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Working Group on Monitoring and Assessment

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Item 4 of the provisional agenda

ASSESSMENT OF THE STATUS OF TRANSBOUNDARY WATERS IN THE UNECE REGION[1]
(Pressure factors in transboundary river basins[2])

Submitted by the Chairperson of the Working Group on
Monitoring and Assessment[*]

[1] At their fourth meeting (Bonn, Germany, 20–22 November 2006), the Parties to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) mandated its Working Group on Monitoring and Assessment with the assessment of transboundary rivers, lakes and groundwaters in the UNECE region. For details, please refer to documents ECE/MP.WAT/WG.2/2007/1 and ECE/MP.WAT/WG.2/2007/3.

[2] This document updates information related to countries in Eastern Europe, Caucasus and Central Asia (see ECE/MP.WAT/2006/16) and provides additional information on other countries.

[*] The present document was submitted late due to resources constraints in the secretariat and late submission by some countries.

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Introduction

1. The 2004 review by the secretariat on "Water and sanitation in the UNECE region: achievements in regulatory aspects, institutional arrangements and monitoring since Rio, trends and challenges" (ECE/AC.25/2004/5 and Add.1 and Add.2)[3] already identified the most challenging water management issues in the UNECE region as a whole and examined further steps to be taken regarding water policies and technical/methodological work. The present assessment of transboundary waters has shed more light on particular issues of concern for countries in with economies in transition and countries with market economies.

2. In the assessment report[4], the river basin's various uses and functions and related water management issues are documented, including a description of pressures on water resources, the status of the water body, the transboundary impact caused by the pressures and future prospects, i.e. the potential improvement of the status, provided that certain management measures (responses) would be carried out. Such an approach generally follows the logic structure of the "Driving Forces-Pressures-State-Impact-Responses (DPSIR) framework" adopted by the European Environment Agency (EEA) and broadly used under the Water Convention's work on monitoring and assessment of transboundary rivers, lakes and groundwaters.

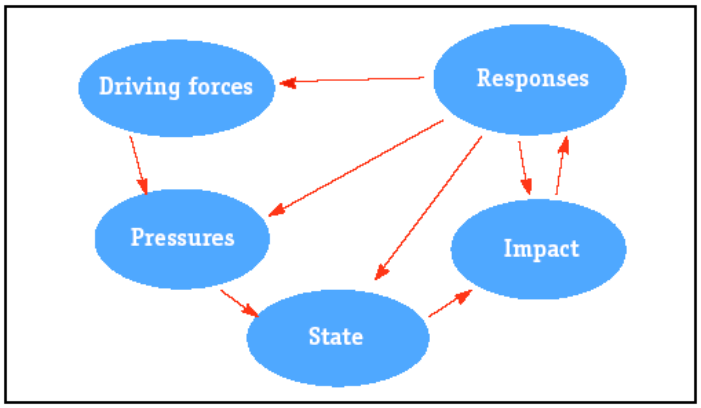

Figure 1: The Driving Forces-Pressures-State-Impact-Responses (DPSIR) framework.

The DPSIR framework assumes that social, economic and environmental systems are interrelated. These links are illustrated conceptually by driving forces of environmental change, which create pressures on the environment. These in turn affect the state of the environment. The subsequent changes in status, or "impacts", include impacts on ecosystems, economies and communities. The negative impacts will eventually lead to responses by society, such as the development of policies for river basin protection. If a policy has the intended effect, its implementation will influence the driving forces, pressures, status (state) and impacts.

[3] See http://www.unece.org/env/documents/2004/ece/ac.25/ece.ac.25.2004.5e.pdf
http://www.unece.org/env/documents/2004/ece/ac.25/ece.ac.25.2004.5.add.1e.pdf
http://www.unece.org/env/documents/2004/ece/ac.25/ece.ac.25.2004.5.add.2e.pdf

[4] The draft outline of the content is part of the annex to document ECE/MP.WAT/WG.2/2007/4.

