

## **Solving Environmental and Water Problems in Uzbekistan**

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Let me start at once with the fact that Uzbekistan is the birthplace of ecology. This is proved by the fact that 3000 years ago our ancestors, or more precisely Khorezmians, first wrote a great book "AVESTA" (7th century BC). It is imbued with the idea: Man should always keep himself clean, protect vegetation and ensure purity of land, water and air.

By the way, today in 23 points of the World there are functioning AVESTA centres, in 1825 the book was published in English, in 1972 in French, in 1973 in German and in 1901 in Russian. Why do we make such a conclusion, yes, because man is the main subject of ecology, and the last three elements of nature, noted in AVESTA, form the basis of the fundamental concept of ecology - biogeocenosis (or we can say ecosystem), more precisely "biotope", which consists of "climatope" (air, atmosphere), "hydrotape" (Water, hydrosphere) and "edaphatope" (soil, soils). Our compatriots-knowledgeable already at that time for the first time paid attention to these main elements of nature and foresaw the necessity of preserving these important elements of the ecosystem.

Based on the works of our ancestors, our President at the 78th session of the UN General Assembly (19.09.2023) once again reminded that: "We are rightly proud that our country is the homeland of such great scientists and thinkers as Al-Khwarizmi, Beruni, Imam Bukhari, Mirzo Ulugbek, Alisher Navoi, who made invaluable contribution to the development of world science and culture...".

It should be noted that only after the statement of these important elements of nature in AVESTA, 100 years later in VI-I centuries BC in the ethical poems of India "Mahabharata" and "Ramayana", as well as 300 years later in the Chinese chronicles (VI-II centuries BC) were made identical statements. It was only in the 5th century B.C. that ancient Greek thinkers - Heraclitus, Empedocles of Agrigent, Socrates, Hippocrates (5th century B.C.), Xenophondus, Plato, Aristotle (4th century B.C.), Theophrastus of Eresia, Eratosthenes (3rd century B.C.), Strabo, Lucretius (1st century B.C.) and others - wrote about it.

Assessing the current state of nature, the President of Uzbekistan at this session of the United Nations emphasised that: "Today, there is an acute ecological situation in the world. The triple planetary crisis caused by climate change, loss of biodiversity and environmental pollution is intensifying".

In order to understand the value of this assessment, it is worth briefly recalling once again the essence of the concept of "Ecology" as a sphere of development of the human mind in the field of biosphere conservation. The subject of ecology is literally the science of organisms "at home" in mutualism with the "environment". Today, the lower boundary covers a depth of 10 kilometres across the ocean floor. The upper boundary is the observable Metagalaxy. Our compatriot Abu Ali Ibn Sino wrote about it in the XI century (Avicenna): that there is otherworldly life, 300 years before the statements of Giordano Bruno. Today, knowledge in this range is necessary for cognition of ecological factors; it will make it possible to clearly present

the importance of the fundamental laws of science and increase environmental literacy, education and culture of society. And as the President noted: We have become convinced that accessible and quality education for all is the most effective factor...for sustainable economic growth.

In general, ecology should be seen as a synthetic science, more or less closely related to almost all sciences. In the process of integration, ecology has found itself, as it were, at the crossroads of natural, basic and technical sciences, on the one hand, and social and political sciences, on the other. It is possible that in the not too distant future, ecology will become the core of a super-science that will unite all our scientific knowledge into a single whole (in the sense of a system of common knowledge). And as Abu Rayhon Beruni noted: "If people do violence to nature by grossly violating its laws, the time will come when it will bring down on their heads unthinkable calamities that no force can stop."

