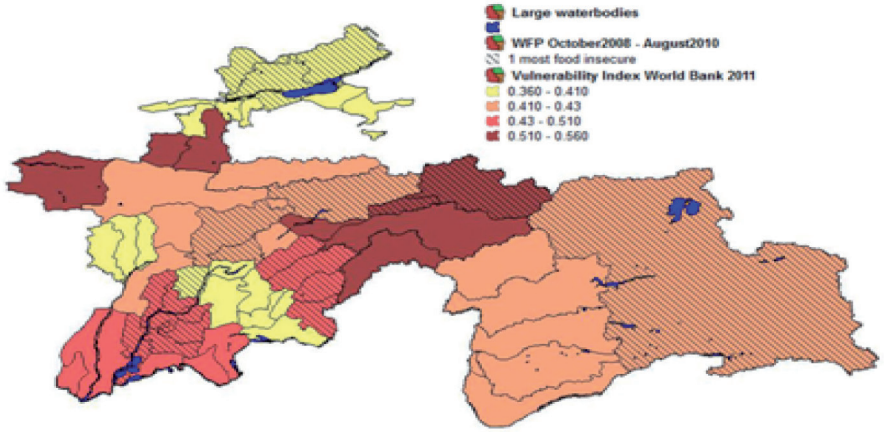
Cartographical vulnerability assessments of regions are equally important for both the rural and urban population. Four groups of potential indicators can be of interest within this analysis:

- Economic potential of the region to adapt to climate change;
- Sensitivity of regions to climate change;
- Characteristics of climate change in the regions;
- Susceptibility of regions at risk of emergency situations.

However, for these assessments, a) a single system of indicators may not be applicable, due to the specifics of residential and economic activity in urban and rural areas, and b) the regional database is limited in many areas of research, including that on climate change. At the same time, such assessments should be initiated by research programs.

As a preliminary experiment, researchers evaluated the vulnerability of the rural population.

Illustration 4



The territory of the Republic conducted a number of research projects that evaluated the levels of climate vulnerability of individual regions (Annex 4.3.)

According to the calculations of World Bank research on WFP monitoring systems from October 2008 to August 2010, the most vulnerable zones for food security are:

- highland regions - Rasht, Tajikabad, Vahdat, Nurabad, Djirgatal, Murghab;
- hilly regions - Faizabad, Hovaling, Baldzhuvan, Shurabad, Muminobod;
- lowland regions - Khuroson Kolhozabod, Vakhsh, Bokhtar Sarband Kumsangir, Panj, Jami, Jilikul.

Vulnerability of households to climatic changes (Kheltberg and Bonch-Osmolovskiy 2011) and less-protected districts for food security according to WFP surveys (October 2006 - August 2010).

BOX 49. **THE ADB PROJECT ON PROVIDING SUSTAINABILITY FOR COMMUNITIES IN THE PYANJ RIVER BASIN**

Tajikistan was included in the pilot programme on adaptation to climate change (PPACC – the multilateral development programme, with the aim of demonstrating action on increasing stability and adaptation to climate change). Under this programme, the Asian Development Bank has created a project to increase the resilience of communities in the Pyanj river basin by financing adaptation measures, including the restoration and improving of water infrastructure resilience to the impacts of climate change The project is being implemented in the following eight areas of the country - Panj, Vose, Kulob, Darvoz, Vanj, Rushan, Roshtkala, Ishkashim. Activity is concentrated on three areas: flood and mudslide management, irrigation and drinking water supply (Annex 4.3).

4.5. LOCAL GOVERNANCE IN TAJIKISTAN AND THE CLIMATE CHANGE ADAPTATION SYSTEM

The local administration is especially sensitive to the real needs of inhabitants of the territory, which means paying close attention to threats, including climate change.

Local authorities are responsible for deciding multiple local issues, including resource management and the provision of social services at a local level.

The head of the local executive administration is appointed by the President of the Republic.

BOX 50. **THE HUKUMAT DISTRICT EXECUTIVE OFFICE WILL FULFILL THE FOLLOWING DUTIES:**

- Project design management by the district Chairperson and local authority representatives;
- To prepare presentations and reports for the Chairperson of District;
- To assist in the development and submission of draft laws, orders of the President and normative – legal acts that are directly related to the area;
- To arrange meetings in Hukumat district;
- To organize officework in accordance with approved procedures;
- To develop and issue orders, decisions and resolutions of the district chairperson;
- To prepare agreements that must be signed by the head of the district;

- To develop annual, semi-annual, quarterly and monthly action plans and obtain approval by the head of the district;
- Analysis of indicators of socio-economic development, the submission of proposals by NGOs, political parties and local self-governments;
- To support and coordinate government and business entities;
- To arrange cooperation with international and regional organizations;
- To organize research activities and invite scientists and experts;
- To maintain control over compliance with labor discipline by staff members;
- To maintain control over purpose-oriented funds expenditures;
- To conduct all other tasks associated with the activities of the chairperson of the district.

Women have the right to be elected and appointed in any government structure in Tajikistan. In 2011, the total numbers of women in state structures of the civil service of the Republic of Tajikistan were 4,373, or 24.7% of total employees. Women occupied 982 people or 17.3% of leadership positions. The representation of women in local government is increasing.