3. In order to systematically analyse the pressures, a number of other basic documents developed under the Convention were used. These included the *1994 Recommendations to ECE Governments on the Prevention of Water Pollution from Hazardous Substances*, which provide an indicative list of industrial sectors/industries for which discharges should be based on the best available technology. Specific guidance related to pollution from agriculture was also available with the *1992 Recommendations to ECE Governments on the Protection of Inland Waters against Eutrophication* and the *1995 Guidelines on the Prevention and Control of Water Pollution from Fertilizers and Pesticides in Agriculture*.[5]

4. Given the DPSIR framework, the Convention's recommendations, and the United Nations International Standard Industrial Classification of All Economic Activities,[6] the following sections address the main pressure factors in general terms.

Pressure Factors in Transboundary Water Basins

5. The following section provides typical examples of pressure factors from human activities in the various river basins. To illustrate these pressure factors, preference is given to basins in countries in Eastern Europe, Caucasus and Central Asia (EECCA) and other countries with economies in transition, as these countries still experience significant pressure from human activities; consequently, response measures (see document ECE/MP.WAT/WG.2/2007/3) focus mainly on these countries. For a detailed description and analysis, part II on facts and figures on transboundary surface waters should be consulted.[7]

A. Crop and animal production

Crop and animal production in countries in transition

6. Water use for crop and animal production in EECCA countries (some 50–60% of available water resources) is quite comparable with the situation in countries in Southern Europe, especially Greece, Italy, Portugal and Spain. However, water-use efficiency is much lower, and the magnitude of water pollution problems caused by agriculture is greater.

7. In general, crop and animal production cause increased levels of nutrients and pesticides in transboundary water bodies due to surface run-off from agricultural land, leaching and – specifically in a number of transboundary waters in the Aral Sea basin – return waters from irrigation channels.

8. Pollution by nitrogen and phosphorus compounds is well measured, but badly documented and publicized. In transboundary rivers, pollution levels seem to be decreasing. This is chiefly a consequence of the still difficult economic situation and high fertilizer prices rather than of good agricultural practice. With the expected economic growth and the need to increase agricultural outputs, nitrogen and phosphorus will regain their importance as pollutants unless

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[5] See ECE Water Series No. 2, *Protection and Sustainable Use of Waters – Recommendations to ECE Governments* (ECE/CEP/10).

[6] Terms according to the United Nations International Standard Industrial Classification of All Economic Activities; see http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27&Lg=1.

[7] For the table of contents, see the annex to document ECE/MP.WAT/WG.2/2007/3.

stringent measures to cut application rates, such as good agricultural practice, are more widely used.

9. Although the use of certain dangerous pesticides has been banned in countries with economies in transition, unauthorized use of pesticides (reported from some transboundary river basins) and leakages from old stocks of DDT will continue to be an important pressure factor. However, data on the concentration of pesticides in transboundary rivers are mostly unavailable: either no measurements are being carried out, or the measurements do not include sediment or biota.

10. Base flow from groundwaters carries nitrates and pesticides into transboundary rivers, for example in watercourses such as the Chu and Talas and their tributaries. The relative importance of this phenomenon is not yet well known in many basins; however, the assessment of the transboundary aquifers already provides a lot of basic information.

11. The impact of animal husbandry (livestock breeding and grazing) on transboundary waters, particularly in the mountainous and foothill areas of the Caucasus and Central Asia, also remains little understood, although evidence of adverse effects on the many smaller rivers in these areas is growing.

12. Watercourses created by human activity (irrigation canals and drainage channels to collect return water from irrigation) are abundant. In the Aral Sea basin, their “management area” covers hundreds of thousands of square kilometres, and their length totals many thousands of kilometres. In Uzbekistan alone, the total length of main irrigation canals (about 450) and drainage canals (400) is 156,000 km, and their total management area amounts to about 1,100 km^2. Water delivery and use are being hampered by increasing vegetation growth in the canals, which lessens their carrying capacity; by algae blooms, which lead to deteriorating water quality and sanitary conditions; and by increasing pollution, sediment transport and sedimentation, which affect the operation of hydraulic structures.

