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The Danube River Basin: Negotiating Settlements to Transboundary Environmental Issues**

ABSTRACT

The deteriorating water quality of the Danube River and the ecological problems created by its continuing exploitation for electricity generation are major issues facing countries in the Danube River Basin. In response, representatives from the eight Danube riparian countries have recently declared their willingness to cooperate on the management of this important European river. In the absence of a comprehensive, basin-wide planning authority, this Danube Declaration is an important first step in establishing cooperative policies. Still, many hurdles remain before intentions become practice. This article describes the scientific and institutional complexities involved in negotiating agreements among the Danube riparian nations and suggests forms of cooperative action. A potential role for an independent analyst in the negotiation process is discussed.

INTRODUCTION

The Danube is one of the most international river basins in the world. Recently, representatives from eight European countries bordering the Danube declared their willingness to cooperate on its management, especially in confronting the mounting problems of water pollution. This non-binding Danube Declaration[1] is an important step towards a more cooperative ecosystem approach to the management of the river. Accordingly, greater attention should be paid to making informed tradeoffs on the river's conflicting uses and particularly to the interrelationships

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1. Declaration of the Danube Countries to Cooperate on Questions Concerning the Water Management of the Danube, especially to protect the Danube from Pollution, *reprinted in* Aktuelle Österreichische Praxis zum Völkerrecht 1985-1986, Österreichische Zeitschrift für öffentliches Recht und Völkerrecht 429 (P. Fischer & G. Hafner eds. 1986) [hereinafter Danube Declaration].

between the biological and physical properties of the river and other environmental media.[2]

The Danube is one of the more than 200 river basins shared by two or more countries which comprise almost 50 percent of the earth's land.[3] The Danube Declaration is one of more than 300 international treaties concerning water resources. For the most part, these treaties relate to issues of navigation, apportionment, and flood control; few have addressed the more qualitative issues of water quality and the ecosystem of the river basin.[4] The challenge presented by the Danube Declaration can be appreciated by considering that its implementation requires cooperation:

- among eight countries spanning Eastern and Western Europe;
- in the absence of effective and enforceable international legal rules;
- in the absence of a basin-wide planning or decision authority;
- between numerous national and international authorities with diverse, conflicting interests;
- on problems for which the geopolitics of the "upstream" and "downstream" countries creates disincentives for cooperative behavior;
- on issues characterized by serious scientific gaps and uncertainties; and
- in an atmosphere of increasing concern about the long-term effects of toxic pollutants and an acute awareness that pollutants cross national boundaries.

The urgency of improving cooperation on the management of the Danube was recently dramatized by the disastrous release of toxic chemicals into the Rhine River, an accident for which no river in the world can claim immunity. Apart from accidental releases, the most urgent issues on the Danube River today are the deteriorating quality of the water and the competing demands created by the exploitation of the river for the generation of electric power. Progress on these issues is hampered more by the political and institutional difficulties in reaching and implementing agreements among the riparian nations than by scientific and technical obstacles. In this article, the political and institutional hurdles involved in negotiating and reaching agreements for improving the quality of Danube water are described, and possible forms that cooperation might take

2. White, *World Trends and Needs*, in Water in a Developing World 1 (A. Utton & L. Teclaff eds. 1978).

3. Biswas, *Some Major Issues in River Basin Management for Developing Countries*, in River Basin Development 327 (A. Biswas, A. Khan & A. Nishat eds. 1983).

4. E. Vlachos, The Challenges of Transboundary River Basins, The Management of International River Basin Conflicts (Sept. 22-25, 1986) (paper presented at the Workshop on Management of International River Conflicts, International Institute for Applied Systems Analysis, Laxenburg, Austria).

are suggested. A potential role for the analyst in aiding the bilateral and multilateral negotiation process is discussed.

THE DANUBE RIVER

Flowing over 2,850 kilometers from the Black Forest in the Federal Republic of Germany to the Black Sea in Rumania and the Soviet Union, the Danube is Europe's second largest river (Figure 1). It is also one of the world's most international rivers with eight riparian countries, including West Germany, Austria, Czechoslovakia, Hungary, Yugoslavia, Rumania, Bulgaria, and the Soviet Union, and it transfers water from the non-riparian countries of Albania, Italy, Switzerland, and Poland. Over 70 million people live in the Danube River Basin.[5]

Near its source, the Danube has the character of a mountain river flowing through West Germany and Austria (passing Regensburg and Vienna) into Czechoslovakia, where at Bratislava it forms the border between Czechoslovakia and Hungary. Flowing south through the Great Hungarian Plain (passing Budapest), it turns eastward into Yugoslavia (passing Belgrade) and later forms the border between Yugoslavia and Rumania with the famous narrows at the Iron Gate. The lower, marshy section of the river serves again as a geographic boundary on the long stretch between Rumania and Bulgaria, where shortly before the Black Sea it separates Rumania and the Soviet Union, and empties into a spectacular delta. Over 300 tributaries flow into the Danube.

The geographic variety of the Danube is matched by the cultural, economic, and political diversity of the countries through which it flows. Connecting Eastern and Western Europe, its joint management symbolizes the potential for cooperation between diverse social, political, and economic cultures. Issues related to Danube development and environmental protection invoke, however, a different set of national and local actors, different administrative laws and procedures, different national priorities, and widely-differing resources for their solution. Countries at the upper reaches of the river (West Germany and Austria) stand in sharp contrast to those at the lower reaches (Yugoslavia and Rumania) both with respect to industrial development and a consciousness of environmental problems. Table 1 shows the different economic and Danube-related alignments of the eight riparian countries. In addition, two U.N. organizations, the Economic Commission of Europe and the World Health Organization, have been active in matters related to the Danube.

The Danube is a natural link between East and West, and its history

5. Benedek & Laszlo, *A Large International River: The Danube*, 13 Progress in Water Technology 61, 61-76 (1980).

Table 1. Economic and Danube-Related Alignments of the Eight Riparian Countries.

Country	*Economic*				*Danube-Related*	
	EC	*EFTA*	*OECD*	*CMEA*	*BT*	*DC*
West Germany	X		X		X	Obs
Austria		X	X		X	X
Yugoslavia			Obs	Obs	X	X
Czechoslovakia				X	X	X
Bulgaria				X	X	X
Rumania				X	X	X
Hungary				X	X	X
Soviet Union				X	X	X

EC = European Communities
EFTA = European Free Trade Association
OECD = Organization for Economic Cooperation and Development
CMEA = Council for Mutual Economic Assistance
BT = Bratislava Treaty of 1955
DC = Danube Commission

reflects the ever shifting balance of power in the Danube basin. In the words of Stephen Gorove:

> In Roman times it was considered as the northern border of the civilized world beyond which the light of the Eternal City vanished into barbarian darkness. Since then it has frequently formed a boundary between many of the riparian states. It has divided men, nations and civilizations from the long and fateful crusades of Christendom against the Turks, down to the gigantic struggles of Slavs and Germans. It has given additional impetus to the descent of the Iron Curtain, separating East and West. . . .[6]

Before World War II, the administration of the Danube was controlled by the single European Commission of the Danube[7] which established free navigation of the Danube for all European countries. Currently the river is governed by the Belgrade Convention of 1948, which clearly established Soviet dominance of the Danube by substituting the concept of free navigation with navigation under the exclusive control of the riparian countries, most of which were Soviet satellites.[8] The convention also changed the structure of the long-standing Danube Commission which was given quasi-legislative powers, but powers governing only river navigation and river inspection.[9]

Diverse, Conflicting Uses of a Large River

Possibly no other natural resource has so many uses as a river. Or-

6. S. Gorove, Law and Politics of the Danube 2 (1964).
7. The Treaty of Versailles, June 28, 1919, 225 Parry's T.S. 188.
8. S. Gorove, *supra* note 6, at 152.
9. *Id.* at 134.

ganizations responsible for river management must find a balance for the following fundamental, but sometimes conflicting, interests:

- Maintaining the river flow (for electric power generation and for the disposal of industrial and urban wastes);
- Maintaining and expanding the navigable waterways (for navigation);
- Assuring an adequate supply of water (for irrigation, industrial cooling processes, and all other uses);
- Protecting the water quality (for potable water, irrigation, fishing, recreation, tourism, and nature preservation);
- Preventing floods (for all uses); and
- Preserving the river and its surroundings (for recreation, tourism, and nature preservation).

Any management strategy will involve tradeoffs. Electric power generation, navigation, and waste disposal, for example, conflict with such uses as irrigation, fisheries, tourism, and supplies of potable water, all of which require good water quality. Irrigation requires enormous quantities of water and may seriously reduce the supply of water for other purposes.

Historically, international river disputes have involved mainly conflicts over water apportionment, for example diverting the water for industrial and agricultural uses by the upstream countries and depriving those downstream of adequate supplies.[10] The financing and control of flood prevention projects, with both advantages and disadvantages for downstream riparians, has been another contentious area, but also an issue that has presented opportunities for the cooperative management of rivers. Cooperation has been established in many river basins to promote large and multipurpose development projects, increase the supply of water, prevent wide-scale flooding, produce electric energy, and improve navigation.[11] Regrettably, this cooperation on river development projects has generally not evolved into mutual programs for combatting water pollution and assuring the environmental quality of the river basin. The potential conflict between the large-scale development of a river and its surroundings (with accompanying pollution problems), and the protection of the water quality and the environment is increasingly the basis of international disputes.[12]

Issues of water apportionment and flood control have not shaken the

10. *See*, Teclaff, *Harmonizing Water Use and Development with Environmental Protection*, in Water in a Developing World 72, 72 (A. Utton & L. Teclaff eds. 1978).

