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INSTITUTIONAL ARRANGEMENTS FOR MANAGING WATER CONFLICTS IN MINNESOTA

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Where there are people, there is water--and conflict over water. In the upper Midwest, conflicts between use sectors, such as agriculture, industry, urban water supply and sanitation, fishery, navigation, environmental preservation and recreation, are becoming increasingly acute because of dry conditions and growing concern for environmental quality.[1] The severity of these conflicts is aggravated by lags in the development of institutions governing water use.[2]

Many, perhaps most, of these conflicts will be resolved politically, guided by economic values and economic and social institutions. This paper briefly reviews some of the conflicts over water use in Minnesota and considers different institutional arrangements and policy tools which

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[1] Within use sectors, of course, there are conflicts, such as those between groups which share a scarce supply in sequence, or which overuse an open access resource at the same time (e.g. lake fishery), or which have differential access to key inputs. We deal with these conflicts later in this paper.

[2] For examples from the western United States, see Vaux (1986), Young (1986), and Thompson (1987).

could be of use in conflict management, including market and government approaches as well as action by water users.

Conflicts over water result from both the quantity of water used and its quality. These days, there are growing conflicts in Minnesota over water use in urban areas as well as water quality in agricultural based communities.

WATER QUALITY CONFLICTS

Concerns about water quality have been growing since the 1960s. At first, attention centered on surface water pollution from point sources, but new information now indicates that ground water and sediment pollution from non-point sources are, at least, equally serious problems.

Water pollution of rivers and streams has the important characteristic of allowing polluters to avoid the effects of their pollution. The effluent is dumped into the river and carried downstream where others must bear the damages. In contrast, it is more difficult for ground water or lake polluters to avoid damaging their own operations, as Chicago found out a century ago:

> From its inception, Chicago drew its water from Lake Michigan and dumped its wastes into the Chicago River running through the heart of Chicago and, prior to 1900, into the lake. The problem was obvious: Chicago was polluting its own water supply. The problem intensified as the city grew, and in 1885 a typhoid and cholera epidemic claimed 12 percent of the city's population (Easter and Waelti, 1980, p. 128).

Chicago was able to "solve" its waste disposal problem by digging a costly canal, completed in 1900, to reverse the flow of the Chicago River so that it emptied into a branch of the Illinois River, itself a tributary of the Mississippi. Until the Chicago Sanitary District added treatment

plants in 1922, the diversion "created a problem of catastrophic proportions for the river and its backwater lakes above Peorie", a stretch of some 250 km. (Stout, 1985, pp. 172-173). Not all lake users are as favorably situated as Chicago to find acceptable alternatives for disposal. The Mississippi basin is only a few miles from the city, and the divide between them is less than three meters high.

The more contemporary story of Waukegan, Illinois, just north of Chicago, has a less happy ending, at least so far. Polychlorinated biphenyl (PCB) accumulations in the city's artificial harbor on Lake Michigan have led to a ban on fishing and dredging. The subsequent buildup of silt effectively blocked the city's harbor (Ashworth, 1986, pp. 176-179).

Sources and Cost of Pollution

Industries and municipalities are major point source contributors of wastes. The major source of nonpoint water pollution is soil erosion. Others include manure, pesticides, and chemical fertilizers from agricultural lands.

Many times, pollution problems are magnified by the variability of water supply over time. Dry periods can concentrate the pollutants while heavy rainfall events can accelerate soil erosion. Irrigation investments which are made to deal with problems of drought may in some cases add to pollution problems. For example, irrigation may cause the leaching of nutrients and herbicides into the ground water, particularly in areas such as the sand plains of Minnesota.

Benefits from controlling or cleaning up water pollution are measured in terms of damages prevented. These damages affect a wide range of users, including municipal, agricultural, recreational, and industrial water users. The damages to municipalities include the increased cost of water treatment, the cost of developing new sources of water, greater health treatment costs and lower productivity of the labor force (days sick increase). Industrial uses also feel the impact of reduced water quality through higher costs.

Agricultural damages come from salt accumulation that reduces crop yields. Toxic chemicals have also damaged both livestock and crops or their products, particularly milk. Farmers and rural communities that are dependent on ground water face the same costs as municipalities.

A wide range of water-based recreational activities, such as fishing, swimming, and boating, are all affected by water quality. This is particularly important for Minnesota, with its 10,000 lakes and a large tourism industry. Increased pollution of Minnesota's recreational water could be disastrous to its economy.