13. Diffuse discharges from agriculture and the continued extensive agricultural use of water protection zones along rivers contribute to increasing chemical and bacterial pollution of water resources. Adverse effects of irrigation on aquatic- and water-related ecosystems include loss of biodiversity and extinction of whole ecosystems.

Crop and animal production in countries with market economies

14. In countries with market economies, agriculture is also one of the most prominent pressure factors. Two distinct cases became obvious from the assessment of the status of transboundary basins:

(a) In river basins, particularly in Central Europe, the relative importance of agriculture as pressure factors is increasing, given the decreasing amount of pollution from point source, most notably municipal and industrial wastewater treatment plants, due to investments in point source control.

(b) Agriculture in other river basins, particularly those in the basin of the Black Sea, the Mediterranean Sea, and parts of the Atlantic Ocean, is a pressure factor similar to that in countries in transition, although in some cases less severe. The pressure greatly varies among basins due to countries' specific hydrometeorological conditions (e.g. need for irrigated agriculture), crop types and production patterns.

B. Mining and quarrying

15. The mining of metal ores has a distinct impact on transboundary waters in the Caucasus, transboundary tributaries to the Danube and transboundary rivers discharging into the Mediterranean Sea. The impact of mining in Portuguese-Spanish river basins seems to be rather limited; however, abandoned mines remain as a significant pollution source.

16. The impact of mining on transboundary waters in Central Asia is less visible, mostly due to the relative importance of other pollution sources. In Central Asia, however, the pollution level will most likely increase given national plans to further develop mining and ore processing.

17. Mining activities, although decreasing, have also an impact in the sub-basins of the Rhine. Adverse effects, sometimes visible over a long distance, include hydraulic changes, thermal pollution, and pollution by chlorides and heavy metals. Mining of hard coal has significantly changed groundwater flow in parts of the Rhine basin, and opencast mining of brown coal requires lowering the groundwater level in parts of the Rhine, Elbe and Oder basins.

18. Pollutants from mining of metal ores that are of utmost concern include lead, copper, zinc, cadmium uranium and, in some cases, mercury from gold mining. While pollution abatement technologies exist for these hazardous substances, their use in countries with economies in transition is limited to the minority of industrial plants that are economically viable.

19. The extraction of crude oil is another pressure factor. Surface run-off from oil production fields located in transboundary water basins is a general problem for many watercourses in the EECCA region; however, information about the relative importance of this type of pollution is still scarce.

C. Manufacturing

20. In EECCA countries, manufacturing is one of the most prominent pollution sources, with a strong impact on the status of transboundary water resources and the future trends.

21. Water-use efficiency in EECCA countries remains low compared to that in Western Europe as well as parts of Central and Eastern Europe. Since the information on water use for various sectors of economy provided by countries in transition and countries with market economies was rather limited, water-use efficiency as a means of saving water and generating less pollution will be examined at a later stage.

22. The magnitude of water pollution problems in countries with economies in transition seems to originate from the abundant number of small and medium-sized industries, rather than

the relatively low number of big undertakings, which were already capable of installing pollution abatement technologies and controlling pollution at the source. In addition, these big enterprises voluntarily carry out self-monitoring in an attempt to demonstrate their compliance with environmental standards.

Manufacture of refined petroleum products

23. A great number of transboundary watercourses in EECCA show increased levels of pollution by oil products, specifically discharges from oil refineries and surface run-off from refinery sites. Unless these countries comprehensively apply the measures set out in safety guidelines and other guidelines developed under the Water Convention and the 1992 Convention on the Transboundary Effects of Industrial Accidents (Industrial Accidents Convention), which in some cases require investments in the safety of industrial installations, a substantial reduction in oil pollution is unlikely. Countries with market economies did not report on this kind of pressure factor, as obviously high standards of pollution control at sources are complied with by the respective industry.