Nowadays ecology is a rapidly developing science. It plays a special role in the life of both society and each individual. Our President noted as a matter of principle that: "...are not sufficiently engaged in the republic in serious issues of ecology" (Narodnoe slovo, 16.01, 2017, p.2). It is appropriate to emphasise that this state has developed precisely because the general level of environmental education and upbringing is still insufficient, the environmental culture of people is low, this is one of the main tasks required by the President (from the video conference call, 02.02.2022). Although in the Law of the Republic of Uzbekistan. "On Nature Protection" (09.12.1992) requires "... to provide environmental education in all types of educational institutions" (Article 4, 3rd paragraph), some universities of the republic, not realising the importance of the subject of ecology in the light of the President's requirement, unreasonably and unreasonably exclude it from the curriculum. In the Decree of the Cabinet of Ministers of the Republic of Uzbekistan. No. 434 dated 29 May 2019. "On approval of the concept of development of environmental education in RUzb." requires: "...to raise the effectiveness of environmental education to a new stage". It is known to all that, according to Socrates, it is easy to teach others, but it is more difficult to know oneself. Indeed, this is the beginning of man, who is different from other representatives of the living world by his Intelligence. But forgive me Socrates, today we can say more: Not only know yourself, but also do not harm yourself, destroying your home, which is the entire biosphere of the Earth. This is what the science commonly called ecology is aimed at. However, this is only one aspect of the problem. The modern level of knowledge and the complex of problems facing humanity requires the creation of a unified scientific picture of the World. The closest to solving this problem is ecology, with its many branches. It is relevant today to say that one of the main enemies of ecology is wars. It may seem strange to some, but in order to feel and appreciate peace, one must know war and not only know it, but be horrified by its inhumanity. And to search, to search for ways, methods, opportunities, how to get rid of the catastrophe, this, perhaps, a little paradoxical revelation we call the Law of Conscience. And as they say, everything will be useless if we do not have Conscience in relation to ecology, to its main subject - the ecological system. Worrying about the current situation, the President drew the attention of the world community to the fact that: "There is a crisis of confidence, increasing problems in the activities of global security institutions and departure from the norms of international law. All this is causing growing tension in the world. ...Even dialogue on issues that concern the fate of humanity as a whole, such as climate change, the fight against hunger and inequality, has been noticeably undermined. The President noted the country's main political strategy: Turning Central Asia into a peaceful and prosperous region will remain a priority goal of Uzbekistan's foreign policy. He demanded: ...UN member states should act even more united in the fight against such common threats as international terrorism.

And then once again touched upon the issue of ecology and conscience: ...At this pivotal moment in history, we should consider what kind of planet we will leave to future generations. ...It is only through shared aspirations and joint endeavours that lasting peace and prosperity can be achieved. More than ever, we need mutual trust, solidarity and co-operation. The words of the

President from the preamble of the Law of Conscience, aimed at preserving the main subject of ecology - Man with a capital letter: Homo sapiens - man of reason. In order to emphasise environmental aspects in each law, the Ecological Code of Uzbekistan has been prepared and is at the stage of approval. The organisation of the Ministry of Ecology, Environmental Protection and Climate Change of Uzbekistan is encouraging. (Decree of the President dated 31.05.2023 No. PP-171).

Paying attention to the main vital factor of ecology - water, the President of Uzbekistan Sh.M.Mirziyoyev noted at the 78th session of the UN General Assembly: ...We are in favour of attracting the most advanced technologies in the process of creating the Platform of water-saving technologies in Central Asia, using the mechanism "United Nations - water resources". On the cover of the book "Water: A Drop of Life" by the American writer Peter Swenson it is noted: "Where water ends, life ends, this is a saying among Uzbeks" [7]. Such recognition is based on the fact that, in fact, if the Sun is the father of all life on Earth, then water, according to many scientists, is the maternal "womb" that gave birth to life. The hydrosphere is the main component of an ecological system or, more precisely, of a biogeocoenosis and its component ecotope (or biotope). It should be noted that Uzbekistan is one of the ancient civilisations of irrigated agriculture in Central Asia. This is evidenced by archaeological excavations and studies of S.P. Tolstov, which showed that the greatest development of the irrigation network in the lower reaches of the Amu Darya reached in the period from the VI century BC to the III century AD. The great Russian climatologist A.I. Voeikov at the end of the XIX century argued: "...that the belt of arid areas of Asia (i.e. Turkestan) is incomparably more favourable for human life and activity than the areas of the United States of America, provided, of course, that irrigation is established" [2].

The Decree of the President of the Republic of Uzbekistan "On Approval of the Concept of Water Sector Development in the Republic of Uzbekistan for 2020-2030" is aimed at solving water management problems at the modern level using innovative ideas of scientists under global and regional climate change.

According to the UN forecasts, by 2050 the population of the Earth will be 8.9 billion people, and from 2 to 7 billion people will suffer from water deficit. Various international organisations estimate that by 2025, a third of the world's growing population will suffer from a lack of water for irrigation. Today, 80 per cent of all global freshwater resources used by mankind are consumed for irrigation. According to the International Food Policy Institute, by 2030, the area of irrigated land is expected to increase by 20 per cent and water use is expected to increase by 14 per cent. As they are the source of about half of the world's food production. In accordance with the United Nations General Assembly Resolution No. 70 adopted at the UN Summit on Sustainable Development in September 2015, as well as in order to organise systematic work on the consistent implementation of the Sustainable Development Goals of the UN Global Agenda 2030, the Cabinet of Ministers of the Republic of Uzbekistan adopted a Resolution (20 October 2018, No. 841) "On measures to implement the national Sustainable Development Goals and targets for the period until 2030", where it is noted in Goal 6. Uzbekistan adopted a Resolution (20 October 2018, No. 841) "On measures to implement the national Sustainable Development Goals and targets for the period until 2030" where it is noted in Goal 6. - Conserve and rationally utilise water resources for sustainable development, availability and development of sanitation for all; in Target 6.4. - By 2030, significantly improve water use efficiency in all sectors of the economy; in target 6.5. - By 2030, ensure integrated water resources management at all levels, including, where appropriate, through transboundary co-operation. It should be noted that scientists of Uzbekistan have developed innovative technical recommendations to put into practice the adopted Resolutions of the President and the Government of Uzbekistan. However, as the President of Uzbekistan noted in his Address to the Oliy Majlis (28.12.2018): "So far they are set out on paper, but we have to turn them into practical actions and real results, and for this we need to work hard".