This distribution of pollution costs has led to a number of conflicts in Minnesota. First was the conflict between industrial and municipal polluters and recreational water users. In response to this conflict, many billions of dollars have been spent on programs to install and improve municipal treatment facilities. Second is the growing conflict between farmers and recreational water users. This conflict not only influenced the U.S. farm bill, but has spawned programs in Minnesota such as RIM. Third is the conflict between farmers and users or potential users of ground water. As measurement of ground water quality has

improved, it has become evident that agriculture is polluting ground water with herbicides and nitrates. Finally, there is a growing potential for conflict among states over pollution control regulations. Will states with strong environmental regulations lose their competitive edge to states with few regulations?

WATER QUANTITY CONFLICTS

Conflicts over water quantity occur mainly (1) when the water level declines or increases significantly due to natural conditions or upstream withdrawals; (2) when significant withdrawals, often involving interbasin transfers or pumping of groundwater, are made; and (3) when the discharge, and therefore the level, of a lake can be regulated in accordance with preset operating rules. When water with desirable properties becomes scarce, due to either quality or quantity factors, the high degree of interdependency among water users intensifies social conflict and cause market failure. Thus water resource development has long been an arena for collective action or government intervention.

Conflicts arise in Minnesota, particularly in dry periods when water withdrawals are large and supplies are low. Good examples of such conflicts include the following. First was the 1988 conflict between the Twin Cities and those living around two northern lakes over the release of lake water to increase the flow in the Mississippi River. Only a timely rain dampened this conflict. Second was the conflict between users of Lake Minnetonka and those using ground water, over pumping ground water to raise the lake level. Third was the 1988 conflict among Great Lakes states over the release of Lake Michigan water into the Chicago river to

increase stream flows downstream. Finally, there is the conflict between irrigators using ground water and other well owners. Minnesota's permit system for wells has helped reduce these latter conflicts (Lotterman and Waelti, 1983). Thus, conflicts arise between rural and urban Minnesota water users, between recreational and agricultural water users, between north central and southern Minnesota water users, and between Great Lakes states. These conflicts will certainly reoccur during dry periods, unless institutional arrangements are developed to help resolve them.

CONFLICT RESOLUTION

One response to the high interdependency among water users and the resulting conflicts is to develop institutional arrangements to govern individual behavior. Since another person is influencing the production or utility you receive from water, and this influence is unintended, you want to be able to control this influence. Thus there are strong incentives to develop institutions that alter the response of others or define rights and duties in the form of rules that provide information concerning how others will use the water. In the absence of institutional arrangements, these conflicts are resolved in the courts which involves very high transactions costs and has resulted, at best, in ad hoc decisions.

These institutional arrangements can establish rights to water use subject to constraints, such as that one must put the water to beneficial use or that stream flows must be maintained at or above a certain level. Many times, private rights specify some priority in use, either in terms of type of use (agricultural, industrial or municipal) or time of use

(first in time, first in right). The problem is that most of these systems of private rights fail to account adequately for interdependencies among users, particularly in terms of return flows and pollution. They do little to stem pollution or large reductions in water flows downstream.

Transactions Costs

Why are institutions not developed to prevent or reduce conflicts over water? One answer is that institutional development is not free. New institutions must be developed, specified, negotiated, enforced and widely accepted by users. In addition, information must be obtained concerning the specific nature of problems the new institution is to address, such as location, nature and magnitude of point and non-point sources of pollution and their effect on water and sediments. These costs associated with institutional development are what is generally called transaction costs (Williamson, 1985). In many cases, these costs can be high. "In a modern economy, the transactions industry is quite massive. It includes....agents of all kinds, attorneys, the police and the judicial system, and the large and growing private sector enforcement systems" (Randall, 1987, p. 158). If the costs of change are higher than the benefits derived from the institutional arrangements, then the new institution will not be developed or the old institution will not be changed. However, as water becomes increasingly scarce and therefore more valuable, it will become more worthwhile to develop new institutional arrangements.

INSTITUTIONAL ARRANGEMENTS AND POLICY TOOLS FOR RESOLVING CONFLICT

Institutional arrangements for resolving conflicts in water use can be grouped under three general headings. One is the increasingly popular approach of establishing markets. The second is the most widely used approach which relies on government or quasi-government agencies to directly manage water use and allocation. The third and final category which can complement the other two, involves collective action by water users. This can be by means of either formal or informal groups of water users or concerned citizens.

