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by

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ABSTRACT

International transboundary water disputes engender more conflict than disputes within a single country. Yet the theory of transboundary resource management offers no simple explanation for this phenomenon. Water management involves two interacting sets of variables: 1) the physical river system (including man-made structures) which determines the distribution logic; and 2) economic, social, legal and political relationships which determine the institutional logic. Disjunction between the distribution logic and institutional logic is the source of most conflict. To answer the question why international water disputes are more conflictual than intranational ones, this paper surveys water management systems in arid agricultural regions of the United States and the Commonwealth of Independent States. The study hypothesizes that conflict created by disjunction in intranational contexts is resolved through multi-level institutional interaction. In transboundary disputes, appropriators turn to the state for conflict resolution; this strengthens the state internally, but diminishes the ability of lower level institutions to resolve disputes. This phenomena suggests an "institutional imperative" of maintaining the vitality of subnational and supranational institutions to resolve international transboundary water conflict.

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Late in 1991, the five Soviet Socialist Republics of Central Asia were faced with an unusual problem. They found themselves compelled by circumstances to become independent states. As the Soviet Union collapsed, the five former Soviet republics became the independent states of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.¹ With the transition to independence, the new states of Asia found that they not only inherited many of the problems of past mismanagement under the Soviet regime, they also acquired a variety of daunting new challenges of participation in international affairs. One of the most serious problems was the legacy of the area's excessively centralized irrigation management system.

Central Asia is an area roughly the size of the combined states of the American Southwest. It is an arid region, with both industrial and agricultural water appropriators. Some oasis and groundwater-fed agriculture is practiced, but the irrigation systems associated with two rivers, the Syr Darya and the Amu Darya, are responsible for irrigating roughly 75 percent of Central Asia's agriculture.² Each of these rivers flows through three of the five Central Asian states; the Amu passes through Uzbekistan twice. Historical records indicate that about 45 thousand cubic meters a year formerly reached Central Asia's largest standing body of water, the Aral Sea. By 1982, the inflow to the Aral Sea from the Syr Darya and the Amu Darya fell to essentially zero due mainly to agricultural draws.³ Today Central Asia finds itself in the midst of a water crisis.

The Central Asian irrigation system was designed and managed by Moscow planners. It conformed to Moscow's grand ideological goal of building a regionally integrated socialist society. Whatever the promises and anticipations of the system's designers, in the eyes of its critics, the system was a grandiose and expensive failure. Rather than building "socialist mutual reliance," the system produced mutual dependence and resource inefficiency. However, as long as the system was under the control of one management center in Moscow, it continued to function without overt conflict among appropriators. With the transition to independence, conflicts that were previously resolv-

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1. These newly independent states were bound loosely in a political organization called the Commonwealth of Independent States.

2. See P. Lydolph, *Geography of the USSR* (1979).

3. E. Rakhimov, *Sotsial'no-ekonomicheskie Problemy Arala i Priaral'ia* [Socio-economic Problems of the Aral Zone] 9 (1990). A small inflow was realized in 1984.

able by fiat from Moscow now acquired at least the incipient aspects of international transboundary conflicts. This raised a theoretical question with great practical urgency: Would not the transition to independent control of the water resources increase the likelihood of conflict among water appropriators over this key transboundary resource?

It is a widely held view that international transboundary water disputes are inherently more conflictual than disputes within one country.⁴ Despite the wide currency of this belief, it is not a proposition that finds easy explanation in terms of the theory of transboundary natural resource use. The fundamental question that animates research on international transboundary disputes is, as Dante Caponera expressed it, the fact that "[n]either the requirements for efficient water resources management nor the technical standards corresponding to the most 'reasonable' regime of water resource management are difficult to identify and propose. The real difficulty concerns the political willingness of states to achieve institutionalized cooperation regarding water resources of each international basin."⁵

If a water basin previously under the control of one sovereign government suddenly passes under the control of several governments, the distribution logic of the physical water system is not changed. Why then should we expect that there will be greater conflict? Why indeed, to use Caponera's apt phrase, would the "political willingness" of the independent states to cooperate be any less than the political willingness of the previous managers of the Central Asian water system?

The collapse of the political and legal infrastructure of the former Soviet state provides us with a laboratory for testing some of our most fundamental propositions about the relationships between the physical infrastructures and the institutional infrastructures for water management. The Central Asian case offers us a rare instance of both "before and after," allowing us to test the effect of political independence on the ability of states to address transboundary water disputes successfully. To control for the atypical features of the Central Asian case, it is important to view the institutional relationships in comparative perspective. There are nine major river systems in arid regions that cross international boundaries.⁶ Four of these systems are remarkably simi-

4. Although this is a frequently observed generalization, it is not clear that it has been tested. Moreover, there may be an explanation for this in that most historical boundaries tend to overlap with basins. K. Wittfogel, *The Hydraulic Civilization, in Man's Role in Changing the Face of the Earth* 152 (W. Thomas Jr. ed., 1956). If this is true, most basins historically have been captured by states precisely to eliminate this kind of conflict. Consequently, the distribution of basins and boundaries would not be random.

5. D. Caponera, *Patterns of Cooperation in International Water Law: Principles and Institutions*, 25 Nat. Res. J. 563 (1985).

6. Of these nine, five have water allocated through bi-lateral international treaties and memoranda of understanding: the Tigris (Iraq-Turkey), the Nile (Egypt-Sudan), the

lar: the Colorado River and the Rio Grande in the American Southwest, and the Syr Darya and Amu Darya in Central Asia. These systems also involve relatively independent political jurisdictions which must cooperate through multi-lateral agreements.⁷ Indeed, there are good reasons for concluding that in all the world there are only two comparable geographical cases of multidistrict management of major river systems in arid agricultural regions—that of Central Asia and the American Southwest.⁸

This paper surveys water management systems in the arid agricultural regions of the United States and Central Asia. First, we discuss the theory of transboundary water management and natural resource conflict, presenting three propositions to illuminate the water management implications of the Central Asian states' transition to independence: distribution and institutional logic; collective action; and interbasin transfers. Next, we outline the distribution logic of water systems in Central Asia and the American Southwest. Third, we discuss the institutional logic of the water management systems. Finally, we conclude by utilizing the experiences of the American Southwest to suggest new institutional regimes for the Central Asian states.

THE THEORY OF TRANSBOUNDARY WATER MANAGEMENT AND NATURAL RESOURCE CONFLICT

International Treaty Practice

An extensive international practice in the use of treaties to resolve transboundary water conflicts has developed.⁹ This practice is marked by the evolution of the doctrine of equitable utilization for resolving transboundary water conflicts. Treaty practice has also led to

Jordan (Israel-Jordan), the Indus (Pakistan-India), and the Euphrates (Turkey-Iraq-Syria). The Euphrates flows out of Turkey into Syria, from which, after being impounded by the Assan Dam, it flows through Syria and into Iraq. Historically, however, the major issues regarding the Euphrates have concerned only Syria and Iraq.

7. Several other river systems in the American Southwest involve interstate arrangements: Costilla Creek, La Plata, and the Pecos River, but these are not substantial enough for our purposes in this paper.

8. Here we are excluding the Jordan River on the grounds that the political complexities of the situation, although they initially had a great deal to do with competition over water, have now so greatly complicated the situation that it does not constitute an easily comparable case.

9. At least ninety-one treaties governing international rivers have been documented. See H. Smith, *The Economic Uses of International Rivers* (1931) (51 treaties); U.N. Economic Commission For Europe, Committee on Electric Power, *Legal Aspects of Hydro-Electric Development of Rivers and Lakes of Common Interest*, U.N. Doc. E/ECF/136 (1952) (40 treaties; original U.N. Doc. E/ECE/EP/98 Rev. 1); W. Griffin, *The Use of Waters of International Drainage Basins Under Customary International Law*, 53 Am. J. Int'l L. 50, 50 n.1 (1959).

another idea, equitable participation, that goes a step beyond equitable utilization.

Four theories have been present in international legal circles as possible ideas for resolving transboundary conflict but here we note only the two that are most pertinent to general development in international treaty practice: absolute territorial sovereignty and limited territorial sovereignty.¹⁰ Absolute territorial sovereignty allows that an upstream state may do as it wishes with waters flowing within its boundaries with no regard for downstream states. Limited territorial sovereignty provides that each riparian state may make use of waters but not interfere with the reasonable uses of each other.

Treaty practice in water disputes shows distinct favor for limited territorial sovereignty and a few of many examples now follow.¹¹ In 1905, the United States espoused the theory of absolute territorial sovereignty against Mexico during conflict over the Rio Grande¹² and, by a 1906 treaty with Mexico, did not purport to recognize Mexico's claims to Rio Grande water.¹³ Nevertheless, the United States, by the treaty, did agree to provide Mexico with 60,000 acre-feet of Rio Grande water.¹⁴ Sweden and Norway concluded a treaty in 1905 that provided each country could not construct works on lakes and watercourses common to both countries unless the other country gave consent.¹⁵ Brazil and Uruguay, in a 1933 treaty, adopted similar terms.¹⁶ By a 1944 treaty to apportion waters in the Colorado and Tijuana rivers along with the Rio Grande, the United States and Mexico engaged in joint action to accommodate each other's water needs.¹⁷ Besides individual treaties,

10. A. Utton, *International Streams and Lakes Generally*, in 5 *Waters and Water Rights* § 49.01, § 49.02 (R. Beck ed., 1991) (citing J. Lipper, *Equitable Utilization*, in *The Law of International Drainage Basins* 15, 18 (A.H. Garretson et al. eds., 1967)). The other two theories are absolute territorial integrity and community. *Id.* The former provides that upstream states may not restrict water flow into downstream states. The latter holds that waters of a drainage basin should be developed as one unit with all riparian states in the basin sharing in the developments and benefits thereof.

11. See Griffin, *supra* note 9, at 50.

12. *Id.* at 50-51.

13. Convention between the United States and Mexico providing for the equitable distribution of the waters of the Rio Grande for irrigation purposes, May 21, 1906, art. IV, 34 stat. 2953, 2955 [hereinafter 1906 Convention].

14. *Id.* arts. II-IV, 34 Stat. at 2954-55 (Mexico, in turn, waived certain claims to Rio Grande waters between Fort Quitman in Texas and the Mexican Canal).