Self-government of settlements and villages occupies a special place in the structure of local government in Tajikistan. The law «On self- government settlements and villages» defined the authority, legal, economic and financial fundamentals for self-government of towns and villages.

BOX 51. **THE UN RESEARCH ON MANAGEMENT SHOWED THAT:**

- Men elected to executive and legislative positions are mostly unaware of the business needs and how the problems of households are linked to local, regional and national socio-economic development. The absence of such knowledge means that policies are not effective and efficient;
- When women are removed from the level of decision-making because of systemic barriers, participation becomes a matter of justice. All citizens have the right to political participation, and to enable men and women to use such a right is the responsibility of the government;
- Gender-balanced representation also promotes confidence in governmental institutions. Women represent at least half of the population, and their presence in the public service supports representative democracy by institutionalizing and legitimizing women in power;
- It is important to understand the fact that women government officials and decision-makers are important role models that can inspire other women to work in the public sphere.

Source: UN Research Institute o n Social Development (www.unrisd.org)

4.6. THE STRATEGY OF CONTRIBUTION TO ADAPTATION OF CLIMATE CHANGE IN A HIGH LEVEL REGIONAL DISPARITIES

The conceptual directions that should be given the highest priority in regional governance are:

- To organize the targeted planning of regional development on climate issues;
- Assessment of the effectiveness of management decisions in the system of territorial administration, regarding increased adaptation to climate change;
- Expansion of land under green plantations;
- Implementation of local environmental management that promotes disaster risk reduction and conflict prevention, while ensuring that the post-crisis assessment and recovery process improves local environmental management and sustainable use of natural resources in the region.

Methods of adaptation to climate change and disaster risk reduction including gender-sensitivity

- It is necessary to improve the interaction between men and women to reduce climate risk. Even the distribution of production risks between all members of a household is a safety strategy due to climate threats.
- The management of agricultural risks is a task for both men and women. In circumstances such as specific mountains, this should be done within the framework of risk management, not just production systems and natural resource management.
- Education of women and the development of women's entrepreneurship will help to train future generations on climate change and the threat of desertification.

- Local communities already have some survival strategies; however, it will be soon not be enough if the current situation does not change. Additional support by the Government and NGOs are necessary to protect rural communities.

- As shown by the recent floods, rural communities are vulnerable to new climatic threats. Therefore the integration of disaster risk reduction becomes more important at national and local levels.

- Assessment of climate vulnerability and capacity (ACVC) is a gender-targeted method of joint training and action to reduce vulnerability to climate change. The first ACVC initiative emerged in Tajikistan in the project “Adaptation to Climate Change (ATCC)”, implemented by CARE in April 2005 - September 2007. CARE worked in Ziddi, Dehmalik and Chorbog jamoats of the Varzob district in Tajikistan. It should continue to study the gender approach to climate change and, especially, legislation to adapt to climate change, in order to promote gender equality as a fundamental part of sustainable development.

- It is important to raise the level of education and environmental awareness of the local population, through appropriate publications and mass media.

- In terms of methodology, the ‘road maps’, detailing actions at central and regional level to adapt to climate change, are necessary to reduce environmental pressures

Conclusions and recommendations

CHAPTER 1. CLIMATE CHANGE AND HUMAN DEVELOPMENT

Government increasingly feels that environmental problems cannot be solved without paying attention to the living conditions of people, especially the rural population. The medium-term strategy for 2013-2015 is being developed for the growth of the welfare of the people of Tajikistan and is an important step towards a comprehensive solution for poverty reduction. According to the UN Development Program, «an effective strategy to address the problems of poverty, development and environment simultaneously should begin with focusing on resources, production and population, climate, and should cover demographic issues, improving health and education, women's rights, the role of young people and the local inhabitants and local communities, and democratic participation process in association with improved governance.»

Poor people are more likely to suffer from the effects of disasters, and they are likely to die or lose their livelihoods as a result of floods, earthquakes and hurricanes. Misery and poverty combine to form a vicious circle. The risk of mortality for the population subject to the threat of disaster in low-income countries is almost 200 times higher compared to OECD countries.

The prioritization of multiple activities needs the most efficient use of resources and support for the efficient and effective implementation of these priorities.

Tajikistan has collected a lot of environmental information, but there is no unified or coordinated database for it. Several organizations conduct environmental monitoring, share data and information or disseminate the results of their observations through the mass media.

Environmental authorities are making efforts to support monitoring within the main areas, such as hydro-meteorological monitoring and control of industrial pollution. Improved planning and management of the environment is largely dependent on access to accurate data on environmental conditions. In Tajikistan, the overall picture is such that environmental information is collected and stored in many ministries, departments and organizations, in addition to the different branches of the Committee for Environmental Protection. There is practically no coordination among government agencies on the ground, and no monitoring stations, sampling, of ways of exchanging information.

Therefore there is a clear need for systematic discussion of information needs, and to set priorities for monitoring, based on the requirements of national environmental legislation and policy documents and obligations under relevant international environmental conventions. The requirements of the Aarhus Convention, to which Tajikistan is a party, specify Assembly (Parliament) and the Government as a basis for the development of legislation and policy making.