11. *See*, Alheritiere, *International Cooperation and Inland Waters: The Influence of Federalism*, *supra* note 10, at 166.

12. Because of the huge areas affected and the sheer scale of some proposed developments, long-distance (interbasin) transfers of water have evoked particular concern over the nature and scope of environmental changes. For instance, intense scientific and public debates have arisen over such proposals as shunting water from the Alaskan rivers through Canada and into the western United States, or the (abandoned) Soviet project for turning the Siberian rivers southward into Central Asia. For a discussion, see Teclaff, *supra* note 10, at 77-78.

Danube countries to the extent these issues have characterized the political development of many other river basins. The water supply of the Danube is not significantly exploited for agricultural purposes. A great deal of water is used for industrial purposes,[13] but much of this water is released back into the water supply and, therefore, only the quality of the water is affected. Flood control has primarily occupied national governments, with a few important exceptions, such as the Tisza River (Hungary and the USSR) and the Prut River (Rumania and USSR).[14]

Major Danube Issues and Conflicts

The principle Danube issues that have provided a foundation for negotiated treaty making and institution building have concerned navigation and electric power generation. The geography of the Danube has presented arduous obstacles to navigation, including large shallow stretches, hazardous rapids, severe ice in the winter, and heavy floods after the spring thaws. The long-standing Danube Commission has been instrumental in remedying most of these obstacles and has served as a forum for negotiating disputes mainly concerning the financing of the necessary investments.

Despite substantial investments for assuring its navigability, the Danube is still not a major waterway in comparison with other European rivers.[15] The international importance of the Danube, however, may radically change with the completion of the Rhine-Maine-Danube canal which, by connecting the Atlantic Ocean with the Black Sea, will allow ships to cross Eastern and Western Europe. This canal is the final link of a long-standing plan to create an interconnected system of inland waterways in Europe.[16] Its critics have protested the possible negative effects on Danube

13. In the U.S., for example, industry accounts for over 40 percent of overall water consumption. *See* A. Biswas, A. Khan & A. Nishat, River Basin Development (Dec. 1981) (paper presented at the National Symposium on River Basin Development, Dublin).

14. Flood control is a potential area of international dispute on the Danube since the past and current trend in building levies as opposed to flood plains increases the intensity of the flooding in downstream countries. *See* E. Wood, Application of Conflict Resolution Techniques to the Problems of International River Basin Management. IIASA Doc.# WP-75-48 (1975) (available at International Institute for Applied Systems Analysis, Laxenburg, Austria).

15. Around 60 million tons of materials are transported annually on the Danube and its tributaries, compared, for example, with around 700 million tons transported on West European waterways. The Yugoslavs transport the most goods on the Danube and its tributaries (22 million tons/year) followed by the Soviets (15 million tons/year), and the rest of the countries (26 million tons/year). *See* J. Linnerooth, The Transportation of Dangerous Substances (1985) (unpublished Report, available at International Institute for Systems Analysis, Laxenburg, Austria).

16. Its full cost (around 1 billion dollars) will be financed fully by the federal government of West Germany and the state government of Bavaria. This cost, it is estimated, will be recovered by the planned hydroelectric stations on the canal and the use of water for irrigation, industrial, and recreational purposes, and including the increased opportunities for German shipping. The Economic Commission of Europe has estimated that by the end of the 1980s, the traffic on the canal between Nuremberg and Regensburg will be approximately 14 million tons per year. *See* Rhein-Main-Donau, Inc., Construction Report 1974, Munich (April 1975).

water quality resulting from the increased chances of accidental spills of hazardous substances due to the expanding traffic on the river.[17]

The mountainous character of the Danube in its upper reaches and the large number of tributaries further downstream combine to make the energy potential of the river significant. This potential has largely, though not fully, been exploited. There are 49 planned or existing hydropower stations on the Danube, 40 of which are located in West Germany and Austria. These 40 power stations are matched in energy output by the two enormous Iron Gate stations between Yugoslavia and Rumania.[18] The huge Iron Gate project is one of several examples of collaboration between two riparian countries in developing the joint water resource.

The further development of the river for hydropower production has become highly controversial. After intense public opposition, a plan to construct a hydropower station in a nature reserve in Austria was abandoned. Another project was planned to improve the navigable channel along the shallow stretch between Czechoslovakia and Hungary, and for the construction of two hydropower stations at Gabcikovo and Nagymaros. A third country, Austria, would have contributed substantially to finance the Nagymaros project in return for imported electricity once the project was completed.[19] The Gabcikovo-Nagymaros project, has come under heavy attack from environmental groups, especially in Austria and Hungary. Among their worst fears are damaging the ecology of the river, destroying the wetlands of northwest Hungary, and adversely affecting the groundwater. Because of the intensity of political opposition in Hungary, the project has been suspended until further study. As a result of this project, and a similarly abandoned plant to construct a hydropower station in a nature reserve in Austria, the development of the Danube has become a visible and controversial public issue in the upper and middle riparian countries.

As early as 1977, the World Health Organization warned that pollution controls on the Danube were not adequate.[20] The pollution problems are worsening mainly as a result of the rapid economic development of the Danube basin and the accompanying increase in point and non-point pollution sources.[21] As countermeasures, at least for the organic pollution, some urban centers, especially in the upper reaches of the Danube, have

17. *See* Benedek, Literathy & Somlyody, *Monitoring and Modeling Efforts on the Large International River (Danube)*, 10 Progress in Water Technology 147, 153 (1978).

18. Benedek & Laszlo, *supra* note 5 at 65.

19. Austria would have financed about 70% of the estimated investment of around $300 million. *Das Donaukraftwerk Nagymaros*, 109 Schiffahrt und Strom 13, 13 (Aug./Sept. 1986).

20. World Health Organization, Pilot Zones for Water Quality Management, HUN/PIP 001/S014, Copenhagen (1977).

21. *See* World Health Organization, Study and Assessment of the Water Quality of the River Danube, ICP/RCF 204 0301 I, Geneva (1982).

or are constructing sewage treatment plants.[22] Without further measures, the planned construction of barrages and hydropower stations may also have an effect on water quality.[23]

The expected rapid economic development in the Danube Basin, the planned opening of the Rhine-Maine-Danube canal, and the possible construction of more barrages and hydropower stations will undoubtedly contribute to a change in Danube water quality, possibly along with other ecological consequences. The costs of this river water degradation as well as the benefits from the development of the Danube are not evenly distributed among the riparian countries. The more prosperous upper riparian countries depend on the Danube mostly for industrial and waste disposal purposes and benefit greatly from the water power potential. The less-developed lower riparian countries are more dependent on the river for drinking water, irrigation, fisheries, and a large tourist industry at the Black Sea. As a middle riparian, Hungary has little exploitable energy from the Danube, is required to make large investments in adapting its wetlands to a navigable channel, and is becoming increasingly concerned with pollution that originates primarily upstream and threatens the large quantities of water used for drinking and irrigation.[24] Some 97 percent of Hungary's surface water originates out of the country.[25] These upstream-downstream disparities will be discussed further in Section IV.

The asymmetrical interests regarding the need for less-polluted Danube water, which are found mainly in those countries at the lower reaches of the river, are confounded by the asymmetry of the resources available for pollution control, which are found mainly in those countries at the upper reaches. The Danube can therefore be characterized by an extreme mismatch between countries which would benefit from pollution control and those with the resources for providing this control. This mismatch is tempered, however, by the greater sense of environmental protection on the part of the upper riparian countries. While West Germany and Austria have the least direct benefits from improved Danube water quality, the emerging environmental movements in these countries, as well as Hungary's recent environmental movement, may give the issue a sense of political urgency.

22. *See* B. Hock and G. Kovacs, A Large International River: The Danube, IIASA Doc.# WP-87-11 (1978) (available at International Institute for Applied Systems Analysis, Laxenburg, Austria).

23. The issue whether barrages and hydropower stations contribute to worsening water pollution is controversial and not fully resolved within the scientific community. Barrages and dams block the flow of suspended particles which may then accumulate on some stretches of the river bed, providing a possible long-term reservoir of pollutants and influencing the water exchange between the groundwater and the river. Moreover, they reduce the velocity of the river flow and, in this way, lessen its capacity for regeneration from organic pollution. This loss in oxygen may be compensated, however, by the increase of the water surface and by the aeration of the water at the barrages.

24. Benedek & Laszlo, *supra* note 5 at 63.

25. Benedek & Hock, *Water Pollution Control on the River Danube*, in River Pollution Control 77, 78, 77-93 (M. Stift ed. 1980).

THE DANUBE WATER QUALITY ISSUE

Despite efforts on the part of the United Nations and the European Economic Community, there are as yet no fully standardized definitions and measures for the concept of water quality. This absence of any generally accepted notion of what constitutes water pollution contributes to the heterogeneity of the Danube water pollution issue. The water quality data collected by the eight Danube countries is not comparable since different measures are taken using widely divergent sampling techniques.[26]

Water quality definitions and measurements are not static, but develop dynamically to reflect their evolving purposes. They also reflect the perceptions, or contexts, of the problems as viewed by the different people or organizations concerned. While perceptions of the urgency of (and the resources for) environmental protection vary widely across Danube riparians, there may be a certain "common culture" shared by persons occupying the same professional or public roles. Three different perceptions of the Danube water quality issue can be roughly identified; those of the national (governmental) administrators, the international scientific community, and the emerging environmental interest groups.

