
Sharing water fairly

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proposes arrangements for adapting the
allocation of water to changing social values

Institutions are slow to change in the face of technological and social evolution, usually lagging far behind the need for more appropriate policies. This is particularly true in water resources where policy-making and administrative processes are subject to the inertia of the historical *status quo* of special interests.

This article focuses on the development and provision of larger-scale water supplies at the river basin and watershed levels (in contrast to, say, urban supplies) in water-short, semi-arid areas where irrigated agriculture represents an historically important water use. As urban areas and industrialization develop - often accompanied by increased concern about environmental quality - reallocating water from irrigated agriculture to urban, industrial and environmental purposes becomes a major issue - in fact, a necessary condition for continuing efficient economic development.

The economic costs of being unable to bring about such reallocation have been the topic of several recent studies. One estimated that annual savings of more than \$200 million could be achieved in California through regional reallocation of water from agriculture to urban areas. This was reaffirmed by a study of the allocation of Colorado River water between the Upper and Lower Basins which found that institutional inability to take into account the non-consumptive uses (hydroelectric power and reduced salinity concentrations) and associated benefits resulted in an inefficient allocation, with too much water being consumed in the Upper Basin.

Opportunities for highly beneficial water reallocation in California are inhibited by the importance of supplies from large public projects that are not subject to market allocation, by the conservatism of the state's water agencies, and by the subsidies for irrigation water and crops that help hold excessive water in irrigated agriculture. As the United States National Research Council has shown, excessive irrigation applications also cause extensive environmental damage through water logging and toxic drainage waters.

Institutional arrangements for the development, abstraction and distribution of water supplies might be classified as follows:

- Regulatory systems that issue permits for abstracting natural waters from rivers, lakes or aquifers.
- Large public or private projects that develop natural waters and provide for their distribution through contracts with water users.
- Riparian water law systems that permit 'reasonable use' of water by land owners adjacent to water bodies.
- Priority ('appropriations') water law systems that permit the establishment of water use rights characterized by priority ordering and transferability.

Regulatory systems prevail throughout Europe, the best-known examples being the Agences de Bassin of France and the Genossenschaften of Germany. Permit systems are also widely used in Canada and in some of the eastern states of the United States and Hawaii. The agencies in charge of these systems typically have the power to develop and distribute water supplies, handle waste water and, in some cases, deal with flooding. The water abstraction permits can be for specific or indefinite periods and typically are *not* saleable or tradable.

Non-tradable permits

The problems with non-tradable permit systems under conditions of water scarcity are clear: allocation is carried out by an administrative board that does not have the information needed to achieve economic efficiency and equity; and the allocation is likely to be rigid over time and not responsive to changing social values.

Large public or private projects generally 'develop' a natural water source by providing storage and distribution. Access to the natural water supply (say a river of variable flow) must be acquired according to the national or regional system of water law, while the developed water supply is usually allocated to customers through contracts. In many cases, these contracts tie the water supply to specific uses (such as irrigation) or even specific lands. These constraints lead to increasing inefficiency as economic and social needs change. However, this need not happen, for some projects have developed flexible, market-like arrangements for the allocation of water: the water markets of the Northern Colorado Water Conservancy District that distributes water from the United States federal Colorado-Big Thompson Project are internationally known for their efficiency and adaptability.

The riparian system of water law found in the United Kingdom and (by inheritance from there) in the eastern United States allows owners of lands bordering on water bodies 'reasonable use' of the waters in terms of quantity and quality. The evolution of riparian law from earlier Roman and English laws illustrates how law slowly changes in response to changing social needs. The Roman and early English water laws were laws of 'prior occupancy', i.e. the earliest uses along a river or canal were protected against damage caused by those of later comers. While this seemed equitable, it served to deny water use to new, often more productive enterprises as the industrial revolution progressed. A more flexible sharing of water was needed, so the English courts

evolved the riparian doctrine, and civil actions resolved disputes. This was established, it should be noted, in regions of plentiful water supply where one party's 'reasonable use' did not frequently interfere with the uses of others. Where water is truly scarce and/or where water quality problems are important, the riparian doctrine simply does not work and many eastern states of the United States are now changing their systems.

