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Main Administration of Hydrometeorology  
(GLAVGIDROMET)

**NATIONAL ACTION PROGRAMME  
TO COMBAT DESERTIFICATION  
IN REPUBLIC OF UZBEKISTAN**

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**"The ground - not only the huge property, but also factor,  
from which the future country depends".**

**I.A.KARIMOV**

**President of Republic of UZBEKISTAN**

## **THE INTRODUCTION**

By international community is recognized, that deserting represents large economic, social and ecological problem for many countries of world. One from many being are problems of degradation of land with increasing of anthropogenic loading on ecological system.

In this connection, the Intergovernmental committee on negotiating (ICN) of United Nations was develops the Convention on struggle with deserting and softening of drought influence, in which emphasize:

*"Deserting" means the degradation of lands in arid, semi-arid and dry subhumidic regions as a result of action of various factors, including the change of climate and human activity.*

*"Drought" means the natural phenomenon, arising, when quantity of precipitation far below of normal fixed levels, that causes the gross infringement of hydrological balance, adversely responds on efficiency of land resources.*

The state - participation pledge oneself to struggle with reasons of formation of desert and beginnings of drought, and turn back the tendency to formation of new desert regions.

The formation deserts it is not wide having deserts it is degradation of soils in side of arid and semiarid lands, based on human activity and climatic changes.

The government of Republic of Uzbekistan, despite on difficult economic situation, accepts the vigorous measures on ecological improve and provide of social-economic development of country.

The Republic of Uzbekistan in December 7, 1994, signed and August 31, 1995 the Oliy Madjlis (Parliament) of Republic of Uzbekistan ratified the UN's Convention on struggle with desertification and drought, recognizing the necessary of struggle intensifying with desertification and taking the effective measure on prevent of ecosystem degradation and rational using of natural potential in cooperation with world community.

As a first step on realization of Convention, at financial support and technical assistance of UN's Program on environment (UNEP), was developed the National program of actions on struggle with desertification in Republic of Uzbekistan.

In development of National Program of Actions on struggles with deserting in Republic of Uzbekistan participated the great scientists, specialists from different Ministries and scientific organization of Republic of Uzbekistan.

The National Program of Actions on struggles with deserting contains the deep analysis of reasons deserting and priority way on struggle with deserting and degradation of lands by antropogen loading. The program offered the scientific-well grounded measures on prevent further of degradation of lands, improve of conditions of pasture and haymakings, decreasing of social-economic consequences of deserting, softening of influence of drought with deficit

of water resources.

**UN's Convention on struggle with desertification in countries, which subject to serious drought or desertification, especially in Africa.**

In 1977 the UN's Conference on struggle with desertification took a plan on struggle with desertification. However, the problem of land degradation in arid, semi-arid and subhumid regions not only didn't was soluted, but also in definite extent has become aggravated. Therefore, the question about struggle way with phenomenon stay in center of attention of UN's Conference on environment and development, which was in 1992 in Rio de Janeiro.

The Conference applied to UN with suggestion to establish a special committee for development of Convention on struggle with desertification, which was taken in Paris, June, 17 1994, and in October was open for signing, and December, 26 1996 has come into force, after 90 days afterwards its ratification 50th state. On today to it added 139 states.

The purpose of this Convention is struggle with desertification and softing of drought impact in countries, which subject to drought and desertification, through effective measures on all level in combination with agreements about international collaboration and partnerships in border of complex method, corresponding to agenda on XXI century and directed on achievement of sustainable development in these regions.

For achievement this purpose is necessary a long-term complex program, directing on increase of land productivity, reconstruction, preservation, sustainable and rational use of land and water resources for increasing of life level of population.

The Convention required from Government of countries, which signed its:

- ♦ To give a first consideration to struggle with desertification and softing of consequence of drought and choice of adequate resources in corresponded with its own adverbs and possibilities;
- ♦ To develop a strategies and establish a priorities on struggle with desertification;
- ♦ To creation a favourable conditions through aggravation of corresponding laws, in those case, when its absent, by means of promulgation of new laws and forming of long-term politics and program of action.

Besides, from governments of developed countries require to provide a assignment of financial resources and other forms of support for help to developing countries – Sides of Convention, effectively developing a own plans and strategy on struggle with desertification, and to promote to access of other countries, especially developing, to achievement technologies, knowledges and now-how.

Sides courage:

- ♦ Coordination of activity, practicable in border of this Convention and other achievemeting international agreements, in particularly a Limits Convention of UN about climatic changes and Convention about biological diversity;
- ♦ The conducting of combined program of training of personnel, systematic observation and exchanges of information.

In text of Convention is express a anxiety of international community in connect with impact of desertification and drought on countries of Central Asia.

The Convention was established a Conference of sides, which is higher organ and take a solution in limits of self status, necessary for help to its effective realization.

### **National program of actions on struggle with desertification in Republic of Uzbekistan.**

Recognizing the important of solution of desertification problem and struggle with consequences of drought, and other question connected with its, Uzbekistan in 1995 jointed to International Convention on struggle with desertification.

In corresponding with politics of Government and for realization of priority obligation, taken in Convention limits, in Republic was organized a development of National program of actions on struggle with desertification, supporting at UN/UNEP. This program was developed a group of specialists from corresponding organization of Republic joint with Main Management on hydrometeorology at Cabinet of Ministers of Republic of Uzbekistan (Glavgidromet), actioning as governmental executive agent.

The purpose and sphere of action. The purpose of National program of actions on struggles with desertification - to supply the realization of uniform general line and structure of planning on management of processes, directed on prevention of desertification and softing its consequences. The creation of program of actions permit to form a mechanism, providing a development of single-minded and effective programs and projects, provide a good planning on national level, will be to promote a help to donor organization, and to development of agreements in support of realization of plan actions.

The organization of program development of actions. The organization of development began from wide discussion of structure and main propositions of program with different Ministries, department, states and non-governmental organizations, that allowed attract to this work a large group of experts and leading scientists of country. Such wide representations is garant, that program of actions developed on multysector basis and is part of efforts of Government on achievement of sustainable development of Republic.

The structure of document. The document consists from introduction, four chapters and conclusions.

The introduction includes the prologue, conditions and preconditions of development of National programs of actions, international, legal and Institute context.

The first chapter - Natural conditions - contains the description of geographical location, climate, surface waters and soils, flora and fauna, and including a natural-climatic division into districts.

Second chapters – Socio-economic conditions and resources of Uzbekistan - contains the analysis of condition, all kinds of resources, and main directs of economic development.

Third chapters – Desertification processes - defines the factors of desertification, its reason, interimpact of climate and desertification, its connect with dry of Aral sea, economic and social consequences of desertification for Republic of Uzbekistan.

The fourth chapter - National program of actions on struggles with desertification -

determines the particular actions, necessary for achievement of purpose; role of governmental bodies, state organization, local bodies of management and non-governmental organization in its realization, and role interregional and international collaboration in struggle with desertification.

The realization of plan of actions. The project settle account on long period with detailed annual check its completion. During of this checks will be consider a realization questions of plan of actions in life and bringing a changes, requires for including a new methods, connected with changes conditions.

From this time for realization of necessary measures will conducts the planning and output of appropriate measures on next step.

### **The participation of Uzbekistan in International conventions in field of environmental protection.**

The questions of natural protection are one of the most priority in world community. The natural-saving activity regulated by international conventions and agreements.

After independence Uzbekistan began to form the ecological policy and has displayed the initiative on activation of entry in international ecological agreements, however, this process connected with determine difficult, provoked with small experience and financial questions.

Nevertheless at present time the Republic has joined to 10 conventions:

1. Convention about prohibition of military or any other hostile use of means of effect on environment.  
The date of preparation of text - on May 18, 1977  
The date of affiliating of Uzbekistan - on October 5, 1978  
(on rights of right-succession).
2. Vienna's' Convention about protection of ozone layer.  
The date of preparation of text - on March 22, 1985  
The effective date - on September 22, 1988  
The date of affiliating of Uzbekistan - on May 18, 1993  
(on rights of right-succession).
3. Montreal's' Protocol on substances, destroying the ozone layer.  
The date of preparation of text - on September 16, 1987  
The effective date - on January 1, 1993  
The date of affiliating of Uzbekistan - on May 18, 1993  
(on rights of right-succession).
4. Basels' Convention about control of transborder carriage of dangerous wastes and their removals.  
The date of preparation of text - on March 22, 1989  
The effective date - on May 5, 1992  
The date of affiliating of Uzbekistan - on December 22, 1995  
(on rights of right-succession).
5. Limits Convention of UN about climatic change.  
The date of preparation of text - on May 9, 1992  
The effective date - on March 21, 1994  
The date of affiliating of Uzbekistan - on June 20, 1993
6. Convention about biological diversity.  
The date of preparation of text - on June 5, 1992  
The effective date - on December 29, 1993



- The date of affiliating of Uzbekistan - on May 6, 1995
7. UNs' Convention on struggle with desertification in that countries, which subject to serious drought and/or desertification, especially in Africa.  
The date of preparation of text - on July 17, 1994  
The effective date - December 1996  
The date of affiliating of Uzbekistan - on August 31, 1995
  8. Convention about International Trade by kinds of wild fauna and flora, located under threat of disappearance.  
The date of preparation of text - on March 3, 1973  
The date of affiliating of Uzbekistan - on July 1, 1997
  9. Convention about protection of world cultural and natural legacy.  
The date of preparation of text - on November 23, 1972  
The date of affiliating of Uzbekistan - on December 22, 1995
  10. Bonns' Convention on preservation of migrationing kinds of wild animal ones.  
The date of affiliating of Uzbekistan - on May 1, 1998

Besides the Government of Republic of Uzbekistan signs a 12 international agreement about cooperation in field of environment protection.

### **The connection between National program of actions on struggles with desertification and other natural-saving programs.**

With finding of independence Uzbekistan has become a country of fundamental ecological, political and social changes.

The most large problem is the overcoming that critical ecological situations has caused as results of absent in past a policy of sustainable development of Uzbekistan.

It's caused the necessity of development of a lot national programs, which in definite degree are connected with problem of struggle with desertification and drought.

In purposes of completion organization of decisions and recommendations of UNs' Conference on environment and development and effective participation's of Uzbekistan in international and regional collaboration on solution of problem of transfer to principles of sustainable development was created a National commission of republic of Uzbekistan on sustainable development.

The main task of commission are the development of national strategy and programs on sustainable development of Uzbekistan and activity coordination of national commission and work bodies on problem of climatic changes, on struggle with desertification and drought, on preservation of biological diversity, on ozone destroyed substances, and organization of preparation of suggestion to new convention and agreements, directed on sustainable development of Republic of Uzbekistan.

Hence, its central duty will be effective and integral realization of agreement, produced by "The meeting on higher level on Earths' problems" in Rio de Janeiro, which signed Uzbekistan. The main instrument for realization will be **National plan of actions on environmental protection** (NPAEP), including its components on struggle with desertification and drought.

The main priority purposes of it are: the improvement of ecological conditions for health of person; the assistance to effective and sustainable using of natural resources, protection of most vulnerable and valuable ecosystems. Was exposed a main ecological problems, determined the actions, necessary for their solution.

In NPAEP for the first time determined a measures, directed on receiving as ecological, as

financial benefits, that in conditions of market reforms in Republic have a important significant. Therefore a preference give to projects, with prompt and higher economical return and ecological effect or unrequiring a large expenditures for achievement of significant ecological results.

For support of realization suggested measures was foreseen a strengthening of legal and institution basis, emphases a role of ecological study and information of population about ecological problems.

The measures of economic policies have the specific significance, which assist to mobilize and more effectively to use a financial resources and promote to improving of ecological characteristics of manufacture activity.

### **The national program on termination of use of ozone-destroyed substances (ODS).**

The purpose of National program is the completion of obligations, following from Viennas' Convention and Montreal's' protocol on substances, destroyed a ozone layer.

In connect with it is scheduled:

- To stop the consumption of chlorine-fluorine-carbons, tetra-chlorine-methane and methyl-chlorine to 2000;
- By degrees to refuse from use of group of hydro-fluorine-chlorine-carbons and bromide methyl, to schedule of countries, falling under title of 2 Montreals' protocol;
- Whenever possible to speed up of replacement of ODS concerning to terms, intended by international agreement;
- With help of Global ecological fund and other international organizations to develop and to enter the proper system of regulation;
- To render the support to enterprises, establishments and organizations, inculcating a ozone-safe technology;
- To advance the legislative base for strengthening of control of replacement of ODS.

### **The national strategy and plan of actions on preservations of biological diversity.**

This, executed on national level, document, is developed in connection with affiliating of Republic to Convention about biological diversity, in corresponding with obligations, taken in limits of this Convention, and approved by Government in April 1998.

The main priority elements of strategy and plan of actions are:

- The establishment of National commission on biodiversity;
- The valuation of modern condition of biodiversity;
- The reorganization and development of network of specially covered natural territories;
- The division of responsibility in management of bioresources;
- Public information, education and participation in business of preservation and undestroyed use of biodiversity;
- The particular actions and gears of destroying use;
- The calendar plan, financial means and their sources.

The state executing agency is Goskompriroda. The GEF/UN was financed a project. The ending of all work, connected with project – September 1998.

### **Uzbekistan - study of country on climatic changes.**

This realized on national level the project of potential escalating in Uzbekistan on

completion of the obligations on limits Convention about Climatic changes, meet the Conventions' purposes.

The elements of project consist from preparation of first National report of Uzbekistan to Conference of Parties. The report consist from inventarization of hotbed gas for 1996, materials for consider of emission trends, a general description of accessible or plan measures for softing of climate, evaluation of vulnerability of Uzbekistan to climatic changes and general description of accessible or plan measures for adaptation.

The following elements consist of:

- Increases of public consciousness and knowledge of state officers, connected with questions of climatic changes;
- Development of organizational structures for strengthening of dialogue and cooperation of governmental and non-governmental organizations, private sector etc.
- Identification of project concerning to climatic changes with hotbed gases.

The state executing agency is the Head quarters on hydrometeorology (Glavgidromet). GEF/UN financed this project. The start of project development – March, 1997. Duration 20 months.

### **The project of Aral sea basin (PASB).**

The development of project is begun in 1994 after execution of meeting of countries - donors in Paris, under aegis of World bank and coordinate with Executive Committee of International fund of Aral rescuing.

The project consists from 8 main projects and 19 subprojects.

On line of World bank more, than 15 mln dollars of USA was given for the first phases of realization of project from 1994 to 1997.

The development of “Strategy of rational water-using and protection of water resources in Aral Sea basin” and Composition of international programs “Fresh water” and “Sanitation” was priority in first phases. The realization of this project was began in Uzbekistan, Kazakhstan and Turkmenistan.

The second phases of GEFs' project in frameworks of program for Aral sea basin is begun on July 1998.

The main priorities of this phases are aimed on effective water use with development and application of national and regional strategies on their rational use in struggle with land salinity and creation of national water reserves for sustainable development of Central Asian counties and solution of problem of Aral sea crisis, on water monitoring in basin of Amudarya and Sirdarya rivers, and equipment of hydroposts with means of calculation of expense and quality of water, and on realization of pilot analogue for determine of possibility of natural diversity recreation (as example Sudochye lake in Karakalpakstan).

Duration of second phases is 3,5 years.

### **The national plan of actions on environmental hygienic of Republic of Uzbekistan.**

The UNs' Convention environment and development has ratified the agenda on XXI century. In it to countries is offered to develop a national plan of actions for achievement of long-term politic purpose in field of environmental protection and public health.

In corresponding with its on initiative of Goskompriroda and Ministry of Public health with approval of Government of Uzbekistan began (February – March, 1996) the development of project.

The main executors – Goskompriroda and Ministry of Public health at participation of

experts from appropriate organizations and technical means of the World Organization of Public Health (WOPH).

The work is practically completed and submitted to Cabinet of Ministers. The financing was conducted at the expense of own means of workers.

This plan of actions is intended first of all for sector of public health services and sector of environmental protection, as main force in planning and realization of national actions in this field, in partnerships with other sectors and social groups.

The prepared plan of actions – guide for putting of environment in favorable condition for health of people.

### **Trans-border project on preservation of biodiversity in Western Tyan-Shan.**

This, financing by GEF and other organizations, the project of cost approximately, 10 mln USA dollars (from which 2 mln for Uzbekistan), intended on 5 years and prepare at present by World Bank (through non-governmental organization “Fauna and Flora International” – Great Brittany) and Governments of Kazakhstan, Uzbekistan and Kirgizstan.

The project will have be a following not the base components:

- The development of national strategy and plan of actions on preservations of biodiversity of Kirgizstan;
- The strengthening of policy, rules and institution preconditions;
- The development of programs, supporting a sustainable use of natural resources by local population in Western Tyan-Shan;
- The development of financial gears for creation of opportunity for especially to covered natural territories to bear their current costs.

The development of project is begun on July 1998. The state executing agency from Uzbekistan is Goskompriroda.

### **The creation of favorable conditions for residing.**

In structure of conducted economic reforms in countries the large attention is paid to questions of improvement of social conditions for rural population, improving of providing with fresh water and natural gas.

"The program of social infrastructure development of village on period 1996-2000", "The program of providing of rural population with fresh water and natural gas" was developed and successfully realization.

### **The legal bases of natural-protection policy in field of environmental protection.**

The social-economic development of Republic of Uzbekistan in structure of former USSR passed without proper account of possible impact of economic policy on environment. In economics with centralized planning and production, depending from last result, indulgence at law violations, weak budget assignments, natural-guard legislation was systematically violated practically without serious pursuit.

In 1991 governmental charges on completion of ecological programs was made only the by 0,06% from gross national product. The natural-guard policy and legislation separate developed and non-content a complex interaction between different ecological environments. Planned ecological program either non-realization or particular realization, that explain with absent of stable legislation base.

The proclamation by Uzbekistan of independence, its integration in world economy and

political structures steel a powerful stimulus for solution of ecological problems. The preservation of environment consider now, as integral part of economical reforms. The social and economic policy of state, its strategy based on principles of harmonization achievement of industry and environment, and stimulated of realization of all serious ecological problem, staying before country. Uzbekistan began to conduct a legislation reform, resee old and antiquated legislave acts and introduce a new in life.

**At present the ecological safety of citizens is guaranteed with Constitution of Republic of Uzbekistan.** The legislation on environment protection created a economic and social preconditions for ecological safety of population on generally accepted principle basis of natural protection and rational natural-using.

The appropriate financing level of ecological programs should be achieved reach through sufficient budget assignations, system of territorial funds on natural protection, non-state ecological funds and new financial and credit mechanisms, developing at transfer to market economics.

For creation of necessary legal base in Uzbekistan for years of independence be accepted already about 100 legislative documents, connected with environmental protection and natural-using.

The main statement, which regulated the natural protection activity in Uzbekistan, is law accepted on December 9, 1992 the Law of Republic of Uzbekistan "**About protect of nature**", which fixed the legal, economical and organization bases for protection of environment, the rational using of natural resources, guaranteed the rights of citizens on the favourable environment. It directed on providing of sustainable development of Republic in field of environment protection and in social plane, including a preservation of biological diversity balance, population health, cultural legacy. The Law determinated the main management's principles of natural protection, plenary powers of state institute .

The Law of Republic of Uzbekistan "**About sanitarian supervision**", accepted July 3, 1992. Regulated a public relations on providing of sanitarian-epidemiological favourability of population, fixing a human rights on favourable environment, establish a sanitation requirement for different economic activity and prohibition activity, in fringing of sanitation standards, norms and rules, and negative impact on environment.

The Law of Republic of Uzbekistan "**About water and waterusing**", accepted on May 6, 1993, regulating the water relations, rational water using on needs of population and national economics, reglament the protection of water from pollution, obstruction and exhaustion, and right of users and citizen's in water relation field.

The Law of Republic of Uzbekistan "**About specially protection natural territories**" from May 7, 1993. Determined a total legal, ecological, economic, organization basis of creation, management and protection of unique natural complexes.

The Law of Republic of Uzbekistan "**About protection of atmospheric air**" from December 27, 1996. Establish a legal regulation of activity of state organization, enterprises, public cooperation and citizens in field of atmospheric protection.

The law directed on preservation of natural structure of atmospheric air, prevention and decreasing of harmful chemical, physical, biological and other impact on it. For evaluation of atmospheric air conditions establish a unite for Republic territory a norms of quality. Introduce a standards in field of atmospheric air protection, which determine a protection regime, methods of control for condition and other requirements on protect.

The law introduced a obligatory taxes for harmful impact on atmospheric air.

The Law of Republic of Uzbekistan "**About protection and use of animal world**", accepted on December 26, 1997. Regulated a relations in field of protection, using, restore and reproduction of animal world in purpose of providing of life conditions, preservation of kind

structure, integrity of natural community and environment.

The established, that animal world is state property and protect by state.

The Law of Republic of Uzbekistan "**About protection and use of vegetation world**", accepted on December 26,1997. Regulate the relations in field of protect and using of vegetation world, growing in natural conditions, and wild growing plants, containing in cultural conditions, for its reproduction and preservation of genetic fund.

The law is determined, that vegetation world is state property and protection of its. The relations in field of protect and using of forest regulated with forest legislation.

The acception of named and other laws, as rule, accompanied with follow taken of sublaw acts, detailing the determine tenets of law. The Governmental resolution, regulating the using and protection of separate kinds of natural resources, fixing resolution, rules, instruction in this field was accepted.

For violation of natural-protection legislation are established a criminal, administrative, civil-legal (material), disciplines and property responsibility, that reflectively in Criminal code of Republic of Uzbekistan, Code about administrative responsibility, Civil and labour codes.

Besides, in acts of ecological legislation have a special norms f ecological-legal responsibility, which non-included in named kind system of juridical responsibility.

## 1. THE NATURAL CONDITIONS OF REPUBLIC OF UZBEKISTAN

According to definition of Convention of United Nations on struggles with desertification, the term "**desertification**" means the degradation of lands in arid, semi-arid and dry subgumid regions as result of action of different factors, including the climatic change and human activity. The term "**earth**" means "earth bioproductivity system, including in self - soil, water, vegetation, other biomass and ecological and hydrological processes, which making inside of this system".

Such interpretation of term the "earth" permits to consider above mention system as the geographical system (geosystem) or landscape, with following from this a need to analyze the all geographical components, which composite her and all processes inside of her. According to point 1 the term "arid, semi-arid and dry sub humid regions" means regions, in which correlation of average annual level of precipitation to potential evapotranspiration to variation in range from 0,05 to 0,65. The last index of drought or aridity (0,05-0,65) several narrow the areas of arid geosystems, which, according to all world map of desertification, printed in 1977 in Paris by UNESCO, include all territories with index of arid to 0,75. However, according to criterion's above mention the documents, the territory of Republic of Uzbekistan with index of arid from 0,03 to 0,20 completely located in arid region, which subject to intensive desertification.

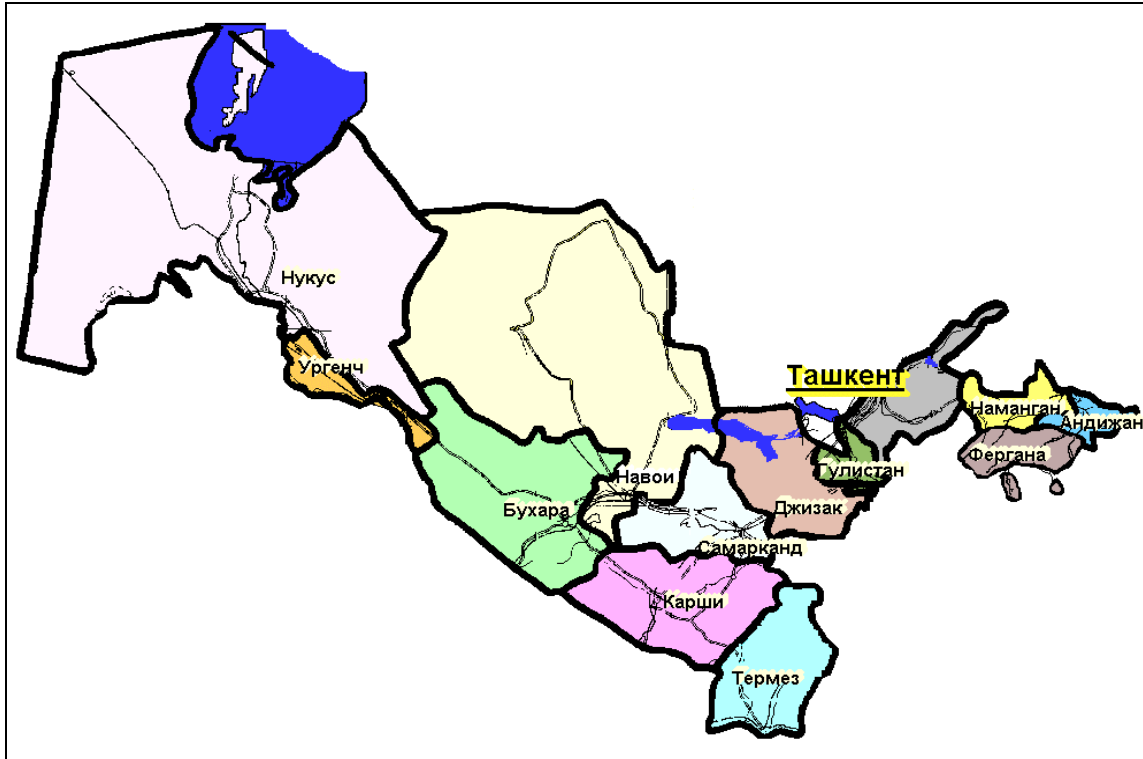
### 1.1. Geographical location

Uzbekistan is located in Central part of Central Asia, between two rivers Sirdarya and Amudarya. The extreme northern point located on north-east of plato Usturt (45°36' north latitude), south - near town Termez (37°11' north latitude), west - on Usturt (56° east longitude), east - on south-east of Fergana valley (73°10' east longitude). Geographical location correspond to location so Mediterranean sea's states as Spain, Greece, Italy. However, the natural conditions are different from nature mentioned subtropical counties. It is connected, that republic by far distant from warm ocean and seas and from north side open for dry and cold arctic air masses. From south the high mountains bar the way for damp and warm air masses.

The large part of republic, extending, from north-west to south-east, is plain, engaged the deserts and steppes, the south-east part engaged the hills and mountains. The area of Uzbekistan 447,7 thousand square kilometers.

**The border.** The large part of borders of Uzbekistan passes on plains. On north the border with Kazakhstan passed on plato Usturt, Aral sea, Kizilkum desert, Korjantau range and north-east part of Ugam range. The border with Kirgizstan passed on Pskem and Chatkal range, the west foot of hill of Fergana range and the north foot of hill of Alay mountains, the border with Tadjikistan - on Kuramin, Turkestan, Zarafshan and Gissar ranges and on Babatag. On south (90 km part on Amudarya) Uzbekistan border with Afghanistan. The south-west border with Turkmenistan passed on Amudarya, Kugitangtau mountains, clayey steppes and sandy deserts of right bank of Amudarya, further on west last part of Khorezm oasis and reach to Sarakamish lake, round from south the Usturt and exit to 56 meridian.

## Administrative distribution of Republic of Uzbekistan



### 1.2. Structure of surface (geomorphology).

On device of surface the territory of Uzbekistan is divided on two unequal parts. The three of quarter (78,7%) of territory of Uzbekistan is plains, the other part (21,3%) -is mountains and intermountain depressions. From west and north-west to east and on south-east the territory of republic gradually rise. Located on east and south-east of republic the foothills (adirs) fringe the mountains. The adirs a strongly cuted to pieces. Especially much the adirs is in foothills of Fergana Valley, Samarkand and Kashkadarya districts. The most less part of republic located in depressions of Amudarya and along bank of Aral Sea (60-100 v over sea level).

**Plains and depressions** combined with sites of ostance plato to Quaternary of age. They basically take a north and north-west part of Uzbekistan's territory. Plains, as component, come into Turan depression, which early was a bottom of nondeep sea. The sea gradually step backed on west and on it place was deposited the friable mountainous rocks, which bringed with rivers from mountains. When sea became shallow and dried, the wind transfer a sandy precipitation from one place to other, swepted a sandy barkhans. In silt deposit was not only sand, but clayey rock. The layer of clay the most part settling in foothills and river's valley.

To north-west from valley stretch **plato Usturt** (height 120-180 m, and the most high its point 292 m - on Karabaur height).

Formed it from ancient sea precipitation, consisting from limestone. The sheer and steep border of plato, rising over plains and Aral sea, named chink. The surface of Usturt is rough, having wave surface with plane and drainless hollows, the some from which (Barsakelmes) engaged with salt flow. Here and there found heights (Karabaur) and depressions (Barsakelmes, Assake-Audan and Sarakamish). To east the Usturt break with steep border (chink), which height to 100 and more meters.



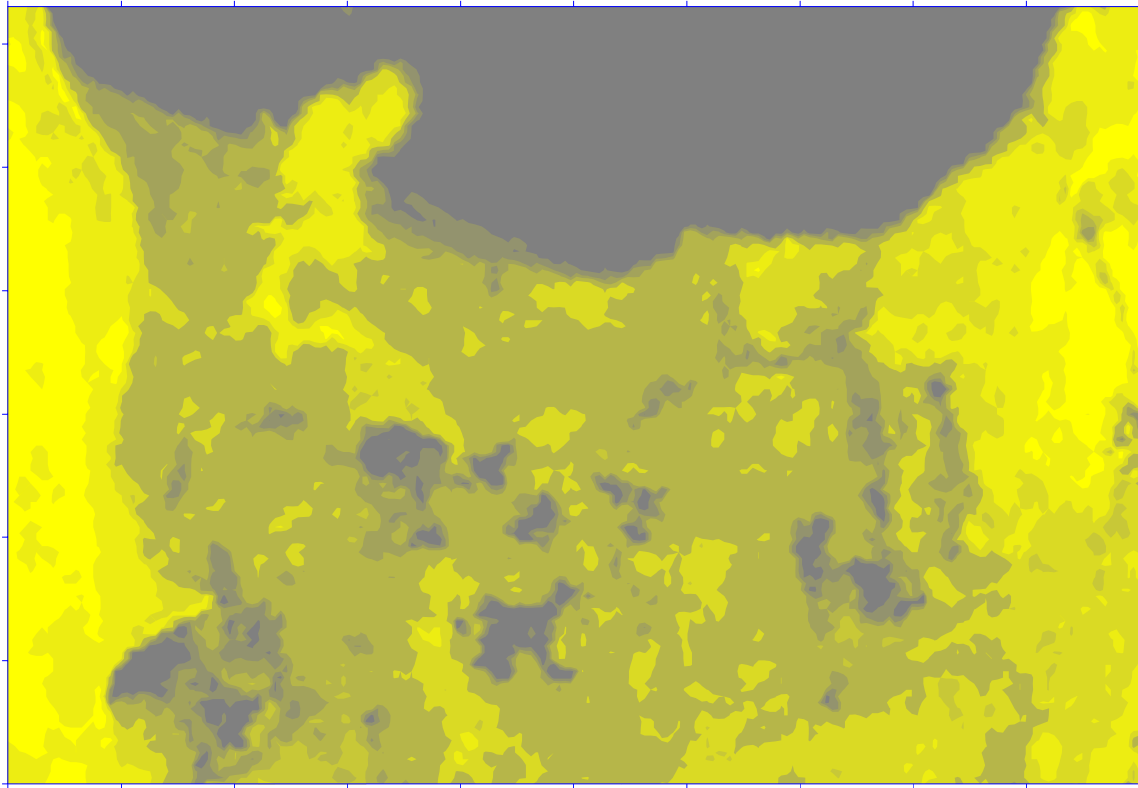
The space between desert Kizilkum and plato Usturt take the depression of Aral sea and delta of Amudarya river. Marine plain, which component of bottom of Aral sea, present with plane part of surface, very change with eol processes. In eol relief more hilly sand.

**The Amudarya delta** takes the large area 44 thousand sq. km. It surface across the ancient and modern river-bed(Kuhnadarya, Darialik and other). The average part takes not great heights, formed from basic rocks.

The Amudarya delta, represents alluvial plain, formed with three generations of different age - Akchadarya on east, Sarakamish on west and modern (or Aral) in center. The first two from their dried in last years, when Amudarya change of river-bed. The last Aral, still 60th years was irrigating and characterized with a big among of canal, marsh-ridden spaces, lakes and channels.

### **Modern conditions in Amudarya delta on sputnik view.**

The dark tone is most moisture zone.



The **Kizilkum desert** located to the south-east from Aral sea. It area about 300 thousand sq.km, that in 3 times less, then area of Gobi desert and in 20 times less, then area of Sahara desert.

On north of desert developed a ridge and hilly sands in different degree fixed with shrub and semi-shrub vegetation.

In central part of Kizilkum between sandy massifs raise the fragments of mountain relief. The represent non-high (to 922 m over sea level) heights, somewhere stretch as explosive chain or collected and formed original landscape from insular or "pierce" mountains - Bukantau, Tamditau, Auminzatau, Kuldjuktau, Etuntau, Sultan-Uvais.

Between these range of mountains located deep depressions takes the salt-marsh - Minbulak, Alkagitma, Karahota and other.

The bottom of Minbulak had absolute point 12 m, that is lies below of level of world ocean.

The south part of Kizilkum represents as ancient plato, is strong wash-away by waters of Zarafshan river, forming here a large delta. The dry channels of Zarafshan - Gudjelisay and Mahandarya - covered of sands.

On territory of Kizilkum found the many ancient river-bed of Sirdarya, Amudarya and Zarafshan. To east and south-east from Kizilkum located clayey and loess deserts - Mirzagul, Karnab, Karshi, Malik and other.

**The mountains** of Uzbekistan enter in structure of Tyan-Shan and Alay mountain systems. On territory turn the western spurs of Tyan-Shan and Gissar-Alay mountain system. To south and west they gradually lower and turn to plains.

**These mountain systems** some have arisen the systems of millions of years ago on location of sea, covered the territory of Central Asia and near regions. Internal (tectonic) power of Earth rised the sea bottom on considerable height. From formed folds grown the powerful ranges of mountains. And the high the mountains, the strong influence on they the external forces. The impact of the sharp day variation, moving of glaciers, flow of water and wind continuos by brook the mountain rocks. The water wash away of slopes, carry away the wash away rocks on plains, intermountain hollows and depressions. As result the mountains is more less, depressions fill up with moved rocks, formed modern river valleys.

**The mountains and foothills** with brook relief, located in east and south-east part of republic, where they unite with powerful mountain deep brook massive on territory of Kirgizya and Tadjikistan. Mainly this Ugam, Pskem, Chatkal, Kuramin ranges and their western and south-western spurs, concerning to Western Tyan-Shan system and Turkestan, Zerafshan and Gissar ranges with their continuous on south-western - Babatag and Kugintangtau ranges, concerning to Gissar-Alay system. Entering on territory of Uzbekistan its spurs formed radiating bundle of mountain chains, constantly less in north-western and south-western directions. The character example is Karjantau, Maygashkan and Surenata ranges in western Tyan-Shan system and Nuratau, Aktau and Kuratau ranges and Karatepa and Ziadin-Zirabulak mountains, being the last of Pamir-Alay.

Entering in **Western Tyan-Shan** system the mountain ranges (Karjantau, Ugam, Pskem, Chatkal, Kuramin) began from Talass Alatau (on border with Kirgizstan), further as fan radiate from here and continuos to north-east to south-west. The more high point of Talass Alatau is mountain Manas (4482m).

The high point of Chatkal range on territory of Uzbekistan - Large Chimgan peak (3309 m).

Between Chatkal and Kuramin ranges located Akhangaran valley. The apexes of Western Tyan-Shan covered with snow and glaciers. The Chatkal and Kuramin ranges border on north with Fergana valley. From east she borders with Fergana range, from south with Alay and Turkestan ranges.

To north-west from Turkestan range raises the Malguzar range, to south-west Chumkartau range. Only the north slopes of Chumkartau entering on territory of Uzbekistan. The valley of Sanzar river separate the Malguzar mountains from Nuratau mountains. The weak point in this valley named Tamerlan gates.

The Nuratau mountains stretch on 180 km. Their north slope is steep, the south slope is gently sloping. The high point of North part of Nuratau mountains is Khayatbashi apex (2165 m). The south part of Nuratau mountains consists from separate apexes (Aktau, Karatau, Karagatau, Gabduntau). On the south and as parallel to Turkestan range located Zarafshan range. With self eastern part he entering on territory of Tadjikistan. On south from Zarafshan range located Gissar range and his south-western spurs (Yakkobag, Surkhantau, Kugikantau, Baysuntau, Chakgar and other). Here located **the high point of Uzbekistan - the Khazret Sultan (4643 m)**.