The Governmental, Administrative Perspective

Following the Danube Declaration, the national governments are stepping up efforts to harmonize water quality definitions with neighboring riparian countries. These efforts are frustrated, however, by the diverse working definitions of the problem on the part of the relevant authorities in each of the riparian countries. These differences reflect, in part, the multiple uses of the water. The upper-Danube riparian countries are the most industrialized and depend to a lesser extent on the river for agriculture and potable water than those riparian countries located at the middle and lower reaches, where there are also large fisheries and a highly-developed tourist industry at the Black Sea.[27] Understandably, indicators of water quality and water sampling techniques have been developed in each country to reflect the dominant uses of the water in that country. In addition, indicators depend to a surprising extent on pragmatic, admin-

26. The problem of obtaining a representative sample for a pollutant is not trivial. Since the mixing potential of a riveris highly complex, the concentration of a pollutant may depend critically on where and when the sample is taken, e.g., on the left or right bank, in the middle, at the surface, etc., and whether sampled hourly, weekly, monthly etc. The length of a pollution plume from its source also depends upon the flow conditions of the river. Thus, the mean concentration of a pollutant at a cross-section of the river may not be representative of the pollution generally.

27. The downstream Danube riparians (Yugoslavia, Rumania, Bulgaria, and the USSR) have the major fisheries with an annual catch which is at least three times as great as the upper riparians (West Germany, Austria, Czechoslovakia, and Hungary). *See* R. Liepolt, Limnologie der Donau 38 (1967).

istrative considerations, for example laboratory facilities and practices, personnel, and equipment.

Despite differences in definition and measurement practices, the responsible national authorities share an overall common perspective of the problem, which is shaped by their mutual interest in limiting the concept to proportions with which they have generally dealt and for which they can currently cope. Water quality has traditionally been defined by such indicators as dissolved oxygen, pH, bacteria counts, temperature, and hardness. More recently the concept has been broadened somewhat to include selected prevalent chemicals and persistent, toxic substances.[28] Still, the most quoted summary notion of water quality in many countries remains the dissolved oxygen content.[29] With regards to this measure, the water quality of the Danube is relatively good, and the river can be classified generally as Class II.[30] This is surprising considering that many of the major cities and regions, especially on the lower reaches of the river, have no or only partial waste treatment facilities[31] (which often operate at far less than full efficiency). Paper and wood pulp industries in the upper riparian countries are also a significant source of organic pollution.[32] Apparently, the Danube has a good capacity for self purification with respect to biodegradable pollutants.

National and local water authorities are becoming concerned, however, that dissolved oxygen, although it remains the most quoted index for water quality with respect to effluent disposal, may not be a vitally important characteristic for establishing whether river water is fit for consumption.[33] This measure does not account for non-biodegradable and persistent toxic pollutants, including heavy metals and compounds of higher molecular weight, for example polyaromatic hydrocarbons. Toxic pollution threatens the use of the river as a potable water source. This is of substantial potential concern to the riparian countries since the river

28. For example, the concentrations of ammonia, calcium, magnesium, sulfates, chloride, phosphates, oil, phenols, detergents, heavy metals and certain hydrocarbons. Benedek & Laszlo, *supra* note 5, at 69.

29. In some countries, the BOD index is used more frequently to describe the quality of rivers or reservoirs. Personal communication with G. Kovacs, former leader of the Large International Rivers Project at IIASA, in Laxenburg, Austria (Aug. 1986).

30. European rivers are often classified on a scale from I to IV. Class I denotes excellent quality with high oxygen content sufficient to support trout; Class II has sufficient oxygen to support fish; Class III denotes water with little oxygen as a result of biological pollution; Class IV denotes extreme organic pollution. Drössler, *Aktion "Saubere Flüsse" 1985-1993*, Bundesministerium für Bauten und Technik, Wien at 4 (Jan. 1985).

31. With the exception of Regensburg (West Germany), Linz (Austria), and Vienna (Austria), the other major cities and regions, Bratislava (Czechoslovakia), Gyor region (Hungary), Novi Sad (Yugoslavia), Belgrade (Yugoslavia) and Budapest (Hungary) have no, or only partial, facilities for treating wastes. B. Hock & G. Kovacs, *supra* note 22, at 77.

32. *Id.* at 5.

33. Beck, *Modeling for Management*, in River Pollution Control, *supra* note 25, at 214.

is used as a major source of drinking water in Hungary, Yugoslavia, and Rumania, and supplies an important part of the drinking water in Austria, Czechoslovakia, and Bulgaria.

The Scientific Community Perspective

The trend in the scientific community is to broaden the water pollution concept, both with regards to the causes of the pollution and with respect to its definition. Kovacs, for instance, describes river pollution as an integrated, environmental problem resulting not only from unregulated industrial pollutants and accidental releases, but also from such factors as airborne and other non-point source pollutants, urbanization, deforestation, erosion, and intensified agriculture.[34] Water pollution is, therefore, a problem of cross-media pollution.[35] This notion of water pollution significantly expands the regulatory task from the more conventional focus on point sources to a more general concern with the side effects of economic and social development. Moreover, the scientific community is becoming acutely aware of the interrelationships between surface and groundwater.

Considerable research effort is also being directed toward understanding the problems involved with toxic substances. Especially in North America, concern over toxic, bioresistant pollutants is dominating more conventional water pollution issues.[36] This same concern has motivated the European Community to issue a directive setting out two lists of dangerous substances. The "black list" includes pesticides, mercury, cadmium, carcinogens, and other substances chosen according to their toxicity, their persistence in the environment, and their properties of bio-accumulation in flora, fauna, and the food chain, and therefore also in humans. The "grey list" includes substances whose harmful effects on the environment can be confined to a given area and depend on the characteristics and location of the water into which the substances are discharged.[37]

The health and ecological effects of toxic pollutants are far from settled in any scientific sense. The problems and uncertainties involved in controlling toxic substances can be appreciated by considering the following:

- there are about 7 million known chemicals;

34. Kovacs, *Decision Support Systems for Managing Large International Rivers*, in The Management of International River Basin Conflicts, 132, 133 (E. Vlachos, A. Webb & I. Murphy eds. 1986).

35. *See* Teclaff & Teclaff, *International Control of Cross-media Pollution—An Ecosystem Approach*, 27 Nat. Res. J. 21 (1987).

36. J. Carroll speaks of nations as being "toxics conscious." *See* Carroll, *Water Resources Management as an Issue in Environmental Diplomacy*, 26 Nat. Res. J. 207, 210 (1986).

37. European Economic Community Directive No. 76/464/EEC (May 4, 1976) (available at the Commission of the European Communities, Brussels). For a discussion, see V. Mandl, *The European Community and Water Pollution Control*, in River Pollution Control, *supra* note 25, at 41.

- approximately 80,000 are in commercial circulation;
- approximately 1,000 new chemicals enter commercial use each year;
- using the total of world laboratory resources, about 500 chemicals per year can be tested for toxicity (at colossal expenses); and
- one test, for carcinogenicity alone, can involve 800 test animals and 40 different tissue specimens per animal for pathology examinations—that is, 32,000 specimens. This requires approximately $500,000 and 3.5 years to perform.[38]

Not unlike many other important environmental issues, the problem of characterizing and understanding toxic water pollutants is not just a matter of more analyses. There will remain many aspects of the problem for which science will not be able to provide answers, at least not in the medium-term. Moreover, choosing from the thousands of chemical pollutants those that are most toxic or hazardous to humans or ecosystems is only part of the issue. There remain equally perplexing questions concerning the migration of these substances into water resources and their dispersion. According to an experienced water modeler, the concept of water quality is intrinsically dynamic and uncertain and the standard dispersion assumptions are often oversimplified.[39]

The Environmental Group Perspective

Since water serves basic human needs, any serious reduction in its supply or quality is, in the words of Frey and Naff "a fighting matter, as many a range war in the United States has demonstrated."[40] Under conditions of severe shortage, water or "good quality water" becomes for many key actors a highly sensitized and zero-sum public issue—one with alarming potential for conflict.

The issue of Danube water quality is by no means a fighting matter! On the contrary, it has the status of a routine, regulatory problem in that it is moderately low-key and spread among many organizations.[41] There are some indications, however, that it might evolve into a more contentious public issue involving citizen action and environmental groups. Just

38. B. Wynne, Risk Management and Hazardous Wastes 237 (1987).

39. *See* Beck, *supra* note 33, at 216. Water pollution is not the only issue in river management characterized by large uncertainties. Scientific opinion differs widely on such topics as the effects of artificial reservoirs on a region's groundwater, the extent to which flood protection, irrigation, and drainage change the fertility of the soil, the transport of pollutants in a river, including changes in the transport of sediment and the accumulation of silt from water works, the efficiency of filtering techniques for drinking water, the possibility and implications of long-term fluctuations in water supply, and generally the prediction of environmental consequences of water development.

40. *See* Frey & Naff, *Water: An Emerging Issue in the Middle East?*, Annals of the American Academy 65, 69 (1984).

