

Identification and review of key environmental and security problems in the Transnistrian region, Republic of Moldova

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I. Introduction

Security is fundamental for the existence and sustainable growth of any state. Ensuring the environmental safety is an essential part of both national and regional policies. By environmental safety is meant a complex of political, economical, juridical, scientific-and-technical and conversion measures taken with a view to reduce and eliminate any environmental danger and to stabilize the environmental and social situation.

The complex of socioeconomic and ecological problems which Transnistria is facing now emerged as a result of political and economical preconditions (reasons) that had existed during both the MSSR and post-Soviet periods. These preconditions include:

- Historically established irrational development and disposition of production and productive forces,
- Systemic socioeconomic crisis associated with a transition to market economy,
- Political, socioeconomic and military impacts of non-settlement of the Transnistrian conflict (1992).

In the early 1990s Transnistria was the most economically developed region of Moldavia, with a high density of the population and production and social objects. The region accounted for about 40% of the gross national product of the MSSR while its population constituted only 15.2% of the total population and the area was only 12.4% (4613 km²) of the total area of the republic. Transnistria accommodated in its territory the Moldavskaya State District Power Plant (SDPP) (with a capacity of 2.5 mln. kWt), which is largest in the Balkan region, the Dubossarskaya Hydro (with a capacity of 48 thou. kWt), the metallurgical works (with a capacity of 500 thou. tons of metal) and over 100 major enterprises of machine building, light, electrical, furniture, canning, and microbiological industries. In the agricultural sector of Transnistria, the level of intensification and chemization was six times as high as that in the USSR as a whole [1].

At the same time, Transnistria has few natural resources suitable for commercial use. The entire lack of primary fuel resources, ore deposits and forests of commercial value makes the region fully dependent on the imports of these raw materials. Power industry is the only branch of the fuel and energy complex that does work and covers in full the regional household and industrial needs in electric power (4.5 thou. kWt-h per capita, 1999). About half of the electric power produced in the region is exported [2].

The fall of the USSR, political tension and then the war conflict (1992) gave rise to a protracted crisis in the region. From 1990 to 1999 the index of industrial production decreased by 72.1% and the index of agricultural production by 68%. The gross domestic product (GDP) declined by 14.2% over a mere 3-year period from 1996 to 1999 [2]. The total population in the region also decreased from 677.9 thou. (1989) to 660 thou. (1999) and then to 555.5 thou. (according to preliminary data of the census carried out in 2004) [3]. All this could not but aggravate the social situation in Transnistria. Wages were dramatically cut, prices jumped and so did unemployment, and allocations for social and environmental protection programs were substantially decreased.

After 2000, there has been a number of positive trends seen in the economy of Transnistria which emerged as a result of the revision of the legislative and institutional basis, economical liberalization, privatization processes and strengthening of the financial system. These changes immediately reflected in the growth of the GDP which increased by 11% in 2001, by 18.4% in 2003 and by 16.4% in 2004. The industrial production also increased by 9%, 21.8% and 4.9% in 2001, 2003 and 2004, respectively.

There are also some negative trends that have an adverse effect on the socioeconomic security in the region. These are a high-degree monopolization in the real sector of the economy and services, large proportion of lossmaking enterprises (20% in the industrial and up to 50% in the agricultural sectors), excess openness of the economy and its dependence on external markets of raw materials and marketing outlets, progressive increase of foodstuffs imports, historical and current debts for the gas supplied, aggravation of the demographic situation, increased allocations for defense and security programs [4].

The socioeconomic crisis, imperfection of the environmental legislative and regulatory basis, and lack of coordination in the activities between different government bodies and of proper environmental control and transparency of the decisions made gave rise to the following environmental problems:

- Reduction of the amount and degradation of water resources,
- Air pollution,
- Accumulation of solid household and industrial wastes,
- Reduction of the forest area and illegal cutting of woods and forests;
- Degradation of land resources. Soil pollution with agrochemicals and pesticides.