Market Based Solutions

The role of the market as a dispute resolution device has long been recognized by economists. For example, Grossman (1974, p. 64) notes:

> The market is....a social mechanism for the relocation of conflicts at a relatively 'low' level....
>
> It localizes ordinary economic business conflicts, settles them in the market place, and keeps them from migrating up to the higher levels of the political structure, as would be inevitable in a hierarchically organized economy....
>
> The market mechanism's very impersonality, often and at times justly criticized, has its positive side. The market respects economic worth and purchasing power whatever direction it may come, and thereby tends to provide economic opportunities where they might otherwise be barred by social or political prejudice.

Young (1985) describes some of the characteristics of water which make it difficult to develop institutional arrangements for market exchange of water or water rights. One of the key characteristics which we have already discussed above is the pervasive interdependency among users. Other important attributes include high resource mobility, economies of scale in large water projects, variability in supply and

demand, and conflicting social values concerning water. An additional problem is the high cost of making transactions, particularly when there are a large number of water users involved.

Water Markets

In cases where interdependence among water users is limited, an efficient market system can improve water allocation and utilization. However, to establish such a market requires several key institutional arrangements. First, water rights and responsibilities for the use and transfer of water must be established. Until this is done, markets will be greatly constrained. A second step is to improve the information system concerning water supplies and demand. This is particularly important if certain uses are dependent on the level of stream flows or low priority water rights do not get water during droughts. Finally, the water delivery system should be operated so that users can buy and sell water throughout the system. In other words, the rules for water delivery must be flexible enough so that trades or sales do not require extensive bargaining among many users which involve high transactions costs (Easter, 1986). For small or highly segmented systems, too limited a set of trading opportunities may exist. In such cases, market power, when allowed to operate, may become too highly concentrated. When this occurs, alternative sources of supply should be developed.

Tradeable Permits

A market medium that is being used more widely, particularly in the case of air pollution, is the tradeable permit. A given level of

permissible effluent discharge is determined by a pollution control agency. This fixed discharge is then allocated among firms based either on willingness to pay or on past discharge levels. The firms can then buy and sell the permits, depending on their need and the permit price. This, of course, encourages the development and adoption of technology that reduces pollution so that a firm does not have to buy a permit or additional permits. Such permits tend to work only for easily monitored point sources of pollution.

Issuing permits is one way to establish comparable water rights. People sometimes oppose permit systems because they do not want to establish rights to pollute. Yet with a permit system it becomes much easier to control and reallocate the pollution so that damages can be reduced. Control could be maintained by issuing pollution permits for a limited period of time, although this would limit their efficiency.

Effluent rights trading is not theoretically the best method of achieving a socially optimum combination of output and hazard. That would require "exposure trading", where the degree of harm caused by effluents is taken into account (Rousmasset and Smith, 1990). The information requirements of exposure trading are likely to be much higher than for effluent rights, however.

Water permits are also used to help manage irrigation well development in Minnesota. The current permit system has helped resolve a number of conflicts over well interference, but the permits are not tradeable (Lotterman and Waelti, 1983). In areas with declining ground water levels due to pumping, tradeable permits would be one way to encourage water conservation and limit the amount of water withdrawn. All

that would be needed is a measure of how much water it is safe to withdraw annually and a procedure to allocate this amount amongst permit holders. Once the allocation is made, then those needing additional water could buy permits from the owners. As the demand for water increases, so would the price of the permits, which would encourage additional conservation.

Bargaining to Reduce Water Pollution

Coase (1960) and others have shown that bargaining can bring about a socially optimum level of pollution when transactions costs are zero. Within a lake, this may be quite appropriate if there are only a few polluters on the lake and a few users being damaged. When there are many actors involved, bargaining is limited by excessive transactions costs.

One key decision that must be made is who has what rights. Do the polluting firms and farms have the right to discharge their effluents or do water users have the right to clean water? Whoever has the rights will determine who pays for the disposal system. In U.S. cities, we solved the problem by making the taxpayers (via the state and federal governments) pay most of the cost of building the waste disposal systems: ninety percent in many cases.

For bargaining to take place among water users, they need to have a common interest in so doing. Institutions need to be developed that allow the different interests to form separate bargaining units. This can be supported through laws, for example, a law that says upstream firms cannot exceed certain levels of discharge or that they cannot change stream flows or sediment loads without a penalty. This would provide upstream users,

who are damaging the water source, with an incentive to bargain over pollution levels.