41. *See* Lowi, *American Business, Public Policy, Case Studies and Political Theory*, 16 World Politics 677, 693 (1964).

as the "toxic problem" has become a dominant issue in North America and in some European countries, there is also growing concern over toxic pollutants by environmental groups and the public of the Danube countries. The recent accidents resulting in toxic poisoning of the Rhine river have dramatically intensified this concern by focusing attention on problems of acute toxic water pollution.

The most significant recent development is the emergence of an influential environmental movement in Hungary. This movement has concentrated much initial effort on stalling the planned hydropower stations on the Danube. The recent loosening of political barriers to environmental protest has catapulted this issue onto Hungary's turbulent political agenda.

UPSTREAM-DOWNSTREAM DISPUTES

Caldwell has noted the paradoxical circumstance that today only sovereign states can collectively establish the cooperation necessary to resolve many transnational environmental problems, and yet for that cooperation to succeed, some part of national sovereignty or of political freedom must be surrendered.[42] Surrendering this sovereignty in order to address Danube water quality issues will ultimately require the conditions and incentives for this cooperation. These conditions are frustrated by the "upstream-downstream" geopolitics of international rivers, where the upper riparian countries have distinct advantages in such policy areas as flood control, apportionment of water supplies, and especially river water contamination. The bargaining chips of the downstream countries may be limited to such areas as granting navigation rights or contributing to joint hydropower projects.

If negotiation is characterized as an interactive process by which two or more parties or countries seek cooperatively to do better than they would have otherwise, then their alternatives to negotiation determine in some sense their negotiating power.[43] Negotiations can be most productive when this power is evenly distributed or when all parties are capable of contributing to a common good (or reducing a common bad) without which each would equally suffer (or benefit). When these conditions are lacking, such as in the "upstream-downstream" situation, then one can speak of power asymmetry.[44] One (or more) parties likes things the way they are and the other (or others) wants to change them. Those who want changes do not have the means to provide incentives to those interested in maintaining the status quo. Negotiations can be stymied when there

42. Caldwell, *Beyond Environmental Diplomacy: The Changing Institutional Structure of International Cooperation*, in International Environmental Diplomacy 13 (J. Carroll ed. 1988).

43. *See* Lax & Sebenius, *The Power of Alternatives or the Limits to Negotiation*, 2 Negotiation J. 215, 218 (1985).

44. *See* Zartmann, *Negotiating from Asymmetry: The North-South Stalemate*, Negotiation J. 23, 27 (1986).

appear to be no possibilities for trade, or when one or more of the parties is reluctant or unwilling to negotiate.[45]

This asymmetry appears particularly troubling for the Danube river. As upper riparian countries, West Germany, Austria, and Czechoslovakia have less direct interest in improving water quality (the proportion of water in these countries used for drinking, irrigation, fisheries and tourism is less than for the countries further downstream), and have further advantages as well. With the exception of Northern Hungary and the Iron Gate region, the energy potential of the Danube is found mainly in the upstream countries, which are also more industrialized than many of their downstream neighbors and thus potentially have more chronic and accidental discharges into the water. As for navigation, the interests of those countries within the Council for Mutual Economic Assistance (CMEA) in an unrestricted navigation route to the Atlantic are at least as great as Western Europe's interests in an unrestricted Eastern route. In sum, there appear to be weaker incentives for the upper Danube riparian countries to cooperate with those further downstream. Alternatively, the downstream countries, with their large fisheries, tourist industry, and greater dependence on the Danube for potable water and irrigation, have a great deal to gain by cooperative policies, especially regarding water quality. In the opinion of the secretary of the Vienna-based International Society for Danube Research, the problems presented by the upstream-downstream politics are more formidable for multilateral cooperation than the problems presented by the East-West politics.[46]

The issue of "upstream-downstream" is not, however, so clear as it may at first appear. Each of the Danube riparian countries lies both upstream and downstream on either the Danube or other rivers crossing its borders; each country has an internal interest in improving the water quality within its borders, especially as environmental interests become more pressing in the upper riparian countries;[47] and many old and new factors of joint interests (such as provision of a shipping fleet and groundwater quality) are apparent. In the words of a former member of the Indus Commission:

> [A]ll riparian conflicts must be conditioned by the recognition that fresh-water diplomacy is a symbol and the test for the fundamental features of international relations: how to balance national interest (the domestic demands which go with availability of water and the

45. Le Marquand, *Politics of International River Basin Cooperation and Management*, in Water in a Developing World, *supra* note 10, at 72.

46. Personal Interview with E. Weber, International Society for Danube Research, Vienna, Austria (Apr. 1986).

47. The most upstream riparian, West Germany, has one of the best reputations in the overall management of its rivers.

> emotion which goes with notions of territorial sovereignty) and the uncontrollable imperatives of international interdependence. We now have new factors which underline that "beggar thy neighbor" approach, and ignoring the logic of integral unity of river basin and common stakes in the optimal progress of upper and lower riparian partners, is self-destructive. Ecology and groundwater potential which do not respect political frontiers and do not necessarily give advantage to the upper riparians are compulsive new considerations.[48]

Even recognizing these emerging, compulsive new factors, inter-basin cooperation will continue to encompass issues, such as water pollution, characterized by unequal negotiating power. Their solution will presuppose the existence of "political will" on the part of the basin states. Since the real financial costs of measures such as pollution control may be substantial, and since national sovereignty is inevitably compromised through international cooperation, some compensating advantage or incentive to the upper riparian states is a prerequisite for cooperation. This compensating advantage may be generated internally by the heightened awareness of environmental issues, or, alternatively, it may be a part of the bargaining process. In an extreme case, the more developed upper riparian nations may wish to create "good will" with their neighbors by contributing more to pollution control while benefitting less.[49]

The need for incentives is reinforced by the rudimentary and relatively ineffectual state of international law as a means of regulating water issues. Traditionally, four theories governing the use of international rivers have been advocated: (1) the Harmon Doctrine which advocates absolute sovereignty to upper riparians; (2) absolute territorial integrity which guarantees the lower riparians the use of the river in an unaltered state; (3) drainage basin development which stresses mutual development of a river's waters by all riparian states; and, (4) the equitable utilization theory, or limited territorial sovereignty, which permits use of a river's waters to the extent of doing no harm to other riparian countries.[50] This latter principle of "reasonable and equitable" utilization of water resources[51]

48. Mehta, *The Indus Water Treaty*, in The Management of International River Basin Conflicts, *supra* note 34, at 33.

49. This asymmetry is also a problem regarding river development projects. Nalven shows how problems arise with respect to development projects where material contributions represent a greater fiscal strain for the less developed countries, and he suggests a broader "international cost" concept for allocating the burdens of the project. This concept, of course, must be sensitive to the social and cultural differences of the countries involved. *See* Nalven, *Transboundary Environmental Problem Solving: Social Process, Cultural Perception*, 1 Transboundary Res. Rep. 4, 4 (1987).

50. *See* Le Marquand, *Politics of International River Basin Cooperation and Management*, in Water in a Developing World, *supra* note 10, at 48.

51. The equitable utilization theory has become the most widely advocated theory, not only by the international legal community, but also as evidenced by treaties, judicial decisions, academics, and international bodies. *See* Utton, *International Water Quality Law*, in International Environmental Law 154 (L. Teclaff & A. Utton eds. 1975).

has now been established by such distinguished bodies as the International Law Association and International Law Commission of the United Nations.[52] These principles and guidelines, although established as rules of customary international law, are difficult to apply unless there is an established international river commission to administer the river on an ongoing basis.[53]

Linkages

With the weakness of effective international rules and institutions, and when one or more of the negotiating partners lacks incentives to agree, broadening the negotiating agenda or linking even disparate issues may increase the bargaining potential of all countries. Even between countries, where there are few explicit tradeoffs, one country may wish to build up a "reservoir of good will" to draw upon in future dealings. The potential of problem linkages in resolving long-standing stalemates was seen in a case involving the Colorado river, where the United States as the upstream country finally agreed to build a costly desalination plant only after river pollution was linked to other problems between Mexico and the United States.[54] The long deadlocked negotiations were only fruitfully resumed when the salinity issue became critically important to relations between Mexico and the United States.

The geopolitics of the Canadian-U.S. boundary, as another example, are more symmetrical. Both countries lie upstream and downstream on sometimes even the same rivers, and both are "sinners" regarding pollution practices. Imbalances, of course, exist, but the economies and societies of these two countries are so intertwined that the benefits of collaborative work are quite apparent. Apportionment and supply issues dominated U.S.-Canadian negotiations until the early 1970s, when more qualitative pollution and ecological issues became a primary concern.[55]

Whereas the theory of environmental (and other) linkages is attractive for reframing issues and facilitating bargaining, too little attention has been given to the institutional and procedural obstacles for putting theory into practice. Environmental policy making has become increasingly specialized and fragmented, reducing the possibilities for more holistic ap-

52. *See* Solanes, *The United Nations Role in Promoting and Fostering Cooperation in the Field of International Water Resources*, in The Management of International River Basin Conflicts, *supra* note 34, at 87.

53. *See generally*, Utton, *supra* note 51; Teclaff, *The Impact of Environmental Concern on the Development of International Law*, 13 Nat. Res. J. 355, 357 (1973).

