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Water Fights in Central Asia: Republican Sovereignty and Collective Action

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Abstract

The past three decades have witnessed a substantial increase in demand upon water resources in Central Asia. The area's population has more than doubled. The aggregate consumptive use of water in municipalities, industry, and agriculture has trebled. Even as consumptive use has increased, the quality of available water has deteriorated. Untreated human waste, industrial effluent, agricultural runoff, pesticides, herbicides, and chemical defoliants have entered the water supply. As a consequence of administrative reorganization and the transition to republican sovereignty, the Moscow-based economic ministries have lost their ability to administer the interrepublican water management system in Central Asia. Each of the republics of Central Asia has claimed exclusive jurisdiction over its natural resources, including the land and water. The centralized bureaucratic administration which managed Central Asian water resources in the past has now been or will soon be replaced by intergovernmental agreements among the republics of Central Asia. Accordingly, public policy institutions are currently being redesigned to manage Central Asia's water resources. This paper analyzes this process of institutional redesign in terms of collective action theory and the framework of common pool resources.

In the arid oases and river valleys of Central Asia, the value of land has always been inseparably linked to access to water. The success of local political officials in ancient times often hinged on their skill at managing local water resources. Streams and wells had to be protected from external threat, they had to be kept clean, irrigation canals had to be maintained, and highly political decisions regarding the distribution of water had to be made and enforced. These responsibilities also conferred a great deal of authority upon those charged with carrying out the relatively complex tasks of maintaining the irrigation networks. Not surprisingly, the watermasters of traditional Central Asian communities were often the most powerful local officials. Unlike the individualistic, participant-oriented political culture that developed in many water-rich agrarian societies, a collectivist and subject-oriented political culture developed in many arid agricultural societies. It has

been suggested that many Central Asian traditions of deference to authority may have had their origins in the high level of socio-political organization required by the "hydraulic society."[1]

Central Asian traditional communities often solved the problems of maintenance, monitoring, and security very effectively. While it would be naive to suggest that they always did so without internal conflict, it is nonetheless clear that there were many cases of successful institutional arrangements which existed over long periods of time. These institutions effectively solved the key problem of natural resource management, namely the attainment of sustained resource yields. The success of these institutions was aided by a number of factors. The systems were primarily local. They were bound to a particular valley or oasis. The technology was appropriate to the demands upon it. And the river basins and oases were physically separated. Those water conflicts that did exist tended to be concerned with the control of irrigation networks within a particular, localized area rather than competition between regions.

By way of comparison, today's much more complex Central Asian irrigation system has failed the chief test of a natural resource management regime. Agricultural production in Central Asia has dropped in large measure because of the declining effectiveness of the irrigation system. Moreover, the mismanagement of water resources now threatens irreversible environmental damage with the desiccation of the Aral Sea. In addition to the failure of the Central Asian water management system to provide for sustained resource yields, the institutional arrangement also tends to pit region against region and republic against republic in competition over access to Central Asia's scarcest resource. As water demand has outstripped supply, economic tensions within Central Asia have led to increasingly severe conflicts among the newly sovereign republics of Central Asia over water use rights. The conflict has in some cases taken on the shades of nationality conflict, reinforcing feelings that some indigenous Central Asian national groups are benefiting at the expense of others.[2]

This paper approaches the water management problem of Central Asia as a common pool resource problem.[3] Using the theory of collective action, this paper analyzes Soviet institutional responses to water management

problems to assess the prospects of evolving public policy solutions to the water crisis in Central Asia.

Water Demand and Irrigation in Central Asia

During the past thirty years, the population of the Central Asian republics increased from about 13.6 million to 32.8 million, or by about 140 percent.[4] During this same period, agricultural production in such key areas as cotton production rose by almost 100 percent.[5] The amount of land under irrigation rose substantially.[6] Meanwhile, output in industrial enterprises involving substantial ingress or egress of water climbed steeply from initial low levels to relatively high levels. Steel production rose by 200 percent. [7] Cement production rose 470 percent.[8] The generation of electricity rose by a factor of twelve.[9] Chemical industrial production is reported to have risen sharply during this period, although precise data on output are not available.

The growth in population combined with growth in agricultural production and industrial development to place a heavy burden on Central Asia's limited water resources. Central Asia's meager precipitation is insufficient to support agriculture or habitation in all but a few areas. Oases fed by groundwater support agriculture and habitation in only a few restricted regions. The great bulk of Central Asia's water comes in the form of runoff from the high mountain ranges in the eastern parts of Central Asia. Most of this runoff feeds the major rivers of Central Asia which flow east and north across the deserts toward the Aral Sea. The average annual flow of the combined rivers of the Aral Sea basin totals approximately 125 thousand cubic meters.[10] Until 1960 and the rapid expansion of Central Asia's arid lands irrigation networks, about 45 thousand cubic meters of water reached the Aral Sea annually.[11] By 1982, the draws for human, agricultural and industrial purposes consumed this amount of water on an annual basis. Central Asia's rivers ceased to replenish the Aral Sea.[12] Approximately three percent of Central Asia's water consumption was used in municipal areas. Roughly ten percent was consumed in the region's industry. The remainder, eighty-seven percent, was consumed in agriculture.[13]