CHAPTER 2: THE ECONOMIC ASPECTS OF CLIMATE CHANGE

It is important to develop plans to adapt to changes and include financing and cost of preventive measures into national development based on scientific information, integrating climate impact assessments and local climate data.

The impact of climate change on the agricultural sector in Tajikistan is extremely complex and little-studied. Due to climate change issues, it is important to develop further forecasts, prepare special programmes on the agricultural sector and adjust to new environmental conditions.

If no attention is paid to this issue now, existing negative environmental and social trends will remain unobserved in the countryside, where the imposition of climate change may affect the overall agricultural situation in the coming decades.

There is a need to not deteriorate the ‘quality’ of the rural population, reducing its capacity to adapt to a fairly radical change in the environment.

It is advisable to implement a complex of measures for the agriculture sector to adapt to climate change in Tajikistan, which are:

- Measures to combat drought;
- Erosion control;
- Soil conservation technologies, minimizing the anthropogenic impact on the soil;
- Moisture saving technologies;
- Optimal crop rotation;
- Selection of new drought-resistant varieties and hybrids of agricultural crops;
- Development of infrastructure (roads, storage facilities, etc.) and new agricultural products processing enterprises to prepare for possible changes in natural agricultural conditions;

- Conducting special training and education programs for rural workers.

It is important to provide people who are responsible for policy development, civil society and the private sector at the national level with better access to relevant scientific information and knowledge about climate change for decision-making.

To implement adaptive measures, it is required to attract appropriate economic mechanisms and instruments that consider local specificities together with changing climatic conditions.

Taking adaptive measures will have a significant economic benefit, along with a positive effects on the environment. Good investments in combating soil erosion are highly cost-effective.

CHAPTER 3. SOCIAL ASPECTS OF CLIMATE CHANGE IN TAJIKISTAN

The Republic of Tajikistan would benefit from the improvement of management of natural resources, the elimination the consequences of environmental heritage, the reconstruction of worn communications equipment and the strengthening of capacity-building for disaster management.

The Republic of Tajikistan should develop strategies to reduce vulnerability to future changes, which should be focused not only on infrastructure but also the formation of stable institutions to support adaptation. It is important to:

- **At the national level:**

To increase energy efficiency, creating active energy-saving policy and solving social issues.

- The integration of climate issues into planning and forecasting at all levels of government. Therefore, the climate change issue should not be considered within the framework of a specific sector or only as an environmental problem; instead, it should be integrated into all sectors, including the social sector.

- Establishment of an effective information system by local authorities, ministries and agencies for providing the entire population with reliable hydro-meteorological information, forecasts for climate change in order to prevent negative impacts and record the positive impacts of climate change on the economy and public health;

- The creation of development systems and the breeding of more drought-resistant crops, while strictly adhering landscape agriculture;

- The establishment of analytical databases on demographic trends, morbidity, the reproductive health of men and women, impact on health of measures in the frame policy on employment, social protection, education and environment;

- Establishment of a permanently-operating sustainable system of vocational education that promotes the influence of environmental factors and climate change;

- To support research programs on the evaluation of climate change impacts, including possible adaption scenarios of social sectors and the labor market. Access to the results for all interested persons. Creation of an information network on gender-sensitive assessments;

- Expansion of programs and activities to reduce the risks of natural disasters, focusing on strengthening institutional capacity: for example, the Committee for Emergency Situations (on early warning systems), the State Agency for Hydrometeorology (monitoring glaciers, snow-melting and flood hazards).

- Creating an inventory of forests to determine the extent of woodlands and CO_2 emissions. Planting forests on the slopes of eroded lands to reduce CO_2 emissions. Joint management of local energy resources focused on local forests and shrubs. Adaptation measures should include activities related to forest protection, reforestation, forest-planting within woodlands and bare forest lands.

- Introduction of renewable energy technologies and energy efficiency measures

- Use of the instrument for PES incentives (payments for ecosystem services)

- Increasing public awareness of government officials and decision-makers who are responsible for education and laborforce development on climate change;

- Creating conditions for the involvement of private businesses to participate in activities related to mitigation and adaptation to climate change;

- Development of information systems on climate change

- **At the community level:**

- Improving the management of water resources, creation of water reservoirs and methods to save water, such as drip irrigation as well as access to safe water from wells.

- Conducting systematic training on natural disasters with the population and provision of training and audio-visual materials

- Raising awareness on climate change by means of joint activities of the state and (non-governmental) civil-society organizations in Tajikistan through the education system and mass media.

CHAPTER 4. REGIONS AND CLIMATE CHANGE

Insufficient and uneven progress in the region is due not only obvious factors - geography, the differences between urban and rural areas, the availability of natural resources - but also the pace and nature of reforms. Regional development affects a number of structural reforms, which are mainly conducted by the center (Annex 4.3.).