54. *See* Gantz, *United States Approaches to the Salinity Problem on the Colorado River*, 12 Nat. Res. J. 496 (1972); Utton, *Problems and Successes of International Water Agreements: The Example of the United States and Mexico*, in International Environmental Diplomacy 117, 122 (J. Carroll ed. 1988).

55. For a full discussion, *see* Carroll, *supra* note 36.

proaches.[56] Expanding the water quality negotiation agenda to include, say, controls for dealing with acid rain or even groundwater introduces a staggering degree of complexity into the process. From a procedural perspective, this may be possible only by moving the issue to a higher political level, as was the case in the Mexico-U.S. negotiations.

A special kind of linkage involves monetary compensation or "side payments." While paying the polluting country to clean up violates the polluter-pays-principle, it may be the only route to promote the desired changes, as evidenced by the recent proposal that the Netherlands and West Germany compensate France for the costly process changes necessary to reduce the salinity of the Rhine.[57] Another type of linkage, which is relevant mainly for the developing world, is international loans and subsidies for river development. Mehta describes how the World Bank with its lure of development funds became an independent arbitrator in the negotiations leading to the Indus Water Treaty in 1960.[58] Le Marquand describes a similar process of agreement on the Senegal river, where the prospective funds from the international community for its large-scale development served to mute much interstate conflict.[59]

COOPERATION THROUGH BILATERAL, STEPWISE NEGOTIATIONS

Improving the water quality of the Danube through cooperative decisionmaking will be seriously complicated by the power asymmetry between the upstream and downstream riparians and the scientifically complex and ill-defined nature of the water pollution issue. Cooperative policy making will also be hampered by the lack of an existing river basin regime for multilateral, integrated decisionmaking on the Danube.

Despite these obstacles, ministers from the eight riparian countries who signed the non-binding Danube Declaration stated that:

> The governments of the Danube states will endeavor to solve, stepwise, through bilateral and multilateral agreements, the concrete

56. Le Marquand has shown that this fragmentation is also apparent within the foreign policy institutions which may be responsible for conducting the negotiations, but which are dependent on other government institutions (such as justice, finance, water resources, and environment) for technical expertise and resources. Without interference and direction from above, the foreign affairs department may be severely restricted in the policy options it can pursue. Le Marquand, *Politics of International River Basin Cooperation and Management*, in Water in a Developing World, *supra* note 10, at 159.

57. Personal Communication with E. Ferguson, Secretary of the Dutch Committee on the International Institute of Applied Systems Analysis (IIASA), in Amsterdam (Nov. 1986).

58. *See* Mehta, *The Indus Water Treaty*, in the Management of International River Basin Conflicts, *supra* note 34 at 47.

59. Le Marquand, *International Development of the Senegal River*, in The Management of International River Basin Conflicts, *supra* note 34, at 68.

> problems of the Danube, especially with respect to its water quality, which is of life-giving importance to the Danube countries.[60]

Of special interest is how the signing ministers of these eight countries intend to secure the cooperation necessary for dealing with the manifold issues of Danube water quality. In this regard, the above quote from the Danube Declaration is revealing, especially its wording "to solve stepwise through bilateral and multilateral agreements." Any progress on combatting the pollution of the Danube will be made through narrowly focused, rather than integrated and more comprehensive agreements, between two or maybe clusters of countries. As expressed by a member of the Austrian-Czechoslovakian Border Commission, the non-binding Danube Declaration should be viewed primarily as a signal for the riparian countries to establish more encompassing bilateral agreements, particularly in addressing problems of water quality.[61]

"Functional" and "participant" incrementalism appears, therefore, to be the explicit strategy envisaged by the signing ministers of the Danube Declaration. In this context, incrementalism means making progress by stages, or often *ad hoc* sequencing, related to Lindblom's seminal description of "disjointed incrementalism."[62] As increasingly complex problems emerge on the international negotiating agenda, the political actors often muddle through with strategic blinders —structuring the issues and bounding each subissue in such a way that it is reduced in its complexity.[63] Functional incrementalism, then, means that progress is made by partial rather than holistic improvements. A counterpart to this functional incrementalism is the concept of participant incrementalism, where agreements are first negotiated only among the most receptive participants with the intention of adding to this core consensus through subsequent negotiations.

Bilateral and Multilateral Agreements: Participant Incrementalism

The Danube Declaration has set the stage for individual country initiatives in negotiating agreements with neighboring countries, in other words, for cooperation through bilateral or multilateral arrangements. This stands in contrast to the 20th century theme of basin-wide planning, where various forms of river basin commissions deal cooperatively on managing water resources common to more than one jurisdiction.[64] There are many different types of river basin organizations with widely differing

60. Danube Declaration, *supra* note 1, at 429.
61. Personal Interview with E. Schmidt, Austrian-Czechoslovakian Border Commission (1986).
62. Lindblom, *The Science of Muddling Through*, 19 Pub. Admin. R. 79, 83 (1959).
63. *See* Linnerooth, *The Political Processing of Uncertainty*, 56 Acta Psychologia 219, 224 (1984).
64. *See* Teclaff, *supra* note 10, at 75.

functions, ranging from the integrated management of a drainage basin or watercourse system,[65] to the management of a development project through a single-purpose commission,[66] to the management of data and statistics.[67] These institutions also differ regarding their respective powers and procedures. Of special interest here are those commissions with explicit mandates to anticipate disputes between the riparians and to facilitate their resolution.[68] Helping resolve disputes is critically important, especially since there are few examples of multi-purpose commissions with significant decisionmaking power.[69] According to Caponera:

> National interests often prevail when shared resources have to be allocated, when priorities have to be established among different uses, and when decisions have to be enforced. Decision making on these issues seldom rests in a joint commission, committee, or like institution. More often, all relevant decisions are negotiated piecemeal and approved unanimously by all states concerned, whether separately or within a collegiate body. Institutionalized cooperation is more successful in preparing the necessary data for decision making.[70]

Even though experience is limited at the international level, there has been important experience with multi-purpose, integrated commissions for dealing with regional water problems on the national (federal) level, for example, the interstate river administrations existing in Argentina, Australia, Canada, the United States, and India. The river basin concept has also spurred the emergence of a new type of regional institute, the

65: For example, the Niger River Authority has the purpose of insuring an integrated development program for all Niger basin water resources and activities. *See* Caponera, *Patterns of Cooperation in International Water Law: Principles and Institutions*, 25 Nat. Res. J. 563, 563-87 (1985).

66. For example, the Danube Commission has responsibility only for navigation. *See* S. Gorove, *supra* note 6, at 28.

67. New institutional mechanisms in the form of joint permanent technical committees have recently been created in Southern Africa, *see* Caponera, *supra* note 65. For the Danube, this function is filled, but only to some extent, by the International Association for Danube Research, itself a part of the International Society for Limnology. This inter-basin association carries out research on topics related to the chemical, biological, and general life properties of the Danube, but does not do any policy related research. It would be of only limited value, thus, in advising on the priorities to be established for different uses and users of the river.

68. For example, the Niger River Commission was created among the nine riparian countries for planning, exchanging information, preparing recorded decisions to be taken by member governments, and settling disputes between the parties. Also, the International Joint Commission (IJC) between Canada and the U.S. was originally created for preventing and settling water disputes. *See* Le Marquand, *Politics of International River Basin Coooperation and Management*, in Water in a Developing World, *supra* note 10, at 76.

69. An exception may be the Senegal River Basin Management Organization (OMVS) with four riparian members which encourages and coordinates water resources development in the Senegal. The unanimous decisions of the Conference of the Council of Ministries of the OMVS automatically bind its member states. *See id.*

70. Caponera, *supra* note 65, at 569.

valley authority, a trend which also became apparent at the international level in the 1960s.[71]

Besides facilitating the resolution of riparian disputes, another important function of a multinational, integrated organization is its potential for building transnational and transgovernmental coalitions to deal with multiple and imperfectly linked issues.[72] However, as Majone has argued with respect to global regulatory agencies, there may be serious conceptual and pragmatic problems with organizations responsible for coordinating policies with widely differing local causes and consequences, that is, the high transaction costs involved and the reluctance of nations to sacrifice their sovereignty.[73] Aside from the many advantages and disadvantages, it is unlikely that minigovernments with the power to legislate and implement river basin policies across national boundaries will emerge. The role of transboundary commissions in defining negotiating agendas, linking issues, and facilitating the negotiating process may, on the other hand, have considerable potential promise.

The political obstacles for creating a supra-national river commission for the Danube, or even a multi-purpose commission with limited powers, are apparent from the history of the Danube Commission. This single-purpose Commission has been the most influential international organization dealing with the Danube, though only with matters regarding navigation.[74] Created in its present form after the Second World War, it is a decidedly riparian institution, where the East European countries have a clear majority. West Germany continues to have observer status only. Despite the power imbalance, in many respects the Commission may be considered a prototype for East-West cooperation, but only in a narrowly-defined functional field.[75] This same cooperation is not likely to develop in areas outside of navigation.

71. In an analysis of federal experience with interstate authorities, Alheritiere shows that the idea of establishing a supranational, integrated, multi-purpose drainage basin commission is largely utopian, and may be unnecessary. Some of the more effective interstate policies have been set by commissions not dealing with the entire river basin or not having jurisdiction over all the uses of the river. *See* Alheritiere, *Settlement of Public International Disputes on Shared Resources, Elements of a Comparative Study of International Instruments*, 25 Nat. Res. J. 701 (1985).