Within the entire Aral Sea basin two main rivers, the Syr Dar'ia and the Amu Dar'ia, are responsible for irrigating roughly seventy-five percent of Central Asia's agriculture.[14] The construction of large scale irrigation

networks in these two river basins was begun in the Tsarist period. In May 1918, the Sovnarkom passed a resolution on the expansion of the irrigation system by 500 thousand desiatins. During the period 1924-1926, a major land reform was undertaken in Central Asia. The land reform deprived the traditional watermasters of the Central Asian oases of decision making authority, transferring it to the Soviet government. Central Asia's water management system was extended during the 1930s by the construction of major canals in the Fergana valley, including the North Fergana Canal, the Andizhan Canal, and the Namagan Canal. In the 1960s the Karakum Canal was completed, bringing water from the Amu Dar'ia at Kerki near the Soviet-Afghanistan frontier for a distance of 900 kilometers to Ashkhabad, the capital of Turkmenistan.

The Central Asian irrigation management system consumed a large proportion of central government investment in Soviet Central Asia. Yet the system has not succeeded in meeting Central Asia's water needs for a number of reasons. First, many of the features of the physical and institutional framework in Central Asia were created to be administered in a colonial context. In Central Asia as in other colonial areas, the political structures inherited from the colonial period involved jurisdictions and area administrative divisions that made sense to the metropolitan planners, but ignored basic features of the colonized area. This is by no means a problem unique to Central Asia. For instance, the European colonial planners, accustomed as they were to northern European conditions where rainfall was plentiful, typically ignored the key importance of watershed boundaries when dealing with arid areas. In some water-rich colonial circumstances this proved not to be a problem. British hydraulic design in the Volta river basin in West Africa, for instance, was quite successful. Here agriculture was mainly dependent upon ample rainfall. The five countries involved in the transnational water district that succeeded the colonial administration suffered from few water conflicts. The states felt no obligation to regulate water flows among themselves through international agreements regarding water use.[15]

In arid agricultural areas, however, where water degradation occurs between head, middle, and tail users, the appropriators at the headwaters seek to draw as much as possible and pay as little attention as possible to the effects of water degradation through salinization, runoff, and so on.

Users at the tail are forced to accept this situation. In the case of Egypt, for instance, the British hydraulic engineers divided up the Egyptian irrigation system in terms of sequential management districts along the Nile. Thus the water moving along the Nile passes from one jurisdiction to the next. This management structure artificially created conflict points among local districts, thereby elevating the central government in Cairo to a position of the only authority capable of resolving interdistrict disputes. In a fashion similar to the English in Egypt, the Russian hydraulic engineers in Central Asia, drawing on their own experience of water rich Russia, paid little attention to the special requirements of arid Central Asia. These irrigation system designers devised a water management system that took control away from local water districts and vested it in the remote bureaucracy of Moscow economic ministries.

In the 1950s, Moscow planners, calculating upon economies of scale supposedly inherent in regional economic specialization, greatly expanded the "cotton first" agricultural development strategy in Central Asia. Since all Soviet cotton is grown on irrigated land, the cotton expansion program dictated a parallel expansion of the irrigation system. Particularly after 1957, cotton cultivation took precedence over all other areas of agricultural development in Central Asia. Cotton specialization was routinely heralded by local and Moscow politicians during this period as the "patriotic duty" of the Central Asian population and the key to Central Asia's success in "skipping stages" in economic development.

By the mid-1980s, however, the practice of extreme specialization in cotton came to be identified as the cause of disastrous social and economic conditions in the Asian republics. In the words of Rafik Nishanov, a former first secretary of the Communist Party of Uzbekistan, cotton monoculture was carried "to monstrous proportions."[16] Cotton monoculture came to be seen as the principal cause of soil exhaustion, the degradation of the region's water quality and, ultimately, of the death of the Aral Sea. With the rise in public concern over the Aral sea crisis, the reversal in attitudes toward cotton monoculture, and the new possibilities for local control resulting from perestroika, a consensus has emerged within Central Asia that the existing water management system is inadequate to meet the region's water needs. This consensus maintains that a new institutional arragement for the management of Central Asia's water resources is a necessity. However, the

question as to what shape this institutional arrangement will assume remains unanswered. The institutional designs associated with previous Marxist economic practice are largely discredited now as "administrative-command" approaches. The vast expansion of the physical irrigation system during the past four decades makes a return to traditional Central Asian irrigation systems of ages past impractical. The emergence of a new, transrepublican water management board seems the most likely alternative. Such a management board will face a natural resource management problem that, judging from the state of development of Soviet economic theory and the statements of regional Central Asian politicians, is not at all well understood.