In western part of Gissar range are two glaciers - Batirbay and Severcev. On south of Uzbekistan along of border with Tadjikistan located Babatag range. The high point - Zarkasa (2292 m).

The main features of orography of Uzbekistan connected with features of geological structure of above-mentioned the mountain systems. This bond found expression in these, that between mountain ranges located spacious foothill and intermountain depressions, the large from which is Tashkent-Golodnosteppe, Fergana Zarafshan, Kashkadarya and Surkhandarya. The takes with products of destroys of mountains and Paleozoic basis lowered here on most deep. The large part of this depressions drain with river, which collecting water from surround mountains.

**Intermountain depressions** formed as result of raised of mountain ranges and lowered the earth crust. The surface basically plain, only somewhere across with river, which form a few terraces. Then near to ranges the relief of depressions gradually change, having character of slope and split place.

**The Tashkent-Golodnosteppe depression** is largest intermountain depression on territory of Uzbekistan. On east she border with Western Tyan-Shan ranges, on south with Turkestan and Malguzar ranges, on west located Kizilkum desert. The average height of valley over ocean level about 300-500 m.

**The Fergana valley** located to south-east from Chirchik-Akhangaran valley. The extent her more, then 370 km, the width about 60-120 km. The average height is 300-400 m. The Syradarya river across a valley.

**Sanzar-Nuratau depression** located between Malguzar and Nuratau mountains, her height fall from south-east to north-west from 800 to 300 m.

**Zarafshan depression** located between Nuratau and Zarafshan ranges and Zirbulak and Ziadin mountains. On it flow the Zarafshan river, which near Samarkand town disjoin on Akdarya and Karadarya, and near Khatirchi settlement again join and formed Miankale island with length 100 km, width 15 km. The height of Zarafshan depression over ocean level in eastern part 900 m, in western about 300 m.

**The Kitab-Shakhrisabz depression** located on south from Zarafshan range. Her height over ocean level on west - 500m on east - 1000m. From east and south east the depression surrounded with south-western spurs of Gissar range, on west she open and gradually transition to Karshi steppe.

**The Sherabad-Surkhandarya depression** located from south-east to south-west from foot-hill of Gissar range and his spurs. The height her over ocean level on south-west 300 m, on north-east 700 m. The Surkhandarya and Sherabad rivers acrossed the depression.

The more observed the reductions of mountains in western and north-western directions the more expanded the located between they depressions. Gradually they flow with large Turan depression, which takes in border of Uzbekistan the almost Central Asian interrivers from mountains to banks of Aral sea and sheer ledges of Usturt plato. The all this territory very original on all complex of physical-geographic conditions and non-homogeneous in geomorphology relationship. In border of Uzbekistan she characterized with totality of different on genesis and relief of separate regions.

The important role during formation of landscapes of Uzbekistan is played the by **earthquakes**. On territory of Uzbekistan, especially in mountain and foothill regions, till now in earth crust showed the tectonic move, therefore here very often have place the earthquakes. The power of shock about 8-10.

During of the strong earthquakes on surface of earth formed the cracks, shifts, owing to that destroyed the buildings, industrial objects and roads, and accordingly change landscape of territory.

### 1.3. Climate of Uzbekistan.

The typical traits of the climate of Uzbekistan are drought, abundance of warm and light, **the continentally**, which manifest in inter year and interial variation of climatic elements.

The north part of territory of Republic of Uzbekistan relates to moderate, the extreme south - to subtropical bands.

On the climate influences geographical location, intensity of the solar radiation, originality of atmospheric circulation and relief of place. The territory of Uzbekistan located in central part of Eurasia continent, far from oceans and seas. Here is many sun days, considerable daily and annual variation of temperature, not much a precipitation. In summer the sun in Uzbekistan very high stayed over horizon. In June 22 on north of republic it raise over horizon to 68°, on south to 76°. On plains of Uzbekistan - in Kizilkum, Mirzachul and Karshi steppes - during of year on every square cm came 137-160 kkal of radiation.

The period of **solar radiation** in Republic more continue, then in Mediterranean and California (USA), located on same latitude.

For formation of climate of Uzbekistan the determining significance has a radiation factor. The main features of climate of country ,with his high temperature of air and soil, and with extraordinary dry of summer period, depend from solar radiate. In warm half-year entering the solar radiation in republic so large, that other powerful climate forming factor (atmospheric circulation) played subordination role. The total duration of solar radiation on plains of Uzbekistan about 445504475 hours in year. In fact annual among of solar radiation about 3000-3100 hours, that about 65-70% from possible.

The duration of solar radiation defines the quantity of arriving solar radiation. The quantity of heat from summary radiation variety in limits 140-160 kkal/sq.cm in year. The part of straight radiation from total sum of heat is 65-70%.

The abundance arriving with solar radiation the warm, and as well as geographical location of Uzbekistan in center of extensive continent, far from oceans, stipulate here the sharpness continental climate.

From north and west the territory of Uzbekistan open for coming the **air masses** of these directions.

**In winter-grade time** the cold air intrusions from Arctic and Siberia freely penetrate far on south of Central Asia considerably decreasing the total level of temperature. Often the cold masses of arctic air and Siberia anticyclone from north-east reaches to south borders of republic.

Therefore the winter in Uzbekistan as often as not cold, cloudy, not-snow.

When come the arctic or north-eastern Siberia air masses the weather is serene and cold. The winter stand not long.

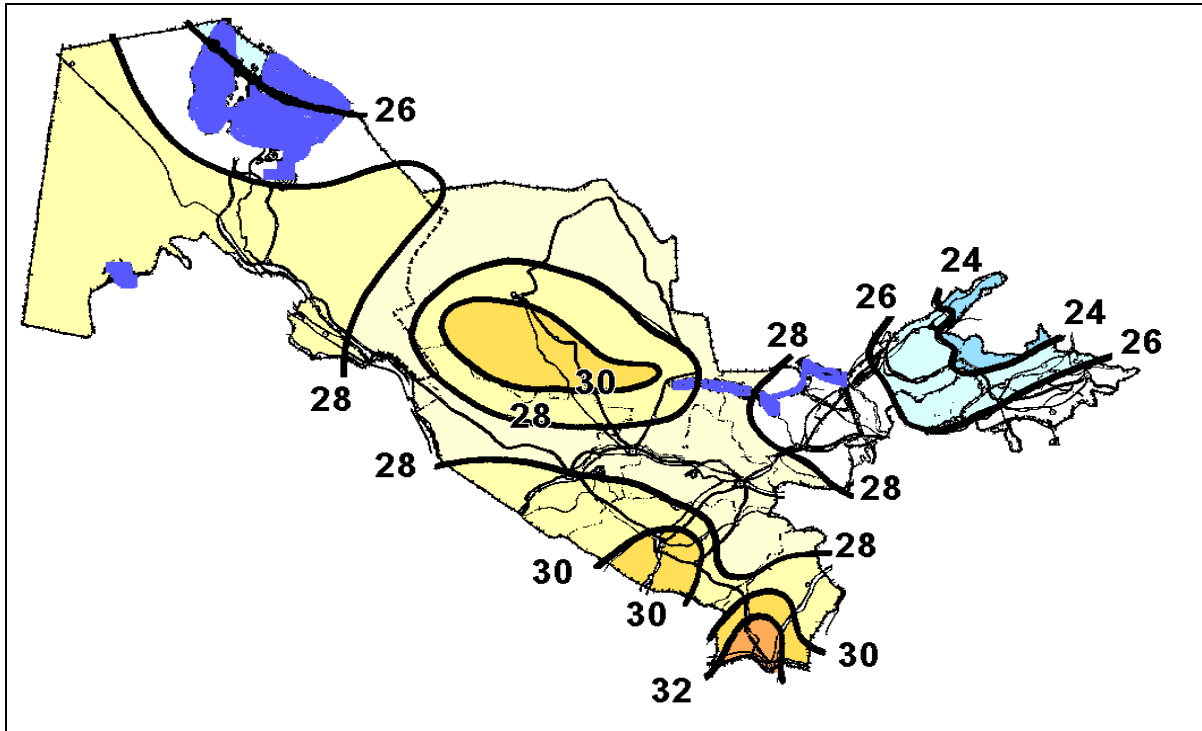
On extreme south, protected from cold northern intrusions with high mountains the average temperatures of air on January is positive: +2, +3,5°C. In Surkhandarya valley, closed from cold air flow with mountains, the winter more warm, then in other regions. In winter over territory of Uzbekistan formed the air front of temperate latitudes, in results the temperate air masses clashed with tropical masses and form the cyclones, drop out the precipitation.

The average temperature of air in January can is lowered to 0°C and below. For example, on Usturt - to -10°C about, and in Tashkent to -1°C, Termez - to +2,8°C. In some years the winter was a very cold. The very low temperature in Surkhandarya - -20°C, on Usturt - -30°C. The absolute minimum on territory of republic was about - 38,5°C (north-western Usturt).

Such strong frosts, casing because of penetration of arctic and Siberia cold air masses, put the harm to fruit gardens and vineyards.

**In summer** on valleys form the warm air masses. The air becomes to dry and hot, is saturated by small-sized dust. The summer in republic is dry and hot. The average temperature of air in July is 32-33,5°C on north (plato Usturt) and 36-37,5°C on south (t.Termez). The absolute maximum is 50,5°C (t.Termez, 1912).

### The temperature regime on July.



The distribution of the warm depends from geographic latitude and relief of the district, solar radiate, movements of prevail air masses. In depends from these factors form the climatic differences. For example in Kizilkum **the sand surface** warm to +75...+80°C. The high temperature of air in summer promote to quick ripening of garden and field crops (under impact of solar raise).

**The temperatures of soil surface** on south of Uzbekistan exceed a 65°C (in Termez to 70°C), on north of country it reaches to 40°C (on plato Usturt 46°C).

The range between days and nights temperatures can to be 10-12°C in air and 20-25°C on soil.

**The springs** in Uzbekistan is moisture, short with non-sustainable weather. For the fall characterized the clear weather and slow low of the temperature of air at the crossing to winter.

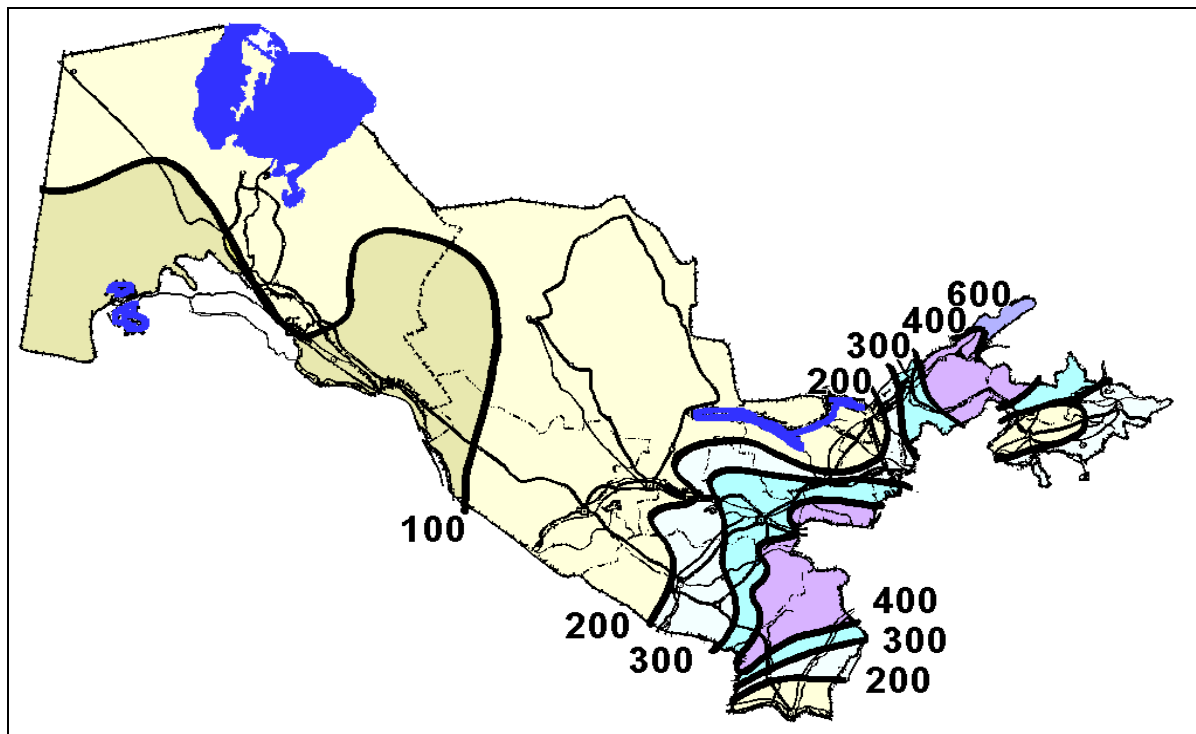
The mountains, located in east part of the territory, detain the south-western damp air masses, owing to that in foothills and mountains drop out a much precipitation. In total **the mountain climate** change from valley climate. In mountain the air is fresh cool, more the cloudy days, drop out a many precipitation: the winter is severe, snowy and long-term. Highly in mountains the snow stayed annual. The summer usually cold, sometimes drop out the rains.

The height and location of the mountains ranges on attitude to sun and direction of the air flows influence on distribute of temperature in mountain regions. On measure of rise up the temperature of the air lowered. The amplitude of the average annual temperatures is about 25-30°C and in mountains - 20-25°C. Such high amplitudes explain, that summer temperatures is very high.

The mountain ranges guard the depressions, which included between they, from invasion of cold masses and further, for example, in Fergana valley, the winter more warm, then in Bukhara or Tashkent.

The main part of **precipitation**, drop outing on territory of Uzbekistan going from Atlantic ocean. On the territory and year seasons the precipitation distribute non-equally.

### The annual quantity of precipitation, mm



In the western part of republic (Usturt, Amudarya Lower) the average quantity of precipitation about 100 mm. To east and south-east with changes of relief (from plains to mountains) increase the quantity of precipitation, reaching to 700-800 mm in some places and in mountains is more.

The main part of precipitation in Uzbekistan is on winter-grade and spring months (30 % drops out in winter-grade months and 40 % - in spring), that connect with activization of cyclone actions in cold season of year.

Loss of precipitation by winter and spring has the important significance for agriculture. In this time of year the evaporation is little, more the moisture absorbed in soil. This is promote to the growth of grass on pastures and winter crops on bogara, and to increase the water reserves. The **snow** almost drops outed on all territory of republic. The snow covered is non-powerful and non-balance, quickly thaw, especially on south. In mountains the snow drop outed of much, the snow covered is powerful and can to last a 2-6 months. The thickness of snow covered in mountains more, then 1 m. In the some high mountains, located in eastern part of republic, founded the non-great glaciers.

**The air on valleys of Uzbekistan is very dry.** Its the relative humidity on south of 20-30%, in desert below, in oases and irrigated regions more high. The moist of air in winter about 65-80%. The dryness of air and parching heat, abundance of solar days and insignificantly the small quantity of precipitation and dry winds is reason of strenuous of evaporation from soil, reservoir surface and plants. The evaporation in a few times above then quantity of annual precipitation (in Tashkent - in 3,5 times, in Nukus - in 27 times): the 80-85% of evaporation has in summer period.

In cold half-year on plains of republic **the atmospheric precipitation** drop out in kind of rain and snow. On extreme north of country the quantity of precipitation drop outed in winter in kind of snow, about 50%, in southern districts its about 10-15%. Only in mountains of Uzbekistan the part of precipitation drop outing in kind of snow, more highly.

The mountain massifs influence on distribution on territory of republic of **atmospheric precipitation**. The flows of air, moving from west and warm masses of tropic air from south-east, passed over plains leave there no moisture. However, at up on slopes of mountains they become cool, condense moisture and drop outed the rain. In mountains of Uzbekistan drop outed in average more, then 400 mm of precipitation in year, in this time in plains only 100-120 mm, and to east from Khorezm oasis only 70-80 mm. The low quantity of precipitation behind the lee mountain slopes.

For the plain and mountain parts of Uzbekistan very characteristically the loss of main masses of atmospheric precipitation in the fall-winter-spring period and sharp decreasing in summer season. On winter months is about 3% of the annual sum of precipitation, on spring - about 40%, in autumn their quantity about 15-20%. In summer the precipitation drops outed only 5-10%, and in south regions only 2-3%.

The average relative humidity of air in Kizilkum's desert in summer period does not exceed 20%, but can be lowered and to 5.

The average annual numbers of days with **air drought** on greater part of plain area of Uzbekistan does not exceed 30, however on south of country it is 30-50, in Karshi steppe - 50-70.

Accumulated by precipitation for the fall-winter-spring period, stocks of moisture in soil begin to be spent on evaporation and transpiration, calling **the soil drought**. On west of Kizilkum and in center of Fergana valley the soil drought begin at the end of March - beginning of April. On largest part of plain district of Uzbekistan it began in first ten-day interval of April. On east of country in foothill regions it began in June.

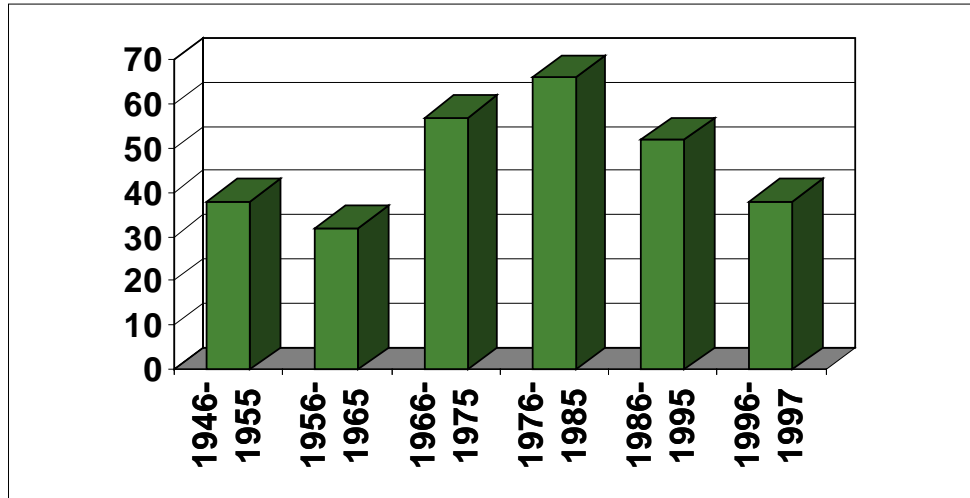
On territory of republic prevail the northern point **wind**. On the north of Uzbekistan prevail the north-east winds, with moving on south they change to winds with eastern and south-eastern directions. In winter this explain with influences of Asian anticyclone, and summer - availability of the low pressure center on south of Central Asia and north-west of India.

In heat summer in central and south-western parts of republic happen **the sandy and dust storms**.

In mountain regions the direction of wind depends from relief. There are a draught here the local winds - mountain-plain and fens. From Fergana valley in side of Yashrzagul blow the Bekabad wind, in reverse side the Kokand wind.

On south of country is characteristic the south-western dry wind is "garmsil". On south of Surkhandarya district blow the south-western hot and dry wind is "afganec", bringing the dust with sand. In Termez region upped the dust darken the sky. In spring this wind destructively impacted on flowering trees, young sprout of cotton and vegetable crops.

### The number of days with dust storms on st.Muynak.



The average annual **speed of wind** as a whole non-great. On plains it is hesitated within the limits of 3-4 m/c, in foothill and mountain part of Uzbekistan - less 3 m/c. To this characterized the very big number of unwind days, in some places more then half-year days. However, the strengthening of wind to 6-10 m/c, against a background of the quickly drying soil, promote to develop **the dust storms**. The average annual number of days with dust storm depend from local natural conditions and hesitated from 10 to 30 on largest part of plain territory, and some-where (Karshi steppe, Amudarya Lower) it can be 50, in Muynak - 64.

The duration of vegetation season (with temperature 10°C) makes from 190 days on north to 240 days on south. The sum of active temperature for vegetation period change from 1900°C on north to 2700°C on south (basin of Surkhandarya river).

#### 1.4. Surface waters.

As elements of landscape the surface water influence on other components of nature and correlate with them. The surface water change a relief of area, participated in form of soil and development of plants, have the importance significance for national economy.

The main area for **forming of flow** in border of Uzbekistan is mountain part, where drops out heaviest quantity of precipitation and its losses on evaporation is minimum. At exit on plain part the water distribute to channels on irrigation, the other part evaporated or absorbed in soil, therefore a many rivers, dry upped, lost in sands. Only Amudarya and Sirdarya flow into Aral Sea. But in last time because of the large expenditure of water on irrigation, only a small part of their flow came to Aral, that is main reason of ecological catastrophe in this region.

**The rivers of Uzbekistan** relate to drainless basin of Aral sea. For country characteristically utterly non-uniform the distribution of the rivers on territory. Especially them lesson plain part , which engaged with deserts, where the main source of supply is ground water. The mountain part of republic is rich of rivers. The main rivers have a snow-glaciers nutrition, that caused two flow - small in spring and main in summer. Such regime of rivers favourable for irrigation. One from main rivers of Uzbekistan - Amudarya, used in lowers. **The water provision of Amudarya is 78 qub.km/year**. The total length of Amudarya with Pyandj about 2540 km. The area of Amudarya basin is 309 thousand square km. The Amudarya in border of Uzbekistan taken the right flow - Surkhandarya and Sherabad. The main role in economy relation played the other large river of republic is Sirdarya and her



right flow - Chirchik, Akhangaran, Keles. **The water provision of Sirdarya is 36 qub.km/year.** to Sirdarya basin relative the small rivers of Fergana Valley - Isfayram, Sokh, Isfara and other, which didn't come to it, so as spent on irrigation. The total length of Sirdarya with Narin about 3019 km, the area of Sirdarya basin is 211 thousand square km.

The third on water the river of Uzbekistan - Zarafshan, the water of which completely expenditure on irrigation. Following the significant river of country - Kashkadarya have a snow-rain nutrition. Her water so expenditure on irrigation. The largest her flow is Aksu, Yakkabagdarya and Guzardarya.

In plain part of Uzbekistan a many lakes, which were formed in downturn of relief. The most large-sized from them and one from largest in World to half of twenty center was being **the Aral sea**, nutritioned from Amudarya and Sirdarya rivers. It area was 66085 square km, the volume is 1061 qub.km. The intensive making of new lands in Aral sea basin in two part of XX century and largest expenditure of river water on irrigation changed it hydrological regime and caused it drying. To now saved only about half of the lakes area and about a third of volume. The mineralization of water in lake increase from 10 to 30 promile.

Get worsed the quality of river water in lower flow of Amudarya and Sirdarya, which became little for drinking. Began the intensive drainage and salinity of lands in deltas there rivers, the deep degradation of ecological systems, animal and vegetation world. The more negative consequences have place in Southern Aral zone. The landscape complex of Southern Aral zone embrace the North-Western part of Kizilkums, Zaungauz Karakums (including the Sarakamish depression), South Usturt and delta of Amudarya river.

At the total area of **Aral zone** 473 thousand sq. km, the south area is 245 thousand sq.km. Here enter the all territory of Karakalpakstan, Khorezm district of republic of Uzbekistan. Early the lakes of Amudarya delta presented the united water system. The cutting down of flow and decrease of level of Aral sea came to dried a more, then 50 lakes with total area 50-60 thousand ha.

Other plain lakes of republic are fed by atmospheric precipitation, underground water, but main role in their formations and saving play the drain in lakes depressions the irrigation and drain water from irrigated massifs. To largest lakes of this type relation the Aydarkul and Sarikamish lakes, formed in waterless salt-marshes depressions.

From this point of view of the data, as well as other plain lakes are ecological antipodes to Aral sea: in those time, when it dried the other lakes increase to volume and area.

In border of Uzbekistan is totaled more 40 glaciers, mostly not very large ones. All of them are located in mountain system of Western Tyan-Shan, mainly in the upper Pskem.

### 1.5. The soils.

Under influence of difference natural factors on territory of Uzbekistan the following types of soil have arisen: flood-lands-alluvial, lerovo-greyish, desert sandy, desert takir, salt-marshes, greyish-brown deserts, irrigated greyish, light greyish, usual greyish, mountain-brown and high-mountain

The aridity of climate of Uzbekistan is reason for poorly expressed of **soilformed processes** on its territory. With slow flow of forming processes of soil the important role play the time factor.

The geological age of different surfaces determines the nature developing on them of the soil types. So, on ancient Paleocene and neogen surface of plains formed the greyish-brown soil, on new Quaternary surfaces develop the takirs and takir soil.

For arid soils are typical weak of structure, high salinity, a small contents of humus.

In genetic and classification attitudes are soils of plains of Uzbekistan is sharp are different from soil foothill plains, foothills and mountains. On plain territory of republic the soil covered subordinated to global law of latitude zonality and in agree with its here wide-spreaded the desert soil. Entering in Uzbekistan the western part of mountain systems of Tyan-Shan and Pamiro-Alay, including foothills plains, form the area of high zone. The border between zone desert soils and soils of high zone located in low border of foothill plain, where began the zone of greyish. Higher the greyish wide-spread on foothills and lowhills. The soil cover of mediahigh mountains presented with brown and brown mountain-forest soils. High mountain zone characterized with develop of light-brown and meadow-steppe highmountain soils.

All set forth above **soil types** are formed and developed in conditions of deep bedding of the level of ground water and related to authomorphic, i.e. to self-forming soils. In conditions of surplus moistening, in plains, flood-lands and deltas developed a hydromorphic soils - alluvial-meadow, meadow-swampy and swampy-meadow and other. Their forming connect with non-deep lieing a ground water, capable through capillaries to moiste the all soil thickness, located over them. With this they provide the development of specific marsh and meadow vegetation, the vertical and horizontal migration of salts, denudation in deep horizons. The moistening of hydromorphic soils has a more high in comparison with desert soils, that provide to them a good development and productivity of vegetation. In this time a more slow time of mineralization of vegetation remainders promote to forming of the powerful humus horizon. In definite geomorphologic conditions, for example on parts, where ground water outed on surface, on low river terraces, hydromorphic soils does go to zone of automorphic soils.

In natural conditions a **soils of desert zone** differ with low fertility. However at irrigation, especially with using of fertilizers the fertility of such soils very increase. With conditions of moistening, accumulation and decomposition of organic substances the irrigated lands distribute on following types: meadow-oasis and swampy-oasis soils of desert zone, takir-oasis soils, meadow-oasis and swampy-oasis soils of greyish zone.

**The soils of plain.** The distinctions in the mechanical structures of rocks, in deserts of various type, inherent to plain area of Uzbekistan (sandy, gyphs, salt-marshes), and non-homogeneous agrohydrological properties of types of desert soils, reflect on peculiarity of them a water regime and distribution of salts and other additions in soil profile.

The distinctions, observable in hydrotermic regimes of northern and south subzones of deserts of Central Asia, also displayed in total view of desert soils. The northern subzone characterized with large quantity of desert greyish-brown soils with strong display of salt and salt-marshes. The moderate hydrotermic regime didn't promote to accumulation of carbonates in soil horizons and soilforming rocks.

For soil of plains of Uzbekistan characteristically the insignificant contents of humus. It is explained by small receipt in them organic remainders and their quick mineralization in conditions of arid climate.

All above named features of soil of plain zone of republic dermine the abnormally high inclination to desertification.

The geographic wide-spreading of **greyish-brown soils** on territory of Uzbekistan connect with desert higher plains and platos, and with ostanic lowhills. There are plato Usturt, central and south part of Kizilkum, and small fragments of Karshi steppe and Lower Surkhandarya.

**Desert sandy soils and sands** dominated on wide territory of Kizilkum. Relatively small their parts found in Karshi steppe, Lower Kashkadarya and center of Fergana valley.

Desert soils includes territory, located on height 400-500 m above sea level, and takes 70% of area of Uzbekistan. In deserts founded greyish-brown, sandy, takir soils and grey lands.

Because of strong hot substances are in soil very quickly disintegrate and mineralized. Therefore in composition of soil is less of humus. On plateau Usturt, in lowhills of Kizilkum and near foothill of Nuratau wide-spreaded greyish-brown soils, in which content of humus is less (0,3-1,0%), its usually salty, the vegetation on them is thin. Here grazed a small cattle.

In Kizilkum, Lower Zarafshan, Central Fergana and Mirzachul on sandy valleys wide-spreaded desert sandy soils contents 0,3-0,6% of humus. The vegetation don't growing.

**Desert takir soils and takirs** located in deltas of dried in ancient of rivers, as well as dried lake plains. The main regions their distributions is South Aral zone, Lower Zerafshan and Kashkadarya, as well as Assak-Audan depression on Usturt.

Playing the visible role in structure of soil covered of deserts is salt-marshes are connected mainly with drainless depressions. Here relate the blinkers of depressions Barsa-Kelmes on Usturt, Minbulak, Mollaly, Karata etc. In Kizilkum, in the latter 30 years is expanded the area of salinity soil and salt-marshes in Amudarya delta and on territory of dried bottom of Aral sea.

**Meadow and swampy soils** in plain part of country time to mainly to plain and river deltas. The main region their distributions is in Amudarya delta. However, in connection with reduction of aquatory of Aral and decreasing of the level of ground water on territories of delta-alluvial plain of Lower Amudarya their areas afterwards 1960 is sharp was reduced.

**Irrigated soils** in Uzbekistan are also widespread basically on plains and river deltas, where they form the peculiar oasis types.

In locations with is close bedding to surface the ground water formed the salt soils. In them contest of the plenty water-soluble salts. The most large salt-marshes located in desert field - Aydarshor and Barsakelmes. In river plains - meadow and swampy. In foothill part the greyish - light, typical and dark ones.

In lower Amudarya, in Zarafshan, Chirchik, Akhangaran, Kashkadarya and Surkhandarya plains already in ancient in locations of development of irrigation have arisen the oasis. As result of long-term treatment of soil these places steel cultured.

In **foothills and mountain areas** of Uzbekistan the generic diversity of soil pursuant with planetary laws depends from their high-altitude location. With increase of absolute height of district the increase of quantity of precipitation, increase the water-supply of mountainous slopes, strengthening of dismemberity of relief, decrease of average temperatures of air, increase its humidity and consecutive change of vegetation from ephemeral-semi-desert to different-grass-steppe, archa-sparse growth of trees, woody, meadow-steppe, steppe and meadow is usual observed.

All diversities of soil of foothill-mountainous areas of republic with vertical zone is contained in three main soil-climatic zones, each of which is characterized of unique peculiarity of soil structure and structure of the soil covered. It, in accordance with increase of height of district, the zone of greyish, zone of mountainous brown soils and zone of light-brown meadow-steppe hightail soils.

The **greyish zone** is located between absolute hights from 250-400 to 900-1500 m. Its lower border divides the foothill plains, relating to area with vertical zone from more low and remote mountainous massifs of plains and ostanic plato with desert soils. In accordance with increase of absolute marks in foothills and lowhills the greyish and connected with them polyhydromorphic and hydromorphic soils are distributed on foothill and intermountainous alluvial-proluvial and proluvial plains, hilly foothills and spurs of mountainous systems.

On hights from 900-1500 to 1300-2900 m, in **average hills zone** prevail the mountainous brown soils. Main their areas are widespread under covered of dense different grass, leaf-bearing woods and archa sparse growth of trees. Soils of mountainous slopes of northern exposition are more humidified so differ with high humus.

Soils of slopes of solar exposition more washing and weak-humus. Separate, the most the humidified sites in this high-altitude zone take a brown and mountainous-woody soils.

In highmountain high-altitude zone, on heights more than 2300-2900 m are advanced the light-brown meadow-steppe highmountainous soils. Among them on the most humidify sites founded meadow and peat-bog highmountainous soils. Soils of highhills frequently change with large massifs of exits on surfaces radical rocks and covers. In the most high mountainous massifs founded also the snows and glaciers.

The intensive development of new massifs promoted to development of extensive use of ground areas of oases, owing to that on improvement of the soil-meliorative condition of old irrigated zone turned the secondary attention, was not inculcated the grass- and rotation of crops, used in large doze the mineral fertilizers, different chemical weed-killes and pest-killes on struggle with pests and weeds. All this has caused the development in wide scales of salinity, erosion, sand-transfer, reduction of fertility of soil etc.

For increase of soil fertility is necessary the radical improvement of them meliorative condition, inculcation of high-grade crop-rotations, rational reduction of entering of organic and mineral fertilizers, deep flare of able layer, creation of soil-protection wood-planting etc.

## 1.6. Vegetation

Uzbekistan - the most rich in florist relation the part of Central Asia. The natural vegetation cover of Republic include a more than 4000 kinds, between its a lot valuable plants: fruitier, fodder, herb, tanning, ether-oil-bearing, dye, decorative etc. including rare relic, endemic plants.

The significant florist and phytocenotic diversity is stipulated with heterogeneity of ecological conditions (first of all in climatic relation) of vertical zone with different hydrotermic regime. The every zone characterized to non-uniform abode in connection with features soil conditions.

Follow to Zone law of vegetation distribution, on territory of Uzbekistan are distinguished 4 zone: chul, adir, tau, aylau, corresponding to geomorphologic steps - plain (deserts), foothills, mountains, highhills. To different basis of vertical zone are prescribed a general landscape, relief, hydrotermic condition and closely connected with them the shifts of vegetation and soils.

In formation of natural vegetation communities of these zone participate representatives of different vital forms of plants: plantation of trees, shrubs, semi-shrubs, grassy with different vegetation cycle. More than 70% from all tree kinds has on mountainous zone. One of them form a main plantation of our mountainous woods, other - tugay plantation. On sandy plain number about 10% of tree kind from leafless (white saksaul) and with succulent leaf (Rihters' solanka) branches. Nearly all kinds of these groups play a aedificator role and form specific landscape on large areas.

The large part of shrubs kinds dominates in plain part, predominary on sandy abodes. Here dominate a shrubs with reduction leafs (djuzgun, aethedra).

The significant part of shrubs kind form of growth is widespread in foothills and mountains, predominary on south slope of stony-road-metal or gypsy parts of ostances hills.

For conditions of Uzbekistan the form of pillow-kind shrubs is characteristic. This typical representatives of opened stony-road-metal slopes, water-distribution of mountainous and high-hills zone in arid zone. A many representers of this form (Akantolimons' kind, aespargeth echidna) are aedificator of whole group of phytocenos of vegetation type so as mountainous xerophits.

The group of succulent-leaf and succulent-caulescent forms of shrubs on number of kinds is small, but many from them (Kaspy potashnik, small-leaf solanka, sarsazan) is aedificators of salt-marshes vegetation.

A small on quantity of kinds a semi-shrubs form of usual type basically in mountains and foothills. In this group founded and typical succulent form, characterized for desert abodes (for example, low-leaf elenya).

Semi-shrubs make the most the numerous group from of mentioned forms of growth. The heaviest kind diversity in mountainous zone (the least in highhills). However a prevailing situation they take on plain, where are landscape plants on large area and aedificators of gypsy formation, salt-marshes deserts. For example, a wormwood dominate on huge spaces of gypsy stances surfaces, sandy plains, foothills road-metal slopes.

Grassy form takes the leading location in flora of Uzbekistan. This the most rich type on kinds quantity and form diversity.

**Chul**, where relate plain (for exception oases) space to 500-600 m over level of sea, characterized with non-uniform of aedafic conditions.

The diversity of aedafic conditions, mechanical and chemical structure of substratum is stipulated a distribution of vegetation. Here are advanced a galophilic, psammophilic, gypsophilic aedafom-type of vegetation and tugay vegetation.

The characteristic feature of vegetation chul - cover rarefaction. A two subzones are distinguished in chul - bottom and top chul. In bottom dominant a grey-brown soils and salt-marshes, in top - loam or sandy light-grey soil, with participate of weathering products of tertiary color rock and gypsy determining its ecological features.

**A salt-marshes vegetation** is more expressed in bottom chul. The distribution of galophilic communities and them kinds diversity depend from extent and character of soil salinity, level and mineralization of ground water. In depend from these factor the different galophilic community is formed the by ecological series and are indicators of definite ecological conditions.

On salt-marshes of hydromorphic series are formed a series from mezogalophitic kinds - on wet salt-marshes and around of them dominant a hypergalophit salt-growth; follow dominant sarzan, follow formed a so shrubs as Kaspy salt-ear, sarzan and sorovnik. Then, in accordance with distance, founded the sites with potashnik and one-year solankas. This is leaf and caulescent-succulent eugalophitic kind.

On salt-marshes of automorphic series are formed a community from xelogalophitic kinds. So on residual salt-marshes dominant a tetir or galimoknemis - uzovbosh, donashur etc.