For bargaining to result in a relatively efficient and equitable solution, all affected parties must be accounted for and information concerning the levels of pollution and their effect must be readily available. Equally important is technical information. Some impartial group or agency must collect information over time concerning levels of pollution and the extent of damage it causes. We also need to know how changes in practices affect pollution levels so that they can be related back to damages. This is no small task, either technically or organizationally. So far, the biggest gap in our knowledge appears to be in determining the damage costs. This is particularly true of the longer term cumulative impacts of pollution, which are often of concern in lakes.

Government Based Solutions

Even where markets are allowed to operate fully, government involvement will be necessary to resolve major disputes and to set the rules for markets themselves. For example, where rights to water use are not clearly specified, a major responsibility of government would be to delineate those rights (and the duties such as payment of taxes and fees which are attached to them) and to make an initial assignment of rights to individuals, groups or government agencies.

Supply Oriented Solutions

A traditional government approach to conflicts over water use is to build another project, or to build one designed to deliver an amount of

water sufficient to meet the "needs" of all relevant users. The construction of multi-stage municipal water treatment facilities mentioned earlier is an example. Projects developed to increase stream discharges during low flow periods is another illustration.

This supply-oriented approach sometimes takes advantage of economies of scale, reduces the level of conflict among users, and is relatively easy for a government agency to implement. It is also politically popular for a state, particularly if the federal government pays most of the costs. Yet it is expensive, with the costs usually borne in large part by nonbeneficiaries (tax payers), and is prone to nonmarket failure (e.g. inadequate provision for maintenance).

A superior strategy is to actually reduce the input of effluents into the water body. This is the only really effective approach for dealing with nonpoint pollution problems, particularly in the case of ground water. For example, methods of cropping, timber harvesting, road building and grazing must all be adjusted to reduce soil erosion and chemical contamination. This can be achieved by using a wide range of possible institutional arrangements and implementation tools, including subsidies, taxes, land use regulations, land retirement, regulation of farming practices, zoning and outright bans.

In a number of cases, this means a reduction of economic activity upstream. Those affected may be faced with difficult choices concerning changes in their production enterprises. With appropriate research and extension, new crops or industries could be introduced that are less polluting. Nonetheless, upstream-downstream conflicts are often difficult

to solve, especially in the absence of effective basin-wide planning and cost-sharing by all beneficiaries.

Incentives and Special Interest

A growing area of concern is the impact of special interest groups on government activity. When high economic rents are at stake, individuals, groups of individuals and firms have a strong incentive to influence government action.[3] This rent-seeking behavior can result in a misuse of resources and involve political manipulation (Gould and Amaro-Reyes, 1983). The rents tend to be captured by those with political power and relatively high incomes. Once the rents have been captured, the owners have the funds and incentives to make defensive expenditures to protect their rights. In addition, those conferring the rights are in a position to increase their share of the rents. Over time, the mechanisms by which successful rent-seekers obtain their gains become entrenched and are extremely well defended (Repetto, 1986).

Nonmarket Failure

Thus, even though problems of market failure have often provided a justification for establishing nonmarket means for regulating and allocating water use--in particular, to involve government agencies, conflicts and inefficiency, arise as well from defects in the use of nonmarket institutions and organizations. Virtually all of the sources of market failure are also present in many nonmarket situations: (1) lack of

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3. "Rent is ... defined to be that part of a person's or firm's income which is above the minimum amount necessary to keep that person or firm in its given occupation." (Henderson and Quandt, 1980, pp. 151-152.)

specification and transferability of rights; (2) conflicts over return flows, especially between administrative units; (3) rent seeking behavior; and (4) high transaction costs.

Based on part on Wolf's 1979 theory of nonmarket failure, there are a number of areas where agency management can be improved. These include adjustments in the incentive structure for managers and lower level agency personnel; staff training; improved communications within each agency, between agencies, and between agencies and users; improved information retrieval, processing and sharing; and developing means for establishing accountability. In general, since the number of users and agencies involved in water management is large, accountability arrangements are difficult to arrange. Quality problems further complicate matters, particularly concerning information, as does the highly variable water supply.