Economical and military-and-political consequences of non-settlement of the Transnistrian conflict that have an adverse effect of the socioeconomic and environmental safety in the region include the disconnection of Moldavian and Transnistrian economies and markets; customs, transport, and information conflicts; the military depot at the Kolbasna railway station (Rybnitski region); the lack of coordinated actions in the environmental protection and other spheres; etc.

From all this, we can conclude that Transnistria is facing a complex of socioeconomic and environmental problems that are potentially hazardous to the health and well-being of the population as well as to the environmental stability in the region.

Major environmental legislative and regulatory acts adopted in Transnistria

Within the frameworks of elaboration and improvement of the regional legislative and regulatory basis, a number of statutes and other documents to regulate the matters related to environmental safety and protection have been adopted in Transnistria.

The Transnistrian Constitution adopted in 1996 is the basic law that recognizes the right of everyone to live in the environment safe to life and health and for a compensation of any harm done as a result of violation of this right (Article 40). Article 29 of the Constitution guarantees the right of everyone to receive, store and spread full, accurate and timely information concerning the state of the environment. At the same time, the Constitution binds everyone over to make thrifty use of the environment (Article 50) [5].

The regional environmental policy is guided by a decree entitled as *On a Concept of Environmental Safety of the Transnistrian Moldavian Republic* (1994), setting forth basic measures to be taken with a view to protect the environment, to ensure sustainable use of natural resources, and to support the right of everyone to the safe and favorable environment [6].

The *On the Environmental Protection* law (1994) is the basic law to regulate the activities in the sphere of environmental protection and use of natural resources in the region [7]. The law establishes basic principles of environmental protection, ownership to natural resources, competence of the authorities, the right of citizens to the safe and favorable environment and their involvement in the environmental protection, measures to be taken to ensure the environmental protection, etc.

Also, there are special laws to regulate specific aspects of the environmental protection and nature use such as *On the Animal World* (1998) [8], *On the Hydrometeorological Activities* (1998) [9], *The Water Code* (1999) [10], *On the Subsoil* (2000) [11], *The Forestry Code* (2000) [12], *On Fees for Environmental Pollution and Use of Natural Resources* (2000) [13], *The Land Code* (2002) [14], and *On the Nature Reserve Stock* (2006) [15].

II. Sources of environmental hazard

Exhaustion and pollution of water resources

Deficiency of water resources, which are not enough to cover the needs of the population, economy and natural ecosystems, is one of the major environmental problems both for Transnistria and Moldova as a whole. Water reservoirs and watercourses in the region are objects of complex use and employed to cover the needs of power engineering and transport, industry and agriculture, as sources of potable water and for the purpose of fishery and recreation.

The Dniester river with its tributaries and underground waters is the basic water resource of Transnistria. The Dniester is the region's largest river and its length within the region is 425 km. The deficiency of water resources is explained by the physico-geographical features of the region, such as a poorly developed hydrographic network, the lie of the ground, climatic conditions, low annual precipitation (400–450 mm) [3]. The run-off of the Dniester river basin is largely influenced by the anthropogenic factor, including keeping the river within its bed, irrevocable water consumption, small area in forest, flood plain development, cultivation of the water catchment area, etc. The change of the Dniester hydrological regime and physicochemical characteristics of the river water has an adverse effect on the condition water and ground ecosystems [16].

Chemical analysis show that the Dniester river water should be assigned to class III in terms of pollution (moderately polluted), and small river and stream waters to class IV (polluted) and V (very polluted). The Dniester water is primarily contaminated with biogenic substances (such as phosphates, nitrites, ammonium nitrogen), phenols, oil products, and synthetic surfactants. Copper impurities levels remain steadily high. The level of microbiological contamination is also quite high. In recent years, a tendency has been seen to a water quality improvement achieved as a result of the reduction of water mineralization and nitrites, phosphates and humic substances load [16,17]. This is mostly due to changes in the structure of water balance. The intakes of water from superficial and underground water sources were substantially decreased from 1357.8 mln. m³ (1995) to 882.5 mln. m³ (1998) [2]. Public utilities became the basic consumers, and thus are mainly responsible for contamination, of water (90%). However, as the regional economy overcomes the crisis, contamination of the Dniester with industrial wastes will increase.