What can the regions do to accelerate their development? Although the development of the regions is mainly determined by the center, the research shows that the willingness to reform and a clear understanding of the new sources of development at the regional level are also important. The stimulation of the sources of economic growth are perhaps the most important part of economic policy. The long-term impact of climate change is important in the implementation of strategic materials. However, there are some limitations in this regard:

- Problems related to adaptation to climate change at the local level (the solution of these problems will reduce the risks of adverse effects of climate change in the country):

- Lack of integration of issues related to climate change into state regional policies and programs, and poor coordination of the activities of government authorities (which would ensure a cross-sectoral approach to the problem).

- Inefficiency of legislative and economic incentives for implementation of energy efficiency and energy conservation at the local level.

- Scientific and personnel problems (overcoming these problems will improve the evaluation of observed climate change, the reliability of the regional prediction of climate change impacts on local resources, the ability to conduct certain activities and the economy and society as a whole).

- Insufficient and/or a lack of access to information resources, the lack of national and regional scientific research, lacking or unsystematic ways to promote public awareness and laborforce development programs on climate change.

- Lack or aging of highly qualified personnel.

Sustainable development strategies included in regional development plans are the key tools for the implementation of commitments on sustainable development at the local level.

The establishment of regional mechanisms is important, including local government institutions and development assistance in sustainable development through capacity-building. At the same time, the provision of coherent and integrated planning and decision-making throughout the chain of command to national and local government is required. It is important to enhance the ability of local authorities to work more closely with the central authorities. Cooperation between local authorities through the assistance of international organizations is required.

Annex

ANNEX 1.1.

THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC)

Climate change is a global challenge: decision-making authorities need an objective source of information on the causes of climate change, its potential environmental and socio-economic outcomes and adaptation measures and the mitigation of its impacts. That is why, in 1988, the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC).

The IPCC is a scientific agency: the information provided in its report is based on reliable scientific facts and reflects a point of view accepted by the scientific community. The comprehensiveness of the scientific content is achieved through contributions from experts who work in all regions of the world in all scientific disciplines. Using this data is necessary to document research, for sectoral sources of information and traditional practices, as well as the use of the two-stage process of project consideration by experts and government authorities. Because of its intergovernmental disposition, the IPCC is able to convey scientific, technical and socio-economic information to leaders in a politically neutral manner. By accepting the reports prepared by the IPCC, and claiming its review for policy makers, the government is confirming the legitimacy of its scientific content.

The IPCC regularly makes reports. Immediately after their publication, such reports are widely used by policy makers, experts and students. In 1990, the First IPCC assessment played a crucial role in preparing the United Nations Framework Convention on Climate Change (UNFCCC), which was opened for signature at the Summit in Rio de Janeiro in 1992 and came into effect in 1994. This report provided an overarching framework on solving climate change. In 1995, the second IPCC assessment report became the basis for the discussions of the Kyoto Protocol in 1997. In 2001, the third assessment report, as well as the special and methodological reports, provided additional information for further development of the UNFCCC and the Kyoto Protocol. The IPCC is the primary source of information for negotiations under the UNFCCC.

Source: IPCC, www.ipcc.ch

ANNEX 1.2.

EXISTING APPROACHES TO INTEGRATED ENVIRONMENTAL AND ECONOMIC ASSESSMENTS

The term 'economic impact of climate change' can mean different things to different people, and methods of conducting assessments of economic impacts of climate change may be even more confusing. But one thing is clear: decision-makers at all levels of government and in the private sector will need – and are already asking for – information on the economic impacts of climate change as well as the costs of adaptation. This trend is reflected in the increase of the volume of work that includes environmental and economic analysis, called the 'integrated environment economic evaluation' of climate change. It has also contributed to co-operation between scientists who specialize in natural and physical sciences, and when combined with economists' work, these results become economic models that link natural and physical processes with the economic principles of the market. This new generation of integrated environmental-economic models has the ability to transfer a physical effect of the climate into action on the macro and industry levels, as well as reducing the value of physical and economic losses of climate change through adaptation measures.

The elaboration of enumerated indicators and assessments is active all over the world. Leading international organizations like the UN, the World Bank, the Organization of Economic Cooperation and Development (OECD), the European Commission, Scientific Committee on Problems of the Environment (SCOPE), and others addressed the issue at various international conferences and seminars.

Although the development of indicators of sustainable development is far from complete, the proposed indicators are used at different scales already: global, regional, national, local, sectoral, and even for individual communities and enterprises.

It should be noted that projects to elaborate indicators of sustainable development as:

- The system of indicators of sustainable development proposed by the UN Commission on Sustainable Development (CSD), consisting of 132 indicators;
- A system of integrated environmental and economic national accounts (System for Integrated Environmental

and Economic Accounting), proposed by the UN Statistics Division, focused on integrating environmental considerations in national statistics;
- An indicator of 'genuine savings' designed and calculated by the World Bank,
- An OECD program of environmental indicators.

As a measure of economic damage, is using a relative index of annual losses as a percentage of GDP: global GDP, if it is a global damage assessment, or national or regional GDP if it is part of a local assessment. Damage is estimated in three ways: (1) market impact, (2) non-market impacts and (3) the social conditions of loss, force-majeure (catastrophic in the Stern terminology) associated with social events. The first component is the possible negative impact of climate change on traditional markets of energy, agriculture, forestry, etc. Here the estimated loss is relatively simple: the growth indicator (reduction) of the relevant sectors in the current market prices. A separate subgroup highlights the economy of coastal areas that could be affected in the event of a rise in global ocean levels. The second component assesses the damage to the environment (reduction of biodiversity) and human health (increased mortality). For this purpose an indirect economic evaluation is applied, such as the cost of human life and the price of extinction of species. The third group combines the possible economic loss (loss of investment) associated with mass migration, the development of international conflicts and other social reactions to the destruction of a way of life as a result of climate change.