Common Pool Resources, Privatization, and Collective Action

The central problem of natural resource management is that of designing a management regime that maximizes sustainable yields of a resource over a long period of time. A regime is established and functions by virtue of the social and political institutions associated with it. Institutions are structures which distribute incentives and thereby influence human behavior, although they do not determine human behavior. In advanced societies of the developed world, the conventions of private property have been found to lead to efficient institutions for maximizing returns at the most economic levels of investment for many types of natural resource. The common economic explanation for this empirical assessment is offered by the "rational actor model." According to this model, a rational, self-interested proprietor on privately held land would be expected to carefully calibrate resource withdrawal to the carrying capacity of the land. Since investment can be expected to lead to greater return and destruction or wasteful use of privately held property could be expected to lead to diminished return, the rational proprietor would naturally practice stewardship.

Students of resource management who proceed from the assumptions of the rational actor model have noted that for a large and important category of natural resources, however, a rational, self-interested individual could not normally be expected to engage in stewardship. "Common pool resource" systems such as fishing grounds, groundwater basins, grazing areas, and irrigation canals involve resources which are migratory, transient or fugitive in nature, or otherwise held as common property. An appropriator using

such resources would be expected to maximize his own benefit, ignore externalities, and generally deplete the resource in seeking short-term returns. In such situations, each individual using the resources would directly benefit from withdrawals but only minimally benefit from investments. Since each appropriator receives a direct benefit from his own use of the common resource and only suffers delayed costs from resource depletion, each would tend to use as much as possible with little regard to the collective good and the long-term sustainability of the resource. In such common pool resource situations, some analysts contend, "ruin is the destination to which all men rush, each pursuing his own best interests in a society that believes in the freedom of the commons."[17]

Political economists have provided a theoretical explanation for such behavior. The idea that groups of people organize themselves to build and maintain lighthouses, common pasturage, or irrigation systems would seem to flow naturally from the idea that if a group is composed of rational, self-interested individuals have a common interest or objective, then the group would organize to achieve that objective. According to the theorists of collective action, however, the simple rational actor model of human behavior would not normally lead to the provision of common goods. If an individual cannot feasibly be denied the benefit of a good even if that individual contributes little or nothing to its provision, then he would not be motivated to sacrifice for the good. The beam from a light house, for instance, is such a "non-excludible common good" in the respect that a particular individual cannot be excluded from enjoying the benefits of the light house beam, regardless of whether he made a contribution to the building and maintenance of the light house. If a rational, self-interested, and value-maximizing individual sees that the benefit from the light house beam is his to use whether he sacrifices for it or not, he will be inclined to use his scarce resources to obtain other goods which may be denied him if he does not sacrifice for them. Consequently, in the absence of selective incentives to discipline people from "free-riding" at the expense of other members of the group, "rational, self-interested individuals will not act to achieve their common or group interests."[18]

In an effort to "humanize" market relations, Marxist economic planners redefined private property as common property. In so doing, they institutionalized on a vast scale the "free-rider problem" as the core problem

of Soviet-type economies. The institutional arrangements of these economic systems fail to encourage a positive relationship between investment and return. Consequently, they erode the psychological basis for human commitment to those public policy institutions that require individual sacrifice for the collective good. Rational people who believe that the fruits of their contribution will be enjoyed by all but who will be able to withdraw only the average benefit, naturally will tend to withhold their contribution to collective institutions.

Irrigation as a Collective Goods Problem

The commitment problem is not unique to Soviet-type economies. Collective institutions exist in many social and economic contexts. All share in some measure the problem of maintaining individual commitment and preventing or limiting free-riding. Irrigation systems provide an example of a physical resource system which, by its nature, requires a institutional framework capable of overcoming the free-rider problem. Canals have to be maintained, diversion weirs have to be regulated, and cheating has to be monitored. In many arid agricultural societies that depend upon complex irrigations systems, a typical farmer may spend as much as twenty percent of his time on tasks which contribute to the collective good. This is time that is lost to the production of goods for his personal benefit. Unless the collective tasks are accomplished, the personal returns of each individual farmer will fall substantially. Therefore, the maintenance of irrigation systems requires a great deal of individual sacrifice, the benefits of which are spread over a very large group of people.

Comparative research suggests that the failure of some irrigation systems in the states of West and Southwest Asia have resulted not from any deficiencies in physical design, but because in the initial design of the accompanying institutions for the accomplishment of collective tasks "a social basis for action among local people [was] not created."[19] Recent empirical research conducted by theorists of collective action has investigated cases in which the free-rider problem has been successfully overcome. Empirical research focusing on the way in which institutions affect incentives has sought to analyze institutions that preserve commitment while minimizing the free-rider problem. The goal of this research is to identify design principles for "effective institutions." When dealing with

collective goods problems, effective institutions may be defined as institutions that are "free rider--proof."[20]

Irrigation water is a "common pool resource," that is, it is a combination of a "natural resource system and a man-made resource system that is sufficiently large to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use."[21] In addition to being a common pool resource, irrigation water is progressively rivalrous and progressively congestible. A rivalrous commodity is one whose use by one party diminishes the amount available for use by another party.[22] Irrigation water is progressively rivalrous because, although water used upstream is carried back to the water source via return drainage ditches, a percentage is diminished in consumptive use. Moreover, the quality of the water returned to the stream is degraded. Consequently, the irrigation water may be only minimally rivalrous upstream but, in the same irrigation system, it may be very rivalrous downstream. A congestible commodity is one for which, under circumstances of open access, an increase in the number of users will eventually result in constraints upon use.[23] Irrigation water in arid areas is progressively congestible because the upstream users may not be affected by water quality constraints. As the water passes to downstream users, however, agricultural runoff degrades the quality, diminishing its value per unit. Consequently, downstream users face a different set of constraints than upstream users.