Manufacture of chemicals and chemical products; manufacture of basic metals and fabricated metal products

24. Accidental pollution from industrial installations and unauthorized discharges of hazardous substances (mostly at night and during holidays) remain major concerns in EECCA and other countries in transition. Due to the high flow velocity of transboundary rivers and their tributaries in mountainous areas, a number of these events are beyond the detection capability of monitoring stations. The establishment of early warning and notification systems in transboundary mountainous and lowland rivers, which is currently being promoted by assistance projects, is a promising tool for the future.[8] Future assessments are expected to shed more light on these industrial sectors/industries in countries in transition as a source of a great number of organic compounds with toxic effects as well as other hazardous substances.

25. As concerns pressures from this kind of manufacturing in countries with market economies, the assessments of the status of rivers in the basins of the Rhine and Elbe may serve as best examples. The Rhine basin, for example, is a basin with a high density of chemical and other industries, where more than 950 major industrial point pollution sources have been identified. These big and medium-sized enterprises operate their own treatment plants. However, in 2000, eight industrial enterprises were still responsible for a considerable share of the total emission of at least one of the following substances: Hg, Cr, Cu, Ni, Pb, N-total and P-total. The share of single enterprises varied between 1% (N-total) and 18% (Cr). There were no single enterprises that discharged more than 1% of the total emission of Zn, Cd or lindane. In order to achieve the targets of the Water Framework Directive related to the chemical status of surface waters, further measures have been identified as to nutrients, chromium, copper, zinc and PCB-153 as the relevant pollutants. Further “target” substances include nickel and its compounds, HCB and tributyl-tin.

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[8] See, for example, the assistance projects on the Kura, Nemunas and other rivers by Germany, as documented by the Joint Ad Hoc Expert Group on Water and Industrial Accidents (ECE/MP.WAT/2006/2).

Manufacture of paper and paper products

26. Obviously, the pulp and paper industry can become a significant pollution source in some transboundary waters, as has been reported by Finland, Lithuania, Romania and the Russian Federation. The following water-quality determinands are of concern: BOD_5, COD and some hazardous organic compounds, if bleaching processes are used.

Other manufacturing industries

27. A number of specific manufacturing industries, such as leather, sugar and fertilizers, are of concern, as they have a significant impact on the status of transboundary watercourses in EECCA. Their relative importance, both in countries with economies in transition and countries with market economies, will be assessed at a later stage.

D. Hydropower generation

28. The construction of reservoirs for energy production (as well as irrigation and flood management) has decreased the volume of biological active sediments, changed the hydrological regime of downstream reaches of rivers, changed erosion and/or sedimentation processes in riverbeds, and disturbed the migration of fish.

29. Intense sedimentation, erosion of embankments and changes in the hydrological regime, resulting in a decrease in the self-purification capability of aquatic ecosystems, occur in lowland reservoirs. Eutrophication, a typical problem of reservoirs in lowlands, is intensified due to the shallowness and large water surface of many water bodies.

30. Although adverse effects of dams and reservoirs on the downstream aquatic and terrestrial environment became obvious from the EECCA countries' assessment reports; hydromorphological alterations as a specific pressure factor have only be recognized and described by market economy countries (for basins shared by countries with market economies and some basins on borders between EU and non-EU countries). Therefore, future assessment reports will put more emphasis on this pressure factor, and examine its impact more comprehensively, including in countries in transition.

31. In EECCA countries, the operation of reservoirs, including those built on the interface between the high mountainous parts and lowland parts of rivers, causes a significant impact on the hydrological regime (e.g. river discharge, flooding, erosion) and water availability in the lowlands. The transboundary rivers in the Caucasus and, most notably, in Central Asia, are typical examples for this kind of pressure factor.

The conflict between consumptive and non-consumptive water use in transboundary basins in Central Asia for transboundary rivers regulated by reservoirs			
Time period	Lowlands	Reservoir operation	High mountain areas
Summer	High water demand not satisfied due to small amount of water released from the reservoir	Low water release due to low energy demand and accumulation of high water discharge from upstream rivers	Large water discharges into reservoir due to melting of snow
Winter	Low water demand; flooding, bank erosion and other adverse effects may occur due to large releases of water from the reservoir	Large releases of water to satisfy high energy demand	Small water discharge into reservoir

E. Sewerage and waste management

Sewerage

32. As a rule, each person produces some 75 grams per day of BOD_5 and some 3 grams per day of phosphorus. Unless treated, sewage is an enormous pressure factor in each of the river basins.