ANNEX 1.3.

The State Ecological Program provides a detailed description of the environment of each region and the analysis of its environmental problems. It also establishes a set of activities essential for the recovery and maintenance of ecological balance and the improvement of particular environmental problems. It also includes urgent practical measures for:
- Prevention of soil erosion;
- Allocation of land for highly productive varieties;
- Reforestation and expansion of protected areas;
- Rehabilitation of good quality air, water and other resources;
- Encouragement of local industry to use environmentally friendly raw materials, and to reduce energy consumption by industry through the introduction of energy-saving technologies.

Different government initiatives prioritize important areas of poverty reduction. Nowadays, main initiatives include the creation of employment opportunities in order to increase income for poor people, especially the rural population, and the elimination of imbalances in the agricultural sector. However, a lack of monitoring initiatives remains. In particular, there is no institutional framework for the future implementation of poverty reduction strategies. With the support of the World Bank, the preparation of a poverty reduction strategy review in early 2004 was very helpful and provided a good summary of tested measures. At the time of preparation of the strategy, progress has been slower than expected. However, despite limited progress, some targets have been achieved.

The PRSP recognizes that natural disasters, water pollution, soil erosion and desertification have a serious impact on poor people. Environmental issues are mainly focused on the agricultural sector, which has been targeted with a series of reforms aimed at: the development of family farms, improvement of irrigation systems with the exception of quotas on agricultural products, especially cotton, and stimulating competition among cotton and other agricultural products to provide better conditions for farmers and promote the development of the food industry by supporting the development of small and medium enterprises.

At the same time, there is a clear interrelation between changing climatic factors, the environment, economic development and poverty in Tajikistan. Poor people in Tajikistan re mostly rural, who are highly dependent on natural resources for livelihoods and are most heavily exposed to imbalances in the environment, in particular the process of desertification, pollution of water sources and the effects of natural disasters, including droughts and floods.

A number of problems in agriculture contribute to the spread of poverty among the rural population, for example:
- incomplete land and water reform, which does not allow efficient use of land, water and all the development possibilities of agricultural production;
- Weakness of modern management and operation of the main agricultural sub-sectors such as cotton
- equal access to land becomes more complicates because of the difficult and costly procedure for obtaining land certificates
- land degradation and irrigation infrastructure

APPENDIX 1.4.

EFFECTS OF CLIMATE CHANGE AND THE MILLENNIUM DEVELOPMENT GOALS

Millennium Development Goals	The potential consequences of climate change
MDG 1: eradicate extreme poverty and hunger	The damage caused to life support facilities, in particular to houses, water supply sources, health and infrastructures will deprive people of their livelihoods; Crop reduction will negatively affect food security; Changes in ecosystems and resources, infrastructure and labor productivity will reduce the possibilities of income increases and will negatively affect economic growth; The growth of social tension connected with resource use can lead to the emergence of conflict destabilizing life and sources of income, and will force communities to migrate
MDG 2: Achieve universal primary education	Loss of livelihood and natural disasters will reduce possibilities for normal study, lead students, especially girls, to drop out of school to help carry water, to earn income or to look after elder family members; As a result of an insufficient food and diseases, school attendance and the ability of children to access education will decrease; Displacement and migration will decrease in access to education
MDG 3: promote gender equality and empower women	By strengthening the dependence of women on the natural environment as source of subsistence, including agricultural production, gender inequality will be aggravated. As a result, health can worsen, leaving less time for participation in decision-making and receiving additional earnings; Women and girls usually work in the house and will carry water, forage for firewood, care for cattle and seldom will obtain food. In the period of climatic stresses they will cope with large volumes of work using smaller resources; Households headed by women with limited funds will be especially vulnerable to disasters connected with climate
MDG 4: reduce child mortality	Due to heat and cold waves, floods, droughts and hurricanes, the death rate and sickness will increase; Children and pregnant women are especially prone to tropical diseases (for example, malaria and Dengue fever), and also to waterborne diseases (for example, cholera and dysentery) which can amplify and spread over new areas; A decrease in water and food security will negatively impact the health of children
MDG 5: improve maternal health	A shortage and decrease in the quality of drinking water will negatively affect maternal health; Absence of food security will lead to malnutrition; As a result of droughts and floods, waterborne diseases will grow, which will be reflected in maternal health
MDG 6: combat HIV/AIDS, malaria and other diseases	Shortage of water will strengthen vulnerability to this illness; In poor families affected by AIDS, insufficient food will accelerate the negative consequences of this disease
MDG 7: ensure environmental sustainability	Changes and possible irreversible damage can reduce the quality and efficiency of ecosystems and natural resources; There will be a reduction of a biodiversity and further deterioration in the state of the environment; Changes in interrelationship and interactions of humanity with the ecosystem will lead to a loss of biodiversity and main life-supporting systems of many people, especially in Africa.
MDG 8: develop a global partnership for development	Climate change is a global issue and a global problem: global cooperation is required for countermeasures, especially for assistance to the developing countries to adapt to the negative consequences of climate change; Under influence of climatic factors, there can be a strengthening of international relations.