Vegetation of gypsy chul is connected with grey-brown soils, frequently salt-marshes gypsy, in which a top small-soil over-gypsy horizons is freshening. In this place anywhere dominant a wormwood. Freshening a top soil horizons and availability of salts on definite depth cause the distribution of wormwoods with semi-shrubs xerogalophits - keyreuk, white boyalish, and wormwood kinds - mainly branchy wormwood, turan wormwood and white-ground (in northern regions), are dominant of communities. This characteristic boyalish-keyreuk-wormwood communities relate to main communities, with ephemeral cover in bottom zone, locations with one-year solankas and long-vegetation one-years. At sandy of soil surface in them participate singren.

The typical feature of vegetation distribution is the completeness, caused by distinctions of vital conditions, connected with natural combination of microrelief. This is typical complexes of wormwood and solanka communities on **microtops and microdownturn**. The communities with prevalence of partek (gamadas' bindweed) are widespread in western part of gypsy chul.

The most widespread eolic relief form of sandy chul - barkhan and barkhan ranges, uneven, ridge and cell sands or hollow sand, Sandy plains. The main difference between sandy and other ecological types of desert is favorable water regime, stipulated by physical properties of sand. However the condition for plants weak-favourable in connected with strong superheating of surface in summer and drying of root zone, and sand transfer, which cover a plants or bare their roots.

The condition of growing on different **elements of mezorelief** here non-uniform. The tops of ridges and hills, slopes and downturn is different on ecological conditions, in particularly, different on humidifying conditions. The sand is more condense on slope of ridge and hills, and sand surface steadier, than on top. In downturn formed more condense sandy soils. The temperature of sand surface on hills and downturn is different. With this a features of sandy relief connect a differences in vegetation communities, caused by combination formations of different phytocoenoses and series of combination of psamphilic communities on different relief elements.

For sandy or psamphilic vegetation characteristically the significant form diversity of growth. The important place between sandy vegetation from arboreal-shrubs forms take a white or Persian saksaul, widespread as on a break-sands, as on is good fixed powerful and weak sand. It is aedificator of many associations. Almost anywhere on sands founded a kandim kinds (djuzgun), which have a powerful root system as saksaul, and very good to adapted to lives on moving substrate and dominant in many association. From this group in psamphilic communities founded: sandy acacia, kizilcha (efedra, cherkez), Rihters' solanka, Paleskys' solanka, astragals.

Semi-shrubs let on quantity of kinds and their role in vegetation cover to first group. But among its founded aedificators of fixed sands. It's wormwood - branchy wormwood, white-ground wormwood.

The large significance at vegetation communities have a long-term grass, and important role among them belongs to efemeroids, especially to sedge or ilak, this kind concern to important aedificator of **fixed sands**. The turf cereals - selin plays a essential role in fixed of sand.

The extensive spaces of chul zone are used, basically, as natural all years pasture, mainly, for astrakhan sheeps. The natural vegetation cover consist from valuable food crops.

In chul zone included a river valley, abundance of moisture in which promotes to the development of specific mezophilic edafic type, but subject and peculiar to this zone. This is tugay vegetation. The typical tugay vegetation is flood-lands and salt steady. The sites of desert tugay were preserved in kind of narrow bands or "islands" in Amudarya valley, in its' delta, and locations in valley of Sirdarya, Surkhandarya, Zerafshan. The typical kinds: from arboreal forms - poplar kind, willow, from shrubs - pectinates, from grassy forms - reed, liquorice, ajrek etc.

Adir zone. The zone with grey-land soil, located around mountains and occupying space between xerothermic chul and mezothermic chul, relates to this zone. The annual sum of precipitation approximately in two times more, than in chul and in 2-3 times less, than in tau. The precipitation period here (as a rule, June - September) on 1-2 month shorter, than in chul (May - October). In connect with ecological conditions, which bottom part are approach to desert conditions and in top - to mountains, the adir zone is divided on two subzones (bottom adir with more quiet relief and top - with dismembered and locations with naked surface).

For bottom adir is characteristic a rangic vegetation. Here dominates a original ephemerid vegetation with predominance of desert sedge - ranga. Location, with petty founded a large grassy community with more longer of vegetation, consisting from flomis (zopnik), akkuraya (psoraleya), locations founded a shrubs of prickly almonds.

Pireinik and pistachios founded in top adir. Here in communities of top adir grow a original large-leaf mezophils - devyasil, some kind of rhubarbs, ravocho etc.

Tau zone. To this zone relates a mountainous part from 1200-1500 to 2700-2800 m over level of sea where dominate a brown and grey mountainous-forestry (turf- brown-land) soils. The period without precipitation, as rule in July-October. The vegetative season - spring - summer is interrupted, but only by winter.

The tau zone on natural - historical conditions is classified into of two subzones.

1. - Bottom transitive from adir band (with high-altitude marks from 1200-1400 to 1800-2100 m over level of sea) is characterized having of ephemerical communities with long-vegetating dominants of steppe type. The communities with arboreal-shrubs forms are not expressed (basically in connection with anthropogenic effect). The temperature here higher, but precipitation is more.
2. - In top subzones nearly is not present of ephemerical plants. The communities of arboreal-shrubs forms better are advanced, and is increased the number of mezophilic plants.

In tau zone is wide is widespread a couch-grass - many-grass vegetation, which is the most expressed on heights 1500-1900 m over level of sea. One from main edificators - hair couch-grass locations is formed a pure couch-grassy, but often formed a community with xerophilic many-grasses.

Arboreal vegetation is submitted as archa, broad-leaved forests with fall of the leafy shrubs. Shrubs vegetation is presented with thin out plantation of shrubs from different systematic groups: tavolga, St.-John's wort, many flower cornel-tree, kinds of sweetbrier etc.

Yaylau zone - highhills, are located 2700-2800 m over level of sea and the spaces are allocated usually under name alpine and subalpes zone. Dominate a light-brown, meadow-steppe soils. Often founded a stone and road metal scree, glacial moraines, cirque glaciers, snows, and in some regions - smooth sirt, platos' space. The period of vegetation is observed only in summer.

In limits of yaylau are distinguished of two subzones: bottom and top one. For bottom yaylau is characteristically the development and distribution of mezophilic formation - many-grassy meadow, in top zone accepts here a creep and short shrubs, for example, turkestan archa has a creep form, founded a honey suckle, cornel-tree, sweetbrier etc., as well as are advanced a pillow type mountainous xerophits.

A top yaylau zone takes a mountainous slopes higher 3000-3200 m, a top border beyond to eternal snow band. Here dominate a dry stone slopes with thin out steppe or meadow-steppe cover, where dominate a valisial oatmeal (tipchak), or mountainous xerophits. A short-grass cover meadows take the small areas.

The specific location in yaylau zone take large-grassy and cereal meadow-taranic, shashir, geranium, fox-tail and other covers.

One of characteristic types for high-hills of south regions is mountainous-xerophilic vegetation, non-uniform on structure ecological types and biological forms. With this kinds, is typical for mountainous-xerophilic vegetation, that is prickly-grassy and prickly-pillow forms, a significant part of cover make a steppe plants, in some cases with it associated the elements of meadow vegetation.

The modern condition of vegetation cover is characterized with rarefaction and distribution of derivative secondary communities, formed under influence of anthropogenic factors.

In constanting amplification of anthropogenic impact on vegetation cover has caused the significant changes of phytocenosis in different zones of republic - desert, foothills, mountains. The desertification problem is very sharp in chul zone, where vegetation community, as well as ecological system in whole, are in dynamic and extreme conditions.

The impact of various display of economic, social and cultural activity of people has caused the significant changes of radical steamed and productivity vegetation communities. The extent of breach, degradation of vegetation under influence of anthropogenic factors and distribution of secondary, weak-productivity communities the work emerge way of geobotanic mapping of anthropogenic breach of radical vegetation communities.

The employers of geobotanic laboratory in Institute of Botany of AS RU, was conducted a work, enabling to determine the degree and scale of desertification, and showed, that the in desert zone in separate astrakhan farms the anthropogenic breached a vegetation communities take about 50% of pasture territories.

### 1.7. Animal world.

Many-kinds of natural conditions of Uzbekistan causes the riches of its animal world. On territory of country lived about 83 kinds of fish, about 60 kinds of reptiles (from which five kinds of venomous snakes), three kind of amphilians, 97 kinds of animals and 424 kinds of birds.

Uzbekistan is region for living of endemic animal kinds of central asian origin. Some kinds was originating between river Amudarya and Syrdarya, wided in other redoins of Central Asia.

**Endemic animal kinds** with Central Asian origin play the large role in fauna of republic. Predominary this animal of deserts. To them relate retina lizard, desert gologlas, sandy boa, saksaul jay, Liechtenstein's jerboa, Bobrin's jerboa, rowing-fingered jerboa, fine-fingered suslik.

In foothill-mountainous area among animal of Uzbekistan to endemic of Central Asia relate the turkestan agama, turkestan gekon, silvery field-vole, red marmot, Menzbirs' marmot, relic suslik.

The animal world of **desert zone** is various. All of it inhabitants adapted to desert conditions and have the grey or yellow coloration, some animal are bypassed without water, be content by moisture, which including in eating them plants. Animals of desert adapted to hot climate, many from them quickly moving and have the acute eyesight.

Reptiles are numerous - lizards (steppe agama, spheric-header, gekon, varans), many snakes - sandy boa, venomous efa, shield-muzzle, Central Asian cobra, adder, gurza. From them poison prepared the medicine, serums for treatment of different illnesses. Rodents sander, jerboas, susliks and other. They put damage to desert plants, gnawed to them roots, stems and eating seeds. In desert live the enemies of rodents - polecat, fox, from predators are loopun wolfs, jackals, velvet cats. From large mammalias is jeran and saygak. Birds in desert a little. Here live saksaul jay, owl, sparrow, lark. Very many in desert insects. From arachnida is scorpion, phalanga, spiders, is especially dangerous karakurt.

Many inhabiting animal in deserts of republic, have penetrated here with plain spaces of Kazakhstan, that relate fauna these countries. It bustard-beauty, black-belly hazel-grouse, avdotka, korsak, manul, large sander, small jerboa, land hare, yellow suslik, saygal and many other ones.

Jeran, velvet cat, karakal - typical inhabitants of desert of Uzbekistan indicate on ancient connection of fauna of republic with deserts of Forward Asia and Northern Africa. Afghanistan field-vole, otter, spiral-horned goats, inhabiting in south part of foothill-mountainous area of country, as well as mayna, all further settling on north, are representatives of Afghanistan fauna.

In tugays are loopun the jackals, fox, wolfs, caned cat, founded the wild-boar. The perl of animal world - deer-khanguya, which is loopun also in tugays. Many birds - grey heron, pelican, duck, pheasant.



The animal world of **plain and foothills** of Uzbekistan widespread, some kinds inherent to Indian fauna. For example, jackal, wild-boar, poracpine, lamellitooth rat, honey-eater, Indian sparrow. Here inhabitant the reptile - lizards, snake, founded tortoises, phalanga, karakurt. From predators is fox and wolf, is present poracpine, badgers, hedgehogs. Are numerous here birds: grey-collarer, kekliks, rites, jackdaus, eagle and other.

In **mountains and highhills** of republic many kinds of animal, characteristic for mountains areas of Central Asia: Siberia goats, ounce, Tibet raven, Himalayan ular, Himalayan fibber and some other ones.

The animal world of mountainous zone rich and various. In woods live poracpine, squirrels, susliks, bafgers. Founded the snake.

Have a very many birds - oak-nose, orides, starlings, nightingales and other. The large benefit bring the brown owls, destroying the rodents and insects.

From mammalias - bear, wolf and some lynx, arkhar, mountainous goats, deers, from rodents - marmots. The beauty of highhill meadows - snow ounce and white-claw bear - both put in Red book of Uzbekistan.

Is present in fauna of Uzbekistan and such animals, which are witnesses of it relates with animal world of steppes and deserts of Mongolia, broad-leaved woods of Europe, Siberia taiga, subtropics of Mediterranean, other geographical areas of Eurasia.

The definite part of animal world of republic present and wide-spread animal-cosmopolites: fox, wolf, grey rat, home mouse, home sparrow, field sparrow, magpie, grey crow and other ones.

In rivers and reserves of desert zone of Uzbekistan loopin sazan, pike perch, sheat-fish, bream, jerekh, barbel and many other kinds of aboriginal ichtyofauna, as well as adapted fishes - snake-head, ordinary thick-forehead, color thick-forehead, white amur and other ones. For foothill-mountainous area of country is characteristic marinka.

### **1.8. Natural - climatic division into districts.**

On natural conditions the territory of Uzbekistan is divided on two large regions - valley and foothill-mountainous.

Plain regions: plato Usturt, lower Amudarya, Kizilkum.

Foothill-mountainous regions: Surkhandarya, Kashkadarya, Zarafshan valley, Mirzachul, Chirchik - Akhangaran and Fergana valley.

## **CONCLUSION**

The geographic location of Uzbekistan promote to development of desertification processes, depending from natural-climatic factors and strong human impact:

- the natural sandy deserts took a large area, the small quantity of precipitation on plain territories of country;
- the drought and sharp continental climate on all territory, considerable diapason between summer and winter air temperature;
- intensity of solar radiation and length of the solar radiance, especially in droughty period, which promote to high temperature of soil surface and air drought, and soil drought come early on plain territory;
- wind erosion and transfer of large mass of silt and sandy deposits, which promote to spreading of desert territory, development of dust storms, especially in Aral zone and south parts of country;

- considerable development of desertification in foothills, as result of water erosion on inanchor territories of wood, development of ravines and destruction of slopes with sel (ground and water) flow;
- destruction of vegetation cover with avalanches in highhills, deformation of river valleys and destruction of flood-lands wood at the break the highhill glasialic lakes;
- absence of natural river system on plain territory;
- development of salt-marshes deserts in zones of riverside depression;
- the problem of lower river, strong mineralization of surface and ground water, high level of mineralization ground water, which promote to swarms of vegetation cover;
- spread of arid soils with weak structure, high salinity and small contain of humus, a considerable territories (70%) under desert sandy soils and takirs;
- meagre vegetation of desert zone, a strong vulnerability of ephemeral plants depending on climatic factors and human impact, weak afforestation on foothills and mountainous territories.

## 2. SOCIAL - ECONOMIC CONDITIONS AND RESOURCES OF UZBEKISTAN.

### 2.1. Human potential.

*By maximum value of company, people self bears the huge value, powerful potential, realization of which serves the stronging factor of development and progress of company.*

**I.A.KARIMOV**

President of Republic of Uzbekistan

The Uzbekistan is leader for Central Asian countries and keep a third place from CIS's states, made way to Russia and Ukraina. **From Central Asian countries in Uzbekistan the most high density of population - 51,4 persons on 1 sq.km.**

General number of population makes today in Uzbekistan 23 776 thousand persons, from which the 38,4% live in cities and settlements of urban type, 61,6% in agricultural districts. Nearly the half of population is made men - by 49,6% and a little more of half the woman - 50,4%.

The main demographic factor of Uzbekistan is high level of birth-rate, that explain a quick growth of population. The level of rural birth-rate on 40-50% over, than in cities.

The characteristic feature of Uzbekistan are **the high rates of gain of population**, and despite some recession of its natural gain for last years, it continues to remain one of the most high among countries of CIS. Only for 1990-1998 the number of population of Republic was increased on 13,3 percent.

Annually in Republic be born 600-650 thousand children, it is annual rates of gain of population on 2,3%.

It is assumed, that the number of population of Republic to 2000 makes 24,7 and by 2010 - 30,3 mln.persons.

The period of increase to twice is 30 year.

In Republics is marked very the high level of marriage and one of the most low in world the level of break of families. **The family was and remains of one of major vital values**, appropriate to multicentury traditions and mentalitet of nations. For Republic the difficult families are characteristic, that creates the favorable conditions for education of children, join of them to spiritual national values, traditions, increase of them educational level.

Though the economy of Uzbekistan tested some recession, many parameters of human development have remained stable or even have grown. The level of education remains is high, duration of life grows, maternal and infantile mortality have decreased.

However, it does not mean, that in front of country already the problems in areas of human developments is not present. Having quite comparable with the most advanced countries of world the level of formation and education, having riching natural riches, population of country owing to imperfect structure of production and insufficient level of economic development, has the low level of money incomes.

Today the Uzbekistan has the **powerful labour potential**. The labour resources make nearly 50 % of population and annually growing on 210 - 220 thousand persons.

The difference of labour potential - it age and professional structure. The average age of population of Uzbekistan is equal to 24 years, that permits on border of the XXI centuries to

have the structure of labour resources, in which the persons, distinguished with high labour activities and professional training will prevail.

Because of lack of development of industrial and social infrastructures and sphere of appendix of labour outside of agrarian sector, **agriculture oversaturately by labour force** and is annual filled up by workers for accounts of rural school - leaver.

Now in agriculture is engaged more than of one third of all workers of public production. Let out of them for change profiling in other spheres of economy, first of all in industry and sphere of services, opens the wide possibilities for structural transformations of economy and it dynamic development.

The characteristic feature of labour potential of Uzbekistan is its **high educational level**. The literacy of population makes 99,06 %, that puts the Republic in one series with economical advanced countries with high level of development of human potential.

The level of general and vocational training of labour resources is high. In Republic fixes with legacy the compulsory general average education.

In account on 1000 inhabitants in age of 15 years and senior number possessing the higher education considerably has increased and at present makes 143 person. Thus the quantity of years of training has reached to 11,4. The 200 inhabitants from 1000 - experts with average special education. Each fourth, material production engaged in sphere and services, has the higher or average special education.

### **2.1.1. Population - the demographic parameters, social structure, employment, level of life.**

To present time the demographic parameters of Republic of Uzbekistan are characterized following:

- the settlement number of population for January 1, 1998 has made 23776.3 thousand the person, and for year has increased on 427.7 thousand the person or on 1.8 %
- the number of borned in republic in comparison with 1997 was reduced on 3.1% or 20.0 thousand person, including in rural district on 3.3 % or 14.7 thousand the person. The general factors of birth-rate are preserved on high level - 26.3 promile in republic and 29.1 promile in rural district
- about 75.0 % of gain of population happens at the expense of rural district, average annual gain has made 2.2%
- the number of died was increased on 1.3%. For last years the shifts in parameters of infantile mortality are observed the positive, i.e. the factor of mortality of 1st year children was reduced to 20.7 promile against 22.2 promille in 1996
- appreciably was reduced the parameter of external migration and negative balance of migration process on valuations has made 46.7%
- the population in able-bodied age in 1997 has made 11682.2 thousand the person (in annually calculation) or 49.6% from general number of population and in comparison with 1996 the person has increased on 233.8 thousand. From them 163.7 thousand the person (70.0%) has on rural district. The gain of number of able-bodied population in 1997 has made 2.0%.

The number of engaged on **state enterprises** has made 2493.7 thousand the person: or was reduced on 6.7%. The specific weigh of **engaged on non-state enterprises** has made 71.3 % from general number of engaged.

**The level of life.** The development of market forms of labour activity and measures on holding of inflation have supplied the growth of real incomes of population on 8.8% in comparison with 1996:

- as a whole on republic the share of money incomes of population in structure of cumulative incomes has made 87%.
- the most high the cumulative incomes of families of businessmen and farmers continue to remain, they nearly in 2 times exceed the cumulative incomes of workers, serving and kolkhoz-worker
- is increased the share of personal auxiliary economy in formations of cumulative incomes of population
- is preserved the differentiation on average person money income between social groups of population: the average person money income in families of businessmen in 2,8 times higher, than in families of kolkhoz-worker in 1.7 times, than in families of workers.

The statistical analysis permits to note, that the growth of cumulative and real money incomes of population proceeds.

## 2.2. Agroclimatical resources.

Pursuant to UNEP international classification of arid territories on accepted attitude ( $K$ ) sums of precipitation ( $X$ ) to potential evapotranspiration ( $E_0$ ), the large part of territory of Republic of Uzbekistan relates to semi-arid zone ( $0,20 \leq K \leq 0,50$ ) and arid subhumid zone ( $0,50 \leq K \leq 0,65$ ), and semi-desert and desert territory is taken more than by 60% its area. The border of moderate climate ( $R \geq 0,65$ ) is possible conditionally to be conducted on heights 600 m.

Thus, except of foothill and mountainous regions of Republic of Uzbekistan, other its territory is under **effect air and soil droughts** and is susceptible to processes of desertification.

The having **thermal resources** as a whole permit to cultivate in republic, as the cultures of tropical groups, as moderate zone.

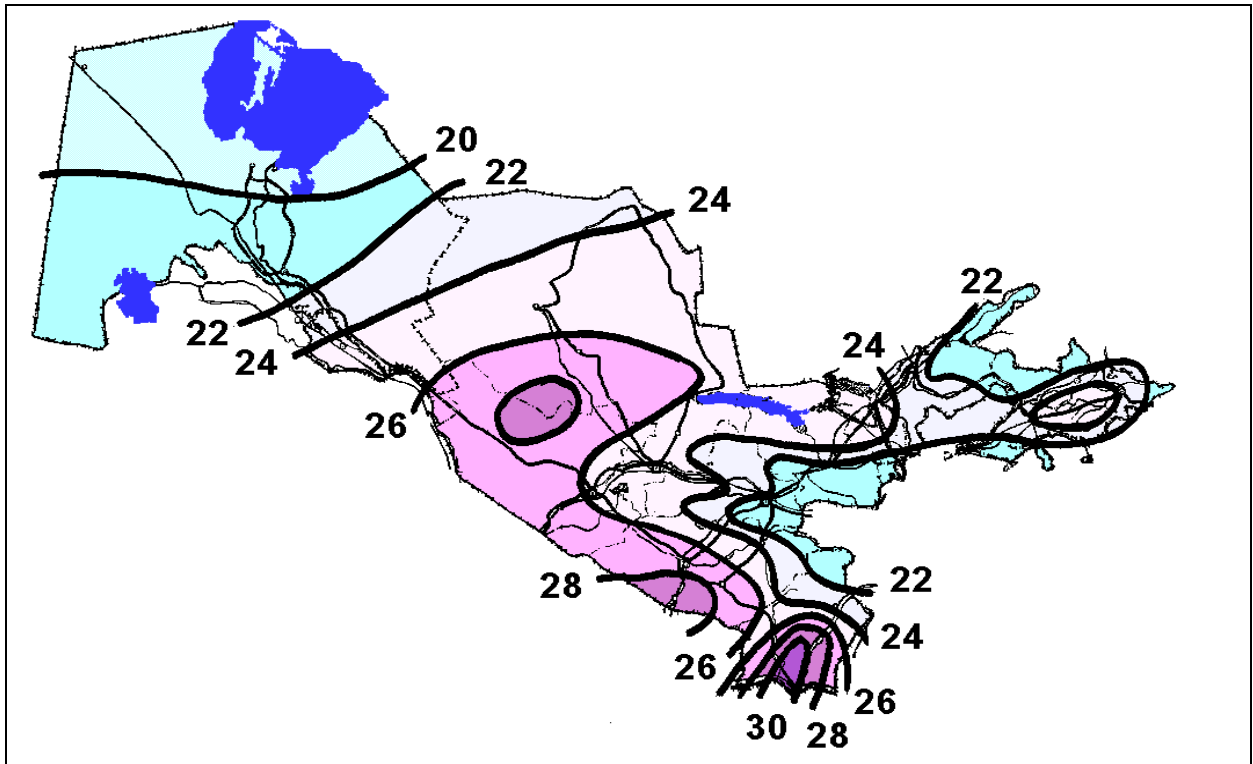
The parameters of security of agricultural cultivate are the duration of vegetative period and sum of effective temperatures of air for vegetation. For each group of agricultural culture have the biological minimum of temperatures ( $5^\circ\text{C}$  with - for grain, cabbage,  $10^\circ$  - for corn, cotton,  $12^\circ$  - for tomatoes,  $15^\circ\text{C}$  - for melons and etc.).

Average dates of transition of air temperature through **biological minimum** in spring differ on districts of Republic of Uzbekistan from north to South on 50 days (for  $5^\circ$ ) and to 25 days (for  $15^\circ$ ), in the autumn,, on 30-40 days.

**Sums of effective temperatures** change from northern to south regions: for temperatures  $5^\circ$  from  $3090^\circ$  to  $4840^\circ$ , for temperature over  $10^\circ$  from  $2050^\circ$  to  $3375^\circ$ ,  $12^\circ$  from  $1665^\circ$  to  $2870^\circ$ , over  $15^\circ$  from  $1165^\circ$  to  $2290^\circ\text{C}$ . Accordingly, various grade on speed for the same culture is different supplied with warm in dependence from regions of their actions.

**The resources of warm**, which can use the crops of cotton and other technical cultures are set up from sowing to the first ten-day intervals of October, when on the average many-year on large part of cotton cultivate zone of republic in this ten-day interval began a first frost in the autumn, for south regions frosts have on beginning of second ten-day intervals of November. At favorable conditions of weather and at sowing in optimum terms the warm-providing of sowing of agricultural cultures in all cotton-growing regions of Uzbekistan is sufficient.

The sums of effective temperatures of air, over 10°C  
 The sums of effective temperatures are multiplied on 10<sup>-2</sup>C.



On providing of sums of effective temperatures given by limits for Republic of Uzbekistan are allocated **three type of regions**:

1. - Northern, where the large instability of climatic characteristics and accordingly, large variability of sums of temperatures is observed
2. - South - Kashkadarya, Surkhandarya, part of Navoi, Bukhara districts) with steady climate
3. - the regions with transitive natures of stability of climate - Fergana valley, Samarkand, Sirdarya, Djizak and Tashkent districts.

The reality for agriculture are the **sharp fluctuations of crops** of agricultural cultures till years, caused by adverse conditions of weather, influence of dust-salt-transition, which limit the use of agroclimatic resources, as well as effect of anthropogenic factors (industrial: the non-observance of terms of sowing, treatment of soil, watering, entering of fertilizers, as well as pollution of atmosphere, soil salinity, as a whole adverse meliorative conditions.

Main adverse agrometeorological factors for productions are late spring and early autumn frosts, storm precipitation in period of sowing-shoots, high temperatures of air of vegetative period, dry wind phenomenon, strong wind, especially accompanying with salt-dust carry.

**The frosts** reduce the period of vegetation, cause the wreck of shoots and necessity of execution of transplantment, and at long-term plantings - present to reduction of crop.

The high temperatures (above 25° for cabbage, 35° for tomato, 39° for cotton, 40° for melons, 42° for corn) considerably reduce the crop. The losses because of high temperatures make for vegetable-melons 10-40%, for cotton 10-20%.

Re-dosage of introduced **fertilizers** also extends the period of ripening and frequently results to losses of crop on 10-30%.

**The effect of industrial wastes**, accumulation of pesticides, herbicides in soil reduces the efficiency of sowings. The increase of concentration of connections are sulfur in air in 2 times

of allowable norms reduces the crop of tomatoes on 20%, high concentration phytoids reduce the efficiency of cotton on 10-20%.

Adverse **meliorative condition**, high concentration of mineral salts in irrigated water, soil, amplifying processes of salt-dust-transfer from dried part of Aral sea largely influence on efficiency of sowing, natural flora.

### 2.3. Water resources.

The water resources of Republic of Uzbekistan consist of the surface and underground water, accommodation of which on territory of republic utterly non-uniformly. In zone of formation of surface flow in top current of basin of Sirdarya river the deficit in water is away, average and bottom current of basin is insufficiently provided, as on volume, as on quality of water.

**Surface waters** are distributed on series separate, independent river basins: Sirdarya, Amudarya, Zarafshan, Kashkadarya. The mountainous part of basins is characterized by advanced system of water-flow with average module of flow about 6,5 l/c sq.km. On extensive plain part, occupying 70% of territory, water-flows is very little, majority from them do not reach to Aral sea.

Rivers of republic basically have snowy-glacier the meal, with maximum of flow in spring - summer period and minimum in autumn - winter-grade period.

**The flow of Amudarya** river in the average makes 78 qub.km/year, maximal charges on July - Augusts, minimum - on December - March. The charges in point Kerky changed in limits from 480 qub.km/c to 9180 qub.km/c. The intraannual distribution of Amudarya flow does not provide in modern conditions guaranteed water-feed on irrigation. Weak-water comes through 4-5 years, multiwater periods through 6-10 years. The periods of weak-water years with duration of 5-6 years are characterized, that causes the significant complications in water-providing.

The water resources of **Sirdarya** basin within the limits of Republic of Uzbekistan consist from flow of the rivers Narin and Karadarya, rivers of Fergana valley, Chirchik etc. The water of basin is evaluated in 36 qub.km/year (at 50% of security ) and 28,2 qub.km/year at 90% of security. Heaviest flow in Sirdarya river - on June - July, small - on October - March. Weak-water periods come through 3-4 years and continue a 5-6 years, multiwater periods short ones last.

The main problems, arisen on water resources of basin, are connected with anthropogenic activity, meliorative construction, exhausting of water resources of surface flow, considerable change of structure of water balance, and as the consequence, deterioration of meliorative condition, salinity of water and soils, strengthening of salt-dust-transfer processes from dried part of Aral sea.

**The underground water** are important source of drinking water-supply; on territory their stocks are distributed non-uniformly in consequence of distinctions in geological structure, relief features, basis of water-content rocks, conditions of their meals and formations. In Republic of Uzbekistan in Amudarya river basin the stocks of ground water are evaluated in 8, 0 qub.km, and are significant (3,13 qub.km) stocks of water with mineralization to 1 g/l. In Sirdarya river basin the stocks of ground water make 11,04 qub.km, from them of large part 10,4 qub.km make the water with mineralization to 1 g/l.

Total on Republic of Uzbekistan the stocks are evaluated in 19,04 qub.km and with good quality 11,53 qub.km. For operation the stocks in 6,35 qub.km/year are authorized. On plain territory the large part of ground water is concentrated in lenses along rivers and large

irrigated channels, i.e. are closely connected with surface channels and selection of ground waters results to reduction of surface flow on size of selection.

The significant **increase of watertaken** in top and average current of rivers Amudarya and Sirdarya, connected with growth of irrigated areas, has caused the decrease of volume river flow. Practically the inflow of waters in Aral Sea was stopped. The significant lengthening of drainage system, increase of volumes of returnable irrigated drain waters, increase of mineralization in rivers, channels is marked. Has taken place the change of stocks of ground water, intensive secondary salinity of soils.

**The dump** in natural water sources of high-mineralization, containing pesticides and herbicides returnable drain water from agricultural fields, along with of significant reduction of flow for account of unrational water-taken on need of irrigation, defines the main reasons of considerable deterioration of quality of water in water-sources.

Ground water, used for drinking water-supply and municipal household purposes make 37% from whole of quantity of used ground water; in large cities, as Tashkent, 40% of water-supply is provided with ground water.

The high level of pollution of ground water by petroleum, wastes of chemical and mining industry in Fergana district, partially in Tashkent, Surkhandarya and other districts is marked. In zones of irrigation the pollution of ground water happens intensive salinity and, its quality is worsened, so it is impossible to be used even for agriculture.

As a whole the situation with volume and quality of water in lower of rivers becomes menacing: very the high levels of mineralization of water, deficit of oxygen, concentration of toxic substances in many places surpasses extreme the allowable norms. The structure and quality of water ecosystem is worsened to level, when their efficiency and assimilative ability seriously and frequently irrevocably, suffered.

## 2.4. Ground resources.

The total area of republic of Uzbekistan on 01.01.1997 is 44,5 mln.ha and use as:

Categories of users	Total	in this number, thousand ha				
		Agricultural lands	Forest	under the water	under the road, builds	other unusing lands
Agricultural enterprise lands (all private form)	29736	24222	455	653	441	3965
Forest enterprise lands	7374	2631	895	193	4	3649
Settlement lands	221	63	4	6	94	54
Lands of industry, transport, communication, defence and other	1834	105	3	65	125	1530
Lands of natural-guard enterprises, recreation, historical-cultural monuments	7	3	-	-	1	3
Water areas	654	6	1	617	4	27
<b>Total</b>	<b>39827</b>	<b>27031</b>	<b>1359</b>	<b>1534</b>	<b>670</b>	<b>9229</b>
Reserve lands	4631	611	5	40	2	3972
<b>Total</b>	<b>44458</b>	<b>27642</b>	<b>1634</b>	<b>1574</b>	<b>672</b>	<b>13201</b>



Agricultural lands occupy a 62% from all territory. The using of lands shown in table:

Lands	Total, thousand ha	Irrigated lands, thousand ha
Arable lands	4088	3339
Perennial plantation	370	357
Long fallow	72	38
Hay-moving and pasture	22394	40
Personal plot	610	489
Total of use in agricultural production	26985	4263

The irrigated lands in arid conditions is main value. Its taken about 15% of agricultural lands, but give more, than 95% of all gross agricultural output.

However, the size of irrigated lands was limited through availability of irrigated water in sources. Now the all stocks of irrigated water is exhausted. Therefore the growth of irrigated areas possible only through water-saving, modern technics and types of watering, improvement the meliorative conditions of lands. About half (46,8%) of irrigated lands is salinity, from its 25,2% is weak-salinity, 15% - medium salinity and 6,6% strong salinity.

The quality of irrigated lands is characterized with Bonitet's index of soil (on 100 - scale). Average bonitet's index on Republic of Karakalpalstan is 41, Syrdarya region - 52, Djizak and Kashkadarya - 54, Bukhara and Navoi - 59, Namangan - 63, Fergana - 64, Andijan - 65, Samarkand and Tashkent - 66, Khorezm and Surkhandarya - 68, Uzbekistan - 59.

Bogara (non-irrigated) lands with area about 800 thousand ha located in foothills zone (absolute height is 400-1000 m and more above sea's level), where the number of precipitation is 300-500 mm and more. The bogara presented with wash soils, through many years ploughing up and water erosion.

In Republic more than 22 mln.ha of pasture, from which 19,6 mln.ha or 88% is irrigated. In accordance with natural conditions its distribute on desert-plain (Chul's zone) with area 18 mln.ha, plain-hills (Adir's zone) - 3,2 mln.ha and foot-hill-mountainous (Tau's zone) - 0,9 mln.ha.

## 2.5. Biological resources.

The biological efficiency develops from vegetative, soil and animal resources.

The kind structure of plants of desert of Uzbekistan differs by large diversity and reaches to 1500 kinds.

The following **types of desert vegetation** allocated:

- psamophilic a arboreal-shrubs in sandy-pebbles deserts
- gypsophilic weak-shrubs in stone deserts of tertiary plato
- ephemeric-ephemeroid grassy in wood deserts
- semi-shrubs wormwood with participation of long-term cereals, as well as ephemera and ephemeroids in loamy deserts
- water-plant-lichenic or layer on takirs with groups of surface lichens and dark-blueey - green water-plants.

In connection with limitation of precipitation the biological resources of deserts utterly small.

The general **biomass stock** in deserts of the Central Asia is evaluated in 50-60 c/ha. The annual gain in is good humidified black saksauls makes not more 10 c/ha, and in the most dry years is away entirely.

The weak biological efficiency of deserts limits the opportunities of development of animal industries. On counts in sandy deserts of Uzbekistan on each sheep is necessary to be had 6 ha of pasture, nevertheless cost price of desert animal industries of far below, than in damp zones.

**The fodder stocks of deserts** of Karakalpakstan have dispersion nature and are ranged from 2 to 9 c/ha. In south-western Kizilkum natural pasture have a various crops in dependence from type of vegetative covered: - tisbuergunic - 1-1,5 c/ha, titric - 1-2 c/ha, salt-wormwood -2-4 c/ha.

More productive ephemeric-wormwood are subject to sharp fluctuations of crop in dependence from precipitation. Northern foothill plains of Kizilkums have the large efficiency. Artificial band sowings of isen, saksaul enrich the structure of fodder's and in 2-3 times increase the crop of pasture.

In many places in comparison of small territory was possible to be met a different grass of pastures - cereals, wormwood, that permits to vary the meal and, main, to use annually in all seasons of year.

On data of Institute of Botany the general fodder stocks one Bukhara district (area of pasture 13 mln.ha) makes 30 mln.c., and capacity these pastures - about 4 mln. sheeps.

Vegetative resources are also used as of fuel for population, building material for household purposes. The wild-growing plants of deserts have the important significance as sources of natural colors and medicine substances. In particular, is wide the roots of liquorice or malt for needs of pharmaceutical and food-processing industry are prepared.

Besides of **driving away cattle-breeding** in structure of resources of animal world of deserts included the kinds of wild animals, many from which early had a hunt-industries significance, and now, in connection with reduction their numbers, are under protection of state. In Red Book are included the Kizilkums' and Usturts' sheeps, jeyrans, is limited controllable the destruction of saygaks. From predators in biocenoses of deserts are submitted the wolf, korsak, jackal, fox.

In connection with intensive development of places of inhabitate of jeyrans and kulans their numbers is supported on territory ecocenter "Jeyran" in Bukhara district. Such protection and artificial maintenance of number require the large desert birds - bustard, strepet, bustard-beauty.