For more than 45 years, scientists of the Karshi Institute of Engineering and Economics have been working on solving the above urgent problems of ecology and water sustainability. Taking into account huge experience in this branch, we offer a number of overdue solutions that can be used throughout Central Asia and arid areas of the World. Firstly, as it is known, scientific and technical policy, especially in various fields of industry, is implemented by engineers and technicians who do not have special environmental training. This also applies to students of technical, technological, economic and social-humanitarian specialities of higher education institutions. In this connection, we recommend to universally use the prepared textbook "Ecology" for non-biological directions, which covers the minimum of necessary ecological knowledge, and specific problems of ecology are linked to engineering measures of environmental protection. The whole methodological material and cross-cutting general scientific educational programme on ecology (with the basics of nature protection) are given. Secondly, as for fresh water for the population, under reasonable utilisation there is enough of it in Uzbekistan for the distant future. These are, first of all, groundwater reserves of the Fergana Valley, Pritashkent and Jizzak zones, Zarafshan Valley, Kitabo-Shakhrisyabz depression of Kashkadarya, Surkhandarya basin. For example, according to scientists' calculations, the availability of fresh groundwater in the republic is about 293.4 cubic metres per second. With the population of 36024946 (01.01.2023), there are 703.7 litres per 1 person per day. With the average norm of 240 litres per day, it is possible to provide 105.6 million people or the supply will be 139.3 years, if we move to the European norm of 120 litres per day, these reserves will provide 211.3 million people or the supply will be 350.6 years. Today, developed countries are thinking about reducing the norm of water consumption to 80 and in the future to 60 litres per day. In our opinion, it is time to create a unified water supply network of Uzbekistan (similar to electricity and gas pipelines). These waters and waters of fresh water reservoirs should be used mainly for drinking needs. In this way we can remove the problem of water supply to the population with own fresh water. This is an extremely vital problem. For example, in Sweden the water consumption per person is 120 litres, in Israel 100 litres, in the Netherlands 80 litres. At the same time, the Swedes take a shower 5 times a day. What is observed in our country. Consumption per 1 inhabitant is set at 240 litres per day. The main reason is outdated fittings, low efficiency of the water supply system, more than 50% is lost due to leaks. In addition, the high cost of water due to the operation of old pumping units with low efficiency. We are developing integrated water resource utilisation schemes. We need to calculate these schemes for all organisations in the long term in the light of the requirements of the Law of the Republic of Uzbekistan "On Water and Water Use", Articles 106, 111, 112 and the Decree of the President of Uzbekistan dated 10.07.2020. The Decree of the President of Uzbekistan dated 10.07.2020 "On Approval of the Concept of Water Sector Development in the Republic of Uzbekistan for 2020-2030" states: To define the priority directions of the Concept: introduction of integrated water resources management principles, guaranteed water supply to the population, stable water supply to economic sectors, improvement of water quality and preservation of ecological balance of the environment. The next issue, domestic utilisation of saline water. This will introduce a complete system of integrated water resources management in the municipal sector.

Thirdly, if we want to ensure water sustainability, and even more so sustainable development in Central Asia, it is extremely necessary to transfer all large industrial enterprises, including planned NPPs, to the use of desalinated ground and surface water. We have developed and tested a water demineralisation plant based on gas hydrate technology, which is recognised as ecologically economical [4]. This will solve the environmental problem as well. Today, the volume of saline groundwater and collector-drainage water is increasing (they account for 30% of water withdrawal). These are artificial saline lakes in Uzbekistan such as Sichankul (600 million m<sup>3</sup>) Achinkul (126 million m<sup>3</sup>) Arnasay lakes (more than 30 billion m<sup>3</sup>) and many lakes in Priaralie, Kazakhstan and Turkmenistan. They account for billions of cubic metres of water. It is already necessary to think about demineralisation and their use in technical needs and



industry. With appropriate treatment, drinking water can be obtained and the waste can be used to produce gypsum, lime, soda and table salt.