15. Convention Concernant Les Lacs et Cours d'eau Communs, Oct. 9-21, 1906, Nor.-Swed., art. 2 (original text in 1 Am. J. Int'l L. 177 (Supp. 1, 1907), translated in Smith, *supra* note 9, at 167).

16. See Utton, *supra* note 10, § 49.03(a), at 8-9 (citing treaty at 181 L.N.T.S. 85-87).

17. Treaty between the United States of America and Mexico respecting utilization of waters of the Colorado and Tijuana Rivers and of the Rio Grande, Feb. 3, 1944, 59 Stat. 1219 [hereinafter 1944 Treaty].

it is also worth noting that the very act of concluding a treaty suggests some acceptance of limited territorial sovereignty.¹⁸

Limited territorial sovereignty has evolved as a theory for transboundary water management through the doctrines of equitable apportionment and equitable utilization. The United States Supreme Court, drawing on its perception of international law, developed the equitable apportionment doctrine to resolve intranational water disputes between individual states.¹⁹ Commentators of international law acknowledge that equitable apportionment embodies the theory of limited sovereignty²⁰ and has evolved, through international treaty practice, into equitable utilization.

The legal term of equitable apportionment was deemed insufficiently precise for international usage. Equitable apportionment suggests allocating a *quantity* of water, a more precise description of actual practice is allocating a *right to use* a quantity of water. In particular, when one considers the physical reality of the hydrologic cycle, it is indeed difficult to actually own specific molecules of water within the cycle. Thus, international legal thought has, over time, rephrased equitable apportionment as equitable *utilization*.²¹

18. Utton, *supra* note 10, § 49.03(a).

19. Limited sovereignty implies mutual respect among states for each other's needs in allocating transboundary water resources. See W. Van Alstyne, *International Law and Interstate River Disputes*, 48 Calif. L. Rev. 596, 605-21 (1960). The United States Supreme Court developed equitable apportionment in resolving interstate water disputes. *Colorado v. New Mexico*, 459 U.S. 176, 183 (1982) (citing *Kansas v. Colorado*, 206 U.S. 46, 98 (1907); *Connecticut v. Massachusetts*, 282 U.S. 660, 670-71 (1931); *New Jersey v. New York*, 283 U.S. 336, 343 (1931); *Nebraska v. Wyoming*, 325 U.S. 589, 618 (1945)). The doctrine presupposes limited sovereignty between states not unlike that presumed in the international theory of limited sovereignty. See *Kansas v. Colorado*, 206 U.S. at 97-118 (1907). Commentators also note national juridical decisions, outside the United States, as proceeding along the lines of limited sovereignty. See Utton, *supra* note 10, § 49.03(c); W. Van Alstyne, *The Justiciability of International River Disputes: A Study in the Case Method*, 1964 Duke L.J. 307, 337 n.110 [hereinafter *Int'l River Disputes*] (both commentators citing the *Donauversinking Case*, 116 *Entscheidungen des Reichgerichts in Zivilsachen*, Anhang 18 (1927) (also reported in *Ann. Dig. Pub. Int'l L. Cases* 128 (Lauterpacht ed., 1927-28) and *Aargau v. Zurich, Entscheidungen des Schweizerischen Bundesgerichts aus dem Jahre 1878*, also noted by D. Schindler, *The Administration of Justice in the Swiss Federal Court in Intercantonal Disputes*, 15 *Am. J. Int'l L.* 149, 169-72 (1921)).

20. Smith, *supra* note 9, at 51; *Int'l River Disputes*, *supra* note 19, at 307; J.L. Briery, *The Law of Nations* 231 (Sir H. Waldock ed. 6th ed., 1963). A series of treaties involving equitable apportionment/utilization are outlined in S. Schwebel, *Third Report on The Law of The Non-Navigational Uses of International Watercourses*, U.N. Doc. A/CN.4/348 (1982) (reprinted in *The Law of the Non-Navigational Uses of International Watercourses*, 1982 Y.B. Int'l L. Commission 65, U.N. Doc. A/CN.4/SER.A/1982/Add. 1 (Part 1) [hereinafter *Schwebel*]).

21. Utton, *supra* note 10, § 49.06, at 31 (citing progress in expression through three international law conferences: Inter-American Bar Association Proceedings of the Tenth Conference held at Buenos Aires, 1957, vol. 1, 246-48; Report of the Forty-Eighth Conference of the International Law Association 28-71, 72-102 (New York 1958) (London 1959); Report of the Fifty-Second Conference of the International Law Association, 477-531 (Helsinki 1966)).

To flesh out the meaning of equitable utilization, it is helpful to consider two references. The United States Supreme Court stated equitable apportionment calls for allocating water based on balancing a number of factors such as physical and climatic conditions, nature of existing water uses, the benefits and damages that would likely come from the proposed allocations of water, et cetera.²² International law commentators call for equitable utilization to be defined as a similar balancing of factors.²³

Beyond equitable utilization, another concept has apparently emerged within international treaty practice - equitable participation. Equitable participation has states engaging in cooperative, integrated efforts to make optimum use of transboundary waters in light of increasing competition for such waters.²⁴ Equitable utilization, in contrast, provides that states respect each other in their individual pursuits of developing transboundary waters. But optimum use of transboundary waters might not be accomplished through a set of separate development efforts among states; instead, cooperative, integrated efforts among states may be necessary.²⁵ Equitable participation, thus, goes a step beyond equitable utilization as states not only respect each other's needs but actively work together to make optimum use of transboundary waters.

International bodies have noted the need for states to adopt equitable participation to attain optimum use of transboundary waters.²⁶ In particular, in 1988, experts and government officials in a United Nations meeting over river and lake basin development expressly recommended states affirmatively participate in cooperative efforts to

22. *Nebraska v. Wyoming*, 325 U.S. at 618 (1945).

23. Factors do include each state's contribution of water to the common water source, past use of the waters, economic and social needs, population dependent on use of the waters, and comparative costs of alternatives to proposed use of the waters. Report of the Fifty-Second Conference of the International Law Association, art. V, 11-14 (Helsinki 1966); see also Schwebel, *supra* note 20, paras. 92-110.

24. Schwebel, *supra* note 20, para. 85.

25. See *id.* paras. 79-84.

26. *Id.*; Utton, *supra*, note 10, § 49.09 (both references trace the various international agreements and declarations of international organs which call for active co-operation among states situated with transboundary waters, for a sample of such agreements and declarations see e.g., Report of the United Nations Water Conference, Mar del Plata, 14-25 Mar. 1977, U.N. Doc. E/CONF.70/29, U.N. Sales No. E.77.II.A.12 (1977) (declaring the Mar del Plata Action Plan)); Natural Resources Development and Policies, Including Environmental Considerations: Report of the Secretary General, Addendum, Issues of International Water Resources Development, U.N. Economic and Social Council, Committee on Natural Resources, 1st Sess., U.N. Doc. E/C.7/2/Add. 6 (1972); *Fifth Biennial Report on Water Resources Development*, U.N. ESCOR, 44th Sess., Supp. No. 3, U.N. Doc. E/4447 (1968); Resoluciones 24-M/66, Informe Final Cuarta Reunion Anual Del Consejo Interamericano Economico Y Social Al Nivel Ministerial, 25 Mar.-1 Apr., 1966, Vol II., Annex 5, at 51, U.N. Doc. OEA/Ser.H/XII.II (espanol).

develop and maintain transboundary waters.²⁷ In practice, equitable participation has not been mentioned as such in treaties but reflected by cooperative efforts of states, usually through creating a joint commission to coordinate and integrate development.²⁸ A number of treaties display such practice.²⁹ The range of this practice with commissions varies but, ultimately, is oriented to develop coordinated, integrated multi-level institutional contacts between states.³⁰

Finally, one may ask why treaty practice has worked, why do states accede to limited sovereignty, to equitable utilization and equitable participation? After all, there is no "higher authority" that can force limited sovereignty among nations. The answer, within international legal thought, lays in the possibility for horizontal action-reciprocal sanctions-by states.³¹ This possibility, this coercion or "reciprocity", is a political process that influences a state to limit its sovereignty and thus, come to a settlement with other states.³² An example of reciprocity is the dispute between Canada and the United States over the

27. U.N. Department of Technical Cooperation for Development, River and Lake Basin Development 36-38, U.N. Doc. ST/TCD/13, U.N. Sales No. E.90.II.A.10 (1990) (proceedings of the U.N. Interregional Meeting on River and Lake Basin Development with Emphasis on the Africa Region held at Addis Ababa, Ethiopia, 10-15 Oct. 1988).

28. See *supra* note 26.

29. See, e.g., Treaty on the River Platte Basin, Apr. 23, 1969, Arg.-Bol.-Braz.-Para.-Uru., 875 U.N.T.S. 3; Statute of the Organization of the Senegal Riparian States - OERS, Mar. 24, 1968, Guinea-Mali-Mauritania-Sen., 672 U.N.T.S. 251; Agreement Concerning the Niger River Commission and the Navigation and Transport on the River Niger, Nov. 25, 1964, Cameroon-Chad-Dahomey-Ivory Coast - Guinea-Mali-Niger-Nigeria-Upper Volta, 587 U.N.T.S. 19; Act Regarding Navigation and Economic Co-Operation between the States of the Niger Basin, Oct. 26, 1963, Cameroon-Chad-Dahomey-Ivory Coast-Guinea-Mali-Niger-Nigeria-Upper Volta, 587 U.N.T.S. 9; see also Schwebel, *supra* note 20, paras. 70-71 (noting several other international agreements that include the concept of equitable participation).

30. See U.N. Department of Economic & Social Affairs, Management of International Water Resources: Institutional and Legal Aspects, at 56-61, 176-81, U.N. Doc. ST/ESA/5, U.N. Sales No. E.75.II.A.2 (1975). There is also some thought, naturally, on what exact attributes of cooperation that commissions need to be successful. Some attributes noted in commentary are cooperation in research and data collection, impact assessment of development/management actions, providing a forum for public participation, permanence in staffing and funding, et cetera. *Id.*; L. Teclaff, *The River Basin Concept and Global Climate Change*, 8 Pace Envtl. L. Rev. 355, 381-88 (1991); L. Teclaff & E. Teclaff, *International Control of Cross-Media Pollution - An Ecosystem Approach*, 27 Nat. Res. J. 21, 33-50 (1987).

31. Reciprocal sanctions may use "diplomatic, ideological, economic, or military instruments." M. McDougal et al., *Studies in World Order* 263-72 (1960).