Bioresources of deserts can be in many times increased at account of irrigation with surface and ground water and creations of large agrobiocenoses for growing of cultural plants - cotton, wheat, paddy, sugar-cane, for account of phitomelioration of deserts and creation of fodder base for animal industries.

### **2.5.1. Forest resources.**

The forest fund, fixed for Goskomles of Republic of Uzbekistan as of January 1 1998 makes 9120 thousand ha, from them, area covered by wood 2776 thousand ha. The specific weigh by covered wood of area makes 30,6%, and the woodity of the Republic of Uzbekistan - 6,2%.

The forest fund of Goskomles for 5 years, i.e. from 1993 was increased on 1158,6 thousand ha at the expense of transmission to bodies of forest economy of sandy massif of Navoi district, and special protection natural territory for this period was increased on 12,1 thousand ha.

On soil-climatic conditions **the forest fund is distributed** on sandy, mountainous, flood-lands and valleys' zone:

<b>Sandy zone makes</b>	-	<b>7833,7 thousand ha</b>
<b>Mountainous zone</b>	-	<b>1173,2 thousand ha</b>
<b>Flood-lands zone</b>	-	<b>83,7 thousand ha</b>
<b>Valleys' zone</b>	-	<b>57,0 thousand ha</b>

Main wood-forming kinds **in sandy zone** are saksaul, kandim, cherkes, grebenchik and other sandy shrubs. The area of zone covered with wood makes 2655,3 thousand ha.

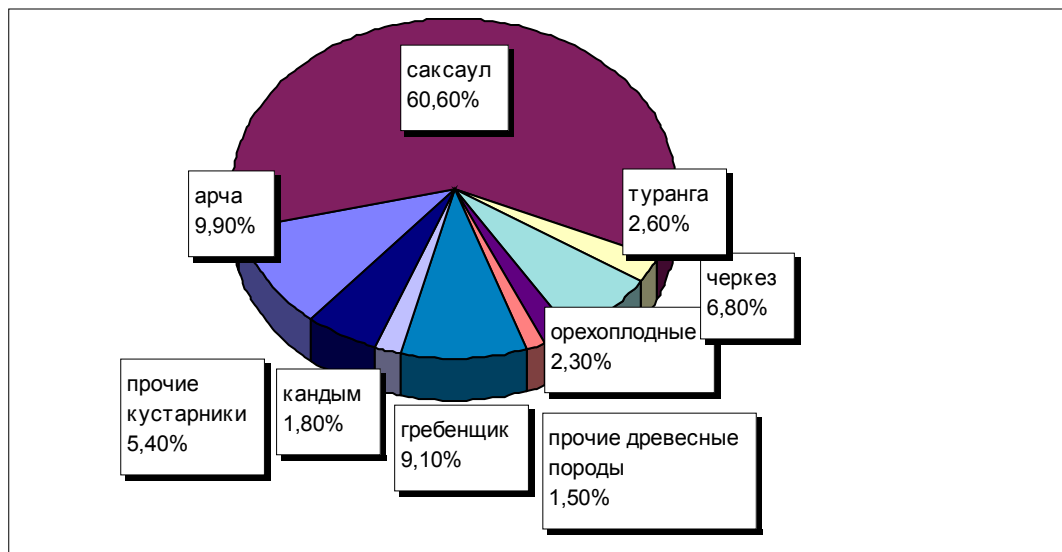
**In mountainous zone** basically grow the zarafshan archa, pistachio-tree and maple, area covered by wood makes 280,3 thousand ha.

**Floodlands wood** are located along Amudarya, Sirdarya, Chirchik, Zarafshan and Akhangaran rivers, where grow the turanga, willow planting and shrub-grebenchik. The area covered by wood makes 30,9 thousand ha.

**In valley zone** grow in basically the artificial woods - wood cultures. In salinity and marsh-ridden soils grow the shrubs - grebenchik and malts.

From general area of forest fund 9120 thousand ha., the lands not used in forest-economy production make 2324 thousand ha is 27,2%, bogs - 1,8 thousand ha, clean mobile sands - 278,6 thousand ha., glaciers - 4,0 thousand ha., and takirs, rocks, screes, river beds, salt-marshes - 2291,2 thousand ha.

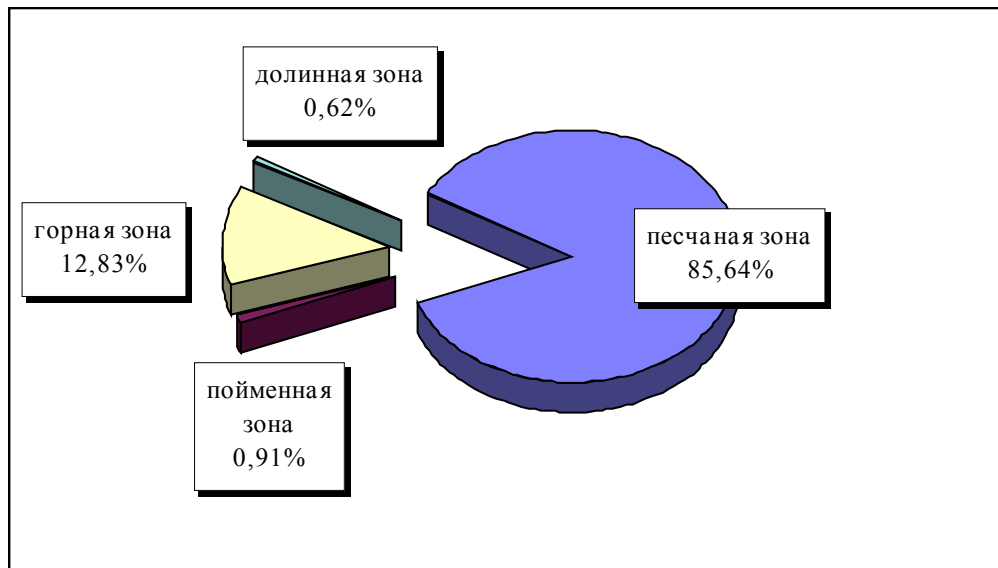
#### **Distribution of forests on main types.**



The preliminary analyses of **condition of woods** in Republic of Uzbekistan has shown the occurrence of complex of problems in field of social and economic life of people, uses of natural resources and preservations of ecological balances.

The open bottom of sea on large spaces is sharp deteriorated the condition of environment of territory of Republic of Uzbekistan and has resulted in to undesired ecological problems: developed and progress the processes of desertification, cover with salt sands the settlements and agricultural areas, particles of the salts are transferred with wind on huge territories.

## The percentage ratio in forests of Republic of Uzbekistan.



The effects of ground water and particles of the salt and other adverse factors have resulted in to decrease of **biological stability of planting** and as a whole of forest ecosystems, decrease of their useful function, wide distribution of centers of vermines and illnesses of wood and sharpening of problems of forest-protection.

At present, dry bottom of Aral sea makes more 1200 thousand.ha, ground deposits of sand are fixed with forces of wood-economies of Goskomles of Republic of Uzbekistan.

The annual volume of planting and sowing of sandy and wood kinds, with simultaneous execution of mechanical fastening of salinity sand does not exceed 10 thousand ha. and for total wooding and fastening of sand is required more one hundred years.

Moreover in coastal zones of Aral sea - in Republic Karakalpakstan, Bukhara, Navoi and Khorezm districts require the fastening and wooding of mobile sand on areas 300 thousand ha.

**Wood-economy enterprises** is conducted sand-fixed works. The work on creations of protective wood plantings are executed in heavy soil-climatic and social - household conditions, in large removal from settlements (150-200 km), and experience the difficulties because of shortage of means and insufficient equipment with powerful tractors, gears and automobiles with high practicability, capable to work in heavy soil-climatic conditions.

Thus, the serious problems in fields of ecological safety, creation of protective wood planting, sand-fixing, wood-recreation, protection of woods, protection of wood from pests and illnesses were generated.

## 2.6. Mineral-raw resources.

**Uzbekistan has large mineral-raw base and large prospects its increase.** Republic is registered more than 2700 deposits and displays of useful mineral, about 100 kinds of mineral raw material, from which 60 kinds are already used in national economy.

Prospects 940 **deposits**, including 165 -petroleum, gas and condensat; 3 - coal; 46 - noble metals; 36 -coloured, rare and radioactivity metals; 17 - mining; 9 - mining-chemical one; 21 - semi-precious stone of raw material; 495 - building materials of various purpose.

**The stocks** of silver, coloured metals, rare and radioactivity elements, lead, lithium, selenium, tellurium, rhenium, scandium and other elements **are significant**.

The prepared stocks of all kinds of useful mineral are today evaluated more, than in 1 billion of USA dollars, and general mineral-raw potential makes more 3,5 billions of dollars.

On series of major **useful mineral**, such as the gold, uranium, copper, wolfram, potassium salts, phosphorites, kaolin, Republic of Uzbekistan on confirmed stocks and prospects their increases takes the leading places in worlds.

Republic of Uzbekistan rather rich and **non-metallic useful mineral**, considered in quality of mining-chemical, mining and semi-precious stone of raw material, various building materials.

In the last years in Uzbekistan study the non-traditional kinds of mineral raw materials, one of which are **agroore**.

Was established the efficiency of application cheap, easily taking agroores - bentonites and kinds of bentinit clay (bentonit raw material), glaukonits and glaukonited-bringed sandy (glaukanitic raw material), bad quality coals and wastes of coal extraction in agricultural production.

The bowels of Uzbekistan have a large potential of **oil-gas** content. About 60% of its territory are perspective on petroleum and gas.

Within the border of Republic are allocated five oil-contented regions: Usturt, Bukhara - Khiva, South - Western - Gyssar, Surkhandarya and Fergana.

The most large on volume of industrial stocks of hydrocarbons are 19 deposits, from them to category of unique relate the Shurtan and Gazly.

They concentrate the 85% of stocks of gas, 37% of petroleum, about 90% of condensat and more than 88% are sulphur from general initial stocks.

Summary oil-gas-content resources make about 11 mlrd.t. of conditional fuel, from them the prospected stocks - 26%, accumulated extraction in view of losses - 1,3 mlrd.t. of conditional fuel.

At the level of extraction, achieved in 1996, the security of oil-gas-extracting industry makes on gas of 38 years, on petroleum with condensat - 32 years.

**The development of new deposits** of mineral-raw resources is conducted predominary in such natural-climatic conditions, which differ with increased ecological vulnerability to technogenic effects. They are stipulated by investigation, development of deposits, as well as operation of obtaining complexes, not appropriate while to requirements of ecologization of economic activity.

On aggressive effect, the duration of it displaying in nature, as well as quantitative scope the extraction of mineral raw material does not compare unfavourably to chemical production.

The significant **negative effect on environmental nature** and bowels rendered the emergency situation (opened oil-gas displaying, surplus of high mineralized waters), works on intensification of inflow during prospecting work and extraction of hydro-carbons, including in hydrochloric acid process of oil-gas content layers, processing of them ingibitors, petroleum, condensat and other reagents.

The obtaining crafts form the various **technogenic flows**, including large numbers of polluters, as a result happens multilateral negative effect on soil and subsoil layers. For example, such components, as methan-geksan, can be preserved in soil and subsoil horizons very long time and, besides to be transferred in atmosphere and hydrosphere. The remaining products of degradation in soil are involved in landscape and biochemical cycle, bring the serious harm to environmental nature.

**The pollution of atmosphere and soil layer**, infringement of ecological environment of inhabitant happens also at the expense of harmful products of combustion of gas in torches, as well as at occurrence emergency of wastes of gas and petroleum.

## 2.7. Hydropower resources.

The water resources of Uzbekistan are part of general water resources, of which the basin of Aral Sea disposes. To this basin relate the largest rivers of Central Asia: Amudarya and Sirdarya, being main sources of surface flow and directly coming to Aral Sea, as well as river hydrographically relate to basin and located in borders of Aral depression.

### The water resources of rivers of Aral sea basin (qub.km).

Basin	The volume of flow at security		
	50%	75%	90%
1. Amudarya basin	78,0	68,5	60,0
in this number Amudarya river	68,1	60,4	54,6
2. Sirdarya basin	36,0	31,2	26,8
in this number Sirdarya river	34,0	28,9	25,3
3. Basin of non-drain river	5,8	5,2	4,8
4. Other small river	4,4	3,8	3,4
<b>Total</b>	<b>124,2</b>	<b>108,7</b>	<b>95,0</b>

The share of water resources, forming directly on territory of Uzbekistan, is equal - on Amudarya basin - 6%, on Sirdarya basin - 16%, and as a whole on Republic - 10% from their summary flow. From requirements of ecology and obvious necessity of preservation Aral sea, the volume of water resources, on which can calculate Uzbekistan at the present stage and on period till 2010 makes 59.2 qub.km, from them on Sirdarya river - 24.1, on Amudarya river - 35.1 qub.km.

**The quality of river water**, arriving from mountainous territories of zone of their formations, very high - practically by nothing these waters are not polluted and mineralization is very small. However, in accordance with progress downwards on current of river, quality of water is appreciably worsened.

### The settlement volume of having water resources in Republic of Uzbekistan till 2010 ( in mln. qub.m).

River basin	Rivers			Ground water	Recommended to use of drainage	Having water resources
	bed	small river	total			
Sirdarya river	10490	9425	19915	1590	2600	24105
Amudarya river	22080	10413	32493	301	2310	35104
<b>Total on Uzbekistan</b>	<b>32570</b>	<b>19838</b>	<b>52408</b>	<b>1891</b>	<b>4910</b>	<b>59209</b>

To majority of rivers of region in their average and bottom current inherent the high mineralization of water - from 1-1,5 g/l on the average current to 2 g/l and more in bottom

current. In Lower Amudarya is constant fixed the excess of MCL on mineralization and rigidity of water, as well as on silphatium, chlorid, phenol, cremnium and etc. The pollution of water with fluorine and mercury comes nearer to MCL.

Is strong is polluted in the bottom current Zarafshan river. The similar insufficient quality of water in rivers Sirdarya, Surkhandarya and Kashkadarya.

The hydraulic interrelation of surface waters with ground water has resulted in actually to total loss of early normal quality also and ground water, especially in lower rivers and zones of advanced irrigation.

**The use of water resources in branches of national economy of Uzbekistan  
on the average for 1991-1995.**

Water-user	Water used	
	qub.km	%
1. Economic - drinking water-supply	2,45	4,1
2. Agricultural water-supply	1,00	1,6
3. Industry	1,30	2,2
4. Fish-breeding	1,05	1,7
<b>Total non-irrigation users</b>	<b>5,80</b>	<b>9,6</b>
5. Irrigation	54,8	90,4
<b>Total</b>	<b>60,60</b>	<b>100</b>

**The ground water** in Aral sea basin, on prospected resources are evaluated in 32.5 qub.km., that makes about 25% from volumes of surface water, including on Uzbekistan - 19.7 qub.km. The operational stocks make 12.1 qub.km. on region and 6.8 qub.km. on Uzbekistan. The actual summary selection of ground water as of 1995 made: on region -13.5 qub.km., and on Uzbekistan - 9,8 qub.km.

the reason of progressing pollution of ground water basically is the deterioration of quality of surface flow, as the ground water hydraulically are connected on receipt articles of balance with surface flow approximately on 80%.

As it is visible from adduced tables, on irrigation in Uzbekistan spent about 90% of having water resources.

**2.7.1. Opportunity of development of hydropower resources and problem  
of combination of interests of irrigation and power.**

At present in Uzbekistan operation the 30 hydroelectric stations with general capacities 1684 MVt, are maintained which produce to 6,4 mlrd.kvt.h of electric power per annum and use thus only about 30% being present in Republic of hydropower resources of large rivers.

Besides of hydropower potential of large rivers, in Uzbekistan the large potential of small rivers, irrigation channels and reservoirs, estimated in 1760 MVt of capacity and to 8,0 mlrd.kVt.h of manufacture of electric power per annum is present enough, however this potential on today remains non-used.

Thus, general hydropower potential of Uzbekistan makes 7445 MVt of the capacities with manufacture 26,7 mlrd.kVt.h., from which use today about 23%.

**The main ecological problems, connected with water resources**

- the general deficit of water resources

- non-rational use of presented volume of water resources
- the deterioration of quality of surface and ground water
- the dried of Aral sea and desertification of Aral zone
- the bad ecological and water-economic conditions in Zarafshan river basin
- the maintenance of population of Lower Amudarya with good-quality drinking water
- the coordination of interests of irrigation and water-power engineering.

## **2.8. Main directions of economy development.**

In Uzbekistan are fixed achieved for previous years positive shifts in macroeconomics stabilization, is created the steady base for economic growth.

The realization of programs of economic transformations is based on particular improvement of structure of economy, refusal from one-side, hypertrophic raw direction.

In 1997 the volume of production of industrial production exceeded the starting level of 1990 on 12.7%.

**The economic growth** in Uzbekistan in 1997 is supplied first of all:

- the increase of volumes of development of capital investments in economy on 18%
- construction and enter in action a new, progressive productions, equipped with modern process equipment
- result of successful execution of measures on antiinflationary regulation
- of financial stabilization, strengthening of system of money reference - increase of level of incomes and address social protection of population

**Major priorities** of realization of development of economy on nearest prospect are:

- the fastening of tendencies of steady economic development, further strengthening of macroeconomics and financial stability, strengthening of payment discipline, sharp reduction of level of inflation.
- deeping of economic reforms in agriculture
- the development of small and average business
- the expansion of export and strengthening of currency and payment balance
- the maintenance of realization of National program on training of personnel
- the development of fund - market

**At present time:**

- the increased the share of incomes, received from market forms of property (of enterprise incomes, incomes from properties and from personal auxiliary economy)
- the tendency of the smoothing of level of differential of incomes is observed

## **CONCLUSION**

The analysis of social-economic conditions and natural resources promote to tedermination of next ecological problems connected desertification:

- the growth of population is good factor for development of country, but in result increase the human impact, especially in agriculture;
- high increase of population in country-side give a replanty of manpower in agriculture, that demand of organization of production for produce processing industry on places. Furthermore appear a preconditions for migration of population to big industrial centers, that increase a urban population;



- in whole, the Republic had a sufficient thermal resources for growing of tropical crops, however, the large territory be under impact of air and soil drought, that is reasons of sharp variation crops;
- unfavourable meliorative conditions, high degree of mineralization of irrigated water, the strengthen processes of dust-salt transfer from dried bottom of Aral sea decrease the sowing productivity;
- the deficit of water resources come to origin of desertification and soil degradation;
- the use of high mineralization irrigated water come to degradation of irrigated lands, especially for using of low-technological watering methods;
- in considerable degree run low the ground water stock with good quantitative, especially in lower river;
- all areas for agriculture is completely developed. The irrigated lands on large area be in unsatisfactory meliorative conditions;
- the weak biological productivity of deserts is determine from season climatic factors;
- the exploitation of deposits maked in zones with heightened ecological vulnerability, that can come to dangerous consequences, especially at technogennic damages;
- the total deficit of water resources and low-quantity of surface and ground water, especially in lower-river, come to development of negative ecological processes;
- weak control for quality of surface and ground water, atmosphere conditions, soils, vegetation come to different negative consequences in ecological conditions.

### 3. DESERTIFICATION PROCESSES IN UZBEKISTAN.

#### 3.1. Factors of desertification.

Desertification at the present stage is result of difficult interaction of two groups of factors - natural and anthropogenic.

##### 3.1.1. Natural factors of desertification.

To number the most important driving natural forces, promoting to developments of processes of desertification relate, certainly, **climatic factors**.

Abundance of **solar radiation**, high temperatures of air, scarcity of atmospheric precipitation and huge deficit of humidity is caused the by specific climatic conditions in arid countries, manifesting in them droughty. The droughty climate the deflation or wind erosion of soil, soil salinity and reduction of them humus is reason of distribution in deserts such negative processes.

From other climatic factors of desertification is necessary to be noted the active **windy regime**, characteristic for arid territories. The strong wind promotes to the activization of deflation processes, as well as dispelling of humus soil horizon.

One of basic reasons of natural desertification is also the group of **hydrogenic factors**, to which relate the nature of surface flow, level of ground water and their mineralization. In connection with scarcity of dropped out of atmospheric precipitation the scattered (slope) surface flow in prevailing of part of arid territories is characterized is extraordinary of low parameters. The module of flow does not exceed here, then 1 l/c from square kilometer. Connected with it drought of top soil horizons is limiting factor of increase of soil humus and serves by reason of progressing of the deflation.

**The high evaporation**, inherent to arid zones defines the increased level of mineralization of ground water. For greater part of arid territories the size of mineralization of up water and is more deep located the ground water exceeds 3 g/l. This circumstance, depping in places with non-deep of them location, promotes to soil salinity. In that locations, where ground water located on depth below 5 meters the drought of top the horizons of soil serves by reason of development of deflation processes.

The important factor of desertification are significant **slopes of lands surface**, observing in conditions is pleased of strong dismemberity of greater part of arid territories. The high horizontal and vertical dismemberity of relief, inherent to many deserts - base of development of area water erosion of soil. In foothill loesses and stony deserts periodically happened the storm rains proceed the large relief-forming work. Subsequent powerful flow on characteristic for given high-altitude zone with temporary canals causes the active lateral and depped bed-river erosion. Firm drifts are transferred thus on distance, measuring by tens of kilometers.

Factors, determined by properties of soil, also influence on the development of desertification. The friability of the top soil horizons, being the main attribute of sandy deserts serves by basis for progressing of deflation processes. Surface or non-deep **soil salinity**, frequently observable on delta-alluvial plains bears in self the threat of conversion of them in salt-marshes deserts.

Very wide spectrum of effects on potential increase of area of deserted areas render the phitogenic factors. They are displayed basically through rarity of vegetative covered, inherent to arid landscapes. Because of significant dispersion of plants on area the wind and agricultural animals are forced as it is possible total utilize the surface phitomass, that conducts to serious spoil of vegetation on large territories.

This the reason hinders to accumulation on soil surface of the vegetative cover and formation of the humus horizon. Connected with rarity of plants the low soil turf poorly resists to development of soil erosion as water, as wind. The other phitogenic factor - low efficiency of arid vegetation also conducts to bypass by animal the greater area of pastures, than on high-crops areas. Except for increased salvaging of surface organs of plants it conducts to spreading of the top horizons, development of deflation and hinders to increase of soil humus.

**Zoogenic factors** of desertification unite such main reason as the digging activity of rodents and migration of locusts. Creating the self colonies the rodents friabilited the soil promoting to activization of wind erosion of soil. On slope surface the animal burrows are centers of development of water erosion of soil. The migrations of locusts, sporadically observable on desert territories also introduce the contribution in them desertification. Afterwards invasion of vast on number the flocks of these insects the vegetative cover on large areas is destroyed completely. The spoil of vegetation in turn threatens by potential development of wind and water erosion of soil.

### **3.1.2. Anthropogenic factors of desertification.**

At the present stage of technological progress in development of desertification in many cases determining significance have not natural, and anthropogenic factors, that is, sphere of human activity. All kinds of activity of community, affecting on processes of desertification is possible to unite in some groups; economic, social, military and legal ones.

Is the most strong on expansion of desert area the economic factors influence. Numerous negative consequences, promoting to deeping of desertification attract the non-rational methods of development and operation of arid territories. The large damage to nature of desert is put not organized duly the prospecting and extraction of useful mineral.

In conditions of **sandy and road metallic deserts** the random locomotion on territory of geologic-prospected technics is strong breaks the top soil horizons on significant areas, that negatively affects of safety of soil cover. The processes of deflation and water erosion of soil are here developed, as well as is destroyed the insignificant humus layer. The development of precipitation of useful mineral promotes to expansion of technogennic landscapes with industrial enterprises, settlements and advanced network of transport mains (different roads, pipelines, electric lines). The moving technics and motor transport are reason of occurrence here of centers of soil erosion. On significant areas around of industrial complexes and settlements the landscapes of deserts are polluted with wastes of production and household dust. Technogennic landscapes and adjoining sphere of their influences reduce the area of natural ecosystems, that conducts to reduction of biodiversity on developed territories.

**In agricultural regions** the development and irrigation of lands without due the observance of agrotechnical receptions of soil processing and cultivating of cultures conducts to them of salinity and conclusion from economic rotation.

On many **irrigation massifs**, located in arid areas as a result of non-rational methods of management of agriculture are progressed the processes of wind and water erosion of soil. On periphery of irrigated lands, closed downturn, where dump the drain water, such kinds of desertification as flooding and soil salinity are observed.

The development of irrigation and regulation of river flow can result to radical changes in environments for 20-25 years. Specially negative consequences of non-rational methods of irrigation affect the nature of lower rivers, where is radically changes the hydrological regime of river valley and deltas, drought the swampy and meadow areas and as a result of

desertification on huge territories is sharp is reduced the production of fodder's, and consequently and cattle population.

On **pasture massifs** of arid zones the main factor of desertification is excessive pasture of cattle. The rarity of vegetative cover and low efficiency of desert phytocenoses are reasons of significant spoiling of vegetation with pasture animal and her degradation on extensive territories. The low irrigation of pastures, the very rare system of wells in deserts is sharp deeped this process. In radius to 2-3 kms from wells the radical vegetation of deserts as a result of herds undergoes the strong changes, and in half-kilometer around of them it get out completely. The humus horizon is here destroyed, the processes of deflation are developed and formed the barkhan sands. In regions with excessive herd of agricultural animal the numbers of kinds of plants in phytocenoses is reduced in 2-4 times. In structure of dropping out enter the rare and lossing kinds, that is negative influences on biodiversity of deserts. It happens and in view of availability of definite competition between wild and agricultural animal ones.

The important role in development of desertification belongs also to **social factors**. Insufficient centralized providing of inhabitants of near desert and especially desert regions with various kinds of fuel (coal, gas and etc.) impels to prepare the firewood's on environmental territories. Are thus destroyed in large volumes not only wood and shrubs vegetation of deserts, but also semi-shrubs (wormwood). As often as not the preparation of fuel is conducted such, barbarian way as rooting out of shrubs and trees with metal rope, tighted between two driving tractors. The destruction of desert arboreal-shrubs vegetation, performing soil-protection function conducts to development of deflation and progressing drying of the territories. From flora drop out a many other plants, connected with trees and shrubs. Is damaged to biological diversity desert.

The strong negative effect on animal world of deserts, and consequently and on biodiversity of deserts renders the poaching. From desert fauna, especially on territories, adjoining to settlements and wells, the kinds of valuable animal, playing the important role in desert biocenoses drop out.

To is pleased to considerable factor of desertification relates nor organized duly the recreation activity of community. Random, the "wild" tourism, mass departures on barbecues especially in spring time of rural and in greater degree of urban population of attached desert and desert regions is accompanied with uncontrolled collection of mushrooms, wild-growing flowers, valuable in aesthetic relation plants, as well as concern of animal in critical periods of their vital cycle.

The consequence of it is the reduction of kind structure of biota and even the total destruction of rare and the most valuable in economic relation of animals and plants. In the most attractive so the most popular in recreation sense and attending landscapes through some years of excessive tourist load begins the degradation of vegetative cover and the development of deflation processes is made active.

In last decades one from main reasons of anthropogenic desertification has become the **military factor**. Reorienting of management methods of modern wars on the wide introduction of hardware in conditions of increased injure of arid landscapes was source of strong press on nature of deserts. Military training and maneuvers of overland armies, tests of nuclear and strategic weapon, and such battle action in arid countries play the large role in development of technogennic, wind and water erosion of soils, destruction of the horizon, expansion of area of technogennic landscapes and reduction of biological diversity of deserts.

The universal factor of anthropogenic desertification is juridical or legal factor. The legal aspects of nature-using in deserts, including in development of literate laws about land, water, bowels, vegetative and animal world, protection of nature, other ecologically directed deeds

and control, absolute of their executions, have the decisive significance for reduction or, opposite, expansion of area of anthropogenic deserts.

### **3.1.3. Interaction of the natural and anthropogenic factors at desertification.**

Use by person of lands in drought zones includes pastures, bogara and irrigation, and as a rule influences on the changes of adapted systems with large temporary and space fluctuations of precipitation, soil humidity and productivity of plants.

At present the important significance has information about role of infringement in maintenance of long-term changes of ecosystems and environment, which can short-time preserve their properties in connection with external effects.

Such reasons of desertification, as the climatic variability and anthropogenic effect are the most evaluated in case of soil degradation.

In **case of salinity** at wrong practice of irrigation, the role of human activity far surpasses the climatic variability. As is wide it is known, the large ecological problem of Uzbekistan was had become the high degree of second soil salinity.

The regional climatic factors very depend from global climate. To this reason needly to considerate a global climatical changes for management of economy activity, especially for dried zones.

The bellow adduced the model scheme of interaction of climatic changes with anthropogenic effects, used in world practices for analysis of desertification.

### **3.2. The degradation of vegetative cover on pastures.**

The process of desertification begins from the moment, when the speed of anthropogenic effect on arid territories exceeds the ability of landscapes to self-restoration.

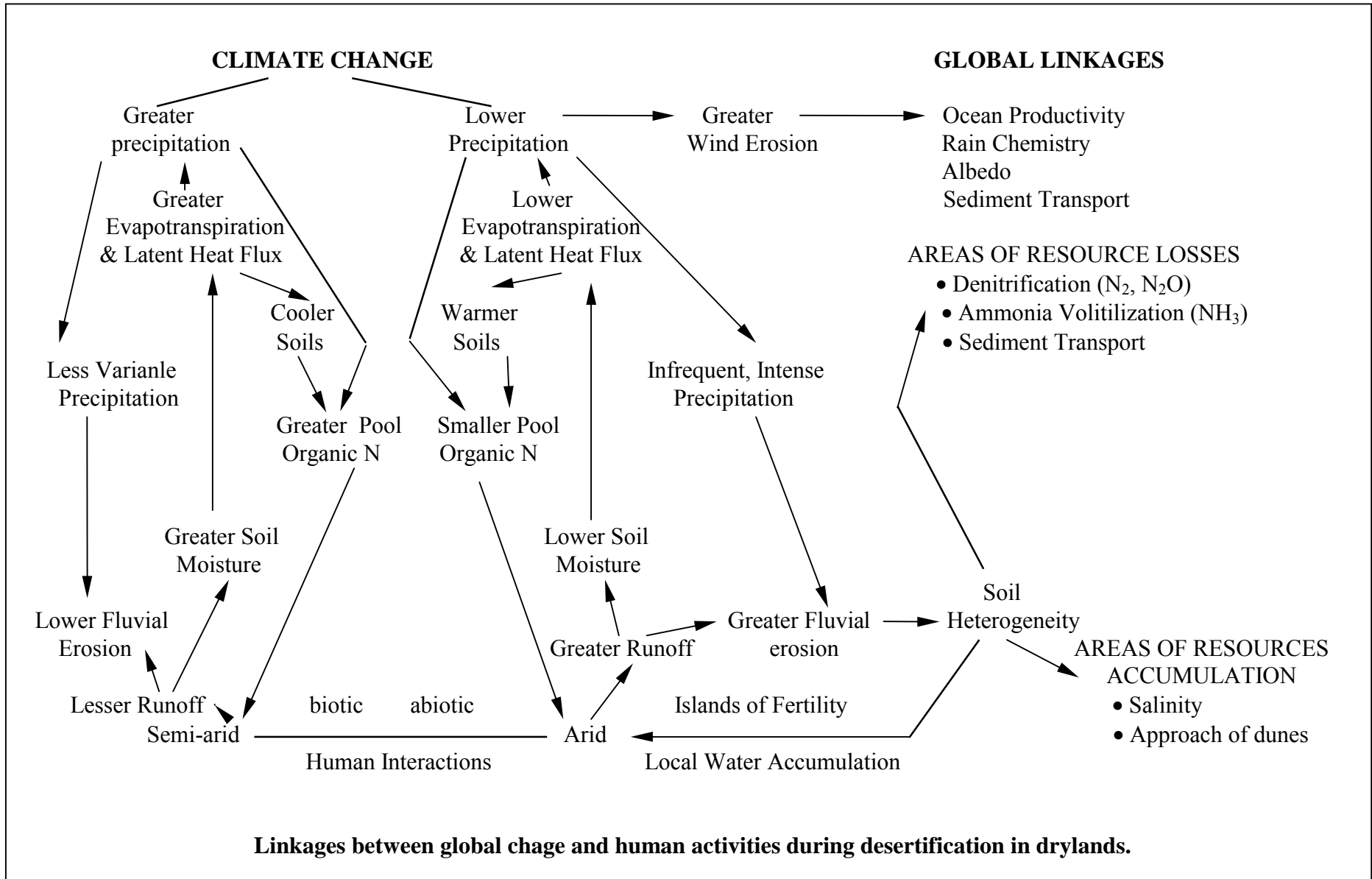
Main reasons of **degradation of vegetative cover** are:

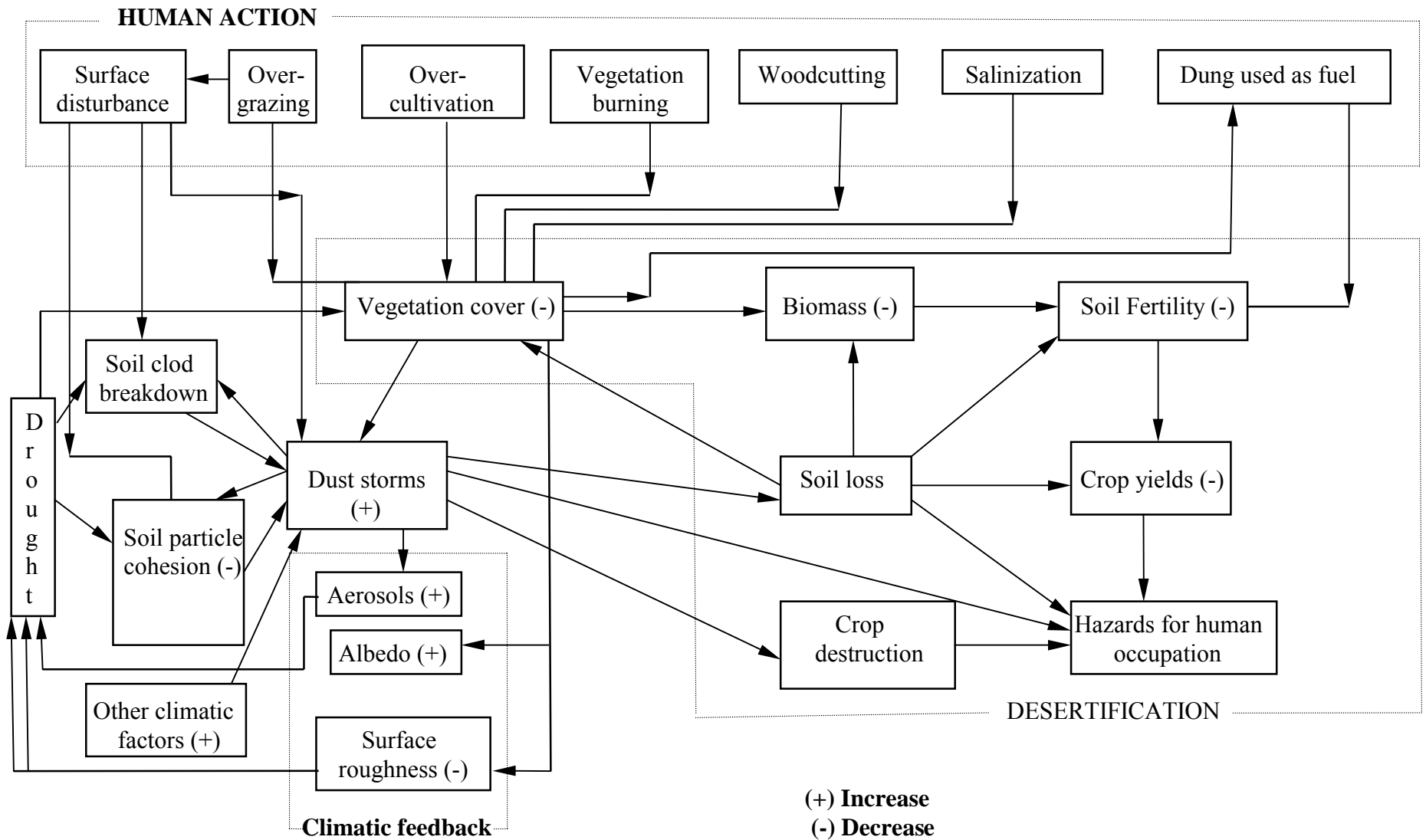
- The intensification of cattle herd.
- The development of new lands for irrigation.
- Felling of wood and shrubs for fuel.
- Irrigation with mineralization water, over-watering, secondary salinity, use of non-prepared lands, dump of drain water in downturn zone of deserts and etc.