ANNEX 4.1.

Considering the variety of climate of Tajikistan, several districts with similar physiographic conditions can be identified:

- Wide valleys and plains with a height up to 1000 m are the main areas of agriculture and cotton-growing. These include the South-West part of the republic, Hissar, Vakhsh, Lower Kafirniganskaya, Kulyab Valley and Ferghana valley with the adjacent plains of Sughd. The temperature in broad valleys and plains is high during the summer period **when the summer thermal depression dominates**. The summer is characterized by clear and hot weather, when the maximum temperature can reach 43-47 °C. The average monthly temperature of the hottest month of July is 28-30 °C. In winter, Tajikistan is under the influence of a permanent Siberian anticyclone. The cold period of the year is characterized by the invasion of cold Arctic air, in which, even in the south, the air temperature can go down to 24-30 °C below zero. The average monthly temperature in January is generally 0.3-2.5 °C warm, but in some northern areas of the country (Khujand) it is 0.3 °C below zero.

- the Zerafshan valley, the mountainous regions of Central Tajikistan and part of the Western Pamirs are part of a transition zone from the valleys to the highlands up to an altitude of 2500m. In summer the weather is dry and with some clouds but remains cool in the high mountains. The landform has a significant influence on thermal conditions in this area.

The Central and Eastern Pamir and mountain ridges are high-altitude areas above 2,500 m. The rarefied atmosphere in these areas brings increased solar radiation, but at the same time it is a cause of heat loss and lower temperatures. Therefore temperature fluctuations from winter to summer and from day to night are quite considerable, and increase towards the East.

ANNEX 4.2.

SURVEYS AND STUDIES CONDUCTED IN TAJIKISTAN, WHICH MAY HELP TO DETERMINE THE LEVEL OF VULNERABILITY ASSOCIATED WITH CLIMATE CHANGE

Name of the study	Level	Source
Classification of typical vulnerability models in global arid zones	Global	(Siets et al., 2011)
Climate change adaptation in Europe and Central Asia	Europe and Central Asia	(World Bank, 2009)
Food security and climate change in Central Asia and The Caucasus	Central Asia and Caucasus	(ICARDA, 2009)
Climate and ecological changes in arid zones of Central Asia: Impact, vulnerability and adaptation	Central Asia	(Lyubimseva and Khenebri, 2009)
Central Asian regional risks assessment: responding to water, energy and food security issues	Central Asia	(UNDP, 2009)
Climate change and land degradation in Central Asia: scenarios, strategies and funding opportunities	Central Asia	(GTZ-CCD, unpublished report, October 2008)
Second national Communication of RT to the UNFCCC	Tajikistan	(Hydromet, 2008)
Information bulletin of the food security monitoring system	Tajikistan	(WFP, 2005), annually since 2005
Integrated food security phase classification (IFSPC)	Tajikistan	Semi-annual assessment of CPCP, World Food Programme, 2010
Climate change vulnerability map	Tajikistan	(Heltberg and Bonch-Osmolovskiy, 2011)
Tajikistan: monitoring and early warning report	Tajikistan	UN Early Warning Indicators
Assessment of development impact to rural vulnerability and sustainability	Tajikistan (18 districts)	World Bank jointly with USAID, 2011 (ongoing)
Assessment of MECO risk	DRS and Khatlon	Committee of Emergency Situations, 2009, continues since 2009
Food security assessment in Rasht Valley	5 districts (DRS)	Mercy Corps, 2011
Food and nutrition survey in Khatlon and GBAO regions	Khatlon region, GBAO	Save the Children Fund, 2010
Women - small farmers in Tajikistan: lessons of climate change adaptation	Khatlon, Sughd, DRS	(Oxfam International, 2011)

ANNEX 4.3.

TARGETED INTERVENTIONS AND COMMUNITIES IN THE FRAMEWORK OF ASIAN DEVELOPMENT BANK: «CLIMATE CHANGE ADAPTATION IN THE PYANJ RIVER BASIN»