All common pool resource systems face similar challenges. Management systems must supply the rules that allocate water to appropriators on the basis of some definition of equity and efficiency. The systems must encourage commitment on the part of users of the resource system such that those users have a reasonable expectation that their sacrifices will be met with rewards and that investment will result in returns. Finally, management systems must monitor use and sanction misuse to discourage free-riding and other violations of the rules.[24]

The challenge of the redesign of water management in Central Asia is how to reorganize the existing infrastructure to solve the problems of supply, commitment and monitoring. The system of irrigation water management in Soviet Central Asia is undergoing substantial change. In order to analyze the significance of the changes, the current policies, and the prospects for

the success of those policies, it is necessary to distinguish among three levels of analysis. The first level concerns the nature of the resource itself, the second concerns the nature of the resource management system as a functioning institutional arrangement, and third concerns the way in which the local institutions interact with other political and social institutions.

Water Districts in Central Asia

Hundreds of localized irrigation networks exist in Central Asia.[25] However, throughout the last three decades, the control of the water management districts of Central Asia has been in the hands of central officials. Consequently, the main drainage basins often link a number of separate networks that draw water from the same source. The most important physically separate drainage basins are:

* The Syr Dar'ia basin. This area includes all the irrigation networks drawing on the feeder rivers of the Syr Dar'ia. This includes the waters of the Naryn from above Tash-Kumyr in Kyrgyzstan and the waters from the numerous feeder rivers of the Fergana valley. The basin reaches all the way down the Syr Dar'ia river valley to beyond the major irrigation networks in Kzyl-Orda oblast of Kazakhstan. Three republics, Kyrgyzstan, Kazakhstan and Uzbekistan, share this basin.
* The basin of the Zaravshan. This includes valley from below Pendzhikent in Tadzhikistan to Chardzhou in Uzbekistan. It includes the cities of Samarkand, Novoi, and Bukhara.
* The basin of the Kashka Dar'ia. This includes the river valley of the Kashka Dar'ia basin with a center at Sharisabz.
* The basin of the Vaksh. This includes from the Nurek dam all the way down to the Piandzh on the Afghanistan border.
* The basin of the Surkhan Dar'ia. This includes the irrigated regions of the Surkhan Dar'ia basin to Termen just above the border with Afghanistan.
* The basin of the Amu Dar'ia from below the confluence of the Piandzh and Vaksh all the way down to the Aral Sea. This is the largest and most important drainage basin of Central Asia, including jurisdictions of three union republics (Tadzhikistan, Uzbekistan, Turkmenistan) and one autonomous republic (Karakalpakia).

* The basin of the Murgab. This includes the Murgab valley with a center at Mary.
* The basin of the Tedzhen. This includes the Tedzhen valley with an administrative center at the city of Tedzhen.

The most important problems within the drainage basins are upstream-downstream conflicts over water quality. In the Syr Dar'ia basin the interests of agricultural users are divided into three categories. The first group consists of users in the Fergana valley. The water that leaves the valley then flows into the irrigation network of users in the Golodnaia Steppe. Finally, the water leaves the UzSSR at Chardara, flowing north through the Kazakh republic to users of the Syr Dar'ia river basin on its way to the Aral Sea. Although the water is not rivalrous for the upper Fegana valley users, it becomes progressively so along the Syr Dar'ia basin such that it becomes simply rivalrous in the lower reaches of the basin. The water is depleted before it reaches the Aral Sea.

The interests of agricultural users on the Amu Dar'ia are divided mainly into upstream and downstream conflicts mainly over the issue of water quality. However, since 1980, the amount of water flowing into the Aral has dropped to zero.[26] Consequently upstream draws have deprived downstream users of water. Upstream agricultural draws take place at several diversion points along the Amu Dar'ia. The most important diversion is at the mouth of the Kara-Kum canal at Kerki. Thus, the users of the Tadzhik SSR and the Surkhandarin oblast of UzSSR are at odds with the downstream users located in the Chardzhou and Tashauz oblasts of the Turkmen republic, in the Khorezm oblast of the UzSSR, and in the Karakalpak ASSR.

Under the guidance of Minvodkhoz, Soviet water managers of the 1950-1980s have created an expansive irrigation system for the area's cotton production complex. It is a system that links different drainage basins and links upstream--downstream users that may be separated by thousands of kilometers. The large scale of the system is disadvantageous in two ways. First, it mingles various categories of appropriators in the same water management district. Agricultural irrigation water users thus compete with water users for municipal and industrial purposes. The ability of local users to form enduring institutions to allocate water among themselves is

diminished when external agencies or constituencies routinely intercede to satisfy their own interests.