The bright example is degradation of vegetative cover of South Aral zone, where reed overgrowth were reduced from 1 mln.ha (1961) to 77 thousand.ha (1974). The main reason of degradation of vegetative cover and pasturing digression is over-herd, infringement of bases of pasture rotation. Moderate herd renders the positive influence on quality of pastures - promotes to friability of soil, duly doing up of seeds and good resumption, entering of fertilizers.

The important self-restoration resource of planete, without it impossible a human life, is natural vegetation cover with it's floristic and phytocenotic diversity.

The stop of desertification process development, restoration of degraded pastures for phytomelioration works, which give a different choose of pasture phytomeliorants for different natural-territorial complexes. The phytomeliorant choose carry out with tolerant of different types to special edaphic conditions of desert territories (grey-brown gypsy, salt-marshes, desert-sandy with different capacity, takirs' and other soil types).





The work carried out in South-Western Kizilkum, showed, that at phytomelioration with sowing of wormwood, black saksaul and other crops kind, the pasture productivity increase to a few times.

**The correct pasture rotation** can directly to change the kind structure of plants and provides the expedient in economic relation combination of various plants. However excessive herd results in excessive break of light sandy soil down to formation of barkhans, depressing of plants in result of systematic eating out and destruction of young growths. Annual spoil in the same spring-summer season inevitably conducts to degradation of vegetative cover. Thus radical phitocenosis is in the beginning replaced with large-grass-shrubs grouping - sandy sedge, or ilak, fixing sand, drops out completely and occur stains of nude sands.

The reason of deterioration of pasture is their non-uniform use, concentration of live-stock close of cultural-irrigated zone on poor monotonous pastures and unload of deep massifs of deserts, where the crop of fodder partially losses.

The long-term absence of herd on good fixed areas adversely affects on herbage and through 4-5 years of rest the crop can decrease on 20%.

The large loads have on pastures around wells and chinks, in radius of 2-8 kms the soil completely is nudes. Around of settlements the intensive destruction of plants on fuel happens. On space cards are precisely allocated more light stains of desertification around of settlements, wells and chinks. By zone of active soil degradation are self-pouring out chinks with mineralization water. The negative role render the over-norms preparation of wormwood, singren, partek and other medicine plants.

For the last 15-20 year continue the degradation of pasture as results loss of fodder capacity.

Region	Total of pasture	In this number under digression	Loss of fodder capacity, %		
			20-30	30-40	> 40
Republic of Karakalpakstan	5,4	4,5	2,1	0,6	1,8
Bukhara	2,9	1,7	1,4	-	0,3
Djizak	0,7	0,2	0,2	-	-
Kashkadarya	1,5	0,3	0,1	0,2	-
Navoi	10,2	9,2	5,1	4,1	-
Samarkand	0,8	0,4	0,4	-	-
Surkhandarya	0,9	0,1	-	0,1	-
<b>Total</b>	<b>22,4</b>	<b>16,4</b>	<b>9,3</b>	<b>5,0</b>	<b>2,1</b>

Serious competitors of home animal on pastures are rodents, which can to destroy to 50% of fodder weights, eating the roots, bulbs, seeds and cause the destruction of surface layer of soil. One of effective ways of struggle with rodents is the protection of foxes, wild cats and other predators, which eat the rodents. As compared with 50th years the pasture fund was reduced on 6,5 mln.ha.

Pasture-rotation observance of norms of load (6-6,2 ha on one sheep) and correct organization of joint fodder's gives the possibility to support on pastures the expedient combination of vegetation, its improvement and enrichment.



### **3.3. Water resources, transformation of water-salt regime of irrigated territories.**

The main problem of activation of series of desertification processes is follows to determine the deficit and exhaustion of quality of water resources of republic. To Uzbekistan, on interstate distribution of regional water resources, determined the limit of water-taken of fresh water in total volumes is 59,2 qub.km per annum, in that number from river-bed of interborder and local rivers 52,4 qub.km, ground (without damage to surface flow) 1,9 qub.km and drain water 4,9 qub.km. Actually was used in 1991-95 in dependence from water-supply of year from 54 to 64 qub.km per annum with water-outed from 22 to 29,4 qub.km per annum.

**The deficit of water resources** is covered, mainly, for account of drain water. Nearly the half returnable of drain flow of republics and other states of Aral sea basin is dumped in river-bed and channels and is repeatedly used in below located zones. As a result the mineralization of water in river flow and pollution with chemical weed-killers and pest-killers from middle of 60's threateningly grows. The total volume of salts in flow of rivers Sirdarya and Amudarya, appreciated in 55-60 mln. tons in middle of 60's, to middle of 90's was increased to 135-140 mln.tons.

The expansion of **irrigated arable** has increased the water-taken by republic on need of irrigation from 30-32 qub.km in beginning of 60's to 60-63 qub.km at present. Similarly was increased the water-taken in other republics of region.

The redistribution of water resources of rivers between Aral sea and irrigated arable, was accompanied by simultaneous redistribution the volume of salts. At present from total volume of salts more than 70% of transported with rivers flow is born on economic developed massifs. As a result, the salt load on irrigated massifs, especially of average and bottom current of rivers, increased nearly twice in comparison with 60s years. Is reduced the soil fertility and crop of agricultural cultures.

From 4200 thousand ha of irrigated arable of Uzbekistan, more than 2200 thousand ha (53%) is salinity in various degree, from them average and strong salinity the lands in the average current and in lower of main rivers. On each hectare of irrigated arable 18-20 tons and more salts is born.

The quality of water resources is considerable worsened at the expense of dump in river-bed insufficiently cleared drain water from settlements, animal-breeding complexes, industrial enterprises, containing the fluorine, mercury, petroleum etc. The tendency of deterioration of quality of water is preserved, difculting the problem of maintenance of population with qualitative drinking water.

As a whole on Uzbekistan, in comparison with middle of 60's the areas of flooding of settlements were expanded. In republic of Karakalpakstan the area with level of ground water to 1,5 m exceeds 25%, and Khorezm district reaches to 70%.

The irrigation of new lands in Sirdarya, Djizak, Kashkadarya districts, the lands of Central Fergana, Surkhan-Sherabad steppes etc., on greater part of territory has increased the level of ground water from 20-30 m to 1-2 m.

The insufficient financing of operation created hydromeliorative systems at present seriously hinders the execution of effective measures for struggle with these negative processes of desertification.

### **3.4. Mobile sand - centers of deflation.**

The general area of sand on territories of republic of Uzbekistan makes about 13 mln.ha. The area of mobile sand to middle of 80's as a result of conducted sand-fixed etc. of measures

was reduced from 1 mln.ha to 500 thousand ha. However, in connection with drought of Aral sea the new large center of desertification was formed in Aral zone.

The significant areas of territory of republics, contiguous to desert zones, historically under threat of mobile sand, dust storms and dry winds.

To main zones, traditionally located under threats of deflation of sand, relate: the zone of Amudarya delta in republic of Karakalpakstan, the part of regions of Khorezm district, contiguous to Kizilkum desert; Alat, Karakul, Djandara, Kagan, Romitan, Karaul-Bazar regions of Bukhara district, boarding with sand of Sundukly; Mubarek, Bakhoristan, Nishan, Usmon Yusupov regions of Kashkadarya district, the land of which also border with Sundukly desert; Arnasay, Ochyabr, Pakhtakor, Mirzachul regions of Djizak district, contiguous to Kizilkum. Fine-hill centers of mobile sand are present in zone of Kizilkum desert and Surkhandarya district.

From positions of desertification of territory of Uzbekistan, the process of locomotion of sands presents the specific threat. The damage to economic activity is brought not only the by drifts of region lands of compact residing of population, but also practically the fixed costs on liquidation of drifts of roads, objects of hydromeliorative systems, irrigated plantations etc.

The deflation of sand, as well as wind erosion of soil cover of processable arable, present to loss of fertility and, as the consequence, to decrease of crop of agricultural cultures.

The science and practice of Uzbekistan, Turkmenistan and many other countries comprehensively investigates the main parameters of process of sand moving, enabling to conduct the effective measures on their elimination.

The substantiation of methods of definition of such parameters, as the volume of annual carry, blowing out from 1 ha, depth of blowing out, speed of movement of barkhans etc. permit to develop and realize enough the effective measures of struggle with these processes.

The most **wind-erosion dangerous zones** in Uzbekistan determine the regions of t.Kokand, Kulkuduk, Djamgelydy (I zone), where the possible volume of carry in barkhans makes 115-205 qub.km per annum; the second zones covers the Karaul-Bazar, Mubarek; Alat, Karakul regions of Bukhara district; Urgench of Khorezm district; Termez of Surkhandarya district, in which the volume of probable carry is evaluated in 40-60 qub.m per annum, and then group of regions of third zones - Karshi, Chimbay, Kagan, Fergana, Namangan, Turtkul, where this volume is evaluated from 12 to 30 qub.m per annum.

The speed of movement of barkhan sand on these zones accordingly is defined in 14-20; 8-15; and 4-5 meters per annum.

A big damage is put with dust storms and wind drift of fertility layer of soil from surface of cultivate soil, as well as into-oasis and attached oases mobile sand, located in Central Fergana, Karakalpakstan, Surkhandarya.

The main wide-spreading center of active deflation - salt-transfer from end of 60's was determined the dried bottom of Aral sea. On area 3,5 mln.ha of bottom of Aral sea, volume of containing salts in top meter layer is evaluated in 1,5 mlrd. tons. Negative consequences of drought of Aral sea not only in view of drift of bottom with mobile sand, increasing the area of desertification of region territory with change of climatic parameters in contiguous zone, but also intensification of process of salt-transfer from drought bottom of sea on zone of economic activity. Is established, that at strong dust storms the volume of carried out dust makes 1,5- 6,5 tons/ha in dependence from remoteness, which contain from 260 to 1000 the kg/ha of toxic salts.

### 3.5. Soil erosion.

The natural conditions of Uzbekistan prepare the potential dangerous for any kinds of soil erosion. To a considerable extent the main reasons is not right use of lands, incorrect made a soil protection. In many cases it connect with occupied crops on erosion-dangerous lands, incorrect soil treatment on arable lands, unmanagement animal pastures, destruction of soil-protection plantations and breach of ecological demands by irrigation-melioration land treatment.

All kinds of erosion present on territory of Uzbekistan: water (irrigation), wind (or deflation). The wind erosion impact both on soil and plants. For Uzbekistan characterized a destruction activity of **sel runoff**.

#### The division into districts of agricultural areas on extent of potential subject to different erosion.

№	Region of Republic	Total	Water erosion (irrigation)			Wind erosion (deflation)		
			unsub ject	sub- ject	in this number to average and strong extent	unsub ject	sub- ject	in this number to average and strong extent
1	R.Karakalpakistan	5341	5207	134	5	672	4669	4358
	in this number irrigation	504	396	108	5	12	492	327
2	Andijan	309	262	47	19	215	94	68
	in this number irrigation	276	255	21	19	24	75	67
3	Bukhara	3049	2380	669	170	463	2586	2348
	in this number irrigation	275	269	6	--	114	161	48
4	Djizak	1207	560	676	471	851	356	320
	in this number irrigation	289	240	49	30	76	213	19
5	Kashkadarya	2308	1520	788	560	958	1350	608
	in this number irrigation	500	402	98	8	130	370	97
6	Navoi	10152	9800	352	70	554	9598	9338
	in this number irrigation	115	114	1	--	102	13	2
7	Namangan	420	260	160	135	267	153	91
	in this number irrigation	276	215	61	25	136	140	78
8	Samarkand	1380	734	646	491	1207	173	7
	in this number irrigation	374	267	107	17	306	68	7
9	Surkhandarya	1295	250	1045	714	952	343	209
	in this number irrigation	327	140	187	87	157	170	86
10	Sirdarya	385	296	89	70	122	263	91
	in this number irrigation	295	252	43	8	92	203	67
11	Tashkent	832	363	469	148	811	21	10
	in this number irrigation	389	292	97	53	374	15	5
12	Fergana	405	381	24	17	205	200	126
	in this number irrigation	349	329	20	16	156	193	120
13	Khorezm	444	444	--	--	193	251	13
	in this number irrigation	274	274	--	--	23	251	13
	Republic of Uzbekistan	27527	22457	5070	2870	7470	20057	17587
	in this number irrigation	4243	3445	798	268	1879	2364	936

The data shows, that to wind erosion subject about 73% of all agricultural areas, in this number 56% is irrigated. The activity winds characterized for western and central Fergana, south-east part of Golodny steppe, Karshy steppe and Bukhara oasis.

To water erosion subject 18% from all agricultural areas, in Surkhandarya, Samarkand, Kashkadarya - 50-80%. The water erosion spreaded on mountainous slopes, foothills and adirs. In greater size this kind of erosion have on slope areas, occupied with bogara and pasture, where weak development of vegetation cover. In mountainous-foothills region a water erosion developed as result of woodcutting, plough of slopes or intensive pasture. The soil wash began on loam slope with steepness 0.5-1°, on sandy - 1-2°.

**The intensity of water erosion development** dependence from quantity of precipitation, their intensity and frequency. The water erosion during vegetation period destroyed 40-80 t/ha of fertile soil layer.

On irrigated lands sudden a irrigation erosion. To it subject about 800 thousand ha of agricultural lands (19%), very developed it in Surkhandarya, Samarkand, Tashkent and Kashkadarya regions.

The irrigation erosion is result of incorrect watering on bad planning field, watering with big norm and in furrow with significant slope, when speed of water move more, than infiltration speed.

The very dangerous kind of erosion is ravine erosion. In irrigated zone its results of incorrect drainage.

The big danger for national economy present a activity of soil runoff, which have a big destructive power and characterized with suddenness. More dangerous a soil basin, located on mountainous slopes of Fergana valley. Many centers located in mountainous zone of Kashkadarya, Samarkand and Tashkent region.

### **3.6. Non-irrigation zones (bogara) - condition of use.**

The zones of non-irrigated agriculture in republic, take the area about 4,5 mln. ha, from which the arable is makes 753 thousand ha, other lands - mainly the pastures and wood. Processable arable in dependence from water-supply is engaged with sowing of grain, pleace, fodder and vegetable-melons cultures. The population of zone of non-irrigated agriculture exceeds 3 mln. person.

Processes of desertification and degree of them display in largely depend from high-zone location, features of soil, density of vegetation cover, woodity, slopes and precipitation. The zones of non-provided, half-provided and provided non-irrigated lands are allocated.

**Non-provided non-irrigated lands** with light desert greyish 230-450 m. of absolute marks are located. The area of these lands is evaluated more than in 1,6 mln. ha. The vegetation - sedge - cereal ephimers. The zone basically is animal-breeding. The precipitation of 250-280 mm. The crop of fodder 3-4 c/ha.

**The half-provided zone of** non-irrigated agriculture with dust-loam desert-steppe typical greyish, occupying area about 1600 thousand ha, is located on marks of 450-750 m. The quantity of precipitation of 280-350 mm. Sowing the drought-stead pleace culture, fodder, natural herbage (sedge-cereals ephimers).

**Providing non-irrigated lands** of foothill zone with wide-spreaded typical greyish takes the area 264 thousand ha. and located on marks of 750-900 m. The precipitation is 350-450 mm. The main areas of arable are engaged with sowing of cereals. Sowed the alfalfa, vegetable-melons, potatoes and oleaceae. The zone is poorly woodity.

Besides more 240 thousand ha of pasture located in mountainous and highhilly zones on marks 900-2000 m. with quantity of precipitation of 450-750 mm. The lands are used basically under pastures, growing a cereals, oleaceae and other cultures.

The main areas of non-irrigated lands zone are located in Kashkadarya, Samarkand and Djizak districts. The small areas are present in Surkhandarya, Navoi, Tashkent districts. The area of sowings under cereals, in 1997 is reduced from 500 thousand ha to 310 thousand ha.

Ravined lands of mountains, foothills because of strong rarity of natural woods, low project cover of slopes with grassy vegetation are subject to intensive development of water erosion, downing phenomena, formation of frequent clayey flows, wash out of soils.

The areas of pasture of non-irrigated lands zone because of over-pasture of cattle and wood felling considerably were reduced. With ravined erosion are covered 33 thousand ha of lands, located mainly in Djizak, Samarkand, Surkhandarya, Namangan and Tashkent districts.

In last years because of mono-culture of cereals, non-observance of rotation and agrotechnical methods, field pollution, the crop of cultivate agricultural cultures is reduced. The latter boniterity of soils, system of land-tenure and inventory of lands of non-irrigated zone relates to middle of 60's.

Slope lands of non-irrigated zone at present because of strong rarity of natural woods, lost and unrestored cover of grass vegetation, over-pasture of cattle are subject to intensive development of water erosion, down and clayey phenomena, wash out and deflation of soil.

### **3.7. Transformation of woodity of territory - threat to desertification.**

**The forest fund of republic** makes 9,1 mln.ha, from which 7,5 mln.ha (84%) take sandy-desert zones. About 2,5 mln.ha of forest fund - is sand, ravines, slopes and other unsuitable lands. The actual areas, covered by wood, are insignificant (1,3 mln. ha) or about 14% from general forest fund of republic.

More than 84% of area of woods is shrubs: saksaul 1690 thousand ha, cherkez, kandim etc. about 200 thousand ha with completeness 0,3-0,4. On oases and mountainous-foothilly zone has 215-220 thousand ha.

To the last years was reduced the shrubs planting in Bukhara, Fergana, Kashkadarya districts and republic of Karakalpakstan, where heavily were mastered the irrigated lands for production of cotton and paddy. As a result strengthen the processes of wind erosion and desertification of mobile sand. Especially the large loss was caused to Bukhara shield, where were felling the shrubs on area more 150 thousand ha, effectively guarded of zone of economic activity from barkhans and eolic deposits.

**The deflation of sand** spread more, than 5 mln.ha of pasture of republic. The threat to development of wind erosion of soil and was created loss of efficiency of significant part of pasture was created. Root-cutting of tugaies nearly in 10 time has reduced the area of flood-lands woods of large and small rivers. Heavily was reduced the biodiversity of flora of Uzbekistan. From 4 thousand of kinds of plant, not less than 15% require the acceptance of effective measures of protection.

### **3.8. Irrigation and secondary salinity.**

The arid zone of Uzbekistan has the difficult geological history of development; only in Paleocene and neogene it the some time has undergone the transgression of seas.

As is known the marine deposits predominary is salinity, is strong gypsy, on plain part of region under small capacity of Quaternary deposits is wide are widespread mainly Paleocene

and neogene salt-containing clayey layers, locations are designated the marine very salinity clays of Cretaceous age.

**The quaternary deposits** of delta plains, cone of bearing-out - the average and peripheral part, low terraces of rivers, proalluvial loops also contain the definite quantity of salts, which were carried out by flow of waters from slope burn. Thus, soil of Turan depression differ primary salinity. They were formed at hyperhenoz of salts, on time of them accumulation.

The Accumulation of salts in plain part of Uzbekistan proceeds and at present time.

The huge of Aral-Kaspy depression is considered intro-continent unflow territory, where is not present the exit in opened ocean, hence all salts, transported from mountainous slopes are concentrated here, here fall salts, brought together with atmospheric precipitation and other ways.

**Loess deposits** of alluvial and proalluvial plains of deltas, cones of carry-out, loops, terraces differ predominary weak drain, in some places even the natural outflow of ground water is away, i.e. the unflow territories practically prevail. This property of various geomorphologic regions predetermines the salt regime of soils, as a result of domination of ascending currents of moisture on significant part is observed close location of level of ground water to surfaces.

Slowed down outflow and prevalence of vertical movement of ground moisture cause the increase of mineralization. Thus the ground water coming nearer to surface is dissolved the salts, containing in root zones, increasing the degree of them mineralization in space.

Close location of mirror of ground water is caused also by availability of regional waterproofs on various depth - from 2 to 50 m and more, consisting predominary from clayey deposits and sandy of neogene, some places of Paleocene.

To 50 % of irrigated lands in Uzbekistan are subject to various degree of salinity. Developed lands in geomorphologic relation cover mainly alluvial river terraces and deltas, cones of carry out, proluvial loops.

Their lithologic-geomorphologic structure naturally changes from head part to periphery - cones of carry out, deltas, loops, and from break part to center - river terraces. In the same direction varies the natural drain of soils: from head part of delta to their peripheries the factor of filtration of deposits is worsened, and in borders of alluvial terraces the waterproof of soil becomes low in direction of them central part.

In zone of intensive **horizontal water-change** the salt-collection in soils is practical not observed, and on measure the domination of difficulty of ground outflow begin to prevail the ascending currents of moisture, that is stipulated by charge of moisture on evaporation. With these phenomena is connected the accumulation of salts in root zone of soil. In this connection the peripheral parts of cones of carry out of Sokh, Isfara, Akbura and other rivers of Fergana valley, Zarafshan delta - Bukhara and Karakul, Kashkadarya, ancient delta of Amudarya, modern Aral delta and other are considered by regions of salt-accumulation.

The deterioration of **natural drain** of deposits and in this connection the prevalence of stagnant nature of horizontal movement of ground water in conditions of close location of level of ground water to 1 -3 m, stipulated the increase of ions of sulfates and chlorides. The maximal quantity of mentioned ions is reached in trailer part of periphery of delta, where is sharp prevails the inflow of ground moisture in comparison with outflow. For example, Kagan site of Bukhara delta, zone of contact the Attached to Sarikam delta of Amudarya - Khorezm oasis with Karakums. At conditions of acceleration of horizontal ground outflow of ground water is possible much more to be reduced the process of soil salinity in border part of delta.

**The process of salinity** depends also from microrelief of district: conditions concerning to deep - 2-3 m, location of ground water usually the concentration of salts amplifies on increases of microrelief, as after next watering they dry up faster, than from downturn.

Thus in them on measure of drying of soil accumulate the salts (so named "wick" of salt-accumulation). Therefore on beds of cotton fields usually more salinity the shaft of bed are considered just. Is established, that these sites frequently correspond to increases of cotton fields, with relative height 15-30 cm, as a whole by area from 10 to 20 sq.m. Seemed these invisible height, on general background of irrigated land they are sites of salt-accumulation owing to fast out of salts, located in aeration zone. In this connection the careful, qualitative lay-out of cotton fields before sowing is considered compulsory one.

At present time all oases, located in delta plains of peripheral part of cones of carry out, third terrace of rivers of Sirdarya, Amudarya, low terraces of Zarafshan, Karadarya, Surkhandarya are subject to flood. The ground water located on depth 1-3 m, is rare 3-5 m. Certainly the result of bad drain of soils and introduction of hydromorphic in some places semi-hydromorphic meliorative regime of irrigation.

Before irrigation, in particular, in **Golodny steppe** the level of ground waters located on depth 15-20 m from surface, at present the all this area is filled with water and outflow on periphery is practical away (as Arnasay-Aydarkul lake, Chardarya reservoir and Sirdarya river does not permit to outflow of ground waters from borders. In these conditions the unique exit is artificial drain by way of drainage system, including vertical drainage.

To 90th years **the drainage system** in Golodny steppe and other oases of republic the artificial drainage functioning closer to normal, except of Karakalpakstan, series of regions of Bukhara district. At present in conditions of market economy and their efficiency much more has decreased, significant quantity of vertical holes don't work, more 5 thousand pieces, the large part of horizontal dren, average length 30-32 m ha, is filled and over-silt.

But except for about 0,5 mln.ha of irrigated lands is not in general supplied with drainage. All this is negative affects on soil-meliorative condition of irrigated lands.

One from unhappy in meliorative relation oases is considered Karakalpakstan, where the processes of salinity and desalting happens in is extraordinary difficult conditions. As a whole Lower Amudarya in hydro-geological relation are considered practically the unflow region. However the diversity of delta plains in lithologic-geomorphologic relation causes the availability of local, local areas, which differ among themselves on natural outflow of ground water. In this connection the salt regime of irrigated lands also in sufficient degree is mosaic.

However the detailed and comprehensive analysis of materials of salt filming of soil in oasis in interpretation with condition of relief, lithological structure of soil, the regime of ground water and especially average-scale space films shows, that past between-river downturn, though they already the some the tens of years are used in irrigation, are sites of accumulation of salts in root layer.

Main that in conditions of **Amudarya delta** the between downturn usually formed with deposits, heavy on mechanical structure - is sharp prevails the mix the heavy loam's with sandy and clay, is rare with small grain sand.

The inflow of flows of ground water goes from side of increased parts of delta, where the irrigated canals, past channels of Amudarya and their head part are located. As a whole here the inflow in some times more, than outflow of northern, north-east and north-western directions. While on increased sites of delta, where to development of lands proceeded the channels of Amudarya, owing to prevalence of deposits easy on mechanical structure, basically small grain sand and sandy, mixing with average loam, less often with heavy loam, all as is observed relatively the deep location of level of ground water, that is stipulated by outflow in direction to interrivers of downturn.

In conditions of overestimated norm of watering of cotton and other cultures and domination of depth of ground waters with gradation 1-2 m, less often 2-3 m, duly outflow of ground moisture in side of downturn as a whole happens with insignificant speed, though on

separate local sites because of deep location of ground moisture the processes of soil salinity not very intense.

In these situations it is necessary the dense drainage system in downturn, that allows reach to high effect on transportation of ground water for oases borders. Then is sharp is improved the meliorative condition not only interrivers downturn, but also increased elements of delta owing to intensification of outflow of moisture to downturn. But insufficient efficiency of drainage systems in Karakalpakstan, in some places even their absence stipulates steady salt-accumulation in aeration zone. Therefore nearly all area of irrigated lands of republic is subject to salinity in this or that degree.

Is established, that **irrigated lands of oases is salinity is motly**. Here the degree of salinity of one and that area fast varies: on background of unsalinity sites are present the stain of weak, average and strong salinity and salt-marshes. The sizes of these stains - 0,1-0,5 ha,, they form the continuous sites with various degrees of salinity, occupying the significant space.

The reasons of formation of stain salinity usually connect with slope relief of irrigated areas. The increased sites during washing are not released from salts, and on period of vegetative watering are in regular intervals not humidified. Thereof they serve by accumulators of salts, about than testify salt horizons in soil structures. In Lower Amudarya, Golodny steppe, Kogan region of Bukhara oasis the 10-60% of lands in account on hectare is marked salinity. For liquidation of stain salinity the qualitative capital and annual lay-out of lands is necessary. In Karakalpakstan the majority of irrigation massifs are developed without engineering project.

From end of 70's **the drainage water of oases** steel to direct in Amudarya, Sirdarya, Zarafshan. In accordance with increase of quantity of returnable waters in basin of Amudarya and Sirdarya rivers the quality of waters of rivers has become to be worsened, and main increase the mineralization in vegetative period has resulted to fall of additional salts in irrigated lands of oases, as a result of use in irrigation. In Lower Amudarya, point Tuyamuyun, in summer the average mineralization of river water makes 0,6-0,8 g/l, in point Takhiatash - 0,8-0,9, in Kizildjar - 1, in Muynak - 1,2 g/l, in separate years or months these parameters are increased to -1-3 g/l. The irrigation of cultures in conditions with insufficient drain of soil promoted to accumulation of salts in soils. Thus with irrigated water on hectare from 10 to 15 tons of salts is come. This causes the out with wash waters annually from irrigated fields on drainage system to 20-40 t. of salts from hectares.

Provided insufficient effective operation of drainage system, especially on massifs, where they are in general away, intensification the positive salt balance of region, the same picture is observed in Khorezm, Bukhara, and Golodny-steppes and other oases.

But there, where the efficiency of drainage system functions on high level, the deterioration of meliorative condition of lands does not happen, but it only the theoretical conclusion, really in oases the soil salinity is progressed.

On practice is proven, that watering of cultures, in particular of cotton, with mineralization irrigated waters practically does not bring the harm to crop. Yes, really thus the considerable soil salinity is practical not observed. But for this the soils should have the easy mechanical structure, as a whole natural drain of soils should provide the normal horizontal outflow of ground water. Then happens steady desalting and degree of mineralization of irrigated water renders not considerable influence on soil conditions. While in conditions of oasis (where, natural-meliorative condition of lands is motly) use the mineralized water for watering only worsens the meliorative condition of lands and requires the construction of additional drens.

According to research materials of salt and soil filming (Lower Amudarya, 1997) poorly salinity lands taked 1748,0 thousand ha (50,5% researched lands), from they of 960,8



thousand ha (27,7%) are submitted with poorly salinity, 546,5 thousand ha (15,7%) - average salinity, 240,7 thousand ha (6,9%) - is strong salinity soils. All this testifies about necessity of application of radical measures on radical improvement of soil-meliorative conditions of irrigated lands of oases in republic, only then was possible is sharp to be increased the crop of agricultural cultures.

### **3.9. The chemical pollution of soil and ground water.**

From all geophysical environments the specific location in biosphere takes the soil, in heaviest degree ensuring the biological efficiency of biosphere and in too time subjecting to heaviest anthropogenic effect and circulation being one of dangerous links of pollution substances (PS). The accumulation the PS in soil conducts to change of its chemical structure, physical, biological, microbiological properties. These changes can be little appreciable, but extended, capable to cause the serious consequences - loss of soil fertility, partial or total desertification.

In country-side the soil pollution influences not only on quantity and quality of food production, but also on functioning of soil system as a whole. In cities the polluted soils is dangerous first of all as the source of receipt of pollution substances in human organism (through secondary pollution of atmosphere or - for children - perorally). Besides the **soils of cities** influence on development of microbioses, including pathogenic, and define the sanitarian situation.

In natural landscapes the soil pollution defines the general conditions of functioning of ecosystems and recreation opportunity. The research of last years shows, that soil pollution always has a multicomponent structure and characterized rather of diverse parameters of quantitative structure of ingredients of pollution and their quantitative correlation.

**The soil resources.** From 7,6 mln.ha of irrigated lands of region more half, as follows 4,2 mln.ha is a share of Uzbekistan. The sharp deficit of irrigated water and necessity of submission in Aral sea for maintenance of its level, from 1991 in republic is terminated the mass development of new lands.

Especially heavily the irrigation in republic was developed in 1975-85. For this period was developed about 1 mln.ha of new lands. In agricultural rotation were involved the salinity and difficult meliorative lands, that was of one of reasons of sharp increase (on 0,8 mln.ha) for the latter of 15-20 years of area of salinity lands.

At present time in Uzbekistan to processes of salinity in this or that measure is subject 2,0 mln.ha of high-productivity lands, from which 0,85 mln.ha with average and strong salinity. Practically on 90-95% is salinity the lands of Karakalpakya, Bukhara and Sirdarya districts, on 60-70% is salinity the lands of Kashkadarya and Khorezm districts. On 30-50% the contents of humus - main parameter of fertility was lowered. At present the soils with low security of humus (from 0,4 to 1,0%) take about 40% from areas of irrigated lands.

Continuing the many years the dominance of monoculture of cotton, absence of necessary system of rotations (base of soil-protection system of agriculture), the insufficient development of animal industries (that has served by reason of deficit of organic fertilizers) has caused the necessity of application in wide scales of mineral fertilizers and pesticides. All this in the end, has resulted in to destruction of natural biological processes, degradation of natural regulating gears, conversion of soil from difficult ecological system in substrate for transmission of introduced mineral connections to roots of plants. Thus, because of low factor of efficiency of chemical preparation more than 30% of phosphoric-potassium and more than 50% of nitric fertilizers not assimilate with plants, washed, polluted the surface and ground water.

The total **volume of fertilizers** used in agricultural practice relatively is high. Table adduces the average volumes of entering of fertilizers on hectares on some cultures.

**The volumes of application of fertilizers, kg/ha.**

The culture	Nitric	Phosphoric	Organic	Crops
Cotton	180	140	5000	3400
Winter wheat	180	120	5000	3400
Paddy	120	100	...	3500
Tomato	180	125	5000	27000
Potatoes	120	100	5000	23000

The distribution of pollution by close image is connected with existing technology of application of fertilizers. The fertilizers are introduced, as a rule, unitary in beginning of vegetation and in process of irrigation washing from soil and the fall in drainage water, that is reason of pollution of surface and fresh ground water with nitrates.

**The organic fertilizers**, besides during transportation, storage and uses, are sources of pollution of soils with bacterium.

The control for quality of chemical fertilizers is not executed, though it is known, that some kinds of fertilizers contain the heavy metals. The improvement of situation depends not so much from reduction of use of fertilizer, but also from technology of application and storage of fertilizers. For example, fractional entering of fertilizers has allowed to reduce the loads on soil, ground and surface water.

In conditions of Uzbekistan leading polluting components of soils of environment are **pesticides**, which heavily, and sometimes in surplus are used with the purposes of increase of crop. The leading branch of national economy in region is cotton-growing and processing of products of cotton-growing. The growing of cotton and reception of high steady crops is impossible without application of plenty of chemical means for protection of plants in current of whole vegetation period from ploughing to defoliation.

Other methods of struggle with pests and illnesses of agricultural cultures, for example the complex measures (biological methods, crops rotation and etc.) are used is very limited.

In last years in republics has **decreased the application of pesticides**. For period from 1990 on 1996 the total volume of realization of pesticides in republic was reduced in 1.5 times, and mineral fertilizers - in 1,5 times. Thus the consumption of insectic-akarithids and fungicide (the most toxic preparations) has decreased in 2 times, herbicides - in 2,6 times, defoliantes - in 1,4 and sulfuric preparations - in 1,5 times. Considerably range of used pesticides has changed.

The large part of pesticides (92%) is submitted with **defoliantes**, as a rule is weaktoxic inorganic connections, and sulfuric preparations. Approximately in 10 time the application of hightoxic PhOC has decreased, are in general not used such toxic and persistent preparations, as GHCG, tiodan, sevin. The preference to perspective piretroidic preparations is given back: karate, danitol, decis, cimbush, having high biological activity and low toxic for person. The average load on irrigated territory in recalculation on acting substance has made of 0,5 kg/ha (Karakalpakstan - 1,29; Samarkand - 0,92; Tashkent - 0,77; Namangan - 0,71) against 3,0 kg/ha on 80's.

**The agrochemical and fertilizers** have the dual effect on environment: the local pollution of objects of natural environment on moment and in location their uses, frequently this significant load on territory, resulting to degradation of soil; the large-scale pollution of

natural objects, caused by carries of pollution substances with air masses, high over-dust of air, dust storms, surface and drainage flow large territories, is caused by this problems in bottom current of rivers and even on that territories, where agrochemical are not used, penetrate in ground water, cause the pollution including the fresh ground water.

Thus, the population - users of ground water, as well as polluted waters of lower of rivers, become actually is hostages of modern system of struggle with illnesses and pests of agricultural plants.

In spite of the fact that the surface density of used pesticides a small in comparison with other polluted substances, they are the most dangerous for separate objects of environment, especially for soil microflora.

The high biological activity of pesticides become the constant ecological factor, affecting on usual biochemical cycles of exchange of substances and on ecological balance of natural systems.

Accumulating in various links of trophical circuit, they present the real threat for maximum levels of ecosystem, including for person.

The types of soils, in particular the availability of loess cover, characteristic for all foothilly areas, promotes to accumulation in them the pollution substances.

All proof pollution, brought with extensive system of drains and inflows, proceeding on heavily used agricultural areas in Sirdarya river promote their accumulation in south-east part of Fergana valley.

Thus, Fergana valley, and especially Fergana districts is presented by region of increased danger of accumulation of persistent pesticides.

Contents of **isomers of GHCG** in soils territory of Republic of Uzbekistan is not large. The excess of MCL was not observed, the average significance of GHCG approximately 0,01 (at MCL - 0,1 mg/kg).

On data of systematic supervision of Glavgidromet of Republic of Uzbekistan, from 1992 in republic was scheduled the definite **tendency to decrease of level of soil pollution** with residual quantities of HOP.

The average weighted residual quantity of DDT in 1996 has made 2,2 MCL in the spring and 1,4 MCL in the autumn. The most the high level of pollution was observed in Fergana, Andijan and Kashkadarya districts and has made 4,7; 4,0; 2,8 MCL in the spring and 4,3; 1,6; 1,9 MCL in the autumn. In other districts - no more, than 1,5 MCL.

The residual quantities of FOP (metaphos, phozalon, tiodan), herbicides (trephlan, kotoran, dalapon), defoliants (chlorate magnesium) everywhere practically did not exceed the MCL.

The considerable sources of pollution of environment with remainders of pesticides, besides of agricultural productions, are warehouses - storehouse of pesticides and fertilizers, enterprises, processing the cotton and is at last strong the polluted territories past agricultural airfields.

The intensive use of **agrochemicals**, including pesticides in agriculture of irrigated zone, has resulted to distribution on all territory of basin. On our sight, levels of accumulation of residual quantities of pesticides in soil, water, bottom deposits and the most main in biota can serve one of criteria of desertification.