33. Unfortunately, in many EECCA countries organic pollution is not being dealt with effectively because, over the last decade, the technical status of wastewater treatment plants has greatly deteriorated. Although wastewater treatment plants in cities continue to operate (although with decreasing efficiency), most of the other treatment plants are out of order. For some cities, for instance in the Dnieper and Dniester basins, new treatment plants are under construction.

34. In countries with market economies, with the exception of some new EU Member States, municipal wastewater treatment is usually not a pressure factor of particular concern, except in cases where the discharges from sewage treatment plants end up in relatively small tributaries. Some new substances, including pharmaceuticals, were also reported to interfere with treatment processes and require pollution control at source.

35. Municipal wastewater treatment in some new EU countries is sometimes below the required standards, but these countries have still a transition period of some more years before the relevant Council Directives have to be fully implemented.

36. Breakdowns of municipal wastewater treatment systems have been repeatedly reported as the cause of significant discharges of polluted waters into the rivers; these breakdowns are also responsible for bacteriological pollution in some basins and sub-basins in Central and Eastern Europe.

Disposal activities

37. Tailing dams and waste storage ponds containing hazardous waste from mining and ore processing, as well as hazardous waste from metal processing and the chemical industry, are important pollution sources in some of the transboundary basins and more importantly in the

sub-basins of their tributaries. For countries in transition, there is a need for better guidance on the safe operation of these installations. Such guidance is currently being developed by UNECE under the Water Convention and the Industrial Accidents Convention.

38. Illegal waste disposal along rivers as well as old and often uncontrolled waste disposal sites are reported from a number of transboundary river basins in countries with economies in transition and some basins of rivers discharging to the Black Sea, the Mediterranean Sea and the Atlantic Ocean. If these dumpsites are not properly taken care of, they will generate increasing pollution.

F. Transportation and storage

Land transport

39. Water pollution from land transport was reported from the narrow river valleys in the Caucasus Mountains and the ranges of Central Asia as well as from some Portuguese-Spanish transboundary waters. The analysis of the Scheldt basin also revealed transport as a matter of concern, although the pressure on the aquatic environment (e.g. by polycyclic aromatic hydrocarbons) was difficult to estimate as accurate data were still lacking.

40. Water pollution from leaking cars and seepage from petrol filling stations is a general problem in EECCA countries, particularly in rural areas. Losses of crude oil and petroleum products during railway transport and leaking transloading facilities are also causes of increasing water pollution in these countries.

Transport via pipelines

41. As is the case with manufacturing of refined petroleum products, a number of transboundary watercourses in EECCA countries show increased levels of pollution by oil products due to leakages from pipelines crossing transboundary rivers or their basins.

42. Despite the many pipelines crossing transboundary watercourses in the entire region, only Portugal (Tagus River) has referred to the potential danger of pipeline accidents and consequences on the aquatic environment. One should recognize that some pipelines already have a high standard of operation and maintenance, as it is the case with the Marseille-Geneva pipeline, located in the Rhone basin (a multi-product pipeline along the Rhone River with a crossing of the Rhone downstream of Geneva (Switzerland). Many pipelines from oil fields in EECCA countries, for example, may not yet have such a high standard, and are potential pressure factors. UNECE therefore addressed these issues in the 2006 *Safety Guidelines and Good Practices for Pipelines*[9]

G. Tour operator activities

43. Along with the growth of urban populations and of tourism, the use of mountain areas and their watercourses for recreational purposes is increasing in the Caucasus and Central Asia.

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[9] See document ECE/MP.WAT/2006/8, available at: http://www.unece.org/env/water/meetings/documents_MoPWC.htm#FourthMoP

There is an urgent need to control the impact of recreation on mountain ecosystems, including rivers and lakes. It is also necessary to install hydrometeorological stations to warn tourists of extreme weather and high run-off. The intensive tourism in countries in South-Eastern Europe, particularly around Lake Ohrid and Lake Prespa, is another example of this kind of pressure factor.