Priority water rights

The evolution of priority water rights systems occurred in response to needs in water-short regions where many uses were located away from the river. In the western United States, this evolved from practices in 19th century mining camps where water was transferred away from the natural streams to ore processing facilities. Security of tenure was needed, so the rule became 'first in time, first in right'. Similar developments took place in Australia and Chile. Thus, priority water rights have come to be characterized by:

- A priority system with senior rights having first call on available water.
- Quantification in terms of diversion flow rates, consumptive volume, type of use, place of diversion and seasonal time of use.
- Saleability, subject to 'no injury' to other water users.
- A 'beneficial use' requirement.

Such priority systems are spreading as water scarcity increases. They seem the best systems to fit a set of desirable criteria for water allocation mechanisms: (a) flexibility in allocation over time; (b) security of tenure for water owners; (c) reflection of the real cost of water to the user; and (d) fairness to participants. The priority system clearly corresponds to these: (a) water rights are personal property and are saleable; (b) sales of water rights are voluntary, and so they can be held as long as the owner desires; (c) water rights prices, when set in fairly competitive markets, reflect real opportunity costs (in contrast to the arbitrary, often politically motivated pricing of water from large projects); and (d) transactions between willing buyers and sellers appear to meet the test of fairness.

Water systems always involve interdependency. The withdrawals and consumption of one user, and the changes it makes to water quality, affect others. 'Externalities' are pervasive. Thus a market system in water rights cannot perform efficiently without some kind of supervision. The 'no injury rule' - avoiding damage to other users when water is first appropriated or later traded - must be enforced by a supervisory agency. But even when other water users are protected from injury, there remains a range of increasingly important social values that will not be protected or adequately taken into account by supervised water markets as we now know them.

Water markets and market-like arrangements are increasingly being used. As traditional water demands are joined by new demands for environmental quality and the attainment of social/cultural goals, increased 'social efficiency' of water use is needed. In many settings this

efficiency is more likely to be achieved through supervised markets than through other institutional arrangements, but the need for market oversight or supervision must not be underemphasized.

Many of the emerging demands for water are *non-market* ones - uses of water that do not directly enter the market economy and which have no visible price as a measure of value. Values generated by such demands can be divided into *use values* (such as recreation on public water bodies) and *non-use values* (such as personal enjoyment from knowing that natural streams and riparian habitats are being protected). These increasingly important non-market values are not taken into account by typical water market buyers and sellers because the benefits in question accrue to others. If they are to be protected, it will have to be through the actions of public bodies (local, county, state and national governments or special districts) acting either as buyers in water markets for these public purposes or using governmental powers outside the market to reserve water. Buying through the market assures that opportunity costs (benefits foregone elsewhere) will be fully taken into account.

Thus it seems desirable to have public bodies actively participating in water markets on behalf of their constituents. The city of Boulder, Colorado recently dedicated \$12 million worth of water rights to maintaining streamflow in Boulder Creek - a major aesthetic attraction in the town.

There are, however, legal and economic barriers and limits to protecting public values in this way. One is the definition of 'beneficial use', which has historically been narrow, often excluding instream uses. The definition must be broadened to include all uses that generate social benefits. Perhaps the notion of 'beneficial use' should be completely expunged from law books.

There are economic limits to the public purchase of water rights when social and cultural goals are sought for poor communities. Community governments are not likely to have the financial resources to buy or retain water rights commensurate with the goals being pursued. Several years ago an old Spanish community in New Mexico decided to sell part of its water rights to a new ski area. The social and cultural fabric of the community was centred around the ancient irrigation system, where the channels defined property lines, supported subsistence crops and provided a common maintenance task for all the people. These values were endangered by the water sale, but the economic needs were also great. The district court responsible for supervising water transfers ruled against the transfer - the first time in the southwestern United States that cultural values had been invoked in denying or modifying a water transfer.

Thus, as pressure on water systems continues to increase, the 'social efficiency' of water allocation must receive increasing attention. The day of big dams is over for most of the world because the economic and environmental costs have become too high. Improvements in the 'social efficiency' of allocations of *existing* supplies are necessary. The allocation strengths of water markets are necessary to this task but public agency involvement as market participants and supervisors is also essential.

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