Many sources of underground water fail to meet relevant water quality standards and are characterized by elevated levels of fluorine, iron, hydrogen sulphide, chlorides, and sulphates, and a high level of mineralization.

Below are the major factors responsible for water resources contamination:

- Discharge of undertreated or untreated sewage due to a lack or low efficient operation of sewage works.

- Lack of sewage works at many storm-water systems.
- Improper control over the quality of effluents discharged by industrial enterprises into the sewer on the side of the public utilities authorities.
- Washout of agrochemicals, pesticides and other contaminating substances from the fields, storage areas, animal farms, spontaneous refuse dumps.
- Lack of any, or non-compliance with the regulations on the use of water protection and sanitary zones.

The chemical and microbiological contamination of the Dniester basin water has an adverse effect on the people's health and the state of ecosystems.

Ninety eight percent of the people living in Tiraspol and Bendery may enjoy benefits of the central water supply and sewerage systems. For Rybnitsa, Kamenka, Dubossary, Grigoriopol and Slobodzeya, these figures are 65-80% and 35-20%, respectively. In rural areas, 66 communities (45%) may make use of the water supply and 28 communities (19%) of the sewerage systems. As of January 01, 2000, the proportions of apartments (houses) with water supply and sewerage were 57.4% and 54.1%, respectively [3]. It should be noted that there are substantial losses of water (up to 30-35%) in the outdoor water-supply lines from water intake facilities to water consumers. Responsible for such losses are pretty worn-out water distributing pipes and stop valves (50-80%), lack of investments, as well as inefficient management of water resources by public utilities authorities [18].

Underground waters are the main source for potable water supply (90-99%). The quality of water in the central water supply systems is generally meets the requirements of the GOST, except for the hardness and iron loads. Of particular concern is a poor quality of water in the departmental water supply systems, open wells and springs. Most of them do not meet the hygienic requirements either in chemical or microbiological qualities.

The hygienic characteristics of water in the Dniester river at places of water use (mass recreation zones) continue getting worse. According to the bacteriological laboratory of the Republican Center of Hygiene and Epidemiology (RCHE), the percents of seeding of cholera-like NAG germs in this July-August achieved 68.8% for the samples taken from the Dniester water and even 75-80% for the samples taken near Bendery and Tiraspol and in the Slobodzeya region [19].

In 2000, the TMR Government adopted a resolution *On Top-Priority Urgent Measures on Protection, Complex and Rational Use of Underground Waters in the Transnistrian Moldavian Republic* to regulate the matters related to complex use and protection of underground water resources used for household and industrial purposes.

Air pollution

In recent years, with an industrial depression, there has been a steady tendency to a reduction of hazardous emissions into the air from stationary sources and an increase of these from mobile sources. Hazardous emissions into the air from stationary sources decreased from 68.8 thou. tons in 1995 to 27.2 thou. tons in 1998 and then to 29.5 thou. tons in 2003 [2,19]. The main stationary sources of air pollution are boilers, operating enterprises and the thermal power station. Especially notable for their contributions to air pollution are the Moldavskaya State District Power Plant (75%), the Moldavski Metallurgical Works, the Rybnitski Cement Works and Tiraspoltransgaz [20].

The motor transport is the main source of air pollution. The total number of registered means of transport exceeds 100 thousand units [3]. Most vehicles have been in use for from 9 to 14 years. In 2003, hazardous emissions from mobile sources amounted to 11 thou. tons (motor transport in private use excluded) [20]. A significant damage to the environment is caused by the use of the leaded gasoline as motor fuel. About 70% of the lead added to gasoline with ethyl fluid are released into the air with exhaust gases, of which 30% immediately settle out on the earth and 40% remain in the air. Tetraethyl lead and other pollutants also cause contamination of water

objects, the soil, vegetable and cereal crops which are cultivated along motor ways. As a consequence of air pollution, the incidence of lung cancer, upper respiratory tract diseases, allergies, oncological and other diseases increases.

In 2003, uniform toxicity (exhaust smoking) coupons were first introduced in Transnistria. This made it possible to regulate the ecological monitoring at service stations.

