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Will global warming force us to adopt sensible resource policies?

Warming Up to Water Markets

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Ensuring access to quality water supplies is among the most pressing environmental policy challenges of the 21st century, and not just in the developing world. In the United States, demographic changes and existing water use patterns have placed tremendous pressure on water supplies, particularly in the West. Most states anticipate water shortages in coming years, even in the absence of drought conditions. It is no wonder water policy experts contend, without exaggeration, that the United States is heading toward a water scarcity crisis. Yet as bad as the current water situation is, global climate change is likely to make things much worse.

If current projections are accurate, global climate change will exacerbate pressures on water resources, increasing the urgency with which managers and policymakers must address water supply concerns. Even a modest greenhouse warming over the next several decades will increase the stress on freshwater supplies. Unless adaptive measures are taken now, the consequences could be quite severe. In particular, the threat of climate change requires the development of water supply institutions and policies that are sufficiently flexible, adaptive, and robust to deal with an uncertain and changing water future. Water markets fit the bill. A gradual shift toward water marketing and market pricing will improve the management of water supplies, ensure more efficient allocation of available supplies, and encourage cost-effective conservation measures, thereby blunting the impact of climate change on supplies and availability. Failure to take such steps, on the other hand, could allow a bad water situation to get much worse.

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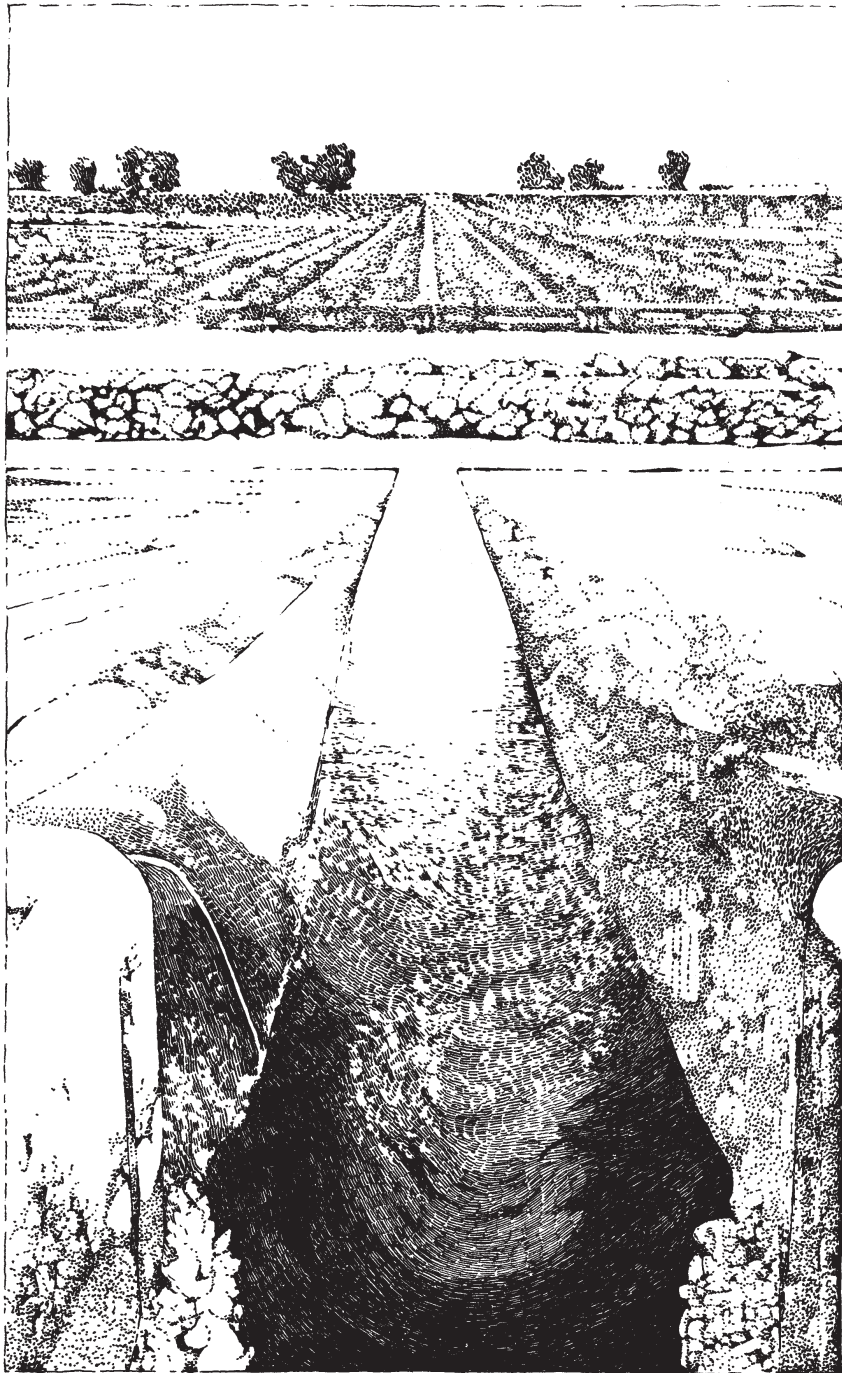
WARMING AND WATER