**The flow of residual quantities of pesticides in arid zone** happens a non-uniformly, depends from climatic conditions, orography of district. The strategy of protection of soil and water resources from pollution with pesticides should be based including on deep knowledge of processes of behavior and conversion of pesticides getting in objects of environment, processes of detoxication and effect of them on biocenoses.

*The Aral crisis - one of the most large ecological and humanitarian accidents in human histories. At present in national economy completely uses the all resources of Aral sea basin.*

I.A.KARIMOV

Uzbekistan on border to XXI century.

### **3.10. The desertification connected with drought of Aral sea.**

In present time in national economy completely use a all resource of Aral sea basin. From middle of 60s of XX century the increase of water-taken on expansion of irrigated lands with all states of region happened at the expense of reduction of dump in sea the flow of main rivers - Amudarya and Sirdarya.

At present time, **the Aral zone is subject to all main processes of desertification:** nudling of saturated by salts soils of dried bottom of sea; land salinity; loss of wood plantings, tugaies and vegetative cover; drought of lakes and ponds; lands degradation; to strengthening of deflation and salt-dust-transfer; to increase of mineralization of surface and ground water; flooding of irrigated and adjoining to it lands; saline of soil etc.

The effect of main processes on desertification of Aral zone territories accrues.

The high level of ground waters (1-3 m) is practical preserved on all zone of irrigated arable, being reduced in direction to sea and strengthening the process of desertification.

The desertification amplifies because of intensive reduction of wood plantings, tugaies, vegetative cover, the area of which has decreased in comparison with beginning of 70's approximately on 95%.

Has increased the general pollution and mineralization of river water, acting in Aral zone, from 0,7 g/l in 1960 to 1,5 g/l in 1997, the general area of floods in Amudarya delta, made in 1950 350 thousand ha and floods lakes, reservoirs 80-100 thousand ha was reduced nearly twice.

The tendency of reduction of soil fertility is preserved. The general area of lands in republic of Karakalpakstan with low fertility (from 20 to 60) numbers on 240 thousand ha has increased.

The quantity of dust phenomena on west of Central Asia for period of supervision (1965-1988) was increased from 1724 to 7766 per annum. The zone of loss of 80-90% of salt-dust particles, carry out from dried bottom of sea and salt-marshes, practically covered the all Amudarya delta to Nukus.

Was increased the flooding zone of territory in comparison with 1970 (46 thousand ha) nearly in three times. About changes of landscape of drought bottom of Aral sea is possible to be judged on example of its South part. On general area of past flooders of Adjibay, Djiltirbas and Amudarya delta.

The areas of **out of ground water** and damp soil were increased from 208,5 sq. km (1976) to 1010 sq.km (1995). The crust-pudgy hydromorphic salt-marshes according from 230,9 sq. km to 884 sq. km. The hydro- and semi-hydromorphic salt-marshes from 458 sq.km to 1234 sq.km, semi- arid automorphic salt-marshes from 79 sq.km to 986 sq.km. The unfixed and poorly fixed sands from 316 to 1500 sq.km.

On Akpetin archipelago, occupying the area about 1 mln.ha were generated hilly and beds sand with height to 10 m with set closed hollows. In result of increase of desertification process has increased the negative effect on health of population, economic development, quality of natural resources and environments. The pollution of quality of water resources,

especially for drinking needs and increase of other desertification processes have resulted in to growth of morbidity of population in Aral zone.

The production of gross production of agriculture on 100 ha of irrigated arable (in prices 1993) has decreased from 137 thousand rubles in 1970 to 117 thousand rub. in 1995. This the most low level among districts of republic and more than in 2 times below of average parameters of republic. Degraded about 2 mln.ha of lands, the climatic conditions, the kind structure of plants have changed, the navigation, as well as significant volume of fish-breeding, hunt-breeding, fur breeding is lost. On side of disappearance, the keeping in **Red book of Uzbekistan**, such kinds of fishes, as Aral thorn, Aral barbel, large Amudarya pseudo-spade-nose and small Amudarya pseudo-spade-nose, has increased the load on pastures. At some growth of living-stock of cattle, the pasture area was reduced nearly on 400 thousand ha and accordingly the production of fodder on 130 thousand tons of fodder unit has decreased.

The conditions for migrations of bird of passage from Siberia to Africa and South Asia are infringing - the horizon, flowing and quality of water in Sudoche lake and other reservoirs has decreased.

### **3.11. The technogenic pollution of soil, as technogenic factor of desertification.**

During the industrial production is formed, is thrown out in atmosphere, and then fall out on soil the plenty of toxic substances, which is not possible to destroy with biological way.

The incessant accumulation of such substances, stopped the activity of microorganisms in soil, causes the considerable change of geochemical processes, reflecting on vegetative cover and condition of soil, down to formation of "technogenic" desert. Main chemical pollution of soil in Uzbekistan, besides of chemical means of protection of plants are: derivative of nitrogen, petroleum and petroleum products, fluoric connection, toxic heavy metals, organic substances, subject to fermentation in soil, plastic, synthetic surface active substances, wastes of industrial enterprises, mining industry, animal production complexes and poultry farms, dust-holes.

**The petroleum and petroleum products.** The main potential sources of pollution of environments and soil in particular by petroleum - it oil-fields, oil pipelines, oil refining enterprises, oil storage, ground transport, transfer the petroleum.

The urgent practical significance are represented impact pollution of environment with petroleum. Such pollution, possessing, as a rule, the particular source, are created the significant lumpsum load on soil, water, by biological objects, brought the large damage to national economy and nature.

At pollution of soil with petroleum (P) and petroleum products (PP) the ecological balance in soil system is infringed; change the morphological, physical-chemical and chemical characteristics of soil horizons; the water-physical properties of soil is change; the ratio between separate parts of organic substance of soil, in particular, between lipid and humus component is infringed; the danger of washing from soil the P and PP and secondary pollution of ground and surface waters is created. On the average floor level of concentration of P and PP in polluted soil is changes from 0,1 to 1,0 g/kg. By criterion also the concentration 0,005 mg/l of P and PP in water, filtered through polluted soil can serve.

**The stores of industrial wastes.** The absence of effective technologies and industrial base on processing of industrial wastes on enterprises has resulted in to creation in republic of significant number of various sort of special stores and other buildings, accepting the wastes of productions, with natural and artificial anti-filter screens.

Annually in stores is directed about 1.5 qub.km of liquid industrial and home flows and more than 100 mln.tons of firm wastes, half from which is toxic. The total volume of wastes at present makes 2 mlrd.tons. The heaviest quantity (65%) has on mining and processing complexes (rocks of mining, tail of flotation enrichment, shlams).

**In chemical branch** are accumulated in kind of wastes of phosphogyps, lignin, manganic shlam, sulphur. Shlams of metallurgical repartition, wastes of enterprises of engineering, heat-power engineering, easy and food-processing industry, flow of animal-breeding complexes - all this is directed in various sort the stores, which frequently are already by independent sources of pollution of soil, surface and ground water, air. The research of 44 stores, accumulating the industrial wastes has shown, that the 43% from them have not hydroisolation screen, 59% are not equipped with observed chinks.

The significant role in pollution of environment belongs to **stores of flow of animal-breeding complexes**, as well as dust-holes.

From 965 stores of animal-breeding complexes of republic more than 70% is executed without project and more than 80% - in ground canal. The annual volume of animal-breeding flows - 21 mln.qub.km. The many stores - receivers of liquid wastes present the potential threat of flooding of adjoin territory or volley dump of toxic wastes in water-flow, because of low level of operation of stores and technical condition of border constructions.

**The specific danger presents the radioactive pollution.** Along coast of Maylu-Su river (Kirgizstan) on period from 1944 to 1967 was kepted the wastes of processing of uranium ore and to present time is present 23 tail-stores, requiring the strengthening of downflow-protection dams and completion of work on maintenance of stability of slopes in down-dangerous sites.

Ecologically dangerous center of the pollution are tail-stores in Navoi districts, where is present the radioactive sand with real threat with wind out. **The radiation factor** can render such effect on land resources, in comparison with which the other processes darked. The desertification in this cases can happen practically instantaneously and remove from turn-over the whole regions.

### **3.12. The atmospheric dust-salt-transfer.**

The most considerably from abiotic factors the balance of halogeochemical cycle in region is infringing. At high-grade functioning the Aral sea executed the role of natural salt-receiver. The Amudarya and Sirdarya rivers brought in sea more than 25 mln.tons of salts annually. They accumulated in aquatory, were involved in processes of air carry with precipitation and aerosols, partially filtrated with ground flow, accumulated on bottom of sea in small water lagoons and bays.

**The river flow change** in connections with withdrawal of water on economic needs: irrigation, industry and other has resulted to that, that the part of this flow of salts has become to be redistributed on all territory of basin, including zone of formation and consumption of flow. Proof of this process - growth of mineralization of precipitation on all territory of region, increase of mineralization of surface water in zones of consumption of flow, reduction of areas of water-collection basins in zones of formation, growth of soil salinity, increase of concentration of salts of aerosols in atmosphere of region, carry with air masses over all territory of region with subsequent loss on the surface.

Thus, considerable criterion of desertification are the data, describing changes of concentration of salts in objects of biosphere: soils, plants, atmospheric precipitation and drought loss, atmospheric aerosols.

Main problems of study of effect of atmospheric dust-salt-transfer on environment, its role in desertification of territory of Uzbekistan following:

- absence of systematic data on sources of out of dust, sand and salts in atmosphere; (temporary and area characteristics)
- insufficient degree of study of gears of occurrence of dust storms and ground wind, development of processes of dust-salt-out during stationary condition of atmosphere
- the absence of modern system of monitoring for atmospheric dust-salt-transfer
- weak study of influence of processes of atmospheric dust-salt-transfer on environment, including biota, pastures, agricultural areas, the health of population; soils, surface water.

Arid territory on data of many researchers are characterized by high level of pollution of air with dust particles, and mineral and soil particle are main component of aerosols. The appreciable increase of heir concentration is observed on time of dust storms. The first way of receipt of dust-salt particles in atmosphere - eolic carry out from natural sources of soil cover, salt-marshes, aquatory of seas and oceans; second ways - moving of firm weighted particles with air masses from industrial sources of throws; third heterogeneous and homogeneous reactions in atmosphere between gas, liquid and firm ingredients.

For revealing of main components of processes of dust-salt-transfer was appreciated the contribution in emission of salts of natural and anthropogenic sources on examples of Bukhara district, south Aral zone and Fergana valley was appreciated.

The general size of salt weight, subject to eollic carry on territory of Bukhara district, makes 167136 thousand tons per annum, to them from salt-marshes come in atmosphere about 13,8 thousand tons per annum (expert valuations).

Total in sum for year (1990) general size of carry out of salts makes 7683,83 t/sq.km.

The adduced data as a whole give some information on valuations of sources of eollic carry out of salts, sand, dust.

Quite the necessity of creation of modern system of monitoring of emission sources of eollic carry out of sand, salts, dust is obvious. This system should be operative, enabling to predict and to observe the sources of emission, their developments in space-temporary structure.

The divergence in sizes of valuations of salt-dust carry out received by various authors, have shown the necessity of study of gear of process.

**The settlement valuations of eollic carry of salts from drought part of Aral sea, it aquatory, salt-marshes in view of contribution of precipitation and dry atmospheric losses (DAL).**

<b>Year</b>	<b>Aquatory, t/sq.km</b>	<b>Salt-marshes, t/sq.km</b>	<b>Dry zone, t/sq.km</b>
1977	826,25 (with DAL)	394,88 (with DAL)	352,90 (with DAL)
1982	991,90 (with DAL) 81,28 (with precipitation)	471,00 (with DAL)	1102,93 (with DAL)
1990	1274,25 (with DAL) 236,20 (with precipitation)	4645,8 (with DAL)	1764,78 (with DAL)

Is necessary to be noted **three main ways of atmospheric carries** of salts aerosols. First - migration of salts with precipitation, second - carry of salts with wind during stationary condition of atmosphere, third - carry of salts and sand on time of dust storms and ground wind. The heaviest attention was given to study of processes of carry of salts and sand with air masses in conditions of occurrence of **dust storms** and ground winds. The general share of

contribution in general balance of loss of salts on surface in this zone makes on water-dissoluble salts from 30 to 50% in dependence from physical-geographical characteristics.

The comparisons of data on wind regime of territory of RU, with significance of speeds of wind at surface of ground, promoting to rise the dust-salt particles has revealed, that in current whole of year are observed the favorable conditions for eollic carry of dust-salt particles.

Follows to note, that the main share of terrigenous material drops out near to source of emission of salts and sand. The question about distribution of weak-dispersion particles with air masses on territory of region with account of space-temporary distribution is practical little investigated.

**The mass shares of eollic carry out of aerosols of salts on natural supervision in periods with dust storms and at stationary processes.**

Name of station	Weight share of eollic carry out, the dust storm	Weight share of eollic carry out, the station process
Uyali, July	0,79	0,31
Chimbay, July	0,59	0,41
Akpetki, July	0,81	0,19

**Having system of monitoring of dust-salt-transfer** on territory of Republic of Uzbekistan consists of the following components:

- supervision on MS for phenomena of dust storms and ground winds
- the stationary system on selection of tests of precipitation with programs of supervision, appropriate to requirements of global service of atmosphere
- stationary system on selection of tests of dry atmospheric losses working on program of supervision developed in SANIGMI, Glagidromet of Uzbekistan
- incidental expeditional research, including ecological intense zones
- aviazonding of atmosphere with the purpose of revealing of intensity, direction of processes of dust-salt-transfer.

The most difficult are the questions of study, supervision and forecasting purely of processes of atmospheric dust-salt-transfer, its influence on territory in plan of desertification.

Is necessary here in after to be recommended realization of research and practical work on supervision, forecasting of processes of atmospheric dust-salt-transfer, development of recommendations on decrease of negative effect.

The increased mineralization of precipitation and dry atmospheric losses causes the effect of secondary salinity of surface. The losses of salts from atmosphere reduce the bioproductivity of agricultural lands on 5-10%, pasture on 20-30%. The increase of general over-dusty of atmosphere results to increase of respiratoric, oncologic, stomata-intestinal diseases.

The important part of this problem are the questions of study of flow and redistribution of specific pollution's with way of eollic processes, their influences on development of desertification.

**3.13. Indicators of desertification.**



The duly revealing of conception and standing of desertification has exclusively the important practical significance in prevention of its further development. For these purposes the indicators of processes of desertification are usual used.

For **arid conditions of Uzbekistan** at revealing of indicators of desertification expediently to take into account the category of use of agricultural lands (irrigated lands, pasture and hay-mowing, non-irrigated lands, objects of engineering construction etc.), as just the kind of use of natural resources determines their natures. With effect of person on nature in connection with beginning transformation of definite components usually the attributes of desertification, connected with it occur. Is established, that the occurrence of separate attributes already beforehand testifies about conception of desertification processes from local sites. The further development of this process results to occurrence at first separate stains, and then their quantities is increased, in due course they are merged in one or two contours, by degrees in space.

**In desertification Amudarya delta** is possible to be observed the whole spectrum of indicators, determining conception and formation of desertification or intensification. Thus on nature of indicators it is here possible to make out the some groups of them stage development. In particular, it is possible to allocate the indicators of hydromorphic, semi-hydromorphic and automorphic series, indicative about various stage of development of desertification processes. In particular, occurrence and development of takirs on meadow-takir and meadow-takir-tugay soils on periphery canals testifies about conception of takir soils on separate sites (with area from 10 sq.km to 40 sq.km), where the appropriate natural conditions, i.e. decrease of level of ground waters below, than 5-7 m, flat relief with invisible downturns, formed mainly from soils with heavy mechanical structure are present.

The occurrence and gradual distribution of takiring process in Amudarya delta informs about wide development in nearest future of desert with automorphic conditions, on place of semi-hydromorphic.

**Indicators can be** the form of relief, lithologic structure of deposits, ground and surface water, soil and vegetative cover, natural processes etc. But among them in dependence from particular conditions one of them can be leading, sometimes together with dominated, founded and subdominated indicators. In drought part of bottom of Aral sea by leading indicator of desertification is considered the vegetative cover, but with it the soil also act with determining factor of conception of desertification processes. However the vegetation gives more complex information about condition of desertification - the degree of salt accumulation in soils, mineralization and depth of level of ground waters, mechanical structure of soil, direction of salt regime and etc. Then, as soil gives the general information about salt regime, degree of subject to erosion and efficiency of root zone. In general complexity of both these indicators can add one another, they confirm the indication on determination of direction of degradation intensification of agricultural lands, that increases the conditionity of the indications.

In **desert pastures** the leading indicator is the condition of vegetation. Thus the occurrence of new kinds (which to here not founded) testifies about sharp degradation of pasture, and insufficient condition - about gradual deterioration its efficiency. Really, at over-pasture, especially near wells (as a whole water-sources) the pasture is strong degradation not only as a result of continuous eating of vegetation, but also of trampling.

Therefore the efficiency of pasture of these sites largely is low (from 0 to 0,5 c/ha), prevail the inedible grass (garmala) and shrubs (selen, kumarchik, sandy acacia). Weeds, which here were not distributed, become dominant, between forms of eolic relief prevailing become bakhans (them more especially near wells). The wide development of mobile sand and

domination plants, which reluctantly eat the astrakhan sheeps, testify about strong degree of development of desertification.

The indicators of degradation of **irrigated lands** serves mainly the condition of agricultural lands and nature of soil cover. The cotton field with area of salinity stains (where the density of cotton shrubs decreases to 5-6 pieces on 1 sq.m and condition is very stunted) already become the objects of development of desertification, at absence of appropriate measures the salinity stain, being merged among themselves, will cover the large sites, that results in to sharp expansion of areas subjecting to desertification. Thus frequently not weak and average salinity sites the general condition can be not very satisfactory, though the density of plants can be close to normal one. Then the indicator becomes the general condition of cotton or rice culture.

The most the important form - **the forecasting indication of processes** - is largely based on results of retroindication and stage-synchronous indicator researches. The forecasting indication, possessing the applied significance, is applied for determination of opportunity of development of desertification processes hereafter, for that is necessary beforehand to be prepared the measures on their prevention. But for application as indicators expediently to use not less two or three leading natural factors, that allows to confirm the results of forecasting of development of processes, by application of complementary indicators.

In this relation the important significance has the use of relief forms, lithological structure of soil and regime of ground water, quality of surface water, condition of soil cover and its water-salt regime and other properties as indicators. The most difficult to apply the forecast indication in oases with complicated meliorative conditions, at use of polluted water for watering etc. In this situation to us seems expediently to take into account the properties of all main indicators in forecasted context, especially for Lower Amudarya, Zarafshan and some sites of Kashkadarya delta.

**The cartography of desertification.** For reception of the integrated information about condition of desertification of territories and development of complex of measures on their prevention usual made the thematic cards.

As far as desertification is difficult process to cartography it in summary kind in largely degree in field conditions is labour-consuming and not is always considered effective one. Therefore expediently the card of desertification to develop in office conditions on the analyses basis of series of theme analytical cards, reflecting the separate aspects of given process, in particular, deflation, erosion, salinity and other for use of GIS's technologies.

At use of various sources is logically to apply the landscape method of cartography of desertification, as far as this method particularly reflects the distribution of this or that processes in dependence from structure of the natural border territory, i.e. hills, downturns, slopes etc., with appropriate lithological structures of deposits, soils, vegetation, categories of use the lands.

**The remote method** is the most effective at reception of information on all territory of country on definite time. Multizone and colored photos, on which the effect of interpretation of processes is higher, than on black-and-white, are convenient for decoding of condition of vegetative and soil cover, water objects, seliteb geosystems and agricultural lands, various natural processes (erosion, halogeochemical etc.).

**Space-born monitoring** permits continuously to monitor for dynamics of degradation of environment. In this relation the regular monitoring pertinently to use at study of the most ecologically destabilized regions - Aral zone, Aral sea, dynamic regions - pastures of Kizilkum, Usturt, Arnasay-Aydar lake system etc., oases, where intensification the salt-accumulation, deflation, erosion, shrinkage of soils, suffusion and other phenomena.

The use of **Geographical information systems** (GIS) for analyses of desertification permit to joint a all above mentioned methods of monitoring, especially for mapping of desertification. In this case being is a possible the analyses of desertification dynamics and make a preventive measures. Mapping is possible in short term, that a very significant for taking a timely solution on struggle with desertification. At regular mapping give a possible to determine a desertification trend and found a major factors. Necessary to mark, that in case the use of formalistic mathematical models is possible, that agree to carry out a analyses and calculate a prognosis and found a optimal solution of ecological problem.

In **arid zone** of Uzbekistan for each natural complex this or that type of desertification is characteristic. The combination two or three types is frequently observed, such phenomenon follows to think the difficult desertification, that is connected with sufficient complexity of structure of territory (geosystems) and multibranch influence of economic activity of person.

In **Aral zone** is at present wide the processes of desertification of various types are widespread, , in particular, deflation in combination with degradation of vegetative cover, erosion, technogenic desertification in non-irrigated part, and in zone of irrigation - the soil salinity, exhaustion of irrigated lands, pollution of irrigated water.

The main principle of development of card of desertification is offered the historical-generic methods, based on results of landscape-ecological researches. The desertification, developing under influence of various factors and on the basis of numerous reasons, should be studied in generic aspect, it is only thus possible is authentic to cartography the territory of its development.

The card "Desertification of arid zone" in any scale is developed on the basis of synthesis of existing thematic card - landscape, hydro-geological, soil, geobatic, erosion, pastoral and etc., space-photos and literary data, as well as materials of aerovisual supervision. Thus the landscape card is considered main at cartography of desertification, as authentic and generically characterizing the naturally limited territory with all changes their structures in dynamics. Thus landscapes on card are shown with black color contours and inside with serial numbers.

The card fulfills the classes, types and reasons of desertification, besides on it present the objects, which observe the improvement of environment of arid zone.

On the analysis basis of valuation criteria of processes the following **classes of desertification** are allocated:

1. the desertification is away
2. weak
3. moderate
4. strong
5. very strong
6. combination of various classes

On card the classes of desertification are shown with various spectra of color. Thus the color of paints varies from light-blue (the desertification is away) to dark-red (a very strong class) tone.

**The types of desertification** (degradation of vegetative cover, deflation, erosion, salt-accumulation and etc.) on card are displayed with symbols. Thus the thickness of symbols or their configurations shows the degree of development of natural process. In particular, the plane wash, weak, average, strong, ravined erosion can be shown with various thickness of chosen symbol.

If the area of contour permits is possible to show with dotted line the distribution of degree of display of it or other natural process, for example, areas of development of ravined erosion,

soil salinity etc. This allows to increase the conditionality of informations of cards and authentic display of observable processes of desertification.

In free part of card follows to show the danger of desertification of arid zone of republic, its separate regions, where anthropogenic desertification with high rates is developed - Aral zone, Karshi steppe and other. Expediently to place the separate tables, graphic and textual information materials, legends and explication of cards, which add the general contents of card of desertification.

At development of desertification card is necessary to be used the modern information technologies and geoinformation systems, as the most the perspective methods of monitoring of natural objects.

The desertification processes in arid zone of Uzbekistan are developed on definite **trends**, that connect with structure-dynamic condition of geosystems, influence of economic activity of person, and degree of them management. In desert and semi-desert zone was possible to be allocated the geosystems of alluvial, superacval and subacval series.

Is caused with various lithological-morphological conditions, determining in turn the nature and properties of other mobile components, in particular, hydro-geological processes, flow, soil-meliorative condition, condition of development of phytocenoses and etc. The complexity of lithological-morphological conditions of geosystem defines simultaneously the complexity and different-character of other natural components and in result the complexity of geosystem.

**In elluvial geosystems**, processes of desertification have also the automorphic character of development, i.e. they completely correspond to the mentioned physical-geographical conditions. By other words the elluvial geosystems as a result of development of desertification promote to intensification of that processes, which correspond to this stage of development of landscape systems (in particular, blow out, accumulation of substances, erosion, desalting, suffusion and etc.). This is law inherent for superacval geosystems (with development of processes of accumulation of salts in aeration zone, blow out of soils, etc.) and subacval complexes (flooding, salinity, shift of phytocenoses etc.).

From these reasons it is possible to reveal the definite **tendencies of development of desertification processes**.

In particular, for arid zone of republic are characteristic the following **general tendencies of development of desertification**:

- the eolic dismemberment - blow out, accumulation
- the technoerosion
- the erosion dismemberment
- the technogenic infringement of lands
- the salt-accumulation and desalting, intensive salt-accumulation, progressing salinity, stabilization of salinity
- the degradation of vegetation - pasture
- anthropogenic succession - shift of vegetative communities
- the soil degradation
- the ecogenetic evolution or transformation of soil
- the development of halomorphic, halo- and xerophytic geosystems
- the subacval development
- the superacval development
- the alluvial development

For definite regions can be characteristic the specific tendencies of developed processes of desertification and their combinations.

For example, for **oases**, located in delta plains of Zarafshan, Kashkadarya, Amudarya characteristically mainly the progressing of soil salinity and exhaustion, that conditionally with insufficient management of water-salt regime of irrigated lands, use for irrigation the salt and polluted water, and in northern zone of Karakalpakstan follows take into account the accumulation of salts by air way, blow out from drought part of Aral and from periphery salt-marshes of Aral zone. On near future, approximately to 2006-2008, us seems these natural-anthropogenic phenomenon on all probability don't will be prevented.

Therefore **the salt-accumulation period** in Lower Amudarya will be preserved more long. This trend will be preserved in lower Zarafshan, Kashkadarya, Golodny steppe, separate massifs of Central Fergana, where the regulation of water-salt regime of irrigated soils enough difficult.

The development of eolic processes, degradation of pasture and as a whole the decrease of efficiency of desert ecosystems will be preserved on Usturt plato, in Kizilkum desert, south and south-western regions (Devkhan sands) of Karshy steppe in connection with intensification of erosion and technogennic infringement of lands as a result of mining of various useful mineral (predominary the petroleum, natural gas, drinking water etc.) and their investigations. In this relation here follows to include the drought part of bottom of Aral sea, where at present more and more strengthens the drilling of petroleum and natural gas.

In mentioned regions of desert zone as a result of technoerosion can occur the separate areas (linear and areas) is strong of desertification massifs, where completely disappears the vegetative cover, the mobile sand and steeply-wall hollows of various size occur.

On drought part of **bottom of Aral sea** the tendency of development of processes of desertification has the stage nature. In coast band of Aral already the continuous zone with width from 1 to 15 km and more was generated, where dominant of steel the barkhan sands (this band corresponds to 53-48 m abs. of isobats), at present are here observed the gradual over-growth with psamophits.

The band between 47-43 m abs. because of deeping of level of ground water below 7 m is subjected to **waterless development**. In this connection the large active salt-marshes go in stage of residual, locations on separate areas are formed the takir residual salt-marshes, i.e. the stabilization of salt-accumulation in combination with desalting is observed, hereinafter this process will amplify with salt-collection in aeration zone, as far as the mirror of ground water is in interval 0-3 (locations 4 m), goes to summary evaporation of capillary border. Hereinafter the concentration of salts in salt-marshes structures (in band from 35 to 24 m abs.) amplifies owing to increase of mineralization of marine over-flow and ground water, and from depth of 24 m it will be possible to be formed the typical blinkers.

### **The desertification process in most subject to him regions. The role of irrigation for struggle with desertification.**

The role and significance of irrigation in aridity is very important. Only irrigation to promote a development of new lands from desert, to create oases with favourable conditions for peoples' life. The efficiency of irrigated lands more high, than non-irrigated and its give a possible to received a agricultural production diversity.

Thus, the development of irrigation is not only important vital condition, but basis of social-economic development of State.

The increase of land productivity is major purpose in irrigation development and it basic measure in struggle with desertification. The questions of increasing of effectivity, rational use, protect and reproduction of land-water resources is main in here.

More, than 95% of all land and 85% water resources of Republic use in agriculture. Only 15% from all agricultural lands under agricultural irrigated lands.

The history of irrigation in Uzbekistan, as in whole Central Asia, very ancient and connect with human life and development. The irrigation development and dynamics of population growth in Uzbekistan for last 35-40 year is a good show it.

From 1960 to 1997 the irrigated area in Republic increase in more, than 1.5 times, a total population number increase in 2.9 times. So in Kashkadarya and Surkhandarya districts the irrigated area increased more, than 2 times, population number in 3.8 times. The growth of irrigated area and population number was observed in all districts of country with different extent.

### The use of irrigated areas on regions.

Regions of Republic	Year									
	1960		1970		1985		1992		1997	
	irrigated (thousand ha)	population (thousand pers)	irrigated (thousand ha)	population (thousand pers)	irrigated (thousand ha)	population (thousand pers)	irrigated (thousand ha)	population (thousand pers)	irrigated (thousand ha)	population (thousand pers)
Karakalpakistan and Khorezm	450	891	363	1256	686	1992	764	2411	781	2644
Fergana valley	730	2301	784	3238	887	4845	909	5725	921	6326
Samarkand and Djizak	386	1254	545	1802	624	2549	699	3071	670	3380
Surkhandarya and Kashkadarya	409	930	384	1463	744	2483	813	3141	835	3557
Bukhara and Navoi	243	574	244	934	270	1613	348	1934	403	2088
Tashkent and Sirdarya	489	2169	526	3106	665	4444	698	4925	696	5386
<b>Total on Uzbekistan</b>	<b>2710</b>	<b>8119</b>	<b>2846</b>	<b>11799</b>	<b>3876</b>	<b>17926</b>	<b>4231</b>	<b>21207</b>	<b>4306</b>	<b>23381</b>

### Structure of irrigated lands using.

Areas	Year				
	1960	1970	1985	1992	1995
Arable	2172	2482	3305	3331	3341
Many-year plantations	132	180	318	367	357
Disused lands	295	19	2	27	38
Hay-moving and pasture	--	1	37	40	40
Individual plot	111	147	185	435	488

Total of use lands in agriculture	2710	2829	3847	4199	4262
Forest and shrubs	--	17	29	32	42
Total irrigated lands	2710	2846	3876	4231	4306

Also result of development and irrigation of new lands is complete exhaust of water resources, that negatively affect on Aral Sea's conditions, but it promote to consolidate a material basis of social-economic development of country and softing a demographic load on economics.

### Dynamycs of irrigated land salinity.

Regions of Republic	Investigated land		Salinity lands		In this number with average and strong extent	
	I	II	I	II	I	II
Karakalpakistan and Khorezm	694	655	604	562	298	309
Fergana valley	840	721	124	162	45	93
Samarkand and Djizak	602	552	218	176	107	55
Surkhandarya and Kashkadarya	745	685	381	327	149	110
Bukhara and Navoi	355	271	336	253	102	74
Tashkent and Sirdarya	644	585	304	275	156	146
<b>Total on Uzbekistan</b>	<b>3879</b>	<b>3468</b>	<b>1967</b>	<b>1755</b>	<b>857</b>	<b>787</b>

The meliorative condition influent on character of land use, and in first time on salinity. On struggle with desertification annually spent a many labour, means and addition water on washing.

Bukhara and Lower Amudarya are more subject to desertification.

**Bukhara district.** The type and desertification intensity have a deep regional character. For territory of Bukhara district the leading factors, stimulating desertification, are:

- deep desertity of natural conditions on territory;
- the geographical location of this region on attitude to all basin of Zerafshan river, that is, predisposition of its territory to water-chemical and water-physical pollution;
- subject of territory to influence of Aral accident;
- the increasing load on natural systems, demographic and social-economic factors.

The decisive role in ecosystem life belongs to stocks of moisture in soil, which are formed, basically, at the expense of precipitation. The latter 100-150 mm per annum drops out rather little. Moreover, on seasons of year its are distributed utterly non-uniformly, main their weights drops out in winter-grade - spring period (72-87%). On moistening degree this region relates to very dry zone.

For development of grassy vegetation the most important significance has the moisture of top soil horizons (0-20 cm).

The stock of productive moisture in this layer, 5 mm and more, is provided the by normal development of grass. On greater part of desert territory in soil layer 0-20 cm the humidity is lowered below, than 5 mm, on May the all grassy vegetation is fade. The some late the stocks

of moisture in layer 0,5 m reach to 6 mm and below, subsequently a many shrubs (wormwood) change in condition of summer half-rest.

During of vegetation period the activity of adverse weather phenomena, which adequately affect on strengthening of desertification processes. To its relates damage done by hail, wind, dust storm and dry wind.

In desert conditions a landing aerodynamic flows (wind) are important factor, stimulating the desertification process. This dynamic component is typical phenomenon of desert zone.

The primary alluvial-delta plains were subjected to radical change as a result of eol processes for quarterity time. As a result of the processing of sandy-shingle deposits were formed the huge massifs of eol sand with various degree of fixing. At present time about 40% of territory of district is engaged by them.

To the most desert land relate the narkhans' sand with general areas 200 thousand ha. These naked sand not are only fruitless, but also are centers of desertification. The naked mobile sand are parameters of final stage of desertification in desert zone.

The large areas of barkhan sand are concentrated basically in three massifs: Kandilim (on north-western border of Karakul oasis); Azgakkum (on south-western border of Bukhara oasis) and Djilikum (on north-western border of Djilvan massif).

Also founded the small local congestions of mobile sand, formed as a result of strong anthropogenic load. Oases barkhan sand is harmful, observed the cases of covering by them of main channels, collectors, roads, new cultivated lands and other objects. They should be the objects of prime phytomeliorative development.

According to geocological law development of basin geosystem is increased a mineralization and the sanitarian-bacteriological structure of river waters downwards on current of river is worsened. That is, in given region the waters is salinity and chemical polluted. Annually in Bukhara district with irrigated water acts about 5 mln. tons of water-dissoluble salts and other chemical migrants. The main mass is accumulated in aquatory of oases put down lakes. Therefore a zone of influence of these lakes is remoisture. The new massifs of flooded, arsh-ridden and salinity lands have occurred.

The real indicator of desertification degree of irrigated lands in Bukhara district is salinity. If in Samarkand district the area of soil salinity makes 5,2% from irrigated fund, then in Bukhara district this parameter reaches 94,3%. As a result of multientury accumulation of chemical-gens substances in oases lowered sites were formed a salt-marshes and blinkers.

The additional salt source is the water surface of salinity lakes, area of which makes more 350 km<sup>2</sup>. All above-stated permits to conclude, that for given region the paramount gravity has a watersalt regime management of irrigated lands and adjoining territories.

The considerable factor, stimulating the desertification development, for territory of district is vicinity to Aral accident center. The conducted researches have shown, that the 40-50% of salt-transfer mass on region territory has a Aral genesis. And size of year loss of salt-dust aerosols makes 300-400 kgs/ha. Besides, the aquatory of dried part of Aral sea is source of microelements such as lead, cadmium, zinc and other ones. The arrival of salt-dust migrants amplifies on April, May, September. This negative process deep with anthropogenic pollution in atmosphere, which make on territory of district is about 130 thousand tons.

These factors have served of one of main reasons of decrease of biological efficiency of pasture and deterioration of biological diversity condition.

On data of aerophotometric investigations the average pasture harvest in comparison with 1981 has decreased in 2-3 times. More than on 40% has decreased the fodder pasture capacity in Gijduvan, on 20-30% Karakul, Peshkun, Romitan regions of district. This circumstance requires the realization of effective measures on preservations and increase of pasture efficiency and kind diversity.



The fourth factor, strengthening a desertification process, is the increasing load of demographic, socio economic factors on natural systems. Today is preserved relatively the high growth of district population. With increase of population number adequately will be increased the volume of natural resources consumption. Moreover, year after year grows the power- and technical arms of population.

From beginnings of 50's here conducted the geological investigation and boring work, and is from 1962 executed the extraction of useful mineral. The each boring installation - peculiar sore of desert landscapes. It takes usually 15-20 hectares of area, and term of drilling proceeds not one month. As a result on this area is completely destroyed a soil substrat, vegetation cover, and disappear a animals. In radius 50-70 m from location of drilling the area is transformed in desertification poligon.

Moreover, "borer" cut a shrubs for various household and other needs. A large loss puts a poaching. After completion of boring work a "boring ring" usually not recultivation, and on the contrary, remains as storehouse for household, technical wastes and wastes of materials, which were used for boring of hole.

The cutting of pasture shrubs and semi-shrubs on fodder and fuel, as well as for other purposes is of one of desertification reasons. The reduction of cotton wedge in structure of sowing of last years appreciably has increased the deficit on fuel materials as after cleaning of cotton his stem is wide was used by local population as the fuel material. Gas-providence of rural regions in district makes 73%, in Djondorm, Karakul and Shafrikan regions 59,47 and 46%, accordingly. Besides, so far not is completely terminated a cutting of wormwood, partak, singren.

Some-times a shrubs cutting with main root, that nabefully for worm-wood, singren. And, cutting is proceeded in spring before plant flowering. As a result is naded the surface, that causes of the strengthening of deflation processes.