District	Jamoat	Type of infrastructure	Climatic risks, which will be reduced	Benefits
Ishkoshim	Zong	Irrigation	- Heavy floods; - Drought (more effective water use / sustainable agriculture)	- Uninterrupted water supply to crops through improved function of irrigation system and reduction of damage to irrigation infrastructure. - Reduction of economic damage due to destruction of agricultural lands and crop failure
Ishkoshim	Vrang	Protection from floods /mudflows	Mudflow/ fragmental flow as a result of intensive heavy shower, snow melting	- Increasing safety of villages' inhabitants, reduction of loss from destruction of houses, other buildings, infrastructure and farmlands
Roshtqala	Tusiyon	Protection from floods /mudflows	- Climatic events caused landslides; - Drought (more effective water use)	- Increasing safety of village, water supply through reduction of damage to irrigation infrastructure, economic losses due to destruction of lands and houses
Vanj	Jovid	Protection from floods /mudflows	Damage to infrastructure and irrigated lands from floods, protection of population from mudflows and floods	- Protection of villagers, irrigated lands and households from floods
Kulob	Ziraki	Protection from floods /mudflows	Damage to infrastructure and irrigated lands from floods, protection of population from mudflows and floods	- Protection of villagers, irrigated lands and households from floods
Kulob	Dahana	Protection from floods /mudflows	Damage to infrastructure and irrigated lands from floods, protection of population from mudflows and floods	Reclamation of irrigated lands and protection of collector-drainage networks, canals, houses and streets from floods, reducing the rate of infectious diseases
Darvoz	Vishkharv	Protection from floods /mudflows	Damage to infrastructure and irrigated lands from floods, protection of population from mudflows and floods	Protection of irrigated lands from erosion, protection of canals, houses, streets from floods
Vose	Tugarak	Water supply	Damage to water supply infrastructure floods and mudflows, hydrological drought	Improving water supply, reducing the rate of infectious diseases
Vose	Michurin	Water supply	Damage to water supply infrastructure from floods and mudflows, hydrological drought	Improving water supply, reducing the growth rate of infectious diseases
Vanj	Vodkhud	Protection from floods /mudflows	Damage to infrastructure and irrigated lands from floods, protection of population from mudflows and floods	Protecting irrigated lands from erosion, protection of households and streets from floods, irrigation water supply for 30 ha of land
Roshqala	Tusiyon	Irrigation	- Climatic event caused land instability; - Drought (more effective water use and providing uninterrupted water supply)	Decreasing instability of land leads to more effective water use and uninterrupted water supply
Kulob	Dahana	Water supply	Damage to water supply infrastructure from floods and mudflows, hydrological drought	Improvement in drinking water supply, reduction of the growth rate of infectious diseases
Kulob	Ziraki	Water supply	Damage to water supply infrastructure from floods and mudflows	Drinking water supply for residents of villages, hospitals and reducing the rate of infectious diseases
Pyanj	Mehvar	Water supply	Damage to water supply infrastructure from floods and mudflows	Improvement in water supply

ANNEX 4.3.

TARGETED INTERVENTIONS AND COMMUNITIES IN THE FRAMEWORK OF ASIAN DEVELOPMENT BANK: «CLIMATE CHANGE ADAPTATION IN THE PYANJ RIVER BASIN»

Район	Джамоат	Тип инфра-структуры	Климатические риски, которые будут уменьшены	Выгоды
Vose	M. Mahmadaliev	Water supply	Damage to water supply infrastructure from floods and mudflows	Drinking water supply for residents of villages, hospitals and reducing the growth rate of infectious diseases
Vose	Mehnatobod	Protection from floods / mudflows	Damage to internal infrastructure from floods, erosion of irrigated lands and protection of population from floods	Protection of lands from erosion, protection of houses, streets and population
Pyanj	Namuna	Water supply	- Hydrological and meteorological drought	- Providing uninterrupted water supply to people of the village; - enhance general sustainability through improving health and decreasing the growth rate of infectious diseases among the population
Pyanj	Namuna	Irrigation	Damage from floods to spillway and irrigation infrastructure, houses, bridges and irrigated lands and protecting population from mudflows.	Protection of lands from erosion and flooding, protection of houses, streets, bridges and water supply systems
Rushon	Barushon	Irrigation	Damage from floods to infrastructure and irrigated lands	- Protection of irrigated lands from floods; - increasing land productivity
Pyanj	Nuri Vahdat	Irrigation	- Meteorological drought - Hydrological drought	Improvement in irrigated water supply for dehkan farms, increase in yield and increase in income

ANNEX 4.4.

AREAS OF RELATIONSHIP OF CENTRAL AND LOCAL GOVERNMENT BODIES

1. Ministry of economic development and trade → Local government bodies

- schedule for submission of reports, estimated development indicators;
- format for monthly reporting on the state of sectoral development;
- inquiry into the state and trends of regional development;
- endorsed methodology of district development programmes;
- guidance on elaboration of strategic development programmes, including regional development as a component of the national strategy or the strategy for improving population welfare;
- guidance on elaboration and representation of investment projects, including those designed for foreign donor aid;
- raising awareness about the macroeconomic situation and development benchmarks for the future;
- training;
- invitations to round tables, conferences and Ministry sessions

Mechanisms or leverages of the present Ministry over regional development

- analysis of regional development and justification for changes in the direction of regional development;
- initiate drafting new laws and standard and legal acts affecting regional development;
- joint development of policy and strategic papers with local bodies of government;
- development of patterns of development and productive forces of the Republic.