Second, the large scale of the system is attained through linking different drainage basins through interbasin transfers. Interbasin transfers change the logic of the situation since interbasin transfers are rivalrous transfers. That is, water that is diverted from one basin at an upstream point proportionately diminishes the amount of water available to downstream users in that drainage basin. Interbasin transfers, therefore, involve a different politics than typical common pool resource management.[27]

The diversion of water for the interbasin transfers takes place in many contexts in Central Asia. The most important transfers are the Kara-kum canal, the Bukhara-Amu canal, and the Kashkadar-Amu canal. One might also include the North Fergana Canal in this category since, even though the water remains in one drainage basin, it is physically separate from its original users. Of these interbasin transfers, the most potentially contentious is the Kara-Kum canal. The canal diminishes the amount of water available to users lower down the Amu Dar'ia river valley.

Republican Sovereignty and Control of Natural Resources

The transition to republican level sovereignty has returned virtually all the responsibility for decision making regarding natural resources to the republican level. In this period of institutional redesign, three questions stand out. Who will decide on the amount of water provided to agricultural users? Who will decide on the price of water? Who will decide on the distribution among users within the Aral Sea basin?

In the past, the job of accommodating differing interests between the upstream-downstream users was delegated to the central economic ministries located in Moscow. However, the various levels of ministries, committees, and agencies often issued competing and conflicting orders.[28] The lead agency was Minvodkhoz (The Ministry of Land Reclamation and Water Resources), a union-republic ministry whose offices were located in Moscow. Minvodkhoz had primary operational responsibility for determining the timetables and the amounts of water to be discharged for irrigation purposes. Criticism of the pro-development approach of

Midvodkhoz led to the reorganization of the ministry and the renaming of it as the Ministry of Water Management Construction (Minvodstroi) and the renaming of it as a scientific research institute in June 1990. Even during the ascendancy of Minvodkhoz, disagreements regarding the distribution of water were often settled by Gosplan which was said to have the final authority on establishing limits on water withdrawal.[29]

Even as Minvodkhoz, along with a score of other ministries and agencies, was being downgraded in relevance, the republican level institutions were being pushed forward by the transition to republican level sovereignty. All of the Central Asian republics maintained their republican level ministries of water economy.

Declarations of Sovereignty were passed in all the republics in the summer of 1990.[30] Each of the declarations asserted sovereignty over the land, water and resources of their respective republics. All of the Central Asian republics have announced plans aimed at "privatization." But, to an extent greater than in the other republics of the USSR, the Central Asian republics have retained control over the land and resources, in particular, water. The USSR Law on Land passed in February, 1990, in Moscow 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.[31] There were suggestions that formal water protocols would follow the laws on land, but no such protocols have been published.

In addition to the calcification of republican boundaries, there have been some efforts to form multilateral and bilateral agreements between and among the republics. The text of 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.[32] The Presidents of Turkmenistan and Uzbekistan, in the recently adopted Agreement on Economic and Cultural Cooperation, recognized that it was "necessary to resolve the issue of dividing the flow of the of the Amu Dar'ia in equal measure at the Kerki water metering station."[33] Yet no concrete provisions for accomplishing this were published. Indications that agreements are in place do sometimes surface. For instance, in some unpublicized

interrepublican agreement, Tadzhikistan was apparently allocated a water use quota for 1990 of 11.1 billion cubic meters.[34]

Polices and Prospects

The current reforms in Central Asia are still in their initial stages. The steps that have been taken to address the Central Asian water management crisis are serious and substantial, but they are not based on a clear and determined set of policies regarding how to solve the problems. In other words, a consensus has not yet emerged among Central Asia's water management specialists and politicians regarding the specific policies necessary to solve the area's water problems. A variety of policy options are being debated. There are some appeals for "miracle solutions" such as a proposal to artificially alter weather patterns to increase the amount of rain in Central Asia on a continuing basis.[35] But such proposals are rightly being dismissed as impractical. The chief policy options that are being taken seriously include: 1) an increased emphasis on privatization; 2) greater water conservation efforts; and 3) the rehabilitation of river diversion projects.

Privatization is a word that frequently appears in formal government documents, but the meaning attached to it by Central Asian political leaders appears to be different than that attached by Russian politicians, let alone market economists. The historical record is of course clear that land can be privatized, but the privatization of water rights is a more problematic process. Since irrigation water is a fugitive resource, the privatization of water rights assumes a legal structure which recognizes the rights of a collective decision making body to provide for the regular functioning of the irrigation system. With the withering of the USSR Minvodkhoz in Moscow, the republican minvodkhozes have stepped in to solve problems of local monitoring, distribution and enforcement. Traditionally, water in Central Asia has been "free." Many Western and some Soviet economists have suggested that the rational use of Central Asia's water resources will require the recognition of a basic wisdom of market economics: that goods which belong to all belong to none. Accordingly, water in Central Asia will continue to be wasted until its value is fixed in the pricing structure.

Some symbolic measures have been instituted to introduce a payment schedule for water.[36] Yet the opposition to a water pricing system appears to be relatively strong within Central Asia. According to press reports, some small farmers fear that increased water costs would consume their already meager profits.[37] Some officials also claim that water pricing would be a false economy. Since agricultural water is currently unmetered, new equipment for metering would need to be purchased and installed.[38] Moreover, these officials maintain, water pricing schemes would only increase their headaches with poachers, and thereby raise monitoring and enforcement costs.