72. *See* R. Koehane & J. Nye, Power and Interdependence (1977).

73. Majone, *International Institutions and the Environment*, in Sustainable Development of the Biosphere 137, 143 (W. Clark & R. Munn eds. 1986).

74. Currently, the Danube river is regulated by the Belgrade Convention of 1948 and by a series of special agreements. The Danube Commission deals with problems concerning the regulation of the Danube for navigation purposes, the maintenance of the navigable channels, regulations regarding signals, safety matters, etc., measures against the obstruction of channels with ice, taxes on ship traffic, development of the Danube fleet, improvement of navigation technology, development of industries and harbors, and general water management. It plays only a small role in energy projects and flood control. *See* S. Gorove, *supra* note 6, at 154.

75. The processes of the DC have been described as cumbersome and sometimes frustratingly slow—and its secretariat remains largely powerless, yet it has functioned quite effectively as an instrument of East-West cooperation. The principle of unanimity has protected those in the minority from being forced into decisions to which they object and the search or a consensus has often resulted in constructive compromises. For a full history of the Danube Commission, see F. Pichler, Die Donau Kommission und die Donaustaaten: Kooperation und Integration (1973).

As Pichler writes, it would have been natural for the highly qualified and ever increasing membership of the Danube Commission to have expanded its authority from that of navigation to areas such as energy production and water planning.[76] This integrative process did not occur, however, and for deliberate political reasons. The neutral and non-aligned countries, Austria and Yugoslavia, formed a blocking coalition preventing the USSR from expanding the influence of the Danube Commission, and thus its own influence, beyond that of navigation. According to Schmitter, this was a predictable process of regional integration, where decisions of the commission were "encapsulated" rather than allowed to spill over into other areas.[77]

It is clear from the history of the Danube Commission that cooperation among the eight riparian countries on issues such as transfrontier water pollution will not be facilitated through the creation of a multi-purpose commission with the breadth to make politicized tradeoffs between the conflicting interests or uses of the river, or even with the power to facilitate negotiations. A single-purpose commission for water quality monitoring and pollution control, as advocated by Benedek and Laszlo,[78] also does not appear likely at the current time. In the absence of an international river basin authority, the most likely mechanism for achieving collaboration appears to be through mainly bilateral agreements. Table 2 shows that, with only two exceptions, all agreements and treaties for the Danube tributaries and especially the border waters have been bilateral.

What this style of river management means, in contrast to an idealized multi-purpose, supranational, basin-wide commission, is that joint decisions will be made through agreements involving complex procedures of international bargaining. In Austria, for example, authority for the Danube, both domestically and internationally, is spread among six federal government ministries and their various service organizations.[79] The jurisdiction of these federal ministries ends with the Danube and border waters; responsibility for all other Austrian rivers rests with the Austrian provinces.[80] Environmental groups are also arriving on the scene with

76. *Id.* at 71.

77. *See* Schmitter, *A Revised Theory of Regional Integration*, 4 Int. Organization 82, 86 (1970).

78. *See* Benedek & Laszlo, *supra* note 5 at 64.

79. The Ministry for Agriculture and Forestry has responsibility for the water quality of the Danube and frontier waters, whereas the Ministry of Health and Environment must assure safe drinking water. Hydro-electric and other projects must be approved by the Ministry for Construction and Technology, which has a special fund (Water Management Fund) for subsidizing sewage systems and water treatment plants. The Water Police (Strom Polizei), which are responsible for enforcing the navigation codes, are located within the Ministry for the Interior, whereas the Shipping Police (Schiffahrts Polizei), which assure that the channel is properly marked, etc., is part of the Ministry of Transportation. Coordinating water policies with other countries brings in another governmental authority, the Foreign Affairs Ministry.

80. Constitutionally, the Austrian Federal Government has responsibility for all rivers in the country, Bundesverfassungsgesetz, Art. 102, Para. 2 (Austrian Constitution). In practice, however, the powers of the responsible federal ministries are restricted to maintaining and regulating the Danube, March, and Theya (Bundesgesetzblatt Nr. 78, Para. 120, 1987). This dispersed authority

Table 2. Some Multilateral and Bilateral Agreements Concerning the Danube

Year	*Countries*	*Topic of Agreement*
1948 (1960–	(Austria), Bulgaria CSSR, Hungary, Rumania, Ukraine, USSR, Austria)	Danube Convention of navigation of Danube
1950	Hungary, USSR	Convention to prevent floods and regulate R. Tisza
1952	Rumania, USSR	Convention to prevent floods and regulate R. Prut
1954	Austria, Yugoslavia	Convention concerning water economy questions relating to R. Drava
1954	Austria, Yugoslavia	Convention concerning water economy questions relating to R. Mura
1955	Rumania, Yugoslavia	Agreement concerning control of frontier waters
1955	Hungary, Yugoslavia	Agreement concerning water economy
1956	Austria, Hungary	Treaty concerning water economy in frontier regions
1956	Albania, Yugoslavia	Agreement concerning water economy in frontier regions
1957	Hungary, Yugoslavia	Agreement concerning fishing in frontier waters
1957	Rumania, Yugoslavia	Agreement extending R. Prut convention (1952) to Tisza, Suceava and Siret, and other frontier waters
1958	CSSR, Poland	Agreement concerning use of frontier water resources
1958	Bulgaria, Yugoslavia	Agreement concerning water economy
1959	Rumania, USSR	Agreement extending R. Prut convention (1952) to Danube
1963	Rumania, Yugoslavia	Agreement relating to navigation and power generation Iron Gates
1967	Austria, CSSR	Treaty relating to management of frontier waters
1969	Hungary, Rumania	Convention relating to control of frontier waters
1971	West Germany, CSSR	Local (nongovernment) commission dealing with pollution and management of frontier waters

Source: World Health Organization, Study and Assessment of the Water Quality of the River Danube, ICP/RCP 204 0301 I, Geneva (1982).

strong protests over the possible ecological and water quality consequences of the planned hydropower stations in Austria and further downstream.

While the federal government in Austria has full control over the Danube, this is not the case for two neighboring countries, West Germany and Czechoslovakia, where the respective state (Länder) governments have the primary responsibility for all rivers within their territories.[81] Hungary might be considered at the other extreme of Austria, since most of the competence for the Danube river is found in one central body, the National Water Authority.[82]

Stepwise Agreements: Functional Incrementalism

The difficulties in coordinating measures and testing protocols for conventional water pollution and the huge number of proven and potentially toxic substances which find their way into water supplies underscore the need for regulatory attention to be selective. A comprehensive policy for water pollution with the many diverse sources and effects of hazardous pollutants would overwhelm any regulatory authority as well as efforts to negotiate a common policy between two or more countries. Setting boundaries on the negotiating agenda and proceeding stepwise through the intricacies of the problem will be essential.[83]

As emphasized by the Danube Declaration, the first step in grappling with the manifold problems of improving Danube water quality is arriving at a common agreement on what water quality is and how it should be tested. This means harmonizing the many divergent testing protocols found on the Danube, a process which will meet all the definitional and administrative complications discussed in Section III.[84]

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can lead to serious problems in coordination, for instance, if the Ministry for Agriculture and Forestry detects a change in the water quality of the Danube, it may find it difficult to track the source of the pollution to the tributaries which are outside its jurisdiction.

81. World Health Organization, Water Quality Protection of the River Danube, ICP Proposal 2009 (1986).

82. World Health Organization, Pilot Zones for Water Quality Management in Hungary, HUN/71/505-Hun PIP001 (1976).

83. For a discussion of the political bounding of a similar issue, see M. Dowling & J. Linnerooth, The Listing and Classifying of Hazardous Wastes, IIASA Doc.# WP-84-26 (1984) (available at International Institute for Applied Systems Analysis, Laxenburg, Austria).

84. Obstacles to better coordination of technical definitions and practices have been clearly illustrated by attempts on the part of the European Economic Community to harmonize standards for water quality, which have met with resistance from countries with different administrative working definitions. For example, the U.K. has developed a philosophy of performance-based standards which is contrary to the EC's concept of uniform limit values. *See* Biggs, *Quality Objectives and Fixed Emission Standards—an Industrial View*, in River Pollution Control, *supra* note 25, at 31-35.

The Austrian-Czechoslovakian Agreement on Testing the Water Quality of the Frontier Waters

The workings of the Austrian-Czechoslovakian Border Commission,[85] and a recent agreement within this Commission on common definitions and testing protocols for measuring the water quality of the frontier waters,[86] present a good example of the incremental (participant and functional) procedures set out in the Danube Declaration. This agreement, marking the first stage in the eventual improvement of Danube water quality, involved only two countries, and discussions were confined to a narrow concept of water quality. Besides oxygen content and biological indices, the measures included water pH, ammonia, nitrates and nitrites, phosphorus, chloride, calcium, magnesium, mineral oil, and the hardness of the water. The agreed-upon protocol did not include tests for heavy metals, pesticides, carcinogens, and other toxic substances found, for example, on the EC Black List. Despite its limited scope, it is valuable as a first step in reaching an overall basin-wide agreement on data collection for water quality measurements, and it may serve as a model for further riparian agreements.[87] The way in which this agreement was reached, then, is of interest.