The over-pasture is one of negative reasons of degradation ecosystem. This process intensify in combination with dried year.

The speed of desertification processes in desert conditions depends from the ecosystem stability, intensity of pasture.

At over-pasture are usual observed:

- loosening of soil substrat, as a result created the favorable conditions for disinflations;
- the reorganization of vegetation communities happens, radical associations are replaced of them with anthropogenic variants;
- the efficiency of biomass is reduced, the fodder quality is worsened;
- in final stage of degradation forms a mobile, so named technogenic sand;
- the microclimatic conditions (albedo of earthy surface, humidity of surface layer of atmosphere and etc.) is vary.

In last years because of deterioration sheep pasture, connected with over-pasture, cutting of shrubs, adverse weather conditions, preserve the general tendency of reduction of sheep quantity. The sheep flock usually pasture on flooded pasture, located around wells. Them on territory of district more than 400. The concentration of large breeding mass around wells inevitably results to strong destroyed of soil and occurrence of mobile technogenic sand. In accordance with removal from wells are observed the changes of fixing lands and shift of vegetation cover, forming a peculiar concentric layer of pasture.

**Lower Amudarya.** In lower Amudarya is located one of large regions of Republic of Uzbekistan, including Karakalpakstan and Kharezm, which are advanced agricultural regions. Here the industrial sector of national economy is heavily developed.

The meliorative condition of irrigated territories considered region is in close dependence from formation of ground water (GW) regime, which is described on three subregions,

describing prevalence of water-exchange: horizontal, mixed, vertical and which are united on left-bank Amudarya in flow of ground water of Khorezm-Sarikamish delta, and on right-bank - Akchadarya delta.

However, from 1975 the influence of river on formation of ground water regime in lowers largely has decreased, because of over-regulation of Amudaryas' flow with Tuyamuyun reservoir, though in Khorezm district the size of water-return a some higher, in comparison with other regions of Republic.

In Karakalpakstan the reduction of actual irrigated norm from year to year is precisely marked. This circumstance appropriate image has affected on the formation of ground water regime, which reflects a meliorative condition of irrigated lands.

**Subregion of horizontal water-exchange** is located in flow, flood-lands and valley parts of modern Amudarya plain with width to 8 kms on both bank of river. Here, observes the steady of decreased of ground water level (GWL), connected with decrease of water river level. The expansion of irrigated lands of district basically happens at the expense of tugay plantation part development in river flood-lands in considered region. The mineralization of ground waters here in currents of many-years is within the limits of 1-1,75 g/l; the fresh waters ( 0,3-0,8 g/l ) are basically formed on depth (50-70 m). In separate years during of executions of wash watering (autumn - winter-grade period) is marked the increase of mineralization in top horizons to 2,5-3,0 m.

**Subregion of mixed water-exchange**, located in central part of district includes, basically, old-river and inter-river. The left-bank lands of subregion irrigated from Tashsakin irrigated system, and right-bank - from Pakhtaarnin. The territory heavily irrigation and characterized with a large network of irrigated and meliorative channels. The ground water regime is formed under influence of climate, irrigation, drainage, crop-rotation, irrigation regime of crops etc.

The ground water level here is very close to ground surface and in this connection the areas with increase mineralization tendencies prevail, as well as the deterioration of hydrochemical regime is marked. About 60% of irrigated lands are subject to various salinity degree, that influences on reduction of crop on 15-20%, and on separate sites and it more. The significant areas (to 10-15%) because of strong soil salinity are switched off from agricultural turn-over.

The sharp deterioration of meliorative condition of main irrigation massivs, occurrence of salinity sites among irrigated fields, exception of part irrigated sites from turn-overs, depression of crops, a large wreck of long-term plantation (especially of unique trees, for example, karagach) are explained by appreciable reduction of irrigated norms.

The systematic reduction of irrigated water volume should promote to formation of favorable meliorative condition on irrigated lands. However, in irrigation practice in Lower Amudarya is not marked because of insufficient condition and bad work of collector-drainage network.

In Khorezm district frequently because of weak-water the large part of irrigated network partition off with crosspiece for humidifying of active soil horizon at the expense of rise of ground water level (version of subirrigation) with various mineralization degree.

This phenomenon in mass order is marked from end of April to end of July on growing cotton period, that removes from working condition the all economic and partially intereconomic collector-drainage network. As a result the ground water level is higher, than optimum depth allowable for district, and the active process of toxic salt accumulation in root zone is marked.

**Subregion of vertical water-exchange** takes the peripheral part of territory of Khorezm district, boundary with Karakum, Pitnyak oasis, peripheral part of Turtkul oasis along border with Kizilkum and Amudarya region of Karakalpakstan.

The climate, water-feed and drainage is the regime-forming factors. Is here marked, especially in boundary regions with deserts Karakum and Kizilkum, alongside with salinity of irrigated lands part, also desertification of lands part at the expense of approach of sand on irrigated lands.

The ground water mineralization in considered subregion is stable: - not less than on half (47%) of area is marked its increase (on dense remainder) on 0,1-60,9 g/l at general mineralization 0,6-40,1 g/l, on other territory (53%) is marked the reduction of mineralization within the limits of 0,1-41,0 g/l at average general salinity 0,7-26,2 g/l. On large part of subregion territory the areas with increases of mineralization to 1,0 g/l are present.

Though on large part of both bank of Amudarya in limits of subregion the intensive process of desalinization after autumn-winter-grade wash and vegetation watering is marked, the residual mineralization in first water horizons remains is very large - 18-27 g/l, and on some items to 40 g/l.

The systematic fluctuation of GWL in current even one vegetation period is considerably influences on water regime of soil in aeration zone, as well as on soil-forming process. The formation of water regime in various soil-hydrological horizons and their shifts during one vegetation period have the important technological and practical significance at development of appropriate meliorative measures.

Is established, that on main irrigated territory of Khorezm district, as in long-term period, as on 90's is marked the intensive irrigation salinity, and required the execution of active measures of struggle with salinity process - prevention of fertility land degradation from meliorative condition deterioration of irrigated lands in district.

To main factors desertification in Lower Amudarya relate:

- the meliorative condition deterioration of irrigated lands (fertility land degradation);
- non-includes of fertility land part from agricultural turn-over;
- imperfection of irrigation systems;
- the costs best in republics of irrigated water (on irrigation and washing of salinity lands) on unit of agricultural production.

### **3.14. Economic and social consequences of desertification.**

The deserts of Uzbekistan in last decades of steel the arena of the human activity, that is promoted to decision of many economic and social problems at us on the one hand, and with other - anthropogenic stress conducts to infringement of fragile desert ecosystem and deterioration of ecology as a whole. Excessive, ecologically unbalancing operation of desert lands and their resources is involved by unpredictable consequences. For example is the Aral accident.

The desert territories, occupying large territories of republic, have huge economic potential. These utterly drought territory are good pastures, here extract the petroleum, natural gas, gold and other useful mineral, on irrigated lands growing the cotton, vegetables and fruits.

The sign of time the active approach of person on desert has become: on its territory arise the cities, there, where is possible, is developed the irrigation.

In last years, in connection with uncontrolled herd of cattle in desert grows the load on natural pastures, that results to degradation: at mining of useful mineral, industrial construction are destroyed the natural landscapes. All these factors steel a reasons of desertification, which is expressed by total disappearance of vegetative cover, water and wind erosion of soils, their condensation, salinity and flooding, expansion of zones, covered with

sands, degradation of all forms of organic life. In result - the reduction of natural-economic potential.

In arid zone of Uzbekistan about 10 mln.ha of pasture need in radical improvement, more, than 1,5 mln.ha of desert territories are subject to secondary salinity of soils, on 0,5 mln.ha of arable area is widespread the water, wind and irrigation erosion. Especially the adverse conditions has develops in Bukhara districts, where 192,2 thousand ha are covered with processes of salinity and about 80 thousand ha of fertility lands under influence of wind erosion buried under sandy barhkans.

The population of desert regions lives in extreme conditions. In many regions the ecological conditions as a result of drought of Aral sea is worsened. The problem frequently redouble with absence of competent medical service.

Especially the adverse effect on health of population was had rendered the critical ecological situation in Aral zone and Sariassya regions of Surkhandarya district, as well as in regions with intensive application of pesticides.

More than 370 thousand person (37% from examined numbers) is referred to risk group of possible development of various diseases in Khorezm district, and more than 550 thousand the person (45 % from examined numbers) in Republic of Karakalpakstan.

The morbidity of population makes 72,3% in Khorezm district, in Republic of Karakalpakstan - 70%. In Aral zone the morbidity of tuberculosis, oesophagus cancer, illnesses of blood and blood system, illnesses of digestion organs in some time higher, than average parameters in Republic.

The scientific-practical researches is established, that in 24 regions of Republic with intensive applications of pesticides at adult and children's population in 2-3 times emerges more diseases, than in regions with less application of chemical weed-killers and pest-killers.

The oncologic diseases put the huge damage to economy of Republic of Uzbekistan, affecting the most able-bodied part of population. Despite effort scientist - experts whole of world, the cancer on former remains a terrible pathology, initial stages of which proceed closely and without system. For the last few years in Republic annually fall ill with malignant tumours of various localizations more than 15-16 thousand a person, perishe from cancer 10 - 11 thousand a person. The alarming tendency to growth of cancer of lung, milk gland, skin, lymphatic and blood organs, large intestine is marked. The adverse ecological-hygienic conditions, usual in series of cities and administrative regions, is stipulated by complex effect of natural and anthropogenic factors, accompanying with pollution of environment and natural resources exhaustion, soil degradation, fresh water deficit.

For reduction of morbidity level and revealing of main factors resulting to its growth is planned:

- to conduct the ecological-hygienic division into distticts of territory on parameters of ecological risk;
- to define the location of wastes accumulation from the point of view of least risk for environment;
- to use the technology of ecological processing of wastes;
- to lower the application of pesticides;
- to apply the biological methods of struggle with insect-pests;
- to expand the network of medical items of control for morbidity and preventive maintenance;
- to expand the network of dispensaries in districts, the most subject to desertification.

### **3.15. Migration of population, connected with desertification and drought.**

At occurrence of critical situations, connected with land degradation, drought, and other adverse changes of life conditions of population, the problem of population migration from zones of ecological disaster arises.

At deviation of Aral seas' coast the critical situation in aral zone has arisen. The population was engaged processing fish. Drying of sea and reduction of fish catch have resulted in to reduction of processing production quantity.

Originally for preservation of working place in region the fish production was delivered from other regions, however with growth of economic problems to deliver the raw material for processing has appeared utterly unprofitable one. Therefore the enterprises on processing were closed, and significant part of population is forced to abandon a places. The redoubling of ecological crisis in Aral zone has caused the preconditions for migrations of population in more suitable for residing places. The pasture degradation, at intensive pasture results to necessity of population migration in more suitable for conventional cattle-breeding places.

With surplus of labour resources in country-side, in regions, traditionally engaged by productions of agricultural production, happens redoubling of critical situation. For decrease of critical level the enterprises on processing of agricultural productions are created, and some cases create the enterprises of machine-building and other directions, that permits to increase the employment of population and results to reduction of unemployment. The migration of population happens, as a rule, in large cities, increasing by this surplus of unskilled labour.

For decision of problems, connected with migrations of population from adverse ecological regions, it is necessary:

- to organize the processing of agricultural production on places, and quality of target production should correspond to world standards;
- to develop the network of national craft, that allows to have the additional sources of income;
- to develop the network of competent medical service in country-side;
- to increase the network of special educational establishments in country-side;
- to encourage the development of small-sized business, based on conventional methods of management of facilities;
- to develop the network of non-governmental organizations on levels of communities for attraction of population to careful attitude to natural resources;
- to use the conventional technologies in areas of nature-using.

# **THE STRATEGY AND PLAN OF ACTIONS ON STRUGGLES WITH DESERTIFICATION**

## **Formulation of strategy**

As a result of conducted analysis the main desertification problems were determined, on allowance of which the national program of actions on struggles with desertification and softening of influence drought should be aimed.

The struggle with desertification includes activity, which is part of complex ground resource development in arid, semi-arid and drought subhumid regions, in interests of sustainable development of country and which is directed on:

- The prevention and / or reduction of soil degradation scales;
- The partial restoration of degradation lands;
- The restoration of damaged from desertification lands.

Thus, strategic purpose and task of struggle with desertification is the creation of conditions for sustainable development of Uzbekistan.

Follows to note, that the problem of steady development covers rather the wide circle of questions, to many from which the independent programs and projects, indirectly connected with struggles with desertification are developed and realized.

In present document it should not in more details to consider these programs and projects, however their rules were taken into account at development of program of actions on struggles with desertification.

The program of actions on struggles with desertification consists from three main sections:

- measure on struggle with desertification;
- the system of supervision and control for environmental condition;
- research pre-project and design work.

### **4.1. Measure on struggle with desertification.**

#### **4.1.1. Anti-erosion measures.**

The important role in struggle with desertification belongs to anti-erosion measures. The scientific-justified system of organization-economic, agrotechnical forest-meliorative and hydrotechnical measures include in anti-erosion measure complex. The ratio of separate kinds of measures is established with account of natural-climatic conditions, features of erosion processes displayed and agricultural activity directions.

#### **Organization-economic and agro-technical measure.**

These measures are directed on discontinuance of soil surface destruction and promote to increase of fertility of eroded lands, as well as are component of agro-technical cultivate of agricultural crops on eroded lands.

**The main types of organization-economic and agrotechnical measures and approximate volumes.**

N	Measure types	Irrigated lands	Non-irrigated lands	Pasture	Total
1	Introduction of scientific-valid rotation	3800	750	-	4550
	In this number a soil-protection (with grass)	1600	580	-	2180
2	Constant supervision for microrelief conditions	3300	750	-	4050
3	Applying increased (on 10-30%) norms of organic and mineral fertilizers	1200	530	-	1730
4	Sowing of increased norms (on 5-10%) of seeds	930	350	-	1285
5	Soil treatment is perpendicularly to direction of harmful wind	930	350	-	1285
6	Cultivate of siderites on green fertilizers	850	-	-	850
7	The creation of anti-wind link and band from many-year grass	300	20	-	320
8	Conducting of a watering	930	-	-	930
9	Conducting of a agrotechnical measure complex on non-irrigated lands (outline tillage, deep patch loosening, rolling, and furrowing of autumn plough-land, sereal-picking etc)	-	750	-	750
10	Introduction of pasture rotation	-	-	11400	11400
11	Maintenance of norm cattle pasture	-	-	11400	11400
12	Provisional prohibition for cattle pasture	-	-	600	600
13	Complete prohibition for cattle pasture	-	-	330	330
14	Meadowing of strong eroded lands and steep slopes	-	-	330	330
15	Surface pasture improvement	-	-	760	760
16	Radical pasture improvement	-	-	3100	3100

The leading location among recommended measures belongs to crops rotations. On the most eroded irrigated lands, as well as in regions of average and strong windy activity follows to enter a soil-protection rotations, a base of which is the saturation of fields by cultures, which cover the ground surface in large part of svegetation period.

On specially dangerous sites (sandy, easily dispersed soil) 9th meters buffer bands from cereals-leguminos grass are applied, which are alternated with cotton bands or other main cultures of width to 30 m. A links from high-stem plants, located across of harmful winds, through 25-30 m is a good protect a soil from escaped.

During a strong winds it is important to support a soil in humidified condition, that is reached with 1-2 additional watering.

Sowing of increased seed norms (for exception of cotton, vegetable-melon crops and potatoes), additional entering of organic and mineral fertilizers, cultivating siderites promote to best soil structure, increase of biological weight, and consequently, strengthening of erosion soil stability.

In structure of organization-economic measures the large attention is paid to constant supervision for microrelief agricultural lands condition, execution of sowing and process of agricultural crops with observance of optimum slopes.

In struggle with water erosion (on non-irrigated lands) main task is the localization of runoff and creation of such conditions, at which its absorption on location is provided. It is reached by execution a special agrotechnical receptions (tillage across slope, and on difficult slope a planimetric tillage, deep band tillage, rolling and furrow of autumn plough-land and etc.).

From all system of organization-economic and agrotechnical receptions of pasture lands protection from degradation and with the purposes of increase their efficiency the most important are the regulation of cattle pasture and phytomelioration measure.

The theoretical bases and methods of desert pasture phytomelioration are developed by Institute of Botany of AS, however a wide industrial tests in this direction was not conducted. In this connection the radical pasture improvement in present program is stipulated only on area 3,1 mln.ha or on 15 % of all pasture territory.

#### **Forest-melioration measures.**

In structure of forest-meliorative measures includes:

- the creation of field-protection forest bands system;
- the plant round of large irrigation and main road systems;
- the creation of bank-fixing, ravin-fixing and runoff regulating plantation;
- terracing of mountainous slopes with creation of forest and fruit plantation;
- the fastening and afforestation of sand.

The system of field-protection forest bands consists from main (3-4 - series) bands, located across to main winds, on distance 300-500 m from each other and auxiliary (1-2 -series), placed perpendicularly to main, on distance 800-1200 m from each other.

The accomodation of field-protection bands connected with planed location of irrigation-road network (are located on borders of watering sites, rotation massifs). In regions with strong windy activity under field-protection forest-bands allocate a 2-3% of irrigated lands, average - 1,5-2% and weak 0,5%.

Forest-bands in non-irrigated lands are created only there, where the quantity of precipitations provides a growing a forest cultures (300-350 mm).

Terracing of mountainous slopes with creation on it a plantation is one of effective means of struggle with water erosion and cel flows. Terraces are created in the first place on eroded mountainous slopes from 8° to 40°. The main volumes of terracing are in Kashkadarya, Djizak, Surkhandarya and Tashkent areas.

The fastening of mobile sand and afforestation of sandy territories is carried out with sowing a saksaul and other sandy kinds. Specially the dangerous mobile sand, bordering with oases or located inside, are fixed in addition with application of mechanical protection standing or covering type, which are suit from reed, wormwood, selin, yantak, guzopaya etc. The main volumes of sandy-fixing work have in desert zone of Republic of Karakalpakistan, Khorezm, Bukhara, Kashkadarya districts.



### The volumes of forest-meliorative measures.

N	Measure types	unit of measure	total volume of work	In this number in the first place
1	Field-protection forest bands, total	thousand ha	112	35
	In this number irrigated is	thousand ha	78	30
2	The plant round of main irrigation network	thousand ha	38	20
3	The plant round of main road network	thousand ha	14	5
4	Other anti-erosion plantations	thousand ha	6	2
5	Terracing of mountainous slopes with creation of plantation	thousand ha	168	40
6	Fixing and affrestation of sands	thousand ha	208	180

### The hydrotechnical measures.

The hydrotechnical measures are the most capital-investive from whole anti-erosion measures complex and are carried out, as a rule there, where the application forest-meliorative, agrotechnical measures is not presented probable or they do not give due effect.

In structure of hydrotechnical measures includes:

- bank-fixing work;
- anti-cel measure;
- the reconstruction of irrigation network and reinforced of it with anti-erosion hydrotechnical buildings;
- work on liquidation of karst phenomenas.

Bank-fixing work (bank fastening, construction of flow-direction dams) are carried out for protection of bank from washing and flood-lands from flood. On their shares has about half of all volumes of hydrotechnical anti-erosion measures. The banks is fixing and protect with longitudinal dams.

Cel activity in this or that degree is displayed in all areas, except for Republic of Karakalpakistan and Kharezsm district. The share of anti-cel measures more than 20% of total volume of work. They include the construction of cel-reservoirs and other anti-cel buildings (cel-road, cel-down channels, anti-cel dams, etc.).

The construction of cel-reservoir scheduled on say, which have extended runoff and on high-flood period put the significant damage to national economy.

Whole is scheduled to construct a 301 cel-reservoirs with total volume 434 mln.m<sup>3</sup> (from 0,1 to 30 mln.m<sup>3</sup> is each).

### The distribution of cel-reservoir on territory.

Districts	Quality of cel-reservoirs	Total volume mln.m <sup>3</sup>
Andijan	9	6,8
Bukhara (with Navoi)	13	3,0
Djizak	24	88,0
Kashkadarya	47	146,0
Namangan	17	5,5
Samarkand	93	104,7
Surkhandarya	21	34,9
Sirdarya	7	13,4
Tashkent	29	25,0
Fergana	41	7,0
<b>Total on Uzbekistan</b>	<b>301</b>	<b>434,3</b>

In taking the deficit of water resources, a cel-reservoirs is scheduled to build whenever possible with flow accumulation (cel-water-reservoir), that allows the some to raise a water-providity of irrigated lands, in addition to run a more, than 20 thousand ha of new lands.

The cel-road and cel-down channels constructed on slope and work for organization out of cel water.

On small say (with annual flow volume is less, than 150 thousand m<sup>3</sup>) envisage a dams, cel-snare and dams for regulating a cel moving.

The right watering technics had a large significant in struggle with irrigation soil erosion, which depending from irrigation network conditions and planning of watering maps. A 2,5 thousand km of channels and collectors are need in reconstruction.

At reconstruction of irrigated network envisage:

- at collectors subject to erosion - smoothing of bank to natural slopes and decrease of longitudinal slopes to unwashing by construct of overfalls;
- build of outfall constructs in attended place of collectors and drainage channels;
- buld of water-down channels with pipe-fault constructs for fault of irrigated water;
- slopes revetment of watering channels, where observeted a washing processes.

### The volume of hydrotechnical anti-erosion measures.

N	Types of measures	Unit of measure	Total volume of work	In this number in the first place
1	Bank-fixing work	thousand km	5.1	1.0
2	Build of cel-reservoirs	piece	301	141
3	Other anti-cel measures	mln.rubl. (price of 1980)	63	33
4	Reconstruction of irrigation network	thousand km.	2.6	1.4
5	Build of hydrotechnical anti-	thousand	7.5	5

	erosion constructions	piece		
6	Measures on struggle with ravinias and karst phenomenas	thousand ha	13.4	6.4

#### **4.1.2. Establishment of water-guard zones and bank-protection bands.**

With the purpose of protection of water resources from pollution, safe passing of high-flood along rivers, says, channels and collectors, reservoirs are created water-guard zones, to which gives the status of specially covered natural territories. The width of water-guard zones in dependences from size of channels is ranged from 50 to 500 m. In structures of water-guard zones are allocated the bank bands, contiguous directly to water border. The lands of water-guard zones (except for bank bands) are not withdrawn at natural users, but on them the specific regime of economic activity, more strict in bank bands is established.

In water-guard zones is prohibited:

- the accomodation of objects, being sources of pollution of environment, and being present objects are subject to conclusion from zone;
- the application and buring of any kinds of chemical weed-killers, entering of fertilizers on snow cover, use of unrender harmless manure-content etc. drainage waters;
- normless cattle pasture;
- cutting of arboreal-shrubs plantation (except for sanitarian cutting and cutting of maintenance).

#### **4.1.3. Measure on water-saving.**

Despite on deficit of water resources in Republics, they are used not effectively. About 40% of water is lost at irrigation, (where is used about 85% of all water resources).

In these conditions the measure on water-saving play the important significance and have the priority nature.

Radically to solve the problem of water-saving at irrigatiob it is possible by complex reconstruction of irrigation systems and introductions of modern watering methods, that are required a significant investment and long time. However, simultaneously with it, rather expediently to execute a measure of institutional character, promoting to increase of efficiency of water resources use.

To it relate:

- the perfection of limited water-using systems (in the first place a decreasing of settlement specific norms of water-using);
- the development and realization of economic gears on gradual transition to paid water-using at irrigation;
- the perfection of organization of state control for water resource use.

### **4.2. Observing system and control on conditions of environment.**

#### **4.2.1. Modern methods of monitoring and scientific researches in problems of desertification and droughts.**

The strategic purpose of state politics is providing and supporting an environment on a favourable level on basis of economical development. For achievement of it is necessary an improvement of system complex management of natural resources. The system of ecological monitoring is necessary for effective management.

The main task of desertification monitoring is the valuation of ecological conditions of natural system and lands, staying in economical use, including a processes, which coming to land degradation and economic damage.

Conceptual base of desertification monitoring is presented in following kind:

- the system of target supervision on valuations of lands degradation
- at revealing of factors of effect and kinds of desertification is taken into account their summary effect and is evaluated the integrated parameter of degree of desertification
- the economy is considered as the factor, affecting dynamics of ecological condition of ecosystem, their stable development, destructions and rehabilitation
- the complex of tasks on decisions of particular problems of desertification is defined of them actuality on local level and is systemforming element of ecomonitorings.

A base element of monitoring is the **geographical information system (GIS)**, uniting the electronic cards base, the program maintenance and models of cartographical processing serves. Including:

- supervision for weather (drought, froozes, extreme hydrotermic conditions), realized hydrometeorologic service;
- supervision for condition of ground resources: soil covered, vegetation, animal world and ecosystem of different level;
- considering the agricultural lands (arable, pasture, haymakings), area of wood fund, industry, including of development of bowels and military-industrial complex, area of security zones and natural reservers, national parks, natural-recreation parts.

The lands monitoring includes the supervision and valuation of land conditions, including a soil and vegetation. It is recommended the increasing of target supervision on degradation of environment, valuations on revealing of desertifications centers, on control of observance of ecological norms of nature-using on bases of ecological distribute of regions and periodical cartographical analysis.

The lands monitoring is provided by systematic execution of air- and space photogeodezic, cartographical, soil, geobotanical and other explorations.

The monitoring of vegetation natural fodder lands is carried out on the basis of geobotanical explorations date. Are thus conducted supervision and check of change of condition fodder lands by comparison with previous supervision.

The territorial network of ecological stationary items of monitoring is in the first place necessary in regionax with menancing ecological conditions, for example in Aral zone.

The Convention of UN on struggle with desertification said, that part of the National programs of actions is "strengthening and creation of information system,evaluable, observation notification in regions, subject to desertification and driught in view of climatic, neteorologic, hydrologic, ecological and other factors".

By this, tasks, decision with National Gidrometservices and, in particular, Glavgidromet of Republic of Uzbekistan, his research organizations, given the

definite priority. Its presented as natural: Glavgidromet of Republic of Uzbekistan has a supervision network, carrying out of monitoring of meteorologic, agrometeorologic, hydrologic, ecological factors.

The results of supervision analisys, are generalized in research departments of Central Asian Research Hydrometeorologic Institute (SANIGMI) of Glavgidromet.

From researches, connected with tasks of struggle with desertification and drought, it is necessary to note, that the research of change and variability of climate and connected with these changes agroclimatic and water resources, development of recomendation on optimum use of resources.

These researches take the large place in works of SANIGMI, especially such major task, as the notification about drought.

The drought in Uzbekistan display in several aspects. **The threat of drought** - when far below rates of the accumulation of precipitation in winter-grade period (X-I, X-II, X-III). Conducts to lowered flow of rivers in period of vegetation (IV-IX), as water resources of Uzbekistan on 80% determined by winter-grade stocks of snow in mountains.

The drought displayed in high temperature of air at a small quantity of precipitation in April-May. These conditions conduct to considerable reduction of harvest of sereal crops, growing on bogara, to reduction of fodder pastures.

The drought - it very high (more, then 39°C) air temperature in July, in period of flowering and forming of fruits of cotton.

The most dificult task - prognosis of temperature and precipitation. In SANIGMI work outed the considarate methods for prognosis (average month temperature and month and decade sums of precipitation) with period - week, month and to five months early. By temperature of air such methods of prognosis is present on whole year, and on precipitation only on Octoner - May. Justifiety on temperature of 70-75%, on precipitation - 63-65%.

Worked out the methods of prognosis of air temperature and precipitation on bi-monthly periods, that succesfully, though over climatic prognosis, but does not reach to the desired accuracy. Unfortunately, such the situation with justifiety of long-term prognosises for air temperature and precipitation, and in world practice for continental regions.

Therefore not only for us, but also for World Meteorological Organization work out of prognosis methods for temperature and precipitation on months or season - task is number one on prospect.

The second important direction for prognosis of drought - long-term prognosis of river flow on vegetation period (IV-IX) and on each month.

The base of methods are the mathematical models of forming of flow of mountain rivers, work outed in SANIGMI under supervisors professor Y.M.Denisov. These models remain till now the best in world.

Models realized in kind of Automatical Information System for Hydrological Prognosis, in framework of which considered the prognosis on majority of Uzbekistans' river.

One more from tasks - to evaluate the probable reduction of harvest of sereal crops at the high temperature in IV - V. Such methods also work outed and are improved. These methods construct on use of data of surface network of non-rest monitoring not only for uzbekistan, Central Asian region, but also global scale.

Besides of the standard system supervision for meteorologic, hydrologic phenomena work out and already work out the remote methods of monitoring for different phenomenas and processes of desertification.

Organized in 60'th the aeroplane photometry of desert and semidesert pastures has allowed not only to evaluate the current food-stocks, but also collect the unique natherial on dynamics of pasture, on growth of desertification areas.

In last years **the sputnik information** came on shift to aeroplane probing, that open a new horizons of monitoring of desertification: determining of the beat pasture (toloks), tracking for growth of salt-marshes, for stocks of water in lakes of Amudarya delta, for growth of dried areas of Aral sea bottom, for them overgrowing.

This sputnik information considerably helps in prognosis of flow. The tracking for dynamics(changes) of snowy areas in river basins in winter-grade - spring periods and hight of seasonal snow border, together with data from meteostations and with help of mathematical models of forming of snow covered allows more precisely determine the snow-stocks in mountain on large number of basins and to give a more exact done in good time notices about expected the low river water.

It is necessary to improve the works on creation of supervision network for dry atmospheric drop outs (their quantitative and qualitative structure), the research of salt transfer in Aral zone and subject areas to dust storms - Bukhara district. Here intend to receive a new results with using of digital sputnik information.

**Space and aerovisual methods of supervision** of desertification processes take the specific place in system of monitoring. Such supervision are begun and conducted in Glavgidromet of Republic of Uzbekistan. The moment of reception of necessary information, width of scope (vision) and cartographical accuracy increases the reliability of received data, including quantitative - on count of desertification areas.

On the basis of interpretation of the space information in centres of reception and processing the system of supervision can be specified and is the analysis of condition of territories, subject to desertification is given.

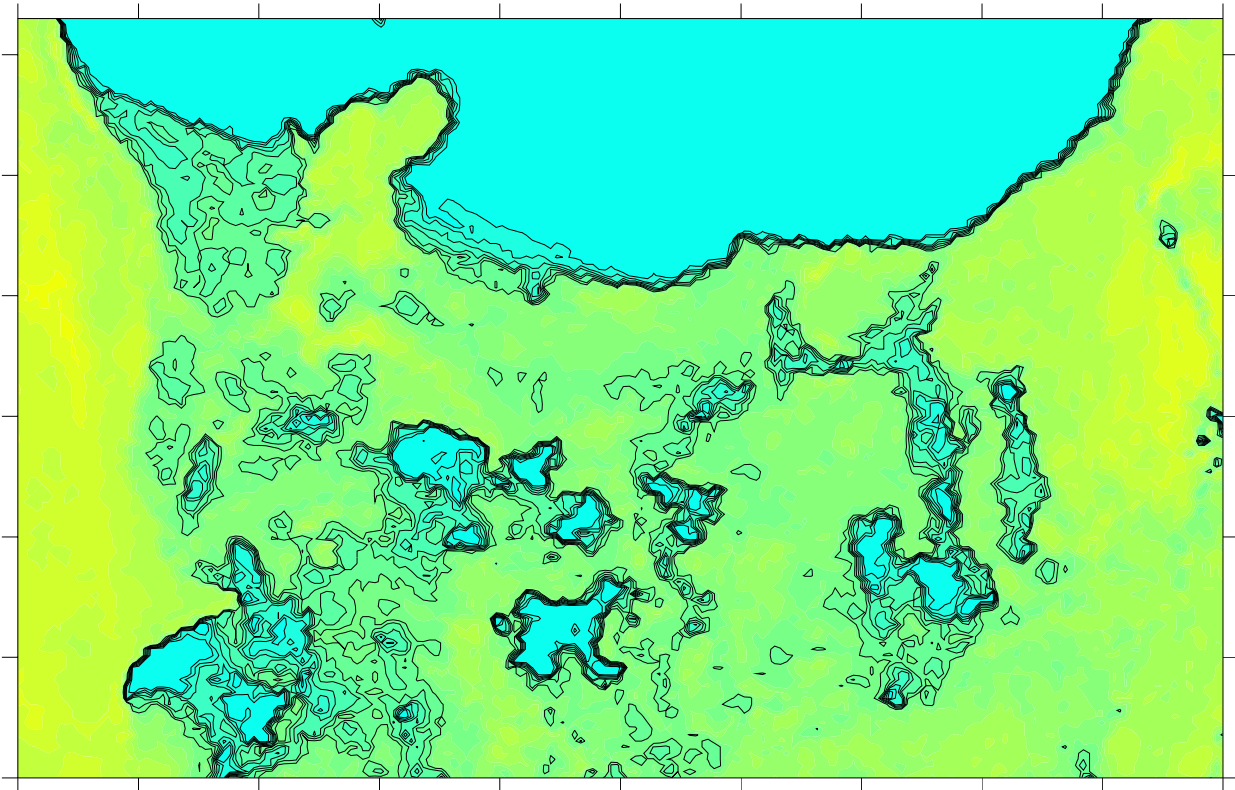
The methods of valuation of optical and thermal heterogeneities of stretching surface with account of space-temporary variability of fields of bright and thermal fields in definite intervals of spectrum allow to reveal the anthropogenic influence on occurrence these heterogeneities of surface at desertification of the pasture, soil degradation, cut down of woods, change of the soil humidity and etc.

It is recommended to use the developed in Glavgidromet **the technologic processing of surface aerospacephotos**, which allow to trace in dynamics the traces of wind activity - wood thicks, fields of eoll forms, deflation depression and furrow, and also to study the modern eoll process.

To evaluate the condition of fodder fields, to supervise the use of resources of water surface.

But interpretation requires the organization of ground methods of decoding, which it is recommended to conduct in conditions of monitoring stations. Is offered to develop the method of standarding for valuation of phenomena of desertification. Under reference space display meant the display, which with a sufficient completeness and reliability on characteristic attributes permits to reveal this or that features of structure of object and it degradation.

**The sputnik display of south part of Aral sea and Aral zone.  
The dark background allocates the water objects,  
the part from which temporar onesy.  
(NOAA-14, on June 3, 1996).**



The main measures for organization of ecological monitoring of objects a most subject to desertification is:

- improvement of prognozic system for runoff of central Asian region, as first measure for prognosisof drought, especially at water resource deficit;
- development supervision system with use of sputnik infirmation to pasture vegetation conditions on deserts' territories;
- monitoring for Aral sea and Aral zone conditions in part of dynamics of reservoirs in Amudarya rivers' delta;
- development system of supervision stantion and point in Aral sea basin;
- include in system of supervision parameters, characterized a desertification territories;
- development of new methodologies, allowing to identify a soil degradation processes with using of distance methods of explore;
- use of technology of geographic information system at desertification mapping;
- development of research methods, based on use of mathematics at analyses of desertification processes on mapping basis.

#### **4. 2.2. The perfection of state control of environmental condition and land-water resources use.**

The states' control for environmental condition and land-water resources use plays the important significance in struggle with desertification.

The structure perfection of environmental protection management and land-water resources uses assumes: the branch of state control functions from natural resource operation functions, if these both contradicting functions are concentrated in one management body, as it is made in Republic of Uzbekistan.

The extraordinary gravity of such natural resource, as the ground, in Republic of Uzbekistan the system of land tenure service with inspection on land use control is allocated from Minselvodkhoz structure, and on its base is created the State Committee of Republic of Uzbekistan on ground resources, subordinating directly to Cabinet of Ministers.

Expediently the similar measures to accept and in area of water management. For it is necessary:

- the sharp differentiation of responsibility between various governmental institutes of nature-using and strengthening of role of local authority and public;
- the further development and deep of delegation of administrative functions on environment protection and natural resources use from centres on location, however decentralization of management on regional level is present not the transmission of authorities, first of all, it legislatively the established rights and duties of local bodies on maintenance of economic stability at steady socio-economic developments of region;
- more the wide use of basin approach principle (creation a basin inspections and etc.) with the purposes of increase of efficiency of protection and rational water resources use (including and transborders water resources);
- for increase of state control productivity, development of law-enforcement activity, chosen it in separate area of law reconciliation, to advance the system of special ecological procurator's office and divisions of ecological militia;
- the attraction of public to discussion, acceptance of decisions and realization of ecological measures, especially on local level;
- the perfection of personnel potential of natural protection bodies.

With the purpose of control strengthening of completion of ecological requirements and standards is necessary the development of pack of legislative documents, regulating and providing the effective functioning mechanism of ecological examination, valuation of effect on environment and ecological audit.