Finally, in actually drafting new institutional approaches to deal with water problems, we should try to answer the following questions suggested by Wolf, 1979:

1. Can desirable outcomes be obtained by making relatively easy changes in the operation of existing markets?
2. Can nonmarket policies be devised which retain useful market characteristics, such as competition?
3. Can suitable measures for nonmarket output be devised which will then be used to measure performance?
4. Can agency standards and goals be changed to align agency behavior, including personnel practices, more closely with the intended output?

5. Can improved information, feedback, and evaluation systems be built into new policies, programs and operating rules, so that the risks of co-optation by a 'client' group is reduced? (Wolf, 1979, pp. 136-137).

Inaction

Problems of nonmarket failure suggests that the Chinese Taoist (Daoist) philosopher Laozi may have been right when he counselled kings that the best way to rule was often to not intervene in the natural course of events. Where conflict resolution mechanisms exist in society, government involvement may be redundant or even an impediment. For example, if there is a possibility of a subsidized, supply-oriented government solution to a local conflict over water use, water users are less likely to work out an accommodation among themselves which would require them to reduce their water use; and they are less likely to build projects on their own. If government resources for support are limited, as they usually are, water users (including local and state governments) will often prefer to wait their turn or devote their resources to lobbying efforts.

The Corps of Engineers used the nonintervention approach in the summer of 1988 when they responded to the Governor of Minnesota's request to increase the flow of water into the Mississippi from two northern Minnesota lakes. They studied the problem until it rained, and then concluded that no action was necessary.

Administrative Pricing

There are also opportunities in government to improve water use and conservation through improved administrative pricing. This is particularly true for municipal water supplies or waste disposal services, where there is a good opportunity for pricing by volume used. In many Minnesota cities, each house has its own water meter. For many Minnesota cities, the problem is not lack of meters, but the lack of imagination by municipal leaders and those managing the facilities. To illustrate, only 24 percent of the Minnesota cities used a flat rate (same charge no matter how much water used) for water services, while 46 percent charged flat rates for sewer services (Easter et al., 1988). Many times the water price or charge is set so that the cost of operation and maintenance are covered by revenues, but this does not usually include a replacement charge for facilities. Water pricing is seldom used to encourage conservation or to reallocate time of use to non-peak periods. At best, you find a constant water rate where the same price is charged for each unit of water used. At worst, you find a fixed charge for water, no matter how much is consumed, or a declining rate where a lower price is charged for each additional unit of water (i.e., 1000 gal.). Although the number of Minnesota cities using the declining block rate has decreased significantly, it was still used by 32 percent of the cities in 1985-86. Less than one percent of Minnesota municipalities use an increasing block rate, where the price per unit goes up for each additional unit of water purchased during a given time period (Easter, et al., 1988). They also do not use higher prices during peak periods to discourage water use in the summer months or other peak periods.

Part of the problem is lack of information. We do not know how people will react to higher water prices. For some uses, we would expect that the price elasticity would be quite low, while for others it may be fairly high. If we are dealing with domestic uses that are price inelastic, then water prices will have limited impact on use and will not be a good means to encourage conservation. In such cases of inelastic demand, water prices or charges should be used mostly as a means to generate revenue. However, during the summer period, consumers appear to be fairly responsive to calls to conserve water, which suggests an elastic demand. Thus, high prices during such peak periods would encourage conservation in water use.

Another reason why water or sewer charges are not used to encourage conservation is political. Many local users consider water and sewer charges as just another tax instead of a price for a good or service. They complain about increasing water charges even when they are provided better service, particularly if they are large consumers. Many city administrators are also afraid that high water and sewer rates may discourage industrial development. Yet it does not appear that the level of water and sewer rates is an important location criteria for most industries.

As more and more cities are faced with water shortages and increasing costs of new water supplies, these administrators will have to begin to look at water charges as a means to allocate water. They have begun to realize that water has many of the characteristics of private goods, i.e., in consumptive uses, it is an exclusive and rival good (Randall, 1987). People can be excluded from using certain water supplies

and consumption by one group reduces the quantity available for others. Higher water charges will also facilitate water transfers from other sectors for, at least, two reasons. First, higher water charges will probably generate more revenue, which means municipalities will have more funds to purchase added water supplies or improve the efficiency with which they deliver current supplies. Second, higher charges will indicate a high willingness to pay, which then can be used to show how much more valuable water is when it is used for municipal consumption rather than to grow corn or other agricultural crops.