The main air pollutants are carbon monoxide, nitrogen oxides, sulphur dioxide, formaldehyde and other pollutants.

This situation brings the serious threat to the environmental safety of the region and to people's health.

Below are the major factors responsible for air pollution:

- Increase in number of private cars in long operation.
- Use of the leaded gasoline and low-grade diesel oil.
- Depreciation of the air purification equipment installed at enterprises.
- Use of out-of-date and environmentally unfriendly technologies.

A reduction of hazardous emissions into the air may be achieved through using environmentally benign technologies, transport means and energy sources; introducing more efficient legal, administrative and economical mechanisms for managing the environmental safety of the motor transport; implementing more efficient principles for the introduction and revision of environmental standards and mechanisms of their observance [18].

Waste disposal and utilization. Pesticides.

According to data of the dedicated parliamentary committee, approximately 450 thou. tons of solid domestic waste and about 252 thou. of industrial wastes are annually generated in the region. There are 8 authorized and over 90 unauthorized dumps to accommodate these wastes. The Tiraspol and Slobodzeya grounds for solid domestic garbage, which are mere dumps, are full, the Rybnitski ground is filled for 95%, and the ground in Bendery for 100%. About 400 thou. m³ of solid domestic wastes are accumulated in the territory of Transnistria, and over 1 mln. tons of industrial wastes are stored on the disposal areas within the territories of industrial enterprises. The amount of toxic wastes accumulated on the disposal areas and dumps is enormous and comes to 4.7 thou. tons. Of significant hazard to people's health and the environment of the region are ash and slag wastes produced as a result of the work of the Moldavskaya SDPP, which are assigned to class III in toxicity. As much as over 13 mln. tons of this kind of wastes have been already accumulated, and this figure is expected to grow in future [21, 22]. Potential brining of sources of radioactive contamination and toxic wastes to the region is of particular concern. During a period from 2001 to 2003, three radiation incidents associated with the use of metal scrap containing radioactive sources had already taken place in the steel-making process at the Moldavski Metallurgical Works. In order to prevent such incidents in future, a state-of-the-art system of radiological detection was installed and a radioactive wastes storage was built at the works [23]. In 2003, 928 tons of highly toxic acid tars under the pretence of alternative fuel were delivered to the Rybnitski Cement Works, and these are still stored in the territory of the enterprise [24]. The lack of dedicated grounds for burial of radioactive waste in Transnistria makes the situation even worse. The existing practice of handling solid wastes year after year contributes to the worsening of the environmental situation in the region and endangers people's health.

In July, 2006, the Parliament of Transnistria adopted the *State Program of Development in the Sphere Dealing with Handling Domestic and Industrial Wastes* for a period from 2006 to 2011. The program provides for a reduction of the environmental exposure to wastes to be achieved through designing and constructing waste storages, creating dedicated enterprises to neutralize and process garbage, and maximally recycling wastes to get secondary resources. To attract investments to the sphere dealing with handling solid wastes, the program suggests that a

those-who-contaminate-must-pay principle widely used in the world practice should be applied when it comes to payment for collection and burial of wastes.

Expired agrochemicals and pesticides are also of serious hazard to people's health and the environment. According to data of the Republican Center of Hygiene and Epidemiology, the total amount of expired pesticides (including those unidentified) is over 119 tons. These are stored at 105 storehouses and 75 of these storehouses do not meet the requirements of relevant hygienic standards. A lack of an approved list of agrochemicals and pesticides authorized for use in the region makes the situation even worse [25].

Degradation of lands and forests.

Soils are the basic natural resource in Transnistria. Black earth prevails and constitutes 90% of the land area. A moderately continental climate with short and relatively warm winters and prolonged hot summers favors fertile soils, which, however, are subject to erosion because of the presence of slope areas in the terrain and the occurrence of heavy showers of rain [3]. Erosion leads to a reduction of biodiversity and desertification.