2. Ministry of Finance of the Republic of Tajikistan → Local government bodies

- schedule for submitting reports and projects on local budgets;
- format for monthly reporting on revenues and local budget expenditures;
- manual for development of draft local budgets;
- manual for forecasting revenues and regional tax capacity;
- local budget parameters after endorsement of the state budget by parliament;
- inquiries about the progress of local budget revenue and expenditure implementation

Mechanisms or leverages of the present Ministry over regional development
- mechanism of interbudgetary relations – provision of financial aid, arranging mutual settlements;
- monitoring the progress of local budget revenue and expenditure implementation;
- performing financial control to ensure rational expenditure of local budget funds;

3. Ministry of Energy and Industry of the Republic of Tajikistan → Local government bodies
- format for monthly reporting on enterprise development of individual branches of industry;
- providing information about sectoral development guidelines;
- inquiries about the state and trends of development of individual sectors and regional enterprises;
- training;
- invitations to round tables, conferences and Ministry sessions.

Mechanisms and leverage of the present Ministry over regional development
- justifying enterprise placement;
- elaborating energy development programmes and seeking funding sources;
- appraisal of projects regarding the placement of enterprises.

4. Ministry of Transport of the Republic of Tajikistan → Local government bodies
- providing information about the guidelines of development of transport complex;
- to make an inquiry about activities of transport structures, inter- and intra-regional shipments;
- invitations to round tables, conferences and Ministry sessions.

Mechanisms and leverage of the present Ministry over regional development
- monitoring of communication status;
- forming and implementation of the strategy for transportation development in the country;
- forming and implementation of investment projects in communication;
- appraisal of projects on transport infrastructure.

5. Ministry of Labour and Social Protection of Population of the Republic of Tajikistan → Local government bodies
- providing information about guidelines, wage reforms;
- inquiries about the situation and perspectives of the regional labour market;
- invitations to round tables, conferences and Ministry sessions.

Mechanisms and leverage of the present Ministry over regional development
- making and implementing suggestions on improvement of salary regulation, to make sure the system of privileges and compensations at the district level takes into account natural, climate and socio-economic factors;
- analyzing and forecasting the labour market situation and implementing unified public policy on regulation of labour market;
- developing national, regional and local programmes to promote employment and monitoring their implementation;
- coordinating activities of territorial bodies in the area of employment, appraisal of the specific-purpose, sectoral and investment programmes with a view towards creating and saving jobs;
- resolving the issues of environmental migration from exogenous zones to secure areas and voluntary relocation of households from mountainous, foothill, densely populated and land-poor areas to districts with sufficient land resources.

6. Ministry of Agriculture of the Republic of Tajikistan → Local government bodies
- schedule of submission of reports and estimated development figures;
- format for monthly reporting on sectors' development status;
- inquiring about the situation and development trends of regions' agricultural sector;
- providing information about agricultural reforms and perspectives;
- training;
- invitations to round tables, conferences and Ministry sessions.

Mechanisms and leverage of the present Ministry over regional development
- initiating the new laws and standard and legal acts on using of land by dehkan farms, subsidizing agricultural production;
- development of policy papers on strategies and perspectives to promote agricultural development;
- assisting the improvement of reclamation and irrigation works in the regions;
- selection of pilot regions for agricultural reforms and outcome evaluation.

7. State Committee on Investments and State Property Management of the Republic of Tajikistan → Local government bodies
- methodological support to the process of privatization;
- cooperation and overall leadership for development and implementation of state programmes on the promotion of entrepreneurship, including small and medium business;
- providing information about investments flows;
- training;
- invitations to round tables, conferences and Ministry sessions.

Mechanisms and leverage of the present Ministry over regional development
- support to attract investments for implementing state programmes and priority social projects, including at the expense of loans and grants of international economic and financial institutions and donor countries;
- coordination of activities of government bodies on cooperation with investors;
- initiating new laws and standard and legal acts on business development and attracting investment funds.

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RECOMMENDED WEB-SITES

Emomali Rahmon, President of the Republic of Tajikistan
www.president.tj

MEDT RT
http://www.medt.tj/

Ministry of land reclamation and water resources of RT
http://www.mwr.tj/

Ministry of agriculture of
http://www.vkishovarzi.tj/

State committee on investments and state property management of RT
http://www.amcu.gki.tj/

Ministry of education of RT
http://maorif.tj/

Ministry of health of RT
http://www.health.tj/

Ministry of labour and social protection of the RT
http://labour.tj/ http://mehnat.tj

Committee on environmental protection under the Government of RT
http://hifzitabiat.tj/

Meteorlogy centre
http://www.meteo.tj/

Statistisc agency under the President of RT
http://www.stat.tj/

National bank
http://www.nbt.tj/

Green park
http://www.rec.org/REC/Programs/Greenpack/

IPCC,
www.ipcc.ch

Youth ecological centre
http://www.ecocentre.tj/

Monitoring and early warning in Tajikistan
http://untj.org/index.php/coordination-mechanisms/disaster-management/monitoring-a-early-warning-system/54-compound-crisis-in-tajikistan/260-monitoring-a-early-warning-system-in-tajikistan

Official site of Rio+20
http://www.uncsd2012.org/rio20/

Pilot project for climate
http://ppcr.tj/

Regional ecological centre of Asia Asia
http://www.carecnet.org/ http://www.mountainpartnership.org
http://webtv.un.org/search/tajikistan-general-debate-1st-plenary-meeting-rio20/1699151934001?term=Tajikistan
http://www.archipelag.ru/agenda/geoklimat/economic-aspect/climate/

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