Great Lakes Charter

A new institutional arrangement which has been developed to help in managing Great Lakes water withdrawals is the Great Lakes Charter. In 1985, the eight Great Lake States governors and two Premiers agreed in principle to coordinate water quantity management in the Great Lakes by signing the Great Lakes Charter. By 1990, five of the state legislature and the two Great Lakes provinces had enacted legislation that gave the Charter the force of law. The Charter requires states or provinces to give prior notice and consultation to all affected states and provinces prior to approving any major new water diversion or consumptive use of Great Lakes water. It also involves the development of a common data base for the Great Lakes and the creation of a Water Resources Management Committee to develop a Great Lakes water management program.

The Charter creates a cooperative forum to regulate aggregate water use in the Great Lakes. The primary instrument that is being used for regulation is non-tradeable water permits (Frerichs and Easter, 1990).

Whether the Charter will be successful when significant water shortage occurs is not clear. Three states have still not fully adopted the Charter. In addition, there is no clear method for reducing withdrawals allowed under the permits during periods of water shortages. It is best suited for slowing down the granting of permits for large increases in water use, either within the basin or through water transfers to areas outside the basin.

Collective Action by Users

Collective action by local water users is nothing new. As Swaminathan (1986, p. v.) so aptly states:

> People dependent upon renewable natural resources have evolved ways of managing them properly. When they have failed to do so, the people, the resources, or both have disappeared. Communities have developed such institutionalized forms of control as irrigation councils in southern Asia, forest-cutting controls in Nepal, wildlife utilization taboos and regulations in the Congo Basin, the hema system of pasture protection in Arabia, fishermen's indigenous associations in western and southern Asia, and land use management for conservation in Zimbabwe.

Although excellent examples of collective natural resource management can be found in Minnesota and other U.S. states, they are difficult to create. What can be done to help establish effective decentralized water management?

Collective action and cost-sharing

Many water conflicts can best be dealt with within the watershed in which they occur by first understanding the distributional effects. People in the upper part of the watershed do not receive the downstream benefits from their soil or water conservation efforts (Easter et al.,

1986, Ch. 11). They, therefore, do not devote adequate attention to soil or water protection activities in terms of the benefits and costs to society. A number of approaches have been tried to overcome this problem, including subsidies. In Japan, before 1920 "irrigation associations and municipalities downstream were very active in improving the deteriorated watersheds at their own expense.... The most common measures taken by the water users downstream were the acquisition of critical watersheds and profit sharing plantations on alien lands" (Kumazaki, 1982, p. 113). Later on, municipalities and power companies shared the costs of upland plantation projects. As water use increased, however, higher levels of government took over more responsibility and "leased the privately owned watersheds and planted tree(s), with financial cooperation of the water users downstream, who in turn enjoyed a certain share of the revenues from the plantations" (Kumazaki, 1982, p. 116).

Thus collective action and cost-sharing by all beneficiaries of clean-up efforts can be an important way of improving water quality and quantity. The level of an area's economic and institutional development and the degree of pressure on the resource appear to play major roles in determining the organizational and institutional forms adopted. Formal and informal private and collective actions can be a primary impetus for water quality improvement. In other cases, government agencies will have to play a larger role in protecting water resources, particularly if a large number of polluters are involved or the polluters have substantial economic or political power.

One of the key components of such collective action is a good understanding by downstream water users of the benefits they receive from

conservation activities upstream. Given this knowledge, institutional arrangements need to be in place that allow them to assist in conservation activities. If they are cost-sharing, they need to know that the funds will be used for the desired purposes. When they want to have more direct control, they need to have the option to lease or purchase easements in the upper watershed.

Cost-sharing by downstream interests would be considered fair by upstream land owners, since the downstream users get most of the benefits. These activities may even encourage upstream land owners to engage in more conservation practices because of the principle of reciprocity (Sugden, 1984). Since downstream users are installing and cost-sharing on conservation practices, the upstream owners may feel they should also contribute.

Assurance and Free Riders

One of the first steps in establishing decentralized water management is to recognize the complexity of the task involved. Institutional and organizational changes are needed at three different levels: (1) the approach must be accepted as legitimate at the state and national levels, (2) government agencies must be willing to establish close working relationships with water users and with each other, and (3) the water users must be willing to organize to manage their water resources.