Conservation of water is being taken seriously in Central Asia. There is near universal agreement that, despite a near reverence for water in ancient Central Asia, recent decades have witnessed increasing profligacy in patterns of water use. Conservation efforts now, however, form a major component of the program to solve the Aral Sea and are routinely championed in the speeches of republican political leaders as a public obligation. Some of the conservation efforts are relatively inexpensive. Raising public awareness of water problems, for instance, is inexpensive and has an important impact. Furthermore, such ancient practices as irrigating fields at night to eliminate evaporation bear little direct costs. Other conservation programs, in contrast, are more costly and often involve infrastructural improvements. Installing drip irrigation systems, lining irrigation canals and drainage ditches, and levelling fields for maximum water use are costly improvements. The redesign and reconstruction of canals and reservoirs to minimize evaporation and the construction of new drainage canals to prevent highly saline or otherwise polluted agricultural runoff from reentering the irrigation water supply are yet more expensive programs. But whatever the recommendations for conservation, there is strong sentiment in Central Asia that conservation programs at most could only incrementally alleviate the water crisis. An enduring solution, many voices insist, would require a more substantial decrease in water use or a substantial increase in the water supply.

Diversion of north-flowing Siberian rivers is regarded as offering one solution to the problem of water supply. Plans for an ambitious project to divert about 27 cubic kilometers of water a year from the Irtysh and the Ob' rivers were summarily cancelled in 1986.[39] Yet the political pressure from

Central Asia for a rehabilitation of the diversion project, although on a smaller scale, has been unrelenting. While the initial river diversion plans were aimed at supplying Central Asia with water to further expand irrigated agriculture, the more recent plans suggest that diversion would be used only to reverse the desiccation of the Aral Sea. As the deputy chair of the Uzbek Council of Ministers summarized the sentiments of a broad segment of Central Asian officialdom, "There are no other alternatives. This is a question of "to be or not to be" for Karakalpakia, Tashauz oblast, and the Kzyl-Orda oblast of Kazakhstan."[40] There is a widespread network of policy officials at all levels who are lobbying for the project Within Central Asia, the opposition which defeated the project in 1986 is now seen by many as having been more generally directed against Minvodkhoz giganticism and mismanagement than against the Sibaral project itself. Now that the tactics of Minvodkhoz have come to an end, suggested Rim Giniiatullin, the Uzbekistan Minister of Water Economy, the subject can be discussed dispassionately and "on the basis of mutual interests."[41]

The current reorganization of authority in Central Asia's water management system along republican lines is motivated by the perception that the failure of the current system can be ascribed to three factors: "foreign" (that is, Moscow) control; external pressures on development priorities; and an insufficiency of capacity for monitoring and control. From this analysis of the situation, local republican level authorities have drawn the conclusion that the failure is basically a result of insufficient capacity. Consequently, a more fully rationalized water management system requires a more capable administrative system with more extensive monitoring capabilities and the ability to impose greater, even Draconian, sanctions to enforce compliance.

The comparative empirical studies of the "new institutionalists" such as Ostrom, however, suggest that while institutional designs are quite varied in practice, there are many societies that successfully solve the key problems of creating institutions to provide for credible commitment on the part of users and provide for mutual monitoring. The sanctions in these successful institutions are often surprisingly light and yet they function effectively to minimize free-riding. These institutions combine local and centralized decision making institutions in such a way as to maintain incentives among appropriators while encouraging interregional integration. Most important,

these organizations succeed in maximizing resource yields over a long period of time.

Given the fact that a new water management system has not yet emerged in full form in Central Asia, the present analysis can only suggest propositions in need of further testing. As the full administrative framework takes shape, a more complete analysis in terms of collective action theory and the common pool resources framework will be possible. Yet, at this preliminary point, the following general proposition seems clear: the idea that more centralized agencies at the republican level will be successful in solving the water management problems of Central Asia is quite suspect. While the motivation behind this tendency is understandable given the severity of the water crisis, the consequences of administrative recentralization at lower (i.e., republican) levels is apt to be unfortunate.

Ostrom has found that a general design principle of successful common pool resource management institutions is that "appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities be organized in multiple layers of nested enterprises."[42] In the case of Central Asia, this would suggest that the solution to Central Asia's water management problems is apt 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. These institutions need to be nested into larger institutions, also independent, that serve entire drainage basins, not republics. The goal of these institutions would be to solve problems of conflict resolution among basins. These institutions then would be tied into a third level of institution at the interrepublican 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. Finally, the scarcity of water has to be recognized within the price structure. As Aristotle observed long ago, "that which is common to the greatest number has the least care bestowed upon it."[43] As long as water is available without cost or at symbolic cost, it is not going to be rationally used. Many Central Asian managers object to water pricing on grounds that it imposes a hardship on the poor. But the destruction of the resource systems of Central Asia through misuse imposes a more permanent cost on poor and rich alike.