The loosely-knit Border Commission is composed of four commissioners from each country, representing separate federal ministries concerned with different aspects of water management. When problems concerning the border waters (for example regulation, flood control, and water supply) come to their attention, usually a working group of experts from both countries is established which makes recommendations to the Commission. These recommendations are approved only with unanimous agreement among the eight commissioners. Once agreements are reached by the Commission, they must then be ratified by the respective federal parliaments. Over a period of six years, the Austrian and Czechoslovakian expert committee for establishing testing protocols met regularly and, with the eventual imposition of a deadline by the Commission, reached an agreement. Having agreed within the expert committee, approval by both the Border Commission and the respective national parliaments was *pro forma*.[88] This represents an example, then, of negotiation and decision by expert committee.

The question arises as to why the current interest on the part of Austria and Czechoslovakia exists in coordinating policies leading eventually to

85. *See* the Treaty Concerning the Regulation of Water Management Questions Relating to Frontier Waters, art. 314, Dec. 7, 1967, Austria-Czechoslovakia, 728 U.N.T.S. 313.

86. Gemeinsame Methodik der Untersuchungen des Gütezustandes der Österreichisch-Tschechoslowakischen Grenzwasser (1986).

87. *See* Schmidt, *supra* note 61.

88. The Austrian parliament has ratified the agreement (Oct. 1986), and Czechoslovakian ratification is expected shortly.

an improvement in the quality of the frontier rivers, especially in view of Austria's position as the upstream country. The answer appears to lie in the long-standing concern on the part of both countries in improving the water quality of the heavily polluted March, a river forming the border between Austria and Czechoslovakia and an important tributary to the Danube. This interest became acute for both countries when plans were made to construct the Gabcikovo-Nagymaros barrage and hydroelectric system. This project, which is now being reconsidered, required an improvement in the organic water quality of the Danube. For Austria, which planned to participate in the financing of this project and, in return, receive electric power, the water quality issue was linked with its interests in hydropower generation in the downstream countries.

OUTLOOK: A ROLE FOR THE ANALYST?

The signing ministers of the Danube Declaration have emphasized that a balanced management of the Danube river can be achieved only through cooperation among the eight riparian countries. Establishing this cooperation, especially on improving the water quality of the Danube, will be complicated by the power asymmetry between the upstream and downstream countries, the scientifically complex and ill-defined nature of the problem, and the lack of an effective river basin authority for multilateral, integrated decisionmaking on the Danube.

A more comprehensive and expedient program for tackling the problems of Danube water pollution is also limited by the inherent difficulties sovereign states face in negotiating environmental issues. In a recent article, von Moltke questions whether sovereign states can speak for all interests within their jurisdiction, and particularly for the needs of environmental protection.[89] However, there is a trend toward enlarging the circle of participants recognized as having legitimate interests and a right for participation in the international negotiations. International cooperation is more and more influenced by non-governmental organizations operating across political and bureaucratic boundaries and forming networks of influence on policy decisions.[90] This influence has worked toward the institutionalization of international cooperation. The viability of many international institutions would be doubtful were it not for the presence of non-governmental organizations behind them. Yet progress will not be rapid. International negotiating processes have adjusted slowly to the existence of non-governmental participants.

89. *See* K. von Moltke, Scientists, Environmentalists, Local and Regional Officials: Nontraditional Participants in International Environmental Negotiations (Working Paper prepared for the U.S. Environment and Natural Resources Task Group, Processes of International Negotiation Program, American Academy of Arts and Sciences, Cambridge, Mass. 1987).

90. *See* Caldwell, *supra* note 42, at 13.

The problem of toxic water pollution on the Danube has emerged as an issue only within certain non-governmental groups, and almost exclusively in the more developed upper and middle riparian states. To date, only a limited program for the development of common testing protocols has found its way onto the negotiating agenda, and these protocols will encompass mainly tests for the more traditional indicators of water quality. As a low-key issue, progress on Danube water pollution will undoubtedly continue very slowly within the incremental procedures laid out in the Danube Declaration. Only as the issue becomes more urgent from the perspective of the scientific community and from the standpoint of the public can more expedient actions be anticipated, but only to the extent that these groups gain standing on the negotiating agenda. The public visibility of the Danube water pollution issue in the different riparian countries is therefore critical to the progress of negotiated solutions. This visibility will depend to a large extent on the economic development of the countries and the corresponding consciousness and concern about environmental problems on the part of the public and the scientific community. At the present, this consciousness varies widely among the eight riparians.

The perceived seriousness of the issue will also depend on future events and their media coverage. Nelkin shows the importance of the media in defining and articulating environmental issues and in establishing a framework of expectations that can influence the agenda of international negotiations.[91] In the case of complex environmental problems, such as toxic water pollution, the public relies heavily on the media as the major source of information defining the reality of the situation for them, although different populations and different subcultures within populations will process this information differently. The media stimulates demands for accountability, forcing negotiators to justify themselves to their constituencies. The extensive media coverage of the Rhine river accidents may be a crucial initiating event, at least in the more developed, upper riparian countries.

A Role for the Analyst?

Even if Danube water quality emerges as an urgent public issue with corresponding pressures on international negotiators, difficult scientific issues, and equally perplexing institutional problems, will stand in the path of its resolution. With the complexity of both the scientific issues and the procedural mechanisms, analysts have become concerned about

91. *See* D. Nelkin, The Role of the Media in International Environmental Negotiations Program (Process of International Negotiation Working Paper, American Academy of Arts and Sciences, Cambridge, Mass. 1987).

how they can be more effective, not only in identifying transfrontier environmental problems and alternatives for their solution, but also in providing support for negotiating international treaties and agreements for their resolution. The use of computerized support systems for aiding policy makers and negotiators has become especially typical.

A wide range of scientific opinion accompanies most environmental issues. In the case of the Danube, for example, there are serious conflicts concerning the effects of river development projects on the quality of the Danube water, the groundwater, and the general ecology of the river basin. Many view the negotiation process, thus, as foremost an exercise in joint learning to reach common understandings and eventual solutions. A hypothesis underlying much of the literature on the use of computers to facilitate or aid negotiations is that information forms a neutral ground for agreement which can free the path for trading off legitimate differences in interests.[92] Raiffa, in noting the enormous scientific complexity in international environmental disputes, notes also the important question of the interrelation between facts and interests:

> Negotiators must argue the merits of their cases, but they don't know the physical facts. There is a need for some mutual learning. How do they learn together and still protect their own interests? That is the beauty of the problem.[93]

This problem of learning together is fundamental to the use of computer support systems in aiding negotiations. This section will briefly discuss the potential and limitations of computer aided negotiations (CAN) for two distinctly different negotiation settings: (1) the "win-win" bargaining setting where all the parties perceive mutual gains in cooperative behavior, and (2) the more adversarial setting where the parties perceive more "win-lose" outcomes. The former can be likened to the routine negotiation of water quality testing between Austria and Czechoslovakia, whereas the latter is more representative of the water quality issue involving disputes over river development and the ecological preservation of the river.

Mutual Learning and "Win-Win" Bargaining

Less adversarial "win-win" negotiations are more receptive to joint learning and cooperative problem solving than disputes for which the advantages of arriving at mutual compromises are not so apparent. The most outstanding example of the use of the computer in a negotiation in which all parties perceived possible benefits was the U.N. Law of the

92. *See* H. Raiffa, The Art and Science of Negotiation (1982); Colosi, *A Model for Negotiation and Mediation*, Int. Negotiation 81 (D. Bendahmane & J. McDonald eds. 1984).

93. Raiffa, *Mock Pseudo-Negotiations with Surrogate Disputants*, 2 Negotiation J. 15 (1985).

Sea Conference.[94] Because of its likeness to many international negotiations for river development, it deserves mention here.

The resolution of the problem of the deep sea mining of manganese modules[95] became important for an international agreement on the common use of the oceans. Prior to the negotiations, the U.N. General Assembly declared the deep sea resources to be the "common heritage of mankind,"[96] and the task of the negotiations was to find a system for their equitable sharing. A conflict developed between the developing and developed countries concerning the profitability of deep sea-bed mining and how the proceeds from mining enterprises could be fairly distributed. After six years of intensive negotiations, a compromise agreement was reached by the over 140 negotiating countries, which appears to have been partly attributable to the joint exploration and learning made possible by a computer model developed at the Massachusetts Institute of Technology showing the engineering and financial aspects of module recovery and processing.[97]

Sebenius attributes the acceptance of the model largely to the properties of the model itself, that established it as unbiased, objective, and credible.[98] Since similar examples of mutual learning and model acceptance are so few, and since all modeling efforts—the MIT model included—have an inherent, subjective component, it is important to look beyond the model to the conditions of the negotiations themselves, which led to a willingness on the part of the negotiators to find a consensus on the structure and analysis of the problem. One likely factor was the "win-win" nature of the negotiations, which gave a strong incentive for the delegates to resolve the distributive questions. Also, the relative newness of the issue and accompanying lack of entrenched interests within countries made it easier for delegates to embrace an outside problem formulation. Without the overriding need to justify their positions in their own countries, the delegates had more flexibility to accept "neutral" evidence. Finally, the delegates represented, for the most part, government ministries, for example finance and foreign affairs, which means that in spite

94. For a full account, see Sebenius, *The Computer as Mediator: Law of the Sea and Beyond*, 1 J. Pol. Analysis & Mgmt. 77 (1981).