32. R. Falk, *International Jurisdiction: Horizontal and Vertical Conceptions of Legal Order*, 32 Temple L.Q. 295, 315-17 (1959). Furthermore, "[f]airness is a perspective useful to give shape to patterns of . . . [reciprocity] . . . , as States seeking to receive fair treatment for their interests must be willing to accord it in exchange." *Id.* at 317. An excellent example of a state opting to provide fair treatment in order to receive the same is the 1957 Lake Lanoux arbitration involving France and Spain. See B. MacChesney, *Judicial Decisions*, 53 Am. J. Int'l L. 156, 156-71 (1959); J. Laylin & R. Bianchi, *The Role of Adjudication*

St. Mary and Milk rivers where reciprocal threats of water diversions between the two rivers led to negotiations³³ and eventually a treaty.³⁴

Distribution and Institutional Logic

What propositions may be drawn from the general theory of natural resource use to help illuminate the water management implications of the Central Asian states' transition to independence? We have identified three salient propositions. First, the institutional logic of transboundary resources, expressed partially through claims of territorial sovereignty, will fail to accommodate the distribution logic of the physical resource. Second, collective action problems are exacerbated by transboundary resources systems and, as corollary, the effectiveness of remedies for collective action problems are correspondingly reduced. Third, because interbasin transfers of water are fully consumptive, exchanges of non-water goods are necessary to redress international imbalances created by the interbasin transfers.

The first proposition—that the institutional logic of transboundary resources will fail to accommodate the distribution logic—derives from the traditional “conflict of laws” legal approach to transboundary resource conflict. This proposition emphasizes the antagonism between two principles, the principle of absolute integrity of a water course (or distribution logic) and the principle of absolute sovereignty of territory (or institutional logic).³⁵ The first principle has its basis in physical realities, the second in political realities. We may expand this definition by distinguishing between the general physical water system and the general configuration of associated institutional structures. Here the physical system is understood to include the water course as well as all man-made, permanent physical structures. Sovereignty in the institutional perspective is one aspect of institutions nested among many other considerations. The institutional structures are understood to include all economic, social, legal, and political incentives and sanctions which pattern human behavior given the existence of the physical structures.³⁶

in *International River Disputes: The Lake Lanoux Case*, 53 Am. J. Int'l L. 30, 34-35, 37-39 (1959); Utton, *supra*, note 20, § 49.05.

33. For a description of the chain of events in this dispute see A. Utton, *Canadian International Waters*, in 5 *Waters and Water Rights* § 50.01, § 50.01(a) (R. Beck ed., 1991); J. Simsarian, *The Diversion of Waters Affecting the United States and Canada*, 32 Am. J. Int'l L. 488, 488-92.

34. Treaty between the United States and Great Britain relating to boundary waters and questions arising between the United States and Canada, Jan. 11, 1909, 36 Stat. 2448.

35. See, e.g., Water in the Middle East: Conflict or Cooperation? 5 (T. Naff & R. Matson eds., 1984).

36. S. Krasner, *Sovereignty: An Institutional Perspective*, 21 Comp. Pol. Stud. 66 (1988).

The physical structures are easily identified; they include dams, weirs, diversion canals, and so on. The utility of the physical structures, however, depends upon the efficiency of the institutional structures. The institutional features, while more difficult to define precisely, are nonetheless critical to the efficient functioning of any water system. Institutional theorists have made substantial headway in the elaboration of the theory of institutions, yet the definition of institutions remains problematic for most analysts because it is so difficult to define the boundaries of the institutions.

Collective Action

The second general proposition drawn from natural resource theory is that collective action problems are exacerbated by transboundary resources systems. This proposition concerns the nature of ownership and control of certain types of natural resource and, implicitly, what this implies for the type of decisionmaking structures that are appropriate for the resource. Irrigation water is a common pool resource. Though its value can be strictly determined (and subjected to market controls), it is rarely privatized.³⁷ The efficient utilization of an irrigation system requires common sacrifice and provides common benefits. In terms of common sacrifice, irrigation systems require considerable input in maintenance, management, and monitoring. In terms of common benefit, the total amount of water distributed is related in some way to the entitlements of appropriators.³⁸

As in all cases of common sacrifice and common benefits, the logic of assignment of costs and benefits among the parties tends to produce collective action dilemmas. We assume that each party is a rational, value-maximizing actor. If the proportionality between withdrawals and inputs is contingent upon monitoring and sanctions, then parties will recognize that their withdrawals are a function not of their inputs but of their ability to satisfy monitoring criteria or to evade monitoring. They will tend to free-ride on the common sacrifice. Even if they do not free-ride out of moral or ideological concerns, they will nonetheless note that other parties attempt to free-ride. The concern with free-riding will tend to dominate the decision process. Within particular resources systems, appropriators design institutions to prevent collective action dilemmas from defeating efficiency. They design eco-

37. For a recent discussion of market approaches to water allocation, see R. Reinhold, *Farmers in the West May Sell Something More Valuable Than Any Crop: Water*, N.Y. Times, Apr. 6, 1992, at B9; R. Reinhold, *In Politics of Water, New Pioneers in West are Vendors*, N.Y. Times, Apr. 6, 1992, at B9. See also sources cited *infra* note 78.

38. See V. Ostrom, *The Water Economy and Its Organization*, 2 Nat. Res. J. 55, 55-59 (1962).

conomic, social, legal, and political institutions in such a way to make people conform to the distribution logic of the system. In the international arena, the logic of collective action also produces conflicting outcomes, yet the ability of appropriators to design mutually beneficial institutions is greatly reduced. In the international sphere, the principal actors are the states themselves, not the appropriators.³⁹

Interbasin Transfers

The third major proposition drawn from the theory of natural resource use that is beneficial in analyzing the Central Asia case concerns the logic of interbasin transfers. Interbasin transfers are especially difficult because they involve redistributive policies, in the sense that the area of origin loses its water permanently and the area of transfer receives the water with no obligation to return it to the original possessors. Although all water polices imply winners and losers, rarely do they come into direct confrontation, as they do when water is transferred between basins.⁴⁰ Interbasin transfers are often used for irrigation because the costs of developing the necessary infrastructure are high, and irrigation demands enough water to provide economies of scale.⁴¹ Water transported into a second basin will, therefore, be more costly than water that originates in the basin, and thus the demand in the receiving basin may not be as high as anticipated once the higher priced water is actually available.⁴² There are alternatives to interbasin transfers: demand for irrigation water may instead be satisfied by water conservation or by improved irrigation techniques or even by crop diversification from high-water crops to low-water crops. Interbasin transfers, especially when the exporting and importing basins are in different countries, cannot be decided on the basis of water policy alone. Writing for the [United States] National Water Commission in 1972, Dean Mann observed:

[T]he basis for discussion of water policy involving investments of the magnitude and of the environmental consequence of interbasin transfers is the nature of the regional economy and the character of public investments most likely to meet the needs of the regional economy—whether they be in water,

39. L. Teclaff, *The River Basin in History and in Law* (1967).

40. D. Mann, *Interbasin Water Transfers: A Political and Institutional Analysis* 13-16 (1972).

41. *Id.* at 15.

42. This has occurred in the American Southwest and involves a portion of the Central Arizona Project near Tucson, Arizona. L. Sahagun, *River of Debt Splits Farmers, Cities in Arizona*, *Albuquerque Journal*, Mar. 14, 1993, at D14.

transportation, education, urban renewal or myriad other investment possibilities.⁴³

THE DISTRIBUTION LOGIC OF WATER SYSTEMS IN CENTRAL ASIA AND THE AMERICAN SOUTHWEST

Our first proposition derived from the theories of transboundary water management was that the institutional logic—economic, social, legal, and political incentives and sanctions—will fail to accommodate the distribution logic—the physical nature of the resources and their physical infrastructure. We begin by describing the distribution logic of Central Asia and the American Southwest.

The physical similarities between the major rivers systems of the arid agricultural regions of Central Asia and the American Southwest are striking. In both regions, the average annual rainfall is under 25 centimeters per year. In both regions, agriculture is primarily dependent upon surface irrigation water. In both regions, the major river systems cross three or more interstate boundaries and pass through numerous local jurisdictions. And in both regions major construction projects, sponsored by strong central governments, have provided for large scale interbasin transfers of water.

Central Asia

Central Asia's two major rivers are the Syr Darya and the Amu Darya. The Syr-Darya has a length of 2,212 kilometers. The irrigated area drawing from the Amu Darya basin is 10,700 thousand hectares. The irrigated area drawing from the Syr Darya basin is 5,200 thousand hectares. The Syr Darya originates in the Pamir mountains inside the states of Kyrgyzstan and Tajikistan and flows through Uzbekistan before turning northward and entering Kazakhstan. Until its exploitation for irrigated agriculture in the recent Soviet period, the Syr Darya was one of two major feeder rivers for the Aral Sea.

The larger of Central Asia's two major rivers, the Amu Darya, has a total length of 1,415 kilometers with a basin area of 309,000 cubic kilometers. If the Piandzh is included, the total length of the system is 2,600 km. The Amu Darya originates in the Pamir mountains and is fed by the Piandzh river flowing out of Afghanistan and then from numerous smaller intermontane basin streams in Tajikistan. The Amu Darya then flows out of Tajikistan, through Uzbekistan, into Turkmenistan, returns to Uzbekistan and then flows through the Karakalpak Republic before reaching the Aral Sea.

43. Mann, *supra* note 40 at 121.

Mainly due to irrigation draws, the flow is greatly reduced by the time the Amu Darya reaches the Aral Sea. Moreover, because of leeching, runoff and the accumulation of agricultural additives, water quality is greatly diminished at this point.

Evidence of effective irrigation systems in Central Asia goes back at least as early as the tenth century. From this period until the modern period, the political and economic fortunes were closely tied to effectiveness of irrigation, so much so that some scholars have characterized the area as a "hydraulic society."⁴⁴ But by the latter part of the nineteenth century, Central Asian government was a patchwork of feuding local satrapies. This condition of political conflict in Central Asia permitted most of the irrigation systems to fall into a state of disrepair. With the Russian military conquest of Central Asia in the late 1860s, the Tsarist occupation government initiated efforts to launch major irrigation projects.