Notes

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1 This thesis is developed in Karl A. Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (New Haven: Yale University Press, 1957).

2 Such is the substance of reports that komsomol volunteer activists have made night raids along borderland irrigation canals to combat water poaching by other nationality groups. See Iskander Khisamov, "Voda kak prichina pozhara," *Literaturnaia gazeta*, January 16, 1991.

3 The theoretical framework for the comparative analysis of collective decision making in irrigation systems used in this article is drawn from Elinor Ostrom, *Governing the Commons:The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990).

4 The combined population of the Uzbek, Kirgiz, Tadzhik and Turkmen republics was 13,682 thousand in 1959 and 32,838 thousand in 1989. *Narodnoe khoziaistvo SSSR v 1989* (Moscow: Finansy i Statistika, 1990), p. 17, p. 23. One might also include the Kyzl-Orda (659 thousand in 1989) and Chimkent (1,859 thousand in 1989) oblasts of the Kazakh republic for a more complete figure of the population of the area of Central Asia.

5 Cotton production in the Central Asian republics in 1960 was 3,837 thousand tons. In 1989 it was 7,669 thousand tons. See Gregory Gleason, "Marketization and Migration: The Politics of Cotton in Central Asia," *Journal of Soviet Nationalities* Vol. 1, No. 2 (Summer 1990) pp. 67-98, and Narodnoe Khoziaistvo SSSR v 1989 g. (Moscow: Finansy i statistiki, 1990), p. 439.

6 According to the statistical handbooks, the amount of irrigated land in these republics increased from 2,368 thousand hectares in 1965 to about 2,772 thousand hectares in 1989, or by only about five percent. See *Narodnoe khoziaistvo SSSR, 1922-1972* (Moscow: Statistika, 1972), pp.

546, 633, 646, 671, and Narodnoe khoziaistvo SSR v 1989, p. 456. Narkhoz figures after 1982 are shown for all "technical crops," a definition which includes sugar beets, sunflower seeds, and some other crops. I have controlled for this definition. It should be noted, however, that the official figures may considerably understate the actual growth in the amount of irrigated farm land under cultivation. Political officials in the large Uzbek republic throughout the late 1960s and 1970s regularly announced at the end of the year that increments of 100,000 hectares of newly irrigated land were brought into production during that year. See Gregory Gleason, "Between Moscow and Tashkent: The Politics of the Uzbek Cotton Production Complex." Ph.D. dissertation, University of California, Davis (1984).

7 *Narodnoe khoziaistvo SSSR, 1922-1972* (Moscow: Statistika, 1972), pp. 545, 632, 646, 670 and *Narodnoe khoziaistvo v 1989 g.* (Moscow: Finansy i statistiki, 1990), p. 378.

8 *Narodnoe khoziaistvo SSSR* (Moscow: Statistika, 1972), pp. 545, 632, 646, 670. *Narodnoe khoziaistvo v 1989 g.* (Moscow: Finansy, 1990), p. 399.

9 *Narodnoe khoziaistvo SSSR* (Moscow: Statistika, 1972), pp. 545, 632, 646, 670 and *Narodnoe khoziaistvo v 1989 g.* (Moscow: Finansy, 1990), pp. 375.

10 E.D. Rakhimov, *Sotsial'no-ekonomicheskie problemy arala i priaral'ia* (Tashkent: Fan, 1990), p. 7.

11 Rakhimov, p. 9.

12 Rakhimov, p. 9. A small inflow was realized in 1984.

13 Philip P. Micklin, "Water Management in Soviet Central Asia: Problems and Prospects." Paper presented at the IV World congress for Soviet and East European Studies, Harrogate, England. July 1990. Micklin's data are from *Okhrana okruzhaiushchei sredy i ratsional'noe ispol'zovanie prirodnykh resursov v SSSR* (Moscow: Goskomstat, 1989), pp. 66-67.

14 The Amu Dar'ia 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 Syr Dar'ia has a length of 2,212 kilometers. The irrigated area drawing from the Amu Dar'ia basin is 10,700 thousand hectares. The irrigated area drawing from the Syr Dar'ia basin is 5,200 thousand hectares. Other major river systems are the Kashka-Dar'ia, Zarafshan, and Kopetdag. Together these account for about 6,000 hectares. See Paul Lydoplph, *Geography of the USSR* (Elkhart Lake, WI: Misty Valley Publishing, 1979).

15 Margaret Petersen, W*ater Resource Planning and Development* (Englewood Cliffs, NJ: Prentice Hall, 1984), p. 44..

16 Rafik N. Nishanov, *Pravda Vostoka* June 2, 1989, p. 1.

17 Garrett Hardin, "The Tragedy of the Commons," *Science* Vol. 162 (1968), p. 1244.

18 Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups* (Cambridge: Harvard University Press, 1965), p. 2.

19 Walter E. Coward Jr., "Direct and INdirect Alternatives for Irrigation Investment and the Creation of Property." In K. William Easter, ed., *Irrigation Investment, Technology, and Management Strategies for Development* (Boulder, CO: Westview, 1986), p. 226.