#### **4.3. Scientific researches on desertification problems.**

At present time in Republic of Uzbekistan pays the specific attention to development of scientific - practical achievement in fields of struggle with desertification and soft of influence of drought. As example was possible to be put the projects and programs, finance from State Committee on science and technics of Republic of Uzbekistan on problems of deserts on 1997 - 1999.

The purpose of National program of actions is support to research activity, which promote to increase of knowledges about desertification processes and drought, role of



natural and anthropogenic factors. The priority investigation fields must be developing for special regions.

**The priority state technological programs.** The development of agro- and engineering-meliorative receptions of soil desalting by optimization of parameters of meliorative system, selection of agricultural cultures, technology of cultivate of phytomeliorants, use of the mineralization water. (Soil desalting in Sirdarya, Amudarya, Surkhandarya, Fergana districts and South Karakalpakya).

To execute of ecologic-agrochemistry division into districts of cotton cultivate zone on migration and accumulation of agrochemicals, heavy metals, radio-active elements; to study the deflation and erosion processes and to develop the effective methods of their preventions, restoration, increase of fertility of irrigated lands and recultivation of sand.

To develop the methods of wood-meliorative development of open bottom of Aral sea, mountain-wood zone and technology of plantation growing of the wood kind for creation of local base of business wood.

**State technological programs.** The development of ecologic-economic models and methods of rational use of water resources in regions of the South Aral zone.

The development of mathematical models and methods of acceptance of decisions in ecosystem of Aral sea and Aral zone.

The regional problems of ecology and development of reasonable natural-guard measures on improvements of ecological conditions in South Aral zone and deltas of Amudarya river.

The development of water-saving ways and technologies of irrigation, accumulation and preservation of moisture and rational its use. (creation of aquasystem of deserts).

The preservation of biodiversity of vegetation world and protection of natural ecosystems (phytomelioration of dried bottom of Aral sea).

Methods of clearing and ways of salvaging of polluted river, drain and returnable water with applications of new local composition materials.

To develop the methods of wood-meliorative development of open bottom of Aral sea and formation of new pasture-protection wood bands in desert.

To develop the system of ecological balanced pasture-using in astrakhan-breeding, ensuring the stably high fodder productivity of arid pasture.

To develop the way of regulation of agrophysical properties and increases of the fertility of irrigated lands in conditions of anthropogenic desertification.

Erosion-deflation-dangerous irrigated lands of desert zone of Uzbekistan, way of prevention of erosion and restoration of fertility of deflition soils.

The anthropogenic pollution and biological activity of soils in irrigated zone of Uzbekistan.

**Program of fundamental scientific researches.** The development of theoretical bases of creation of new kinds unary and complex mineral and organic-mineral fertilizers with accounts of soil-climatic conditions of Central Asia. The law of process of chemical enrichment of Kizilkum phosphorites with solutions of sulphuric and phosphoric acids will be investigated the complex fertilizers, effective on salty soils will be offered.

The nature of osmotic and toxic action of soil salinity on precocious and efficiency of plants and application of antistresses factors. The new method of increase of salt-steadiness of various plants will be offered to agriculture.

The zone features of formation of soil of natural and anthropogenic landscapes of Lower Amudarya and their classifications. 20 year materials on desert zone will be integrated. Classification of soil, feature of soil of desert zones, them cultivated and desertification will be developed the system.

The study of influence of cultivating of drought-steadeness forms of cotton on water-physical properties of alluvial-meadow-irrigated lands, including the rightside part of Amudarya delta. The recommendation on prevention of negative anthropogenic effects on soil structures and on prevention of secondary salinity of irrigated lands will be developed.

The adaptive strategy of main bioforms of plants of arid zone. The summary characteristics main bioforms of South-West of Kizilkum and dried bottom of Aral zone will be carried out.

The study of anthropogenic transformation of desert vegetation and modern condition of rare communities of relicts plants of mountainous zone.

Introduction of wood and grass plants in connection with change of ecology on south of Aral zone. The kinds and forms of saltstreadeness and drought-streadeness plants will be revealed new for Karakalpakstan.

Parasitologic monitoring of reservoirs in South Aral zone for valuation and forecasting of ecological situation. Recommendation on preventive maintenance and struggle with main diseases of fish.

The theoretical bases of economic uses of population of animal (mammals) and preservation their biodiversity. The mechanism of regulation of number and specific of adaptable reaction of animal to actions of eco- and endogennic factors of environment.

Population ecology of rare and losen kinds of fish in Aral-Amudarya region and development of strategy on preservation and rational use of them biodiversity. Biodiversity of ecosystem of South Aral zone in conditions of desertification.

The biochemical adaptation of plants to some factors of environment (including to salinity and drought) and its practical use.

The development of modern theoretical bases of evaporation of moisture from heterogeneous environments with the purpose of definition of optimum conditions of irrigation of agricultural cultures in arid zone, drying of damp materials and active effect on clouds.

### **The main directions of researches on problems of drought and desertification**

№	The main factors	The leading scientific and educational establishments on given problems	The educational establishments, preparing the experts for given structure
1	Degradation of vegetation covered	The institute of botany of Academy of Sciences of RU (IBAS), SANIGMI Glavgidromet of RU, The Karakalpak Institute of Natural Sciences (KKINS) AS, Tashkent State Agrarian University (TSAU), Tashkent State University (TSU), Samarkand State University (SSU), Fergana State University (FSU),	TashGU, faculty of soil biology SamGU, biological faculty Termez State University

		Uzbek Agricultural Academy (UzAA), The Karakalpak forest experimental station (KKFES), Uzbek scientific research institute of forest economy (UzSRIFE)	
2	Wind erosion	Institute of soil and agrochemistry of Academy of Sciences (AS) of Republic of Uzbekistan (RU) (ISA AS), CANIGMI Glavgidromet of RU, TSU, Scientific Production Associate (SPA) SANIIRI of Minvodkhoz, Uzbek scientific research institute of cotton by Academy Agricultural Sciences (UzSRIC AAS)	TSU, dep. "Soil" TSU, biological soil faculty, dep. "Ecology"
3	Water erosion	Institute of Water Problems of AS (IWP), CANIGMI of Glavgidromet of RU, SPA SANIIRI, OGIS AS, KKINS TSU	TSU, faculty biology of soils
4	Soil salinity	SANIGMI of Glavgidromet of RU, UzSRIC, FSU, Karakalpak Scientific Research Institute of grain	FSU dep."Soil, agrochemistry and physical geography" TSU dep."Soil"
5	Dehumification and decrease of fertility	UzAAS, IWP AS, Institute of Microbiology of AS (IMB AS), IBE KKO AS, FSU, Karakalpak State University (KSU), CANIGMI of Glavgidromet of RU, Scientific Research Institute of genetics and experimental biology of plants AS (SRIGEBP AS)	
6	Breach of the water-physical properties of soil	TSU, TSAU, UzSRIC, CANIGMI of Glavgidromet of RU, SPA "Biologist", KKSU, UzAA, KKINS AS, Uzbek Scientific Research Institute of vegetation-melon crops and potatoes (UzSRIVMCP)	TSU, FSU, TSAU
7	Accumulation the toxic combination in soil	TSU, OGIS AS, ISA AS, The management of monitoring for pollution of environment of Glavgidromet of RU, SANIGMI of Glavgidromet of RU, Institute of neorganic chemistry AS (INCh AS), Institute of Nuclear Physics AS (INPh AS), SPA SANIIRI	TSU
8	Influence of the animals on soil degradation	IB AS, UzSRIK, KSRIRP SO AS, IBE KKO AS, KKSU, KKINS AS, Karakalpak Institute of stock-breeding (KKISB), UzAA, Institute of zoology AS (IZ AS), Institute of virusology AS (IV AS)	TSU
9	Influence of	IBE AS, KSRIRP SO AS, TSAU,	Post graduate on

	the antropogenic factor	Tashkent State Technical University (TSTU), SANIGMI of Glavgidromet of RU, The management of monitoring for pollution of environment of Glavgidromet of RU, "Uzbekidrogeologiya", Scientific Center of space nature keeping of management of geodezy and kartography at the Cabinet of Mynistry (SCSNK MGK), The management of network and treatment of information of Glavidromet fo RU, TSU, SSU, SPA SANIIRI, SIPTI "Atmosphere", IZ AS, IB AS, KKSU, Fergana polytechnical institute (FerPI)	ecology: a) IBE KKO AS b) Termez State University (TerSU) c) TSAU d) INCh AS
10	Prognosis of drought	SANIGMI of Glavgidromet of RU,	
11	Influence of the climatic changes	SANIGMI of Glavgidromet of RU, Urgench State University (UrgSU)	
12	Using of wind and water power	Institute of energetics and authomatics AS, FSU, FerPI, TSU, SSU, TSTU, SANIGMI of Glavgidromet of RU, SPP "Gidrometpribor", INPh AS, Physical Technical Institute AS (PhTI AS), Scientific Research Institute of applied physics (SRI Aph AS)	

The desertification is complicated process of ecosystem degradation, connect with decreased of them biological productivity, and caused with natural-anthropogenic processes. Therefore a study of different desertification factors included in field of interes of biological, geographical and agricultural science: geobotany, soil science, landscape ecology, physical geography, climatology, agtriculture, cattle-brings, forestry etc.

While more the insufficient attention to desertification problems is paid the economy, geodemography, sociology, engineering ecology. The development of effective measures on struggles with desertification offers the wide participation of representatives of physical-mathematical, chemical, geological, technical sciences, task of which is as the ecological simulation, system analysis and forecast of desertification processes, as development of particular methods and receptions of struggle with desertification.

In majority of listed educational and research centres are present aspiranturas and doctoranturas, where the staff of higher scientific qualifications - candidate and doctor of sciences on arid theme and problems of desertification in Republic are prepared.

The success of struggle with desertification in many depends from **the propagation of measures on struggles with desertification**. This direction necessary the teleological plan of actions. It includes the following measures:

- the wide attraction of local population to development and realization of local and regional programs of actions by means of consultations, assistance to economic formation etc.;

- the wide attraction of local public to problems, connected with realization of projects of extended use of natural resources, construction of industrial enterprises and transport mains in regions with increased risk of desertification;
- the wide attraction of representatives of local public to ecological examination of projects, connected with transformations of nature;
- the execution of sociological interrogations among population on questions, relating to anthropogenic effect on nature in regions of increased ecological crisis;
- the preparation of technical and financial projects and programs, including of proposals on support of these programs from the part of foreign investors;
- the realization of regular data acquisition on control by ecological condition and tendencies of environmental change in regions of residing;
- the establishment of prime measures on rationalization of local nature-using and allocation of objects of nature protection;
- the decision of local legal differences on penal sanctions pursuant to acting laws on environmental protection;

In frameworks of National program of actions on struggles with desertification it is provided:

- the creation of National Centre on struggle with desertification at Glavgidromet of Republic of Uzbekistan;
- the edition of scientific articles on problems of struggle with desertification;
- the issue of colourful posters, booklets, propaganding the advanced experience of struggle with desertification.

#### **4.4. Role of interregional and international cooperation in struggle with desertification and drought.**

As one of important elements of struggle with desertification and drought the development of national plan of actions is.

The climatic zones, in which the most probably the occurrence of the desertification and drought are located, not on is strict of limited territory of any of country, and, as a rule cover the territories of adjacent countries.

**The participation of Uzbekistan in Convention** is opens to it the opportunity on

- realization of cooperation on bilateral and multilateral base with countries by participants in areas of struggle with desertification and softing of consequences of drought through appropriate national, subregional and international establishments;
- on maintenance of participation of representatives of Republic of Uzbekistan in work of Conference of Parties of Convention, seminars and symposiums on problems of desertification and drought;
- on interaction when due hereunder with Secretary of Convention of UN on struggle with desertification and drought, representations UN, RUN, World Bank, UNEP, UNESCO, other international and regional organizations and programs on struggles with desertification and drought.

The interregional and international cooperation includes:

- the duly preparation and direction, when due hereunder, reports and other necessary information in Secretary of Convention;
- give of proposals on changes, addition acting or acceptance of new acts of Republic of Uzbekistan;

- the distribution and propagation in republic of international and national experience on struggle with desertification and drought;
- the cooperation and exchange by information with similar national commissions of other states - members of Convention;
- the preparation of national staff.

**Interborder nature of desertification effect**, availability of international river ponds, necessity of association of material resources, financial, intelligent and predetermines the necessity of creation of regional and interregional plans of actions.

The Republic of Uzbekistan is located in centre of the Central Asian region, borders with Kazakhstan, Turkmenistan, Tadjikistan, Kirgizya - region, where large part of which is taken the by territories, subject to desertification.

Country of Central Asian region have accepted the active participation in preparation of Convention of UN on struggle with desertification, in series from them are prepared, and in other - have commenced the preparation of National Plans of Actions.

The successful decision of problems of desertification, and it obviously, can be achieved at joint association of efforts.

In Alma-Ata in 1995 on conference of CIS countries was stated the opinion about necessity of preparation of Interregional Program of Actions, the purpose of which - decision of problems of desertification, preventions and reductions of consequences of the drought on the basis of association of efforts and joint actions of countries was stated.

As a result its realization should be created the network of regional and national centres on struggles with desertification.

The interregional program of actions can include particular agreed joint programs and projects on struggles with desertification and drought, on use of interborder natural resources, on decision of social and economic problems, and should be directed on maintenance of steady development of dry, arid and subject to drought regions of participating countries.

#### **4.5. Role of governmental agencies and State institutes.**

In National program of actions stipulates the appropriate roles of government, local communities, makhalya, land users and determining having and necessary resources.

In view of the opportunities it is necessary complexly to conduct and to coordinate the collection and analysis short-term and long-term dates and exchange their for providing of systematical observations on lands degradation in victim regions and for more deep understanding and analysis of processes of drought and desertification and liquidate their consequences. This provide the early notice about periods of unfavorable climatic changes and the done in good time planing of measures on this periods in form, convenient for practical using on all levels.

In Convention allocates the following specific conditions of Asian region, which relate to Republic of Uzbekistan:

- the large part of territory of countries has on regions, subject to desertification or drought or stayed under their threat;
- the intensive operation of natural resources;
- existence of unstable systems of production;

- the dependence from conjuncture of world economy, acuteness of social problems, such as, insufficient condition of health and nutrition of population, absence of food safety, migration and demographic growth;
- the requirement in international cooperation for are under their threats achievement of purposes of steady development, connected by struggle with desertification and softening of consequences of drought.

Directly for development and realization of national program of actions the following measures, are scheduled, the part from which now in processes of realization:

- for of completion of Convention on struggle with desertification and drought in Republic of Uzbekistan is prepared the project of Decree of Ministry Study on creation of National Commission on struggle with desertification;
- will be elaborate a realize mechanism for national program of action on struggle with desertification join with represents from Ministries, Departments, organization, means of mass information;
- is attracted the affected population to development, coordination and realization of program, the consultations and cooperation with local bodies of authority, national and non-governmental organizations;
- conducted the analysis of condition of environment with the purpose of valuation of reasons and consequences of desertification and determination the prime districts;
- developed are executed technical and financial programs.

**Except for it is necessary:**

- to promote the complex use of water-collection ponds, preservation of ground resources, effective use of water resources
- to strengthen the network of information, valuations of supervision and early notification about climatic, meteorological, hydrological, biological and other desertification factors
- at execution of international cooperation, including rendering of financial and technical help, to develop spirit of partnership in support for carrying out their programs of actions.

For achievement of purposes the long-term complex strategy for affected regions is necessary. It simultaneously directed on increase of the land productivity, restoration, preservation and increase of rational using of land and water resources in purposes for increasing of standard of living, especially on community and makhalya level.

The Government of Republic of Uzbekistan consider and ratify a National strategy and program of actiona on struggle with desertification. Only together with all Ministry and Department at a support of Goverment of Republic of Uzbekistan can solve this problem.

For realization a National program of actions on struggle with desertification on state level is necessary:

- setting of corresponding structure, for prepaire, coordination and realization of program;
- for conduct negotiations on subregional and international level;

- conduct of analyses of environmental conditions in victim regions, evaluate of reasons and development of recommendation for soft consequences and increase of land productivity;
- organization of National center on struggle with desertification;
- a choose of priority on liquidation of desertification consequences;
- organization of monitoring system for desertification processes;
- mobilization of financial and people resources for struggle with desertification.

#### **4.6. Local bodies of management**

By main tasks of local bodies of management in realization of Convention UN on struggle with desertification and realization NPA on struggle with desertification and drought should become:

- the increase of information of local population about processes of degradation and desertification, purposes and rules of Convention and tasks of National Program of Actions on struggle with desertification
- collection of dates about processes of desertification
- the participation in realization of new technological projects on restorations of efficiency of land
- the maintenance of maximal participation of local population
- the acceptance of measures on improvements of economic conditions with purposes exterminate of poverty and steady development on local level
- the introduction of projects on alternate sources of power and means to existence

#### **4.7. Non-governmental organization**

The convention of UN on struggle with desertification gives the large significance to participation of non-governmental organizations (NGO) in realizing of the basic her thesis on local level.

The growth of the public activity is characterized by occurrence in Uzbekistan the ecological NGO, though their numbers in comparison with neighbor states of Central Asia relatively not much. The first ecological organization appeared in Uzbekistan in 80th (club "Eremurus" - 1982, union "Ecolog" - 1987, "Union of Protect of Aral and Amudarya" - 1988).

Territorially the majority from them are concentrated in two regions: Tashkent and Tashkent district (Association "Ecolog" and associated with them the organization, for example the school ecoclub "Eremurus", the association of school ecological clubs of Tashkent, the association "Chirchikdarya") and Nukus (Karakalpakstan): "Union of protect of Aral and Amudarya", "Center of Farmer", Center "Perzent", "Wild nature of Aral zone" and other. Known the organization in Fergana valley ("Association for ecological clean Fergana") and in Samarkand district (school club "Green wave").

At present time created the Association of NGO of Aral sea basin, focused self activity on problems of the saving and restoring of Aral and it flows.

The scientific ecological organizations presents on national level to Uzbek Zoological society, Geographic society, Botanical society. Besides in republic work the International Institute of Biodiversity of central Asia (Biostan) and Kazakh-central asian zoological society.



These organizations execute the activity in area of ecological formation and education, preservations of biodiversity, informative changes, rarely - ecological lobby, public health and scientific researches. Its hasn't the clear organization structure, with weak material-technical base, without official registration. From operation network the range of NGO have e-nail, rarely - fax. The total members of NGO in Uzbekistan about 700.

Followed also are to mentioned, created on disposal of the Government of Republic of Uzbekistan, the International Fund "Ecosan", occupying with problems of sanitation and public health, and "Fund of protection of Aral", the activity of which connected with collection of means and conducted of propaganda shares.

One more category of organizations, about which follows to mention in context of given plan of actions - the mahkalya committees, corresponding to term CBO (Community Based Organizations) in west literature, is "local organization", Organization of local communities".

Outside of any doubt the NGO, including Fund "Makhallya", created by disposal of Government, must to play the active role in involved of the mahkalya organizations and other bodies of local management in action on application of Convention in Republic of Uzbekistan.

On meeting in Uagadugu in 1994 was created RIOD - the international network of NGO on coordination of actions on struggle with desertification. In present RIOD unite the NGO from 100 countries of world, present the all part of world. The structure of RIOD consist from coordinating structure of a few levels, from global to local (in some cases - subnational). Pick outed a few regions - continents, in this number is Asia, which divided on a few subregions, one from which from January 1996 considered the Central Asia.

The representatives of NGO of Uzbekistan to invitation of various structures of UN accepted the active participation in work of several international meetings, in this number INCD-10, 1st Conference of sides and other, that being a definite evidence of authority of Uzbekistan NGO in international community.

Is important to be noted, that in Uzbekistan in difference from adjacent countries develop a good partner relations between government structures, representatives to carry out the work on struggle with desertification, and NGO - as on international meetings, so inside of country.

By one more considerable moment is that exist is enough good the adjusted communications of NGO of Uzbekistan, is involved in this activity, with organizations of adjacent countries - as in border of central Asia, so in Asia on the whole, and with other regions of world.

By main directions of activity NGO for realization of Convention and realization NPA in Uzbekistan should become:

- the participation in development of National and local programs of actions on struggle with desertification
- the distribution of information about processes of desertification among the local population
- the realization of communication between governmental agencies, NGO and local bodies of management
- the establishment of interrelation with NGO of different countries of Asia
- development of organizational structure of National network NGO.

#### **4.8. Legislation in area of struggle with desertification and protection of nature.**

The proclamation by Uzbekistan the independence and its integration in world community has become the powerful stimulus for development of countries in all fields, including the protection of environment. The social and economical policy of state based on aspiration to harmonize the industry and environment on stimulate of realizing the serious of ecological problems, staying a front a country.

The bright evidence of realization of this policy was had become by that fact, that Uzbekistan the first from Asian states ratified the Convention of UN on struggle with desertification. In this time having the considerable quantity of different legislative and other statements, connected with saving of environment on the whole, or with different aspects of this activity.

The legislative base is constant improved and expanded, that permits to support on level of requirements, ensuring executions of economic reform in Uzbekistan.

In base of base of legal regulation of ecological relations are prescribed proclaimed by Constitution of Uzbekistan rights and duties of citizens, purposes of state in part of protection of environment and forms of property on natural resources.

This legal regulation, pursuant to Constitution, includes:

- The laws, accepted with Oliy Madjlis of Republic of Uzbekistan
- The Decrees of President of Republic of Uzbekistan, valid of Law, as well as other normative and legal certificates of President
- normative-legal certificates of Government of Republic of Uzbekistan
- the international and other obligations of Republic of Uzbekistan
- the departmental and other normative-legal certificates.

The perfection of legislative system in field of preservation of environment and struggle with desertification relates to number of priority tasks. Follows to note, that the legal base of the economic reform as a whole answers to necessary requirements and promotes to successful execution of reform in Uzbekistan and provides the steady development on prospect.

The national legislation and normative-legal certificates of various levels should interaction with rules, possessing the compulsory legal force, bilateral and multilateral international documents in field of environment. For successful and duly completion of obligations of Republic in addition to remedial and administrative procedures to develop and to execute other, carefully the fulfilled measures. These measures was necessary to be prepared, as a rule, with that, whom they directly touch (population, representatives business and industrial circles, regional or local bodies of authority).

The active participation the independent Uzbekistan in major international ecological conventions and in nature of protection activity of international governmental and nongovernmental organizations in many is defined by theme, as the rule of these conventions and agreement are taken into account in national legislate and Normative-legal (sublaw) certificates.

## THE CONCLUSION

The development of technological progress and productive forces increases the scales of human impact on nature. Alongside with positive side of this factor intensify the negative consequences. The light example of this is wide development of desertification processes in arid zone of Uzbekistan, resulting to sharp decrease of potential productivity of agroecosystem and geosystem.

The development of desertification is stipulated by features of territorial natural conditions and nature of natural resource use. The largest territory of plain part of Uzbekistan presented with sandy deserts, which subject to desertification because of weak steadiness of ecosystems. The plateau Usturt, Lower Amudarya (deflation, ecosystem degradation), delta and terraces river plain (water erosion, deflation) lake too. The complete structure-dynamic condition of geosystem, the intensive development of desertification. The desertification is stipulated with one, or two and more factors and reasons. However, in some arid regions (Lower Amudarya, Kizilkum, Usturt etc.) the desertification intensify in result of factor complex, stipulated with development of different branch of economy on basis of irrational nature-using. The exposure of desertification reasons in spaces - is basis of effective struggle with it.

For authentic valuation of modern condition and tendencies of development of desertification was necessary to be had exact cartographic materials, reflecting the area of desertification distribution, quantitative characteristic of change of ecosystems efficiency, information about inclined of geosystems to degradation. At valuation of desertification development necessary to basis on reliable information about types, factors and reasons of desertification. They is basis for determination of development desertification condition and its trends.

On basis of analysis of modern desertification condition was possible to be revealed a following its kinds:

- progressing desertification (dried part of bottom of Aral sea, South Aral zone, Usturt etc. );
- regressing desertification (irrigated zone of Golodnaya steppe);
- stabilizing desertification (Khorezm oasis, terraces plains of rivers valley of Chirchik, Akhangaran, Zerafshan etc.)

However, such division is formal, as inside of these groups it is possible to reveal separate geosystems, developing with tendency in connect with different natural-economy conditions. Therefore at planning of measure of struggle with desertification is necessary to use a differential method, into accounting a regional and local territorial conditions.

The diversity of natural conditions and reasons of desertification in Uzbekistan stipulate a variety types of desertification. This is - dehumidification of arable as in steppe zone, as in irrigation zone; water and wind erosion, pasture degradation, salinity of irrigated land, degradation of vegetation and decreasing of forest massifs, dry of lakes and desert river deltas, soil pollution with chemical combinations, radioactive and oil pollution of ecosystems.

Besides, a local increasing of pasture area connected with marine regression and transgressions in Aral zone.

The human impact on nature affects desertification development on concerning to large territories, embrace a quite groups of natural regions and districts. This is require

a development of scientific-valid variants of desertification forecast in arid zone of Republic in perspective in connect with development of national economy branch. The complex forecast of desertification development - basis for practical measures on struggle with it. The reliable forecast, the more effective measures on prevention of development of unfavourable processes.

Is whole one of authentic methods of study of desertification processes on time and in space - cartographical with use of distance explore and Geographical information systems. The cartographics of desertification is necessary because on its solute a different intercommunication tasks, up to projecting of struggle measures with desertification. Desertification maps should be not only reach in contain, but reflect a exact, concrete limits, and must contain a new information about ecosystem conditions, subject to desertification. In this relation more effective a regular complex monitoring on all territory, based on materials of surface and aerospace researches. The cartographics and its constant rebewal on date base from aerospace films deciphering give a possible to quickly solute a tasks on prevention of desertification development.

The desertification problem is many-plans and complicated, its decision connected with numerous factors. This stipulated a use of system analyses method in solution of this problem.

The wide-spread of territory of Uzbekistan, diversity of landscape, the sharp continental climate, the deficit of water resources determine the diversity of natural conditions and types of desertification.

The offered National program of actions on struggles with desertification and softing of influence of drought provides the intercombination of ecological problems with problems of economic and social development of country.

The National program of actions on struggles with desertification can not consideration the all local and regional features of Republic of Uzbekistan. Therefore on its base in each field and region the own strategy of struggle with desertification, in view of local, specific conditions should be produced.

All economic plans of steady development of Republic of Uzbekistan, including the agroindustrial complex, extraction of useful minerals, accommodation of enterprises and populated items and other should take into account the protection of environment from desertification and to promote to improvement of ecological conditions.

The struggle with desertification in Uzbekistan, the problem of ecological safety and protection of environments - nation-wide task. This task can be successfully resolved only at direct and joint participation of state bodies of management, non-governmental organizations and local population.

The struggle with desertification is important for sustainable economic development of Republic, preservation of environment and increasing of living standard of population. Therefore the urgent measures on prevention of follow land degradation, increasing their efficiency by development and realization of practical programs and projects, directed on liquidation of desertification and softing of consequences of this process. Such wide-scale desertification come to not only lose of soil fertility and detriment of vegetation and animals genefund, but negatively impact on economic potential of country, living standard and public health.

The desertification reason in Republic of Uzbekistan are caused by many factors, following from unrational economic human activity:

- the intensive development of natural resources without accounts of balanced parity between their uses and preservation;
- the over-pasture and insufficient irrigation of pasture, development of mining industry;
- the technogenic and chemical pollution of soil and ground water around industrial centers;
- the infringement of natural balance as a result of river flow over-regulation;
- the crisis situation in Aral zone, connected with increasing of sea level.

The offered National program of actions on struggles with desertification provides a harmonic combination of problems on ecology and economics, and including a conceptual tents, which liable to first number realization and located in order of they priority.

- The creation of network of ecological stations.
- The organization of monitoring for desertification processes on base of geoinformation systems.
- The reception of complex geographical information.
- The analysis and valuation of ecological situation on all levels of managing.
- The including of desertification monitoring in uniform state system of ecological monitoring.
- The development of desertification criteria with the purposes of gradation of desertification lands on degradation degree.
- The creation of electronic map of territorial desertification for use its at ecological division into districts.
- The perfection of territorial organization with the purposes of non-admission of land degradation processes, ensuring ecological and economic distribution of agricultural areas on landscape-ecological and normative basis.
- The creation of legislative bases on standardization and normative of landusing. The development of economic gears of sparing natural using regime.
- The surface and radical improvement of degraded pasture-hay-mowing lands.
- The restoration of fertility of arable lands.
- The restoration of vegetation cover on outed from agricultural rotations arables.
- The prevention of wind and water erosion of soil.
- The introduction water-saving technologies of irrigation at cultivation of agricultural crops and pasture irrigation.
- The use of non-traditional sources of energy (wind, solar etc.) and development on this base of local stations of power-saving in regions, victimed from desertification.
- The realization of forest restoration works and forest plantation on state-forest-fund lands and other territories, suitable for forest plantation.
- The fixing of sand with the purposes of protection of pasture, settlement and economic objects.
- The mine technical and biological recultivation of technogenic infringing lands with the purpose of use its in economic or recreation rotation and sanitation-hygienic purpose.
- The melioration of soil with secondary salinity.
- The liquidation of technogenic soil pollution.
- The gardening of cities and settlements with uses of biologically cleared sewage.

- The providing of drinking water-supply in strong desertification and waterless regions.
- The organization of ecological education, formations and increases of public information about desertification problems in Uzbekistan.
- The development of system of protected territories.

The all economic plans of development of Republics, including agroindustrial complex, extraction of useful mineral, accommodation of enterprises, settlements, communication and other must take into account a protection of environment from desertification and improving of ecological condition.

The struggle with desertification in Uzbekistan, anxiety about preservation of natural resources - nation-wide task, which should be successfully soluted only at immediate and activity participation of administrative organization, legislation and acting bodies, non-governmental organization and local population.

THE LIST of PROJECTS  
ENCLOSED TO NATIONAL PROGRAM OF ACTIONS ON STRUGGLES WITH  
DESERTIFICATION AND SOFTING OF DROUGHT INFLUENCE

1. Name of project. **Autonomous solary power-generating system.**
  2. Chief of project. Rashidova G.Sh., director of Agency on transfer of technologies of State Committee on science and engineering of RU.
  3. The purposes and soluble tasks of project. The given project assumes the creation of autonomous solary power-generating system (ASPGS) on one object, that to showed a advantages and peculiarity of thus system to other users. The experience of creation and maintenance of ASPGS allow in future to found a more effective strategy of wide spread of new energetic technology on market basis.
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1. Name of project. **The research and valuation of modern condition, development of measures on preservations of biodiversity and bioresources of Arnasay depression and subject to risk of desertification in nortnen part of Aydarkul lake.**
  2. Chief of project. Ashurmetov O.A., doctor of biological sciences, professor. Institute of Botany of AS RU.
  3. Purposes and soluble tasks of project. The prevention of destruction process and degradation of biodiversity components of surveyed region in increasing desertification conditions.
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1. Name of project. **The system of early forecasting of droughts.**
  2. Chiefs of projects. Borovikova L.N. SANIGMI
  3. Purposes and soluble tasks of project. The purpose of project is the creation of automated information system of long-term forecasting of droughts on basis of standard hydrometeorologic information.
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1. Name of project. **The development of struggle measures with desertification of astrakhan-breeding pastures in Uzbekistan.**
  2. Chief of project. Yusupov S.Yu. Doctor of agricultural sciences, professor, vice-rector on scientific work in SamAI.
  3. Purposes and soluble tasks of project. With the purposes of struggle with desertification and increase of pasture crop it is necessary: to study a modern, real condition of pastures on their zone belonging; semi-desert massivs of pasture; to determine the pasture capacity, their crops with account of botanic structure of fodder vegetation, to determine the desertification reasons of pasture massivs; to develop the measures, directed on prevention of degradation processes.
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1. Name of project. **To develop the plan of actions on organizations of monitoring of desertification, salinity and droughts on example of Bukhara district of Republic of Uzbekistan.**
  2. Chief of project. Tolkacheva G.A.
  3. Purposes and soluble tasks of project: The valuation of actual ecological condition of environment of Bukhara district: atmospheric air, soil, surface and ground waters, biota, agricultural lands, pastures, desert forest, atmospheric fall-outs (dry and moist). The development of expert forecasting valuations of development of desertification processes.

The development of program of monitoring organization of desertification, salinity and drought. The choose and scientific substantiation of natural measures, needing in priority investation.

1. Names of project. **The study of soil cover on dried bottoms of Aral sea and and drawing up of soil map (in border of Uzbekistan).**
2. Chiefs of projects. Turapov I.T., Institute of Soil Science and Agrochemistry of AS
3. Purposes and soluble tasks of project. The main purpose is the product of valuation of modern soil condition in desertification territory of dried bottom of Aral sea, established of regional originality and direcion development of primary soils in connect with sea dry, and suggestions of way for they preservation and using.

1. Names of projects. **The development of technologies of forest-meliorative plantation creations on dried bottoms of Aral seas, agrucultural lands in desert, mountainous zone and plantation growing of business wood in purpose of productivity increase of these territories in aggravation ecological conditions.**
2. Chiefs of projects. Kaymanov A.K. Director of UzSIIF.
3. Purposes and soluble tasks of project. The development of forest-meliorative methods with the purposes of struggles with desertification in Uzbekistan.

1. Names of projects. The reasons and consequences of desertification in South-Western Kizilkum and measure of struggle with them.
2. Chief of project. Nazarov I.K. Bukhara State University. Chief of Department "Geography".
3. Purposes and soluble tasks of project. To development the scientific-justified recommendations in view of local geocological conditions, on struggle with processes and types of desertification in purpose of neutralize and rehabilitation of initial biological and economical potential of desert region.

1. Name of project. **The restoration of desert ecosystem of Kizilkum on the basis of optimization of forest-agrarian ecosystems and formation of ecological basis.**
2. Chief of project. Pushkarenko A.N. TashSU.
3. Purposes and soluble tasks of project. The definition and introduction of complex of practical measures on struggles with desertification in border zone of desert-foothills ecosystem with forming of model territory of sustainable development of Nuratau.

1. Names of projects. **To study the origins of secondary form salinity of irrigated lands in delta of Zerafshan river and to develop the methods of struugle with them at different water-providing of lands.**
2. Chiefs of projects. Tadjiev U., doctor of agricultural science, Bukhara State University, chief of department "Agrochemistry and Soil science
3. Purposes and soluble tasks of project. To develop the complex soil-meliorative methods of account, as well as perfection of quantitive account and monitoring of ecological condition of different forms in salinity irrigated lands.

1. Name of project. **The ecological problems of irrigated land development in Samarkand district.**
2. Chief of project. Alikulov A.I. The candidates of economic sciences, senior lecturers of department "Economic cybernetics", in Samarkand Agricultural Institute



3. Purposes and soluble tasks of project. The theoretical and methodological development of proposals on formations and development of ecological balance production structure of irrigation and creation of economic mechanism of its realization in market economics in arid zone conditions.

1. Name of project. **The art dew - source of additional water in regions with deficit of water resources.**

2. Chief of project. Trofimov G.N., TashSU.

3. Purposes and soluble tasks of project. The reception of definite quantity of water for economic needs and irrigation of small area under agricultural crops (vineyard, kitchen-gardens, melons etc.), through artificial condensation of air steam.

1. Name of project. **The choose and division into districts (planting) of arboreal kind for protection from desertification in Aral zone.**

2. Chief of project. Eshchanov R.A., dean of natural science faculty of Urgench State University named Al-Khorezmi.

3. Purposes and soluble tasks of project: The scales and complexities of problems, connected with desertification, require a choose and division into districts (with planting 1000 pieces) – arboreal kind of acacia (*Rjдинia pseudoacacia*), canadian poplar (*Populus canadensis*), torangilya (*Populus pruiosa*) – in contiguous to desert territory of Khorezm oasis, and planting (on 500 pieces) wood kinds in settlement of district. These measures give a next results: protection from desertification, stoping of continous salinity soils, decrease of ground water level, protection from dust and salt storms, economy of water resources with decreasing of evaporation in irrigation, atmosphere disposal from dioxide carbon and regeneration of atmospheric oxygen, increasing of forest natural resource.

1. Name of project. **The use of reservoirs of deserts in Aral zone for power accumulation of natural cold.**

2. Chief of project: Yusupov A., vice-rector of Urgench State University on scientific work. Koshchanov E.O., chief of internal inspection of Urgench State University.

3. Purposes and soluble tasks of project: It is known, that Aral zone is region of ecological disaster, and desertification process in separate districts of region (small farms and auls, cattle-breeding farms, individual farms and pasture, located in almost inaccessible desert or semi-desert places), now is continue. The desertification of these zone, infirst number, connect with hard life conditions, for lack of qualitive drinking water, deficit or for lack of electro-power, for lack of conditions for saving of food products, vegetables and fruits in spring-summer period).

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