Shortly after the Bolshevik government came to power in Moscow in 1917, a series of resolutions on the expansion of the Central Asian irrigation system were passed. Major canals underwent renovation.⁴⁵ During the period 1924-1926, a major land reform was undertaken in Central Asia. Some industrial, hydroelectric and mining projects were begun, but the primary effort was to create a regionally specialized economy in Central Asia with agriculture at its core. For decades, the area's main staple crop, cotton, dominated virtually all discussion of local economic development. Reclamation and irrigation projects were evaluated in terms of their ability to contribute to the amount of land under cultivation.

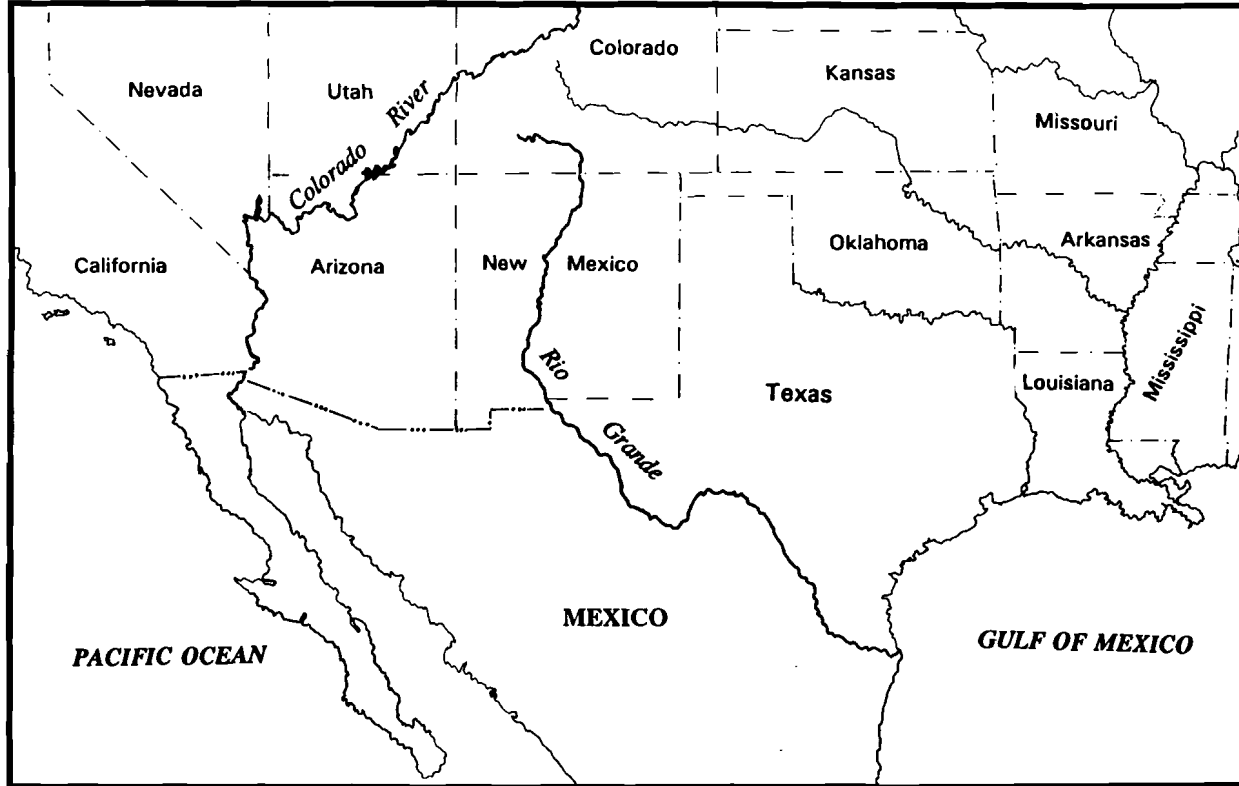
Central Asia's water management system was extended during the 1930s by the construction of dams designed to provide hydroelectric power and major interbasin transfer canals to bring irrigation water to new fields. In the 1930s, most of the interbasin transfers were regional, linking different parts of the large Fergana valley of eastern Uzbekistan. These included the North Fergana Canal, the Andizhan Canal, and the Namagan Canal.

In the 1950s, a number of regional interbasin canals were begun in the vicinity of Samarkand and Bukhara. At the same time, construction began in earnest on Central Asia's major transbasin canal, the Kara-Kum Canal. Completed in 1962, the Kara-Kum carries water from the upper Amu Darya at Kerki near the Soviet-Afghanistan frontier for a distance of more than 1,000 kilometers, passing north of the city of

44. Wittfogel, *supra* note 4.

45. In 1923, the Bolshevik government approved credits for reclamation cooperatives to assist local farmers in restoring their irrigation systems. I. Mately, *Agricultural Development, in Central Asia: A Century of Russian Rule* 266, 287 (E. Allworth ed., 1967).

THE COLORADO RIVER AND THE RIO GRANDE



Scale: One inch equals 237 miles

Mercator Projection

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Ashkhabad, the capital of Turkmenistan. It was originally planned that the Kara-Kum canal would eventually reach the Caspian Sea, but it appears that this goal has been abandoned. The Kara-Kum canal is ecologically and economically the most important in Central Asia. The canal diverts as much as thirty percent of the water of the Amu Darya from its northward course toward the Aral Sea for use in agriculture within the republic of Turkmenistan. The canal pits officials of Uzbekistan against the officials of Turkmenistan, all of whom voice suspicions that the other side is cheating on the amount diverted.⁴⁶

Between 1990 and 1992, the prevailing logic of the political and legal institutions in Central Asia was turned upside down. In this two year period the Soviet Asian republics emerged from the status of dependent quasi-federal constituents of the USSR to the status of full statehood. Declarations of sovereignty were passed in all these republics in 1990.⁴⁷ The declarations asserted sovereignty over the land and natural resources, including water, that existed on the territory of the republics. In late 1991, all of the states declared full political independence. Early in 1992, each of the states was recognized as an independent country by major world powers, including the US government, and each state was offered status as a participant in such international organizations as the International Monetary Fund (IMF) and the International Bank for Reconstruction and Development (IBRD) as well as admission to the United Nations. The "USSR Law on Land" passed in Moscow in February 1990 delegated to the republics the right to make local land arrangements. During the same year, the Central Asian republics all passed laws on property. These laws reserved the right to ownership of water to the republican governments.⁴⁸ After the collapse of the USSR, while the Russian Federation moved haltingly toward privatization of land, all the countries of Central Asia announced that they would retain state ownership of land and water. Although all the Central Asian republics rhetorically announced goals of market reforms and "privatization," in practice the leaders of the new countries tended to assume virtually all the prerogatives of power that previously were

46. This perspective was shared by both officials and private citizens interviewed in Turkmenistan, Uzbekistan, and Kazakhstan during the summer of 1992.

47. A draft of the Declaration of Sovereignty of the Kyrgyz republic was passed in August 1990, but the Republic did not formally declare sovereignty until December 1990. See A. Sheehy, *Fact Sheet on Declarations of Sovereignty*, Report on the USSR, Nov. 9, 1990, at 23.

48. E.g., *Zakon, Sovetskaia Kirgizia*, June 30, 1990, at 1 (noting *Zakon Kirgizskoi SSR o zemle* [The Law of the Kirgiz Soviet Socialist Republic on Land] of which article 4 identifies land as the exclusive property of the Kirgiz Republic"); *Zakon, Sovetskaia Kirgizia*, May 31, 1990, at 1 (noting *Zakon o sobstvennosti v Kirgizskoi SSR* [The Law on Ownership in the Kirgiz Soviet Socialist Republic] which distinguished between three types of property: private, collective, and government, and which, in article 20 of the Law, reserved the ownership of land and water to the government).

controlled by Moscow's socialist managers. Thus, Central Asian water previously had been a common property resource, held in public trust by Moscow, and managed by Moscow's administrative managers. Now it became common property held in the hands of five competing states. The water management plans adopted earlier by Soviet authorities had regulated interrepublican water relations for decades. When these agreements suddenly lost their legal force in the winter of 1991, each of the states of Central Asia acquired an interest in using as much water as possible at the minimal cost.⁴⁹

The American Southwest

Two major rivers, the Colorado River and the Rio Grande, provide approximately ninety percent of the water for irrigated agriculture in the states of the American Southwest. Both rivers have their origins in the Rocky Mountains. The Colorado River flows for 2,334 km (1,450 miles) through seven states including Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming before it flows across the frontier into Mexico. The Rio Grande flows through Colorado and New Mexico for 3,034 km (1,885 miles) before it forms the United States-Mexico border, dividing Mexico from Texas.

The American Southwest was initially settled by Europeans in the sixteenth century, but it was not until the years following the American civil war that the rate of economic development picked up. At this early point, the areas were administered by territorial governments appointed by and responsible to the central government in Washington. In order to encourage development, the national government passed laws allowing the transfer of federally-owned lands to settlers who would improve the land through building and farming.⁵⁰ Land grants were made to railroads to facilitate a rail link between the east and west coasts, an especially important consideration after the discovery of gold in California in 1848.⁵¹ Cattle ranchers were given substantial grazing subsidies for federal lands.⁵²

The Reclamation Act of 1902 paved the way for building the system of dams for water impoundment and irrigation by the Federal Bureau of Reclamation. The Bureau initiated, and the Army Corps of Engineers constructed, an extensive system of dams and diversion canals with primary service for irrigation; the system included inter-basin transfer facilities and was intertwined with other dams devel-

49. G. Gleason, *The Struggle for Control over Water in Central Asia: Republican Sovereignty and Collective Action*, Report on the USSR, June 21, 1991, at 11.

50. See Homestead Act of 1862, ch. 75, 12 Stat. 392 (repealed 1976); see also P. Gates, *History of Public Land Law Development 390-94* (noting development of the homestead Act of 1862).

51. See R. Athearn, *Union Pacific Country* (1971); R. Howard, *The Great Iron Trail* (1962).

52. See G. Coggins & M. Lindeberg-Johnson, *The Law of Public Rangeland Management II: The Commons and the Taylor Act*, 13 *Envtl L.* 1, 63 (1982).