At present, about 35.3% of agricultural lands show signs of degradation [26]. A total decline in fertility of arable lands due to erosion in the lower Dniester basin alone is 43.4% [27]. As a result of improper organization of agriculture and non-fulfillment of prescribed measures to prevent corrosion, washout of the soil covering, formation of gullies, emergence of soil slip areas which create a danger of destruction and burial of the adjacent lands occur at a rapid pace. Non-agricultural activities led to worsening of lands on the area of 0.4 thou. hectares in 1995 and on the area of 0.7 thou. hectares in 1998 [2]. The degradation of lands significantly restricts the opportunities for developing the agroindustrial complex and regional economy as a whole.

Transnistria is a region experiencing a deficiency of forests. The regional forest resources are of no commercial value and perform water protection, field protection, ecological, hygienic and recreational functions. The land development processes led to a reduction of the area of forests in Transnistria. At present, the total area of forests is 36.4 thou. hectares and the area in forest is 23.5 thou. hectares or 8.3% [28]. The area of natural forests had reduced from 6.1 thou. hectares in 1945 to only about 3.2 thou. hectares in 1985. Among causes that led to the reduction of natural forests we should mention, apart from their cutting for the purpose of land allotment for agricultural use, the use of imperfect forest rehabilitation technologies, allotment of the areas for temporary agricultural use and cattle pasture, illegal cutting. Annually, over 10 m³ of timber are produced in the region as a result of care and sanitary cuttings [2].

Measures to preserve soils and forests are a part of larger scale activities on preserving the natural landscapes and biodiversity. The Research Institute of Ecology and Natural Resources has developed a concept of ecological optimization of the landscape with a view to help the formation of the natural skeleton of the territory of Transnistria [28].

Preservation of biodiversity.

In Transnistria, there is a system of protected nature areas, and the provisions are prepared, setting forth the principles of their organizational structure and activities. The area of one of them, located on the left side of the Dniester, is currently 2534 hectares (less than 1% of the territory of the region). Small areas and isolation of these objects cannot ensure the effective preservation of natural landscapes and biodiversity in the region.

In the region, much attention is given to protection and reproduction of the local flora and fauna. The natural park Yagorlyk founded in 1988 is located on the coast of the Goyanski Bay, a branch of the Dubossarski reservoir. It occupies the area of 1008 hectares, 20% of the area being the water surface. A legal status has been given to a state reserve Novo-Andriyashevka with an area of 307 hectares in the south-eastern part of the Slobodzeya region. An ichthyological reserve Turunchuk has been founded on the river of the same name, lying between the Chobruchi and Glinoe villages of the Slobodzeya region [3].

In order to preserve biological and landscape diversity, a regional program needs to be developed, offering measures for improvement of the environmental legislation, creation of the

regional ecological network, optimization of the number and area of protected territories, creation of cadastres of protected territories, plants and animals, involvement of the public in the environmental protection, etc.

III. Ecological risks associated with transboundary use of natural resources

The Dniester is quite a large transboundary river (1380 km) flowing through Ukraine and Moldova. The relationship between these countries in the sphere of protection and use of transboundary water resources are regulated by the *On Transboundary Waters Sharing and Protection* agreement (1994). Any activity that will have a transboundary effect may have a negative political, socioeconomical and environmental impact on the entire Dniester basin, Transnistria included.

Most major and environmentally unfriendly enterprises of Ukraine and Moldova are located in the Dniester basin. These are enterprises of the primary (potassium salts, sulfur, gas, oil, construction materials, etc.), chemical and petrochemical, machine building and metallurgical industries. In the 1980s, there were 520 enterprises in the Dniester basin that added to the Dniester water contamination [29]. For the most part, environmentally unfriendly enterprises are located in the upper Dniester region from where 70% of the run-off originate. It was many times that emergency industrial and household effluents led to a transboundary contamination of the entire Dniester basin.

In Transnistria, enterprises of the construction and power engineering industries (such as Rybnitski Cement Works, Moldavskaya SDPP), public utilities and diffuse pollution sources are mostly responsible for the Dniester water contamination.