Fourthly, it should be recognised that along with hydrological and meteorological drought, soil drought is also observed. In the message of the President of Uzbekistan for 2023, it is noted that for the last 3 years the country has been experiencing low water levels. ...Over the last 15 years, the total amount of precipitation has decreased by 25 per cent. There are more abnormally hot days in summer, which indicates that more challenges lie ahead. Naturally, as in 2022, this has led to an increase in the irrigation norm in 2023 due to intense evaporation, which will lead to soil drought. By the way, according to the forecasts of American scientists 2024 is predicted as a year with abnormally high summer temperatures. For the purpose of rational use of irrigation water, we propose the mass introduction of specially designed devices that promote subirrigation [1]. Cascade introduction of the technology will allow reducing the irrigation norm by 1.5-2 times. They solve a complex of environmental and social problems. They should be arranged on collector-drainage, irrigation and river networks. They contribute to raising the groundwater table to the optimum depth. Fifthly, taking into account repeated demands of the President on wide introduction of drip irrigation, we propose a very necessary technology to reduce evapotranspiration, conserve energy, and increase soil fertility. The essence of the technology lies in the use of local minerals-heavy clays (as opposed to hydrogels). By the way, we propose to use this technology for drip irrigation of forest plantations in the Priaralie zone (1.7 million ha). This technology contributes to the prevention of wind erosion by increasing soil connectivity. Especially in Tebinbulak deposit of Karakalpakstan according to Goskomgeologiya data there are more than 169 thousand tonnes of vermiculite. However, according to researches of 1937 their reserves were more than 1 million tonnes. This technology can be used in the whole region of Central Asia taking into account availability of local minerals. In Kashkadarya region these are the reserves of glauconite sandstones in the villages of Naiman, Mabika and Aksu. There are also glauconite sandstones in Kiziltepa district of Navoi region, clays in Fergana region, Chimion and Shorsu deposits, glauconites in Tashkent region, bentonite clays in Khorezm region and so on. The President of Uzbekistan noted that the system of Goskomgeologiya on drafting the Programme of Development and Reproduction of Mineral-Raw Material Base requires special attention. In this regard, we have developed a "method of soil reclamation" [5]. It is based on the use of local natural minerals - vermiculite, perlite, etc. They increase fertility and reduce physical evaporation from soils. A mechanism for the application of the above minerals and a method of cutting tortuosity along the furrow bottom has been proposed, which prevents irrigation erosion and increases the water retention capacity of soils. Unfortunately, vermiculite of Tebinbulak deposit is currently exported to Russia and Turkey, in 2021 it was sold for \$623 thousand (Zhamiyat, 12.02.2022). Sixth, it is known that the main thing in increasing crop yields is not water but soil fertility. Scientists have identified a link between livestock production and land fertility. So, for example, organic fertiliser from 40 sheep can contain the fertility of 1 ha of land. Or 5-6 head of cattle. Taking into account 4.3 million hectares of irrigated lands of the republic, we should have 172 million heads of sheep and goats in our arsenal. According to the data of 2022, there were 22626.3 thousand heads (which is 7.7 times less), cattle were 12611.8 thousand heads. Total 35238.1 thousand heads, it contributed to providing 63% of irrigated lands with organic fertilisers. And if we take into account 20.3 million hectares of agricultural lands, they are provided with 13.3% of organic fertilisers. Here is the picture, there is no fertility and lack of meat and dairy products. And as for fertility, we all know that the appraisal of our lands is very low, which is reflected in the yield of agricultural crops. We have lost our natural ecosystem, and a complete ecological danger is looming. Scientists have proved that straw from spikelets increases the fertility of land 10 times more than organic fertilisers. It is extremely necessary to intensively implement the crop rotation system. Seventhly, it is necessary to assess the quality of surface and groundwater under current conditions with a forecast for the distant future as soon as possible. For this purpose it is necessary to analyse metamorphisation (change) of chemical composition of natural waters. This

will allow us to forecast salt content in soils and, accordingly, to take measures for soil protection in advance. At present, local soda salinisation of soils is observed in foothill areas. Scientists have proved that if they occupy 20-30% of irrigated area, they are considered unprofitable. To prevent sodic salinisation, we propose a method of soil desalinisation, which simultaneously promotes the release, during chemical reclamation, of Chilean nitrate, so necessary for plants [6]. Eighth, all the above-mentioned innovative solutions contribute to the development of improved integrated water resources management technologies for each administrative district. They should be developed at the level of agricultural plots, large industrial enterprises, provinces and river basins. We have vast experience in calculation, experimentation and implementation at the production level.

It should be noted that all the proposals have been tested in laboratory and field conditions, tested and approved by scientists-specialists from the USA, Europe, Russia, Kazakhstan and Turkmenistan. Technical solutions are ready for stage-by-stage implementation, all technical solutions have received author's certificates and patents for invention. They are brought to the final ecological and economic effect [3]. We hope that this set of technical innovations will be taken into account by water management organisations and clusters, population of homestead plots, relevant agencies and practitioners when developing a "road map" on this issue and will be implemented in order to improve environmental and social conditions and food security of the population of Uzbekistan.

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