THE AMU AND THE SYR DARIA



Map 2

Scale: One inch equals 237 miles

Mercator Projection

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oped exclusively by the Corps of Engineers.⁵³ All these dams and canals were part of the central government's incentives for western settlement.⁵⁴ Economic incentives encouraged development and discouraged conservation.⁵⁵

As this survey of the similarities of the physical characteristics of the major rivers systems of Central Asia and the American Southwest suggests, the distribution logic of the water management system of these areas has important parallels. The water courses are of equivalent size, the amount of land under cultivation is roughly equivalent. Both cases involve major interbasin transfers. Both cases have witnessed increased water demand in recent years due to population growth. Both cases involve multiple districts and multiple jurisdictions. However, the political and legal institutional arrangements that have been developed to manage water in the two cases do not share these same degree of similarity.

THE INSTITUTIONAL LOGIC OF WATER MANAGEMENT SYSTEMS IN CENTRAL ASIA AND THE AMERICAN SOUTHWEST

Institutions for managing water involve two fundamental levels. The first concerns the right to water. The second concerns water policy. The right to appropriate water is controlled through legal institutions. Water policy is controlled through political institutions which recognize, monitor, and enforce legal rights. In some cases, these political institutions may also be responsible for implementing these rights. The following discussion of the legal and political institutions that control water use in both the Central Asian and the American Southwest begins with an analysis of legal principles and then proceeds to describe formal mechanisms responsible for monitoring, enforcement,

53. For an inventory of the interbasin transfers of water in the Southwestern United States see H. Petsch Jr., *Inventory of Interbasin Transfers of Water in Western Coterminal United States* (1985) (published by the United States Geological Survey). An overview of major water development projects in the western United States, including those with interbasin transfers, is in Johannes Humlum, *Water Development and Water Planning in the Southwestern United States* (1969).

54. See R. Dunbar, *Forging New Rights in Western Waters* (1983); D. Pisani, *To Reclaim a Divided West* (1992); M. Reisner, *Cadillac Desert* (1986).

55. See generally Coggins & Lindeberg-Johnson, *supra* note 52 (western rangeland development and conservation problems); S. Shupe, *Waste in Western Water Law: Blueprint for Change*, 61 Or. L. Rev. 483 (1982) (prior appropriation doctrine for allocating water favors development at the expense of efficient water use); C. Wilkinson, *Aldo Leopold and Western Water Law: Thinking Perpendicular to the Prior Appropriation Doctrine*, 24 Land & Water L. Rev. 1 (1989) (criticism of water allocation doctrine in western United States which promoted development over stewardship); M. Wilson, comment, *Reclamation Subsidies and Their Present-Day Impact*, 1982 Ariz. St. L.J. 497 (review of Reclamation law subsidies and economic impacts).

and implementation. The fundamental fact of water management is a consequence not of institutions but of the nature of water. Water is a migratory substance. Questions of "ownership" of water tend, accordingly, to acquire an almost philosophical level of complexity. The question "Whose water is it anyway?" is an ancient one. Yet to encourage stewardship of water, a number of different patterns or regimes of water rights have emerged. Three types of water management regimes historically have proved the most enduring. These regimes may be classified as: administrative disposition, riparian, and prior appropriation.⁵⁶ These are broad categories. There are many variations in practice of each type of regime. Regardless of the regime, however, it is generally not the substance of the water which is owned, but rather the right to put the water to use. Water rights are therefore treated differently from other absolute property rights, where the right to sell, transform or even to destroy the property is generally assumed to follow from ownership. Historically, water rights have been connected to the idea that, within the confines of some agreed ratio between consumptive use and nonconsumptive use, water once used would then be returned to the water course.⁵⁷

Further restrictions on water use are associated with the type of legal regime. In simple riparian systems, the right to use the water is connected to the land through which the water passes. In other words, an appropriator has the claim to water by virtue of a claim to land. In prior appropriation systems, the right to use the water is linked to a legal right to put the water to use, for instance for mining purposes. The claim to water rights is usufructuary. It is independent of land ownership. It is based above all upon previous use patterns that are recognized by some legitimate authority. Prior appropriation rights are summed up in the proverb: "first in time, first in right." In regimes of administrative disposition (such as the former Soviet Union), there are no individual, real property rights in the water because the water, and all allocation decisions relating to water, belong to the state. Usufructuary rights, subject to various constraints, are assigned by the state.

Central Asia

Prior to the Russian conquest of Central Asia, water allocations were determined by local custom and by Islamic law. Islam is not sim-

56. This typology is drawn from L. Teclaff, *Water Law in Historical Perspective* 6 (1985).

57. This concept is part and parcel of the riparian doctrine, and is separate from today's administrative requirements for return flow within modern prior appropriation doctrine. *Anaheim Union Water Co. v. Fuller*, 88 P. 878, 980 (Cal. 1907); see *Tyler v. Wilkinson*, 24 F. Cas. 472 (C.C.D.R.I. 1827) (No. 14,312); see generally T.E. Lauer, *The Common Law Background of the Riparian Doctrine*, 28 Mo. L. Rev. 60 (1963).

ply a religion; it is a belief system that regulates all of society—economics and politics as well as personal behavior. Although Islam has never had the force in Central Asia that it has in the Middle East, its legacy was felt throughout the Russian period and, as Soviet influence wanes, the impact of Islam on Central Asian institutions is increasing.

The two major schools of Islamic doctrine and law are Sunni (the predominate school in Central Asian and the official doctrine in Saudi Arabia) and Shiite (the official religion of Iran). These two Middle Eastern nations are competing for religious control of Central Asia, a conflict with potentially serious consequences for water allocation rules.⁵⁸

In Sunni tradition, rules governing dispersal from small, dammed rivers follow the precepts laid down by the Prophet. Preference is given to upstream users but they must either allow all surplus water to flow downstream or return all surplus water and all water that drains from the fields. Canals, in contrast, are the "joint property of the individuals who built them, and they alone are entitled to exercise the right of irrigation."⁵⁹ All appropriators must agree on the manner of use. Wells are the property of the digger, or, on occasion, of the user. These individuals have the sole right of irrigation from the well water.⁶⁰

There are two important differences between Sunni and Shiite irrigation law. First, according to Shiite doctrine, the "irrigation right is attributed only to the holders, with no privileges given to the community."⁶¹ Rights to use a canal are distributed in proportion to the funds contributed (or, one presumes, the labor). Downstream users have no rights to the water of a natural canal or stream until the upstream user is completely finished, even if the downstream user loses his crops.⁶² Second, the transfer of water rights differs between the Sunnites and Shiites. Under the Sunnites, water rights are attached to the land and transfer with the land. The land may be sold without the water, but how water is transferred without land depends on the school within the Sunnite tradition. For instance, the Hanifites, who predominate in Central Asia, do not allow irrigation rights to be sold separately; the only mechanism for transferring irrigation rights is through

58. Cf. Nazih N. Ayubi, *State Islam and Communal Plurality*, 524 *Annals Am. Acad. Pol. & Soc. Sci.* 79 (1992); G. Mirsky, *Central Asia's Emergence*, 91 *Current Hist.* 334 (1992); V. Naumkin, *Islam in the States of the Former USSR*, 524 *Annals Am. Acad. Pol. & Soc. Sci.* 131 (1992); Y. Ro'i, *The Islamic Influence on Nationalism in Soviet Central Asia*, 39 *Probs. Communism* 49 (1990); R. Stanfield, *Islam's Power*, 22 *Nat'l J.* 2644 (1990).

59. D. Caponera, *Water Laws in Moslem Countries* 22, *Food and Agriculture Organization of the United Nations Development Paper No. 43* (1954).

60. *Id.* at 23-24.

61. *Id.* at 25.

62. *Id.* at 25-26; see also K. McLachlan, *The Neglected Garden: the Politics and Ecology of Agriculture in Iran* 69-75 (1988).

inheritance. However, irrigation rights may be transferred to a second piece of land owned by the same farmer, and he may then sell the second parcel of land with the newly attached irrigation rights. Thus water may not be sold independently, but may be used to enhance the value of land.⁶³ Shiite doctrine permits the sale of water only by weight or measure.⁶⁴

After the Russian conquest in the late nineteenth century, principles of Islamic law and Tsarist law co-existed.⁶⁵ The colonizing Russians simply assumed the position that had been occupied by the Emirs, taking control of land and water as state property. The legal regime for water management that was imposed after the Bolshevik revolution was an administrative disposition regime.⁶⁶ The Soviet state made allocation decisions on the basis of central planners' calculations of social benefit. This system was established early in the Soviet period as the designers of the new socialist system redefined private property as a collective good and established bureaucratic control over collective decision making.

State bureaucratic control had three immediate implications. First, all land was at least theoretically under socialist (meaning state) control. The state became the Watermaster—regulating the water system in such a way as to bind the Moscow-based and local administrative hierarchies in a complex web of management rules. Second, land became non-alienable. There could be no civil transactions such as purchase, sales, gifts or bequests involving land. Third and finally, since Marxist theory stressed that all value originated in labor, land and water had no value because, like minerals and forest resources, it was not produced by human labor. Thus land and water records were kept not in monetary terms but in natural terms.⁶⁷ This point became increasingly important in the 1980s and 1990s as the Soviets tried to establish market equivalents for their agricultural products but were unable to establish the land and water costs as a factor of total production costs.

During the early Soviet period, no federal principle for the use of water was expressed. For 20 years, the only regulation of water use

63. Caponera, *supra* note 59, at 28. A second Sunnite school, the Malikites, who predominate in Morocco, Upper Egypt, and several other African nations, allow full alienation of irrigation rights even to the extent of allowing the sale of irrigation turns and the rental of the right. *Id.*

64. *Id.* at 27-28.

65. D. MacKenzie, Kaufman of Turkestan: An Assessment of His Administration 1867-1881, 26 *Slavic Rev.* 265, 274 (1967).

66. See, e.g., P. Davis, *The Law's Response to Conflicting Demands for Water: The United States and the Soviet Union*, in *Water Resources Law and Policy in the Soviet Union* 53, 65 (I. Fox ed., 1971).

67. N. Syrodoyev, *Soviet Land Legislation* 28 (1975).

was by "current legislation"; for example, the Statute on the Agricultural Use of Water in the Uzbek republic passed in 1941, and statutes similar in name only in the Tajik republic and Kirghiz (later Kyrgyz) republic in 1943.⁶⁸ According to many accounts, this led to uncertainty for the water appropriators of central Asia: "[o]n the local level the [administrative] situation was verged on the chaotic and had a damaging effect on the rational, coordinated use of water."⁶⁹

During periods of relative decentralization, the republics tried to gain greater control over their own water. For instance, during the decentralization of Khrushchev's middle years, new water codes were drafted in the Uzbek republic (1958), the Turkmen republic (1959), the Kazakh republic (1959) and the Tajik republic (1962).⁷⁰ After an all-union conference on environmental problems in 1961, a decision was made to separate water law from other legal areas to such an extent that there would be not only separate "Principles of Water Utilization" but also separate "Water Law Codes" in every republic. Khrushchev's decentralization lost momentum after 1961, however, and little came of this decision.