The construction of the Dubossarskaya (1954) and NovoDniesterovskaya Hydros (1981) was most disastrous for the Dniester basin. Keeping the river within its bed resulted in irreversible changes in the pattern of seasonal and circadian fluctuations of the run-off and in oxygen and temperature regimes and also led to the river water being turbid. The changes of the hydrological and water physicochemical characteristics had harmful consequences for hydrobiological resources and species and landscape diversity in the Dniester basin [16].

A transboundary diagnostic study that was undertaken within the *Transboundary Cooperation and Sustainable Management of the Dniester River Basin* UNO OSCE/EEC project allowed a list of priority environmental issues to be made as follows:

- Water destructive effects: disastrous floodwaters, water erosion, bank caving
- Unsatisfactory water quality, in particular at potable water inlets
- Unsatisfactory sanitary and ecological and hydrological condition of small rivers
- Depletion and deficiency of water resources
- Eutrophication
- Reduction of a biodiversity of water ecosystems
- Reduction of hydrobiological resources

A transboundary air pollution (with sulfur and nitrogen oxides) from the Moldavskaya SDPP also cannot be excluded considering its location (at the boundary with Ukraine) and its “leading” role in air pollution in Transnistria itself. In addition, the thermal and emergency sulphuric acid effluents discharged by the Moldavskaya SDPP to the Kuchurganski Lagoon add to the pollution of the lower Dniester basin. Ash and slag dumps are still sources of environmental hazard as they produce volatile substances and dust to contaminate both the air and aqueous media. This has a negative impact on the health of people living in nearby villages and the condition of natural and agroecosystems [29].

All these problems are of transboundary, national and regional significance. This is why they cannot be solved unless through using a basin approach, but with national and regional features

and priorities being kept in mind. The task can be managed using a mechanism of transboundary, national and regional dialog and cooperation.

V. National and regional cooperation

Unfortunately, possibilities for national and regional cooperation are restricted because of the political non-settlement of the Transnistrian conflict. In these circumstances, priority must be given to measures helping increase the confidence and normalize the relationship between the Republic of Moldova and Transnistria. The interaction between of local politicians, authorities and non-governmental organizations of both parties to the conflict in the course of searching the solutions of national and regional socioeconomic and environmental problems could be the basis for such cooperation.

Possible spheres for such cooperation:

- Participation of representatives of the parties to the conflict in various projects and programs to improve the legislative and institutional basis for the national and regional cooperation in the sphere of nature management and environmental protection.
- Development and implementation of programs to solve national and regional environmental problems, in particular within the frameworks of development and implementation of a plan for integrated management of the water and biological resources in the Dniester basin.
- Creation of bilateral and multilateral (+ Ukraine) working groups to coordinate some environmental protection activities at national and regional levels.
- Development and implementation of joint environmental monitoring programs. Communication of hydrometeorological data.
- Joint exploitation of waterworks, including the Dubyssarskaya Hydro.
- Joint actions to prevent and abate the impact of floodwaters, floods and icejams and to regulate ecological releases.
- Interaction within the frameworks of creation of a regional early alarm system to prevent the impact of floodwaters and technogenic accidents.
- Joint activities to abate bank erosion and soil and landscapes degradation.
- Participation in the development and implementation of a program to create ecological networks both at the national and basin levels.
- Cooperation in research and information.
- Provision of technical and informational assistance for the development and implementation of a program to dispose and utilize solid domestic and industrial wastes.
- The interaction between Moldavian and Transnistrian research-and-production associations within the frameworks of national and transboundary cooperation in the Dniester basin. Implementation of joint projects and programs to develop the partnership between local authorities, research-and-production associations and business for finding solutions of socioeconomic problems at national and regional levels.

Priority problems and possibilities of their solution
[(on a scale from 1 (lowest) to 5 (highest))]

Problem	Priority score	Urgency of solution	Economical need for solution	Political possibilities for solution, given political will
Exhaustion and pollution of water resources	5	urgent	considerable	available
Air pollution	4	urgent	moderate	available
Waste disposal and utilization. Pesticides	5	urgent	considerable	available
Degradation of lands	4	urgent	moderate	available
Reduction of forests	4	urgent	moderate	available
Preservation of biodiversity	4	perspective	moderate	available

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