20 Samuel Popkin, "Public Choice and Peasant Organization." In Robert H. Bates, *Toward a Political Economy of Development: A Rational Choice Perspective* (Berkeley: University of California Press, 1988), p. 271.

21 Ostrom, p. 30.

22 For the definition of these concepts, see David L Weimer and Aidan K. Vining, *Policy Analysis: Concepts and Practices* (Englewood Cliffs, NJ: Prentice Hall, 1989). An example of a non-rivalrous commodity would be a light house beam. The use of the beam by one party does not diminish its availability to another party. In contrast, a pie held in common by a number of people would be diminished in some measure by each person's consumption.

23 An example of a non-congestible commodity would be a radio signal. There is no limit on the number of parties who can use a radio signal at a given time. Access to fishing in a particular part of a stream would present an example of a congestible good. The stream might be freely fished by one, or two or even a large number of people without any problem. At some very large number of fishermen, however, the stream will be so crowded as to make fishing impractical.

24 Ostrom, pp. 42-49.

25 Rakhimov lists some 967 local irrigation systems in the Aral Sea basin. Rakhimov, p. 6.

26 Rakhimov, p. 9.

27 The politics is different but it is still a collective goods problem simply on a different scale. In the case of interbasin transfers, the actors are the political constituencies in different drainage basins.

28 Many official organizations are involved in land and water policy. The UzSSR ministries involved include the ministry of agriculture (UR), the ministry of land reclamation and water resources (R), the ministry of power and electrification (UR), the ministry of rural construction (R), and the ministry of state farms (R) as well as other organizations. The UzSSR Supreme Soviet has a Water Resources Commission. The CPUz had a department for Agriculture as well as a Rural Water Resources Department. The Kirgiz, Tadzhik and Turkmen republics each have parallel organizations.

29 V.Ia. Lashchenov, "Problemy mezhrespublikanskogo reaspredeleniia vod Syrdar'ia," *Melioratsiia i vodnoe khoziaistvo* No. 1 (1990), pp. 3-5.

30 A draft of the Declaration of Sovereignty of the Kirgiz republic was passed in August 1990, but the republic did not formally declare sovereignty until . See Ann Sheehy, "Fact Sheet on Declarations of Sovereignt," *Report on the USSR.* (November 9, 1990).

31 See for example, the Law of the Kirgiz SSR on Land (Zakon Kirgizskoi SSR o zemle). Article 4 of this law identifies the land as the "exclusive

property of the Kirgiz republic." *Sovetskaia Kirgiziia* (June 30, 1990). The Law on Ownership in the Kirgiz republic (Zakon o sobstvennosti v Kirgizskoi SSR) distinguished between three types of property, private, collective, and government. Article 20, Section 1 reserves the ownership of land and water as government property. *Sovetskaia Kirgiziia*, (May 31, 1990).

32 See the "Soglashenie ob ekonomicheskom, nauchno-tekhnicheskom, i kul'turnom sotrudnichestve Uzbekskoi SSR, Kazakskoi SSR, Kirgizskoi SSR, Tadzhikskoi SSR, i Turkmenskoi SSR" that was published in the republican newspapers in Central Asia on June 26, 1990.

33 "Soglashenie mezhdu pravitel'stvom Turkmenskoi Sovetskoi Sotsialisticheskoi Respubliki i pravitel'stvom Uzbekskoi Sovetskoi Sotsialisticheskoi Respubliki ob ekonomicheskom i kul'turnom sotrudnichestve na 1992-1995 gody." *Turkmenskaia iskra* April 23, 1991.

34 See the interview with G.A. Negmatov, the Deputy Minister of Amelioration and Water Economy of the Tadzhik Republic. A. Sorokin, "Dekhkaninu nuzhna zdorovaia zemlia," *Kommunist Tadzhikistana* April 4, 1991, p. 2.

35 For a critical assessment of this idea, see K. Sirozhidinov, "Obrushim livni na zemliu?" *Kommunist Tadzhikistana* April 13, 1991, p. 3.

36 For instance, in Tadzhikistan, water is being charged at a symbolic rate of one kopek per cubic meter. Officials explain that the goal of this program is to educate appropriators regarding use. Nevertheless, complaints have arisen regarding Minvodkhoz using the money for its own purposes. A. Sorokin, "Dekhkaninu nuzhna zdorovaia zemlia," *Kommunist Tadzhikistana* April 4, 1991, p. 2.

37 V. Karimov, "Tsena vody," *Pravda Vostoka*, April 1, 1990, p. 1.

38 See A. Bezverkhov, "Plata za vodu otmeniaetsia?" *Pravda Vostoka* December 25, 1990, p. 2.

39 Philip P. Micklin, "The Status of the Soviet Union's North-South Water Transfer Projects Before Their Abandonment in 1985-86," *Soviet Geography* Vol. 27, No. 5 (May 1986), pp. 287-229.

40 K. Tsikanov, "Bol' i trevoga." *Pravda Vostoka* June 20, 1990, p. 2.

41 Iskander Khisamov, "Voda kak prichina pozhara," *Literaturnaia gazeta,* January 16, 1991.

42 Ostrom, p. 90.

43 *Politics,* Book II, chapter 3.