In practice, virtually all water policy was made in Moscow. The lead agency was Minvodkhoz (the Ministry of Land Reclamation and Water Resources), a union-republic ministry. Minvodkhoz had primary operational responsibility for determining the timetables and amounts of water to be discharged for irrigation purposes. From the legal perspective of the constituent Soviet republics, there was no basis for prioritizing water uses and no mechanism for resolving water disputes except through appeals to the center through the Communist party or through the channels of the various economic ministries involved in water policy (e.g., the Ministry of Agriculture). Conflicts between users, for instance, between hydropower users and irrigators, were frequent. Criticism of Minvodkhoz's pro-development approach were also frequent. The centralized irrigation systems, such as were used in central Asia, provided water to collective farms (kolkhoz) through massive state constructed irrigation systems. Even the allocation of irrigation water to individual small plots was part of the overall system plan.⁷¹ The irrigation systems had their own administrative structures which therefore served as both regulators and appropriators, and their allocation plans were approved by the executive agencies of the local Soviets (local parliamentary councils).⁷²

68. T. Vondracek, *Soviet Water Regimes Under One Umbrella*, in *Codification in the Communist World* 341, 342-43 (D. Barry et al. eds., 1975).

69. *Id.* at 343.

70. *Id.* at 344.

71. O. Kolbasov, *Legislation on Water Use in the USSR*, in *Water Resources Law and Policy in the Soviet Union* 91, 131 (I. Fox ed., 1971).

72. *Id.* at 131-32.

In the mid-1970s, Minvodkhoz became embroiled in a long bureaucratic fight to divert north flowing Siberian rivers to Central Asia to supplement the irrigation water provided by the Amu Darya and Syr Darya. In 1986, however, the Ministry's program was canceled by the new Gorbachev administration. Thereafter, Minvodkhoz was caught in a downward spiral of bureaucratic contention until it was unofficially abolished in late 1990. Most of its functions were then captured by republican level governments. Its central offices in Moscow were turned into a "scientific-technical institute." By December 1991, with the demise of the USSR, Minvodkhoz and its remnants ceased to have any direct authority in Central Asia.⁷³

American Southwest

The common law basis for water rights in colonial America was a riparian regime. In a riparian setting, only the owner of the land adjoining the watercourse has rights in the water. This property right is subject to certain constraints if, for example, the waterway is navigable. But the generally controlling view is that the riparian landowner may make any reasonable use of the water that does not infringe upon the rights of any other riparian owner. In the riparian doctrine that developed in the eastern portion of the United States, "natural" uses such as drinking or watering gardens were preferred to "artificial" uses such as irrigation or mining, but by the early twentieth century, the more economic, commercial uses of water, especially to power mills, were given preference.⁷⁴

During the first and most influential period of economic development in the American Southwest, the greatest demand for water came from mining, not agriculture or ranching. Mining required the development of a physical infrastructure to transport water across lands not owned by the water user. And it required the development of a legal doctrines of water rights that recognized the right of the user of the water. These requirements led to the establishment of a prior appropriation system of water allocation rather than a riparian system.⁷⁵

73. Many official organizations are involved in land and water policy. For example, in the past, Uzbek Soviet Socialist Republic (UzSSR) ministries formerly involved in Central Asia water resources included agriculture, land reclamation and water resources, power and electrification, rural construction, and state farms. The UzSSR Supreme Soviet had a Water Resources Commission that was also involved. In addition, the Uzbek Communist Party had two organizations involved in water resources: a Department for Agriculture and a Rural Water Resources Department. The other four Central Asia republics had similar organizations. Today, all five of the newly independent republics each have several new ministries which are involved in water resources.

74. M. Horwitz, *The Transformation in the Conception of Property in American Law, 1780-1860*, 40 U. Chi. L. Rev. 248, 251-78 (1973).

75. J. McGowan, *The Development of Political Institutions on the Public Domain*, 11 Wyo. L.J. 1, 14-15 (1956).

The prior appropriation system has played a significant role in developing the American Southwest and continues to do so.⁷⁶ The system's virtue is that it creates private, secure, and transferable rights to water which, in turn, enable the growth of mining, agriculture, and cities. However, issues have arisen over the system's ability to foster conservation and to provide for resolving conflicts in fully appropriated watercourses.⁷⁷ In response to those issues the system is evolving such that it still remains the basic water law for the American Southwest.⁷⁸ One issue that arose from prior appropriation in the American Southwest, which has particular relevance to Central Asia, is conflict between western states over allocating waters of interstate rivers.⁷⁹

As the western states developed, the demand for water increased dramatically and interstate conflicts over water allocation and water quality became critical. The response to conflicts among the states was the emergence of the legal instrument of interstate compacts. For American states, the compact form of water management has a number of advantages over other management regimes. First, since compacts are consciously designed and negotiated to achieve limited administrative purposes, they usually have sufficient legal and administrative authority. They facilitate change, and because they are cooperative in design, they encourage cooperation in implementation. Compacts provide both political accountability and responsiveness of the bureaucracy to the participating states and the resource users, and,

76. See Dunbar, *supra* note 54, at 73-85, 209-17; D. Getches, *Water Use Efficiency: The Value of Water in the West*, 8 Pub. Land L. Rev. 1, 4-7 (1987); N. Johnson & C. DuMars, *A Survey of Western Water Law in Response to Changing Economic and Public Interest Demands*, 29 Nat. Res. J. 347, 348-351 (1989); Wilkinson, *supra* note 55, at 6-11.

77. See sources cited *supra* note 76.

78. No western state has completely repudiated prior appropriation as the basic means for allocating water. See Johnson & DuMars, *supra* note 76, at 347-87. But states have modified their prior appropriation systems in response to society's changing goals for water use. *Id.*; G. Sherk, *Meetings of Waters: The Conceptual Confluence of Water Law in the Eastern and Western States*, Nat. Resources & Env't, Spring 1991, at 3. An issue of particular concern for prior appropriation systems is managing water resources that already are in full use, i.e., fully appropriated. The issue focus is on reallocation of existing water rights. What process should be used to reallocate rights? What should be the criteria for reallocation? A substantial discussion has grown up around reallocation and much of the discussion has focused on developing market-oriented systems. For a sample of the discussion see B. Saliba & D. Bush, *Water Markets in Theory and Practice* (1987); Committee on Western Water Management, National Research Council, *Water Transfers in the West* (1992); V. Brajer et al., *The Strengths and Weaknesses of Water Markets as They Affect Water Scarcity and Sovereignty Interests in the West*, 29 Nat. Res. J. 489 (1989); S. Nunn & H. Ingram, *Information, the Decision Forum, and Third-Party Effects in Water Transfers*, 24 Water Resources Res. 473 (1988); S. Shupe et al., *Western Water Rights: The Era of Reallocation*, 29 Nat. Res. J. 413 (1989).

79. See R. Simms, *Equitable Apportionment - Priorities and New Uses*, 29 Nat. Res. J. 549 (1989).

if they use the commission or agency form of implementation, their regional nature helps attract competent leadership and staff.⁸⁰

Three variations of interstate compacts emerged: 1) binding without Congressional consent; 2) binding with Congressional consent; and 3) non-binding. The first type of arrangement is comprised of interstate agreements and interstate compacts that have not been officially approved by federal authority.⁸¹ A second type of arrangement is the development of binding agreements with the consent of federal authority. In the American federal system, states may ask for Congressional assent to their agreements.⁸² In this case, Congressional approval places an obligation on the appropriate federal agency as party to the agreement, allowing the states to pass some implementation costs on to the federal government. The non-binding agreement was developed by management agencies below the state legislative level. These are non-binding because they lack legislative authorization.⁸³ Although at first blush these agreements may seem unlikely to work well, the empirical record is that these "gentlemen's agreements" drawn up between interstate agencies tend to be durable.⁸⁴

In the case of either interstate compact or interstate agreement, there are two varieties of management frameworks that may be used to implement the institutional decisions. These frameworks are differentiated primarily by the amount of discretion allowed by the state to the implementing agencies. The first type—prescriptive—provides guidelines for the state agencies which will be charged with implementing the agreement. The guidelines are hammered out in negotiations between the states and the final agreement is the management framework itself. It is used "to delimit the scope of the arrangements, to control the use of the resource, to control the activities of the management agencies themselves, and to protect the arrangement."⁸⁵ The Colorado River Compact is an example of such a prescriptive management institution.

The second framework is the interstate agency or commission. In the United States, approximately two-thirds of all interstate compacts are administered by an interstate agency or commission.⁸⁶ These interstate agencies are independent of existing state agencies. Because

80. J. Muys, *Interstate Water Compacts: The Interstate Compact and Federal-Interstate Compact S-7, S-8 (1971)* (Legal Study No. 14, National Water Commission, Washington, D.C.).

81. See, e.g., S. Buck, *Interjurisdictional Management in Chesapeake Bay Fisheries*, 16 *Coastal Mgmt.* 151 (1988).

82. Whether express approval of Congress is constitutionally required for legally enforceable interstate agreements is arguable. See *Virginia v. Tennessee*, 148 U.S. 503, 519-25 (1893).

83. V. Tinsley & L. Nielsen, *Interstate Fisheries Arrangements: Application of a Pragmatic Classification Scheme for Interstate Arrangements*, 6 *Va. J. Nat. Resources L.* 265, 272 (1987).

84. *Id.*

85. *Id.*

86. D. Grant, *Water Apportionment Compacts Between the States*, in 4 *Waters and Water Rights* § 46.01, § 46.03, at 559 (R. Beck ed., 1991).

each compact is negotiated separately, each commission has varying responsibilities. Usually, however, commissions have the following authority in some combination: gathering, processing and distributing information; advising state decision makers; and managing and regulating resources within the state that were formerly managed by intrastate agencies.⁸⁷ This may include maintaining streamflow records and establishing gaging stations, coordinating reservoir management, and making legal "findings of fact" when the signatories dispute water allocation impacts.⁸⁸ Some commissions engage in flood control, project development, river basin planning, and pollution control.⁸⁹ The Upper Colorado River Basin Compact and the Rio Grande Compact are administered by commissions.