Obstacles are found at all three levels. Vested interested may block needed legislative action at the national or state level. Agencies may not be willing to decentralize decision making and share control over water resources. Water users may lack the commitment and willingness to

take over new and sometimes risky responsibilities. The risk comes from two sources. First, it comes from the need to resolve actual and potential conflicts among water users. Second, it involves uncertainty concerning whether or not the government agency or agencies will, in fact, work with local water users and involve them in management decisions. Agency commitments to decentralized water management can change as quickly as administrative personnel are changed, especially when appropriate rights and incentives have not been established.

If assurance can be provided that the federal and state governments will indeed implement decentralized water management, conditions still have to be right at the local level. A key to decentralizing water management is broad based local participation, both to ensure consensus among water users and to build important links between the local community and government officials. Constructive participation does not just happen. Local communities and their members must receive significant benefits from participation. In addition, gains to individuals need to be consistent with those for the community as a whole, and the problem of "free riding" must be overcome.

The free rider is a classic problem where individuals who cannot be denied access to a resource or collective good do not contribute to its provision or maintenance (Olson, 1971). If enough users are free riders, the resource will no longer be available or its quality will be low or its management will have to be subsidized by the larger tax paying public.

Experiments and empirical observations, however, have shown that people have a higher inclination to cooperate than indicated by the theory of the free rider (Etzioni, 1988, Ch. 4). Some have attributed this

comforting evidence to shared values and the moral foundations of society.[4] Cultural, ethnic and political factors are clearly important. Others, such as Runge (1984) and Williamson (1985), have considered the role of institutional design as well. Runge found the key to cooperative behavior among fishermen to be the development of institutions that provide assurance that others will limit their fishing effort if you do the same.

A number of factors seem to make it easier to develop and implement institutions that provide the necessary assurance for collective action. These include situations where: (1) communities are relatively small, stable, and homogenous, (2) community leadership is strong and representative, (3) benefits from cooperation are high and relatively evenly distributed and (4) the community has had experience in providing collective goods and has received benefits from doing so (Easter, 1986 and Easter and Palanisami, 1986).

Fairness and Reciprocity

Several authors have argued that there are other important factors determining whether or not institutional arrangements will result in effective collective action (Baumol, 1982, and Sugden, 1984). The first

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4. "We believe it is important to recognize the forces of ethics, etiquette, and 'proper, correct, reasonable, moral, etc.' standards of conduct in controlling business relationships....People do not always violate contracts whenever their own costs are less than their own gains from violation. Temptations of free-riding or stealing are resisted even when the net gains for free-riding or stealing are great. We don't know enough about how much 'moral' forces operate to say more than that they exist and should not be ignored in seeking an understanding of how....economic institutions....evolve and operate" (Alchian and Woodward, 1988, p. 77).

of these is fairness. According to Baumol (1982, p. 640), "A distribution is fair if it involves no envy by any individual of any other." An institutional arrangement would be judged to be fairer if it reduced envy. Thus an institution which fosters collective action that provides uniform benefits across all users would probably be considered fair.

Sugden (1984) takes a slightly different approach to explain the collective or voluntary provision of goods and services. According to him, the principle of reciprocity, critical in explaining the provision of collective or public goods, is that "each person tends to contribute more as others contribute more" (Sugden, 1984, p. 783).

Thus the factors listed above as providing assurance may also enhance reciprocity. One difference is that Sugden argues that the principle suggests that those with the strongest preference for the collective good relative to effort will tend to make the largest contributions. Richer individuals will, therefore, contribute more than poorer ones, because they want to, not simply because of their greater ability to pay.

While Sugden's allowance for income and power differentials make reciprocity more appealing as a basis for collective action in water management than assurance, it does not fully solve the free rider problem in the absence of proper assurances (Sugden, 1984, p. 781). Nor does it adequately address the problem of rent seeking either in collective action or direct government management.

CONCLUSION

This work is still at the exploratory stage of investigating alternative approaches to resolving water conflicts in Minnesota and how

institutional arrangements can be designed to better resolve them. Every approach has its strengths and its weaknesses. The trend is toward greater user involvement, and towards making government agencies more responsive to users, either through changing the way they do business or through "privatization" of their functions. Two factors are likely to lead to increases in the number and type of conflicts involving water: (1) the growing complexity of the structure of water demands, which has grown to include recreation and tourism and certain "rights of nature"; and (2) the profusion of environmental hazards, many of them caused by technical change, improvements in living standards and economic growth, and most of which are dimly understood and inadequately measured. Thus resilience is likely to be the most important characteristic determining the effectiveness of institutional arrangements in the coming years. This includes the ability of the institutions themselves to adapt to new circumstances.

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