95. The modules are composed of commercially promising quantities of copper, cobalt, nickel, and manganese.

96. U.N. G.A. Res. 2749, 25 U.N. GAOR Supp. (N. 280), at 24. U.N. Doc. A/8028 (1970).

97. *See* J. Nyhart, L. Antrim, A. Capstaff, A. Kohler & D. Leshaw. A Cost Model of Ocean Mining and Associated Regulatory Issues, MIT Sea Grant Report MITS6 78-4 (1978).

98. According to Sebenius, several factors influenced the acceptance of the model: (1) the model was developed independently of the LOS Conference; (2) the model's early results fully pleased no delegation, confirming in some sense its neutrality; (3) the presentation of the model's results by the MIT groups highlighted the uncertainties, increasing further its credibility; and (4) the chairman of the financial group, who was highly respected by the delegates, strongly favored the use of the model. Sebenius, *supra* note 94 at 80.

of their national differences they shared a certain professional rationality and thus a common overall frame of the issue.[99]

Although on a more modest level, these same conditions also exist in many negotiation forums, such as the bilateral expert committee appointed by the Austrian-Czechoslovakian Border Commission to work out an agreement on testing protocols for the quality of the border waters.[100] The informal, side-by-side work of these expert committees allows flexibility for brainstorming and joint problem solving. Fisher has contrasted this style of negotiation with more formal, around-the-table diplomatic sessions, and has stressed the advantages of the reduced authority of advisory committees giving the members more freedom to explore interests and to invent options that might promote shared concerns and accommodate those that differ.[101] Independent, outside expertise can then be brought in to aid the negotiations in much the same way as the MIT model was used in the LOS Conference.

In other words, limited-authority committees may provide fertile ground for the use of independently developed, interactive models to aid negotiators of water resources. These models will have a narrow perspective because of the usually narrowly-defined problems with which these committees deal. In reviewing some 30 years of systems models in water resources management, it has been concluded that the disappointing influence of comprehensive regional or basin-wide studies on negotiated policies can be attributed, in part, to the failure of these models to meet the narrower agendas and needs of the decisionmakers and negotiators.[102] Loucks and others applaud, thus, the apparent shift to the more project-oriented models addressing narrower issues:

> Policy changes will continue to be incremental and, barring serious surprises, decisions will rarely be revolutionary. Hence, policy modelers and analysts should focus their problem and issue-oriented research on helping to guide these incremental changes.[103]

Recognizing both the value of an integrated system in clarifying the complex tradeoffs at a more aggregated level, for example the relation between deforestation and river water quality, and the need for decisionmakers and negotiators to have more narrowly focused information, Kovacs has proposed a hierarchal system of decision support systems for managing large international rivers which can anticipate the expected consequences of policy options at various levels of decisionmaking.[104]

99. *Id.* at 78.

100. *See* Treaty, *supra* note 85.

101. Fisher, *The Structure of Negotiation: An Alternative Model*, 2 Negotiation J. 138 (1986).

102. Loucks, Kindler & Fedra, *Interactive Water Resources Modeling and Model Use: An Overview*, 21 Water Res. Research 95 (1985).

103. *Id.*

104. Kovacs, *supra* note 34.

For basin-wide planners, the model would give aggregated results which could be disaggregated for the types of decisions negotiated by, for example, such bodies as Border Commissions.

Mutual Learning and Adversarial Negotiations

In 1986, Hungarian and Austrian environmentalists attempted to march around Margaret Island in the middle of the Danube at Budapest. They were expressing their concern over the damage that they believed would result from the proposed Gabcikovo-Nagymaros hydroelectric system. This type of protest will occur much more frequently throughout the East—protests over perceived adverse impacts will happen as a result of proposed water resource development schemes. In fact, as Loucks and Salewicz point out, there is no shortage of disputes over issues involving water resources anywhere in the world.[105]

Protests in Austria and Hungary over river development projects are only just emerging and signal a beginning interest of environmental groups in the Danube. A notable and recent development in the East European countries, especially Hungary, is that these groups are gaining political standing. With the emergence of such groups, analysts must confront the problems of dispute settlement. Loucks and Salewicz suggest a role for information sharing and mutual learning in negotiating a resolution to adversarial environmental disputes.[106] Information sharing, in the form of interactive, decision or negotiation support, could facilitate more informed negotiations by, at least, focusing the debate on the assumptions and data.

Their advocacy of information systems as a way of facilitating multi-stakeholder disputes fails to account, however, for some fundamental differences in situations where negotiation participants, on the one hand, want to solve a common problem cooperatively, whereas on the other hand, (potentially hostile) parties view the outcomes more as zero-sum alternatives. Research in multiperson decision support systems (DSS) has mostly addressed the first situation where knowledge sharing and preference aggregation have been the main issues. The majority of these DSS systems have been employed in essentially a common problem or problem frame.[107] Neither of these assumptions is generally appropriate for more adversarial bargaining among groups with different perceptions of the problem and different ideas for dealing with it. For these situations, a fundamental shift will be necessary to orient negotiation support away

105. *See* Loucks & Salewicz, *Interactive Modeling and Conflict Negotiation in Water Resources Planing*, in The Management of International River Basin Conflicts, *supra* note 34, at 1.

106. *Id.*

107. Jarke, *Knowledge Sharing and Negotiation Support in Multiperson Decision Support Systems*, 2 Decision Support Systems 93 (1986).

from "information, analysis and solution" to providing the very mechanisms necessary for a constructive dialogue.[108]

In closing, it should be noted that this brief discussion has looked at only one aspect of the computer for providing negotiation support to promote mutual learning through flexible or interactive modeling. Many other promising opportunities exist, for example, in group modeling and gaming exercises which permit mutual generation and exploration of scenarios. Also, more game theoretic and decision analytic programs have been developed to help the group explore outcomes in terms of the preferences and values of the negotiating partners. The use of the computer for aiding negotiations is an exciting new direction, but a direction which can benefit from a better understanding of the human, organizational, and political setting which ultimately determines the effectiveness of the computer as a negotiating tool.

SUMMARY AND CONCLUDING REMARKS

The signing ministers of the Danube Declaration have emphasized that a balanced management of the Danube River Basin can be achieved only through cooperation among the eight riparian countries. Establishing effective cooperation in improving the water quality of the Danube will be severely hampered by the power asymmetry between the upstream and downstream countries, the scientifically complex and ill-defined nature of the problem, the lack of an effective river basin regime for multilateral, integrated decisionmaking on the Danube, and the slow and uneven emergence of public concern in the riparian countries.

Sovereign nations with upstream advantages will be reluctant to negotiate water quality improvements unless compensating benefits are an implicit or explicit part of the bargain. Harmonizing parameters and definitions of water quality as a first step in its control will be complicated by the scientific gaps in understanding the effects of water pollutants, especially toxic substances and their dispersion, as well as the divergent national perceptions of the issue and resulting differences in definitions. Finally, the process superimposes another level of complexity. In the absence of any present or perspective basin wide river authority to deal with water pollution, progress will be made only through a series of mostly bilateral agreements covering small, "bounded" segments of the

108. Nalven for example, suggests a social process model for analyzing transboundary environmental cooperation which focuses on the evolution of technical relationships between nations of markedly different development statuses. Cooperation on the part of the riparians is not simply a technical affair, but social. Since culturally determined expectations will be different among the countries, it may be necessary for the participants of the negotiations to "translate the border"—its imagery, social expectations, jurisdictional responsibilities and processes as well as the differences in resources. Nalven, *supra* note 49 at 4.

problem, as illustrated by the recent bilateral agreement between Austria and Czechoslovakia on water quality parameters and testing protocols.

To the extent that Danube water pollution becomes a more visible issue as a result of (1) increasing public awareness and concern over toxic pollutants, especially accidental releases, or (2) becoming enmeshed in the current controversies over Danube development projects, the process will need to accommodate the interests and views of environmental groups, which are newly and dramatically emerging in Eastern Europe. This will dislodge the issue from the routine, administrative machinery of regulatory politics and place it in the broader and more contentious context of environmental and ecological preservation. As the issue changes form, new procedural mechanisms and different types of analytical expertise will be called upon in the process of negotiating cooperative policies.

The dynamics of the issue underscores the need for different types of analytical support depending on its form. As a low-key, regulatory issue and with an *a priori* agreement on definition, negotiation forums could be usefully served with narrowly defined support systems which facilitate mutual learning and problem solving. If the issue broadens both in terms of the problem and the stakeholders, then the concept of "mutual learning" becomes problematic. To be useful, negotiation support systems will have to accommodate plural problem definitions and rationalities which may be inconsistent with the logic of the system designer. The focus of multi-party negotiation support in an adversarial setting will, therefore, have to reorient from systems emphasizing shared information and analysis to systems which promote communication and mutual problem formulation.

As a final word, the importance of examining international mechanisms which have evolved for managing and negotiating water issues cannot be overemphasized. To date, nearly all forms of international cooperation with respect to shared resources have been in connection with surface water and aquatic resources, and these institutionalized forms of cooperative decisionmaking could potentially form the basis for coping with cross-media, as well as transboundary, pollution problems. How problems and disputes over the shared uses of water resources have been negotiated and resolved, how past and present institutions have succeeded or failed, and the ways in which the analyst can contribute to the substantive and procedural issues, are questions of increasing concern if the world community is to cope with the expanding menu of transboundary and cross-media environmental problems.