Five formal agreements set out transboundary arrangements for the Colorado and Rio Grande rivers. These agreements are two treaties between Mexico and the United States plus three interstate compacts set within the United States.⁹⁰ Together, the agreements illustrate variations on the theme of equitable utilization⁹¹ for resolving transboundary water conflict.

Two interstate compacts comprise the bulk of the current context for division of Colorado River water within the United States.⁹² First, the 1922 Colorado River Compact has the states of Wyoming, Colorado, Utah, New Mexico, Nevada, Arizona, and California all agreeing to a division of water between states comprising the upper basin of the river and those states of the lower basin.⁹³ Second, upper basin states, in the Upper Colorado River Basin Compact of 1948, reached an agreement on apportioning their share of water from the Colorado River Compact.⁹⁴

The Colorado River Compact arose from two fears between the upper and lower basins.⁹⁵ Upper basin states feared that they would not have sufficient water for their own development as the rapidly de-

87. *Id.* at 560; Tinsley & Nielsen, *supra* note 83, at 272-73.

88. Muys, *supra* note 80, at 16-17.

89. A. Tarlock, Law of Water Rights and Resources § 10.05 (1991) (Release No. 4).

90. Extensive discussion of these arrangements can be found in the following sources: A. Utton, *Mexican International Waters*, in 5 *Waters and Water Rights* § 51.01 (R. Beck ed., 1991); R. Hill, *Development of the Rio Grande Compact of 1938*, 14 *Nat. Res. J.* 163 (1974); C. Meyers, *The Colorado River*, 19 *Stan. L. Rev.* (1966) (interstate compacts); C. Meyers & R. Noble, *The Colorado River: The Treaty With Mexico*, 19 *Stan. L. Rev.* 367 (1967).

91. *See supra* notes 19-23 and accompanying text.

92. *See Meyers, supra* note 90.

93. The full text of the Compact is reprinted in several locations including the statutes of each participating state. *E.g.*, 70 *Cong. Rec.* 324 (1928); *N.M. Stat. Ann.* § 72-15-5 (Repl. Pamp. 1985).

94. The text of the Compact is reprinted in several locations including the statutes of each participating state. *E.g.*, Act of Apr. 6, 1949, ch. 48, 63 *Stat.* 31; *N.M. Stat. Ann.* § 72-15-26 (Repl. Pamp. 1985).

95. *See Meyers, supra* note 90, at 10-13.

veloping lower basin would "lock up" virtually all available water.⁹⁶ In turn, lower basin states feared that the upper basin would curtail or even shut off the river water reaching the lower states.

The Colorado River Compact resolved the fears of both basins through the doctrine of equitable apportionment.⁹⁷ The Colorado River Compact limits each basin's annual amount of "consumptive beneficial use" of river water and requires the upper basin to deliver a minimum flow in the river to the lower basin over any period of 10 consecutive years.⁹⁸ Thus, the Colorado River Compact provides some certainty as to the upper basin's future supply from the river and also gives the lower basin some assurance of water delivery by the upper basin.⁹⁹ In addition, both basins equally share any United States' treaty obligation to deliver water to Mexico.¹⁰⁰

The Upper Colorado River Basin Compact arose from the upper basin's need to settle water rights in the basin so that the water available under the Colorado River Compact could be used to expand the basin's economy.¹⁰¹ Again, the doctrine of equitable apportionment was used to develop the compact.¹⁰² The Upper Colorado River Basin Compact establishes, with one exception¹⁰³, each state's right to available water by fixed percentages.¹⁰⁴ The percentages include consideration for each state's hydrologic contribution to the river plus present and future consumptive uses.¹⁰⁵ Also, to ensure fulfillment of obligations to the lower basin and Mexico during times of shortfall, each state will curtail its water use based on its past use for a designated period prior to a shortfall.¹⁰⁶

The third compact involves the dispute between Colorado, New Mexico, and Texas over the United States' portion of Rio Grande water. Initially, this conflict led a 1929 agreement among the three states to

96. This fear existed before and during negotiations for the Colorado River Compact; federal common law also heightened the fear by giving strong weight to a state's established use of water in deciding water allocation suits between states. Meyers, *supra* note 90, at 10-11 n.62 (citing *Wyoming v. Colorado*, 259 U.S. 419 (1922)).

97. Colorado River Compact art. I, 70 Cong. Rec. at 324.

98. Colorado River Compact art. III., 70 Cong. Rec. at 325.

99. See Meyers, *supra* note 90, at 17.

100. Colorado River Compact art. III(c), 70 Cong. Rec. at 325.

101. The Upper Basin needed federal funding to develop the Basin's available water supply from the river and that funding was contingent on the settling of water rights among the Upper Basin states. Meyers, *supra* note 90, at 27.

102. *Id.* at 27-29; Upper Colorado River Basin Compact art. I, 63 Stat. at 31.

103. Arizona, as a state in both the upper and lower basins, receives a fixed amount through the Upper Colorado River Basin Compact and retains access to water available to lower basin states through the Colorado River Compact. Upper Colorado River Basin Compact arts. III, XVIII, 63 Stat. at 32-33, 42; Colorado River Compact arts. II, III, 70 Cong. Rec. at 324-25.

104. Upper Colorado River Basin Compact art. III, 63 Stat. at 32-33.

105. See Meyers, *supra* note 90, at 29.

106. Upper Colorado River Basin Compact art. IV, 63 Stat. at 33-34.

preserve the "status quo" among themselves while creating an interstate commission to negotiate an equitable apportionment of the river.¹⁰⁷

After subsequent clashes among the states and some federal action to assist in preserving the status quo, the interstate commission developed the 1938 Rio Grande Compact.¹⁰⁸ Once again, the approach of equitable apportionment was used to develop an acceptable compact.¹⁰⁹ The Rio Grande Compact imposes requirements on Colorado and New Mexico to deliver certain sums of water downstream of themselves. These sums are based on percentages of actual river flow past certain sites with percentages set on a sliding scale essentially derived to preserve the river flow conditions as existed in 1929.¹¹⁰ The Rio Grande Compact provides for some flexibility in meeting the required deliveries by allowing Colorado and New Mexico to run deficits or surpluses, within certain limits, on their required deliveries.¹¹¹

Two treaties between the United States and Mexico concern apportioning the Rio Grande and Colorado Rivers between the two countries. A treaty in 1944 covers both rivers¹¹² and a 1906 treaty covers water from the upper Rio Grande alone.¹¹³ The 1906 treaty guarantees Mexico, at no cost, an annual delivery of 60,000 acre-feet of Rio Grande water except under serious drought¹¹⁴ or an accidental failure¹¹⁵ in the United States. The United States may reduce its delivery to Mexico by an amount proportionate to the losses suffered by the United States due to the drought or failure.¹¹⁶

The 1944 Treaty guaranteed 1.5 million acre-feet of Colorado river water to Mexico spread over an annual schedule.¹¹⁷ Mexico could receive additional water in the Colorado but that water would come only if there was "surplus" of water beyond the needs of the United States.¹¹⁸ Both Mexico and the United States must share in shortfalls of river water due to "extraordinary drought."¹¹⁹ The Treaty also provides for a roughly equal division of waters in the part of the Rio Grande that borders both countries.¹²⁰

107. Hill, *supra* note 90, at 167.

108. *See id.* at 167-71, 197-98.

109. *See id.* at 174.

110. *See id.* at 174-75.

111. Rio Grande Compact arts. I, VI-VIII, 53 Stat. at 785-86, 789-90.

112. 1944 Treaty, *supra* note 17.

113. 1906 Convention, *supra* note 13.

114. *Id.* art. I, 34 Stat. at 2953-54.

115. Accidental failure refers to failure of the dam and attendant distribution system located near Engle, New Mexico, on the Rio Grande. *See id.* arts. I, III, 34 Stat. at 2953-55.

116. *See id.* art. II, 34 Stat. at 2954.

117. 1944 Treaty, *supra* note 17, art. 10, 59 Stat. at 1237.

118. This surplus has a cap of 200,000 acre-feet per year. *Id.*

119. *Id.*

120. Utton, *supra* note 90, § 51.03(b).

A most notable provision of the 1944 Treaty, however, is its development of the International Boundary and Water Commission (IBWC) to administer the treaty.¹²¹ The IBWC is charged with settling all disputes arising from the Treaty.¹²² If disputes cannot be settled within the commission, then the commission refers the dispute, complete with background information on respective positions, to both governments for resolution through normal diplomatic channels.¹²³ The IBWC has proven itself quite useful to both countries.¹²⁴

The treaties, however, also have their shortcomings. A notable shortcoming of the 1944 Treaty concerns water quality.¹²⁵ The 1944 Treaty lacks specific standards for what quality of water the United States must deliver to Mexico and lacks specific agreement as to what liability, if any, should attach to the United States for failure to deliver water of appropriate quality. This uncertainty concerning water quality has led to problems concerning salinity.¹²⁶ The problems have been resolved, at least temporarily, but salinity of Colorado river water promises to be a recurring issue between Mexico and the United States.¹²⁷

A second shortcoming within the 1906 Treaty and the 1944 Treaty is the ambiguity of the provisions for drought conditions. The 1944 Treaty calls for reductions in water deliveries to Mexico during conditions of "extraordinary drought or serious accident . . . making it difficult for the United States . . . to deliver [the water guaranteed to Mexico, thus the] . . . water allotted to Mexico . . . will be reduced in the same proportion as consumptive uses in the United States are reduced."¹²⁸ The 1906 Treaty provides that "in case, however, of extraordinary drought or serious accident . . . in the United States, the amount delivered to Mexico shall be diminished in the same proportion as the water delivered to lands . . . in the United States."¹²⁹ These drought provisions, while flexible, are ambiguous to a degree that could pose significant administrative and legal questions if the United States ever

121. 1944 Treaty, *supra* note 17, art. 2, 59 Stat. at 1222-25. The jurisdiction of the IWBC, by the 1944 Treaty, also extends over the lower Rio Grande which forms the border between Mexico and the United States. *Id.*

122. *Id.* 59 Stat. at 1223.

123. *Id.* art. 24(d), 59 Stat. at 1256.

124. Collaborative efforts between the two governments through the IWBC led to a productive resolution of a critical Mexican need for Colorado river water in 1966. Meyers & Noble, *supra* note 90, at 419. The IWBC also played a valuable role as a convenient mechanism for facilitating resolution of salinity problems on the Colorado river. See Utton, *supra* note 90, § 51.04(e)1.

125. Meyers & Noble, *supra* note 90, at 406-11.

126. H.E. Dregne, *Salinity Aspects of the Colorado River Agreement*, 15 Nat. Res. J. 43 (1975).

127. *Id.*; A. Kneese, *Environmental Stress and Political Conflicts: Salinity in the Colorado River*, Transboundary Resources Rep., Summer 1990, at 1.

128. 1944 Treaty, *supra* note 17, art. 10(b), 59 Stat. at 1237-38.

129. 1906 Convention, *supra* note 13, art. II, 34 Stat. at 2954.

takes the provisions as a basis for reducing water deliveries to Mexico.¹³⁰ Those questions could inhibit resolving conflict over water deliveries during drought conditions.

While the 1906 Treaty and 1944 Treaty have shortcomings, those shortcomings may be addressed through the institution of the IBWC.¹³¹ Past performance indicates the IBWC is an international institution that can be a useful vehicle in resolving transboundary water conflicts.¹³² At the least, the IBWC forms a reasonable base for building further institutional arrangements as needed to meet future conflict.¹³³

In sum, each of the transboundary arrangements works to satisfy the participants' needs by including constraints on all participants - a mutual limiting of sovereignty.

CONCLUSION

The prevailing situation in Central Asia can be described in the following terms. The Central Asian states have entered into a context of collective action dilemmas. With respect to the Amu Darya, for instance, Tajikistan's interests diverge with those of Turkmenistan, and Turkmenistan's diverge with those of Uzbekistan. With the conclusion of the Afghanistan war, some Afghanistan economists are suggesting the revival of dam projects in the upper reaches of the Amu Darya, adding yet another factor to the calculus of accelerating water tensions.¹³⁴ Unbridled invocation of the principle of unrestricted republican level sovereignty is apt to lead the states into a context of direct confrontation. That much is clear and generally recognized by the policymakers in these states. On a practical level, however, the mechanisms which would encourage a solution to these problems have not yet emerged and are not on the horizon. The former central, Moscow-based officials are now irrelevant. No mid-level political structures currently exist which could provide a forum for equitable conflict management. The legal and political institutions of the pre-Soviet period were replaced by those of the Soviet administrative system. The "strong state" character of the administrative system had profound implications for both the local and the inter-state level of interaction.

130. Meyers & Noble, *supra* note 90, at 411-15; Cesar Sepulveda, *Instituciones Para La Solucion De Problemas De Aguas De Superficie Entre Mexico Y Los Estados Unidos*, 18 Nat. Res. J. 131 (1978).

131. See 1944 Treaty, *supra* note 17, art. 24(f), 59 Stat. at 1256-57.

132. S. Mumme & S. Moore, *Agency Autonomy in Transboundary Management: The United States Section of the International Boundary and Water Commission, United States and Mexico*, 30 Nat. Res. J. 661, 661-62 (1990).

133. See R. Hayton, *Institutional Alternatives For Mexico-U.S. Groundwater Management*, 18 Nat. Res. J. 201, 205 (1978); Sepulveda, *supra* note 130 at 140-41.

134. This observation was repeatedly made during field study by the authors, S. Buck and G. Gleason, in Central Asia.

With the disappearance of the "center" in Moscow, there is no legitimate authority which could broker a disinterested agreement among the parties.¹³⁵ Some political efforts have been made on the part of the principals to find a forum for regional cooperation on water problems. The "Agreement on Economic, Scientific, and Cultural Cooperation" signed by the republics' leaders in June 1990 said nothing regarding joint efforts in solving water problems. Somewhat later, the Presidents of Turkmenistan and Uzbekistan signed a bilateral "Agreement on Economic and Cultural Cooperation," which observed that it was "necessary to resolve the issue of dividing the flow of the of the Amu Darya in equal measure at the Kerki water metering station."¹³⁶

What is the expected effect of independence on the problems of transboundary water resources in Central Asia? What do the findings of this analysis suggest regarding institutional design relevant to mitigating the intensity of expected conflict over water in Central Asia?

We drew from economic theory and natural resource theory a number of premises for the analysis. These included the concept of collective action dilemma, the notion of common pool resources, and the idea of zero-sum effects of interbasin water transfers. We noted that states which competitively pursue common goods in a non-hierarchical structure without a central authority can be expected to encounter collective action problems. We observed that these states will tend to act opportunistically through free riding and shirking. Our analysis of the water management systems in Central Asian and the Southwestern American states proceeded from the assumption that conflict over water is most often a product of disjunction between physical and institutional logics.

The surveys of the distribution logic and the institutional logic of the major rivers of the American Southwest and the Central Asian states suggest that both states face roughly equivalent technical problems. The analysis of the evolution of the development of legal and political institutions in the American Southwest suggested that the American institutions developed in conformance with the demands imposed by collective action dilemmas.

Two forms of institutional response to these challenges are particularly noteworthy. First, the prior appropriation regime that emerged in the Southwestern states vested the right to use the water on the basis of patterns of prior use. The prior appropriation system is largely independent of land ownership. The "first in time, first in right" doctrine represented a departure from prevailing American legal standards, one that was an adaptation to the local environment. Second, the Ameri-

135. See G. Gleason, *The Federal Formula and Soviet Collapse*, *Publius: The Journal of Federalism*, Summer 1992, at 141.

136. *Soglashenie*, *Turkmenskaia Iskra*, Apr. 23, 1991, at 1.

can states discovered that they could not efficiently solve their mutual disputes over water by vesting all authority in central (i.e., federal government) authorities, nor could they solve them acting as individual entities. We noted that American states entered into interstate compacts which allocated the use of interstate streams by mutual agreement, or court apportionment, or congressional apportionment. Compacts help resolve the collective action problems inherent in multijurisdictional resource management regimes. Signatories agree to negotiated compromise positions on resource allocation, sharing monitoring and enforcement costs. Removing discussion from the local level, where individual incentives to shirk or to free-ride are strongest, moderated the interests of the states as separate parties in collective action deliberations. This concerted state action also provided some measure of protection from federal tendencies to assert centralized control over the resources.¹³⁷ In sum, the states of the American Southwest solved the collective action problem inherent in multidistrict water management by simultaneously going above and below the level of the state to establish linkages on a local level through an adaptation of water rights and on a regional level through an adaptation on inter-state relations.

The expectations of the collective action dilemma suggest the following scenario for Central Asia. With the emergence of fully independent states in Central Asia, a disjunction will emerge between the distribution logic and the institutional logic of the water management systems. Specifically, conflicts will develop over the interstate allocation of newly international rivers. Appropriators along each water course are now limited to decisions based on national political boundaries. In effect, the institutional logic has been dammed at the borders, with the same disruptive consequences that physical dams would have on the distribution logic. To aggregate the intensity of all of these at the national level makes the state at once more capable and more hostile. In these circumstances, collective action problems may be unresolvable and we can expect neither efficient resource use nor cooperative resource use. The dynamics of this type of situation are well understood; the competitive search for advantage through the use of tariffs, trade barriers, and the maximal exploitation of migratory natural re-

137. The major reclamation/irrigation projects in the Southwest are federally instigated and managed. In 1893, the Supreme Court noted that if an interstate compact increased state autonomy at the expense of the national government then the compact, to be legally valid, must have Congressional approval. *Virginia v. Tennessee*, 148 U.S. 503, 519-25 (1893). Furthermore, in 1963, the Court recognized the power of the federal government to override state water law when apportioning water between states. *Arizona v. California*, 373 U.S. 546, 565-67 (1963).

sources results in "economic nationalism."¹³⁸ A direct line may be traced from this cycle of economic conflict to political conflict and, ultimately, to violent conflict.

However, the forgoing analysis also suggests that this scenario is not inevitable if collective action dilemmas can be overcome. The general solution to the problem may be stated as the "institutional imperative." The institutional imperative asserts that for the countries to overcome collective action problems regarding water, the higher and lower level institutional linkages must be maintained. The national unit is not an optimal decision making unit for transboundary water resources. Therefore, international agreements are necessary. The solution to Central Asia's water management problems is to be found in a variegated system of management based on independent local institutions solving on a micro level the problems of monitoring, enforcement, and local governance.¹³⁹ These institutions need to be nested into larger institutions, also independent, that serve entire drainage basins—not states—whose goal would be to solve problems of conflict resolution among basins.¹⁴⁰ These institutions then would be tied into a third level of institution at the international level that would address problems of coordination regarding sectoral priorities such as the balance of agricultural as opposed to industrial development, crop diversification and farm employment. How might these multi-level institutional links, particularly the larger institutions in which local institutions are nested, be developed in Central Asia?

For the Central Asia states to develop basin-wide and international institutions, international treaty practice surrounding transboundary waters is one logical vehicle. Through limited sovereignty, equitable utilization, and equitable participation, treaty practice provides a base for developing multi-level institutional links between states. Such international links, in the American Southwest and elsewhere, have worked to resolve collective action problems of transboundary waters.

Where, in turn, might the Central Asian states begin in using international treaty practice? A starting point could be the International Law Commission's Draft Rules on the Non-Navigational Uses of International Watercourses. These draft rules are the present result

138. On economic nationalism, see R. Gardner, *Sterling-Dollar Diplomacy in Current Perspective: The Origins and Prospects of Our International Economic Order* (1980); J. Spero, *The Politics of International Economic Relations* (4th ed. 1990).

139. Ostrom has found that a general design principle of successful management institutions is that "appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities be organized in multiple layers of nested enterprises." E. Ostrom, *Governing the Commons* 90 (1990).

140. See Teclaff, *supra* note 39, at 197-203.

of a long and continuing effort to construct an initial framework for states working to overcome problems of transboundary waters.¹⁴¹ While possessing their share of shortcomings, the draft rules also represent the current advances in international water law. Thus, the draft rules are a possible point of departure for the Central Asian states starting on a journey to fulfill the institutional imperative, a journey that, given history, will demand much patience.

141. See Colloquium, *Doman Colloquium on the Law of International Watercourses: Review of the ILC's Draft Rules on the Non-Navigational Uses of International Watercourses*, 3 *Colo. J. Int'l Env't'l L. & Pol'y* 13 (1992).