Global climate change will affect freshwater supplies in many ways. Shifts in the timing, location, and amount of precipitation are likely to accompany any increase in temperatures. Different amounts of rain and snow at different times in different places could prove disruptive for many communities, particularly those that depend on snow melt for irrigation and seasonal water supplies. A projected warming of the climate is likely to produce changes in evaporation rates and soil moisture, with additional effects on stream flows and groundwater supplies.

Global warming's effects on water resources will be compounded by changes in water demand for various uses as communities adapt to changing temperatures and precipitation patterns. Water use for irrigation, for example, is likely to increase along with global temperatures, even if there is a net increase in precipitation. More rain or snow, if not at the right time or in a different place, may not satisfy increased water needs. Existing water institutions may be unable to cope with such changes, particularly if natural water supplies shift significantly.

Climatic effects on water supplies will occur against a background of increasing water scarcity throughout much of the nation, and particularly in the West where urban growth is fueling dramatic increases in water demand. Domestic water use in western states more than doubled from 1960 to 1990, from 6.5 million acre-feet to 14 million acre-feet, and continues to climb. Per-capita water consumption increased throughout the 20th century, despite increased awareness of pressures on water supplies. As populations continue to grow in western states, demand for water will only increase. Further, demand for in-stream flows and other water uses is also increasing, while traditional means of augmenting water supply through dams, reservoirs, and the like have reached their limits. Without substantial reforms, existing water institutions will have difficulty meeting current demands, let alone the increased demands brought about by climate change.

Climate change presents a particularly thorny dilemma



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for water management. The gradual warming of the atmosphere is certain to change the distribution and availability of water supplies. Yet the precise nature, magnitude, timing, and distribution of such changes are unknowable. This uncertainty complicates the task of water managers who are already faced with escalating demands as past hydrological conditions are no longer a reliable predictor of future conditions. Without institutions capable of accommodating such uncertainty and shifting water supplies to where they are needed most, climate change will impose significant costs on water users and water-dependent communities.

The challenge created by uncertainty requires the creation of institutional arrangements that can foster greater resilience and adaptability in water management. Effective institutions must be robust enough to accommodate changes in water

availability by facilitating reallocation of water supplies. At the same time, the institutions must encourage cost-effective conservation measures and efficiency enhancements, and remain sufficiently flexible and adaptable to account for the uncertain climate forecast. In short, the threat of climate change calls for greater reliance upon water markets.

THE WISDOM OF WATER MARKETS

The demands of current and projected water management challenges can best be met through a greater reliance on water markets for water management. Specifically, water management must shift toward recognition of transferable rights in water that facilitate voluntary exchanges and the market pricing of water resources. While such reforms may be difficult and there are no panaceas for the water management challenges faced by the western United States, greater use of markets offers the best opportunity to adapt to climate change and its impacts on water supplies. Even the United Nations Intergovernmental Panel on Climate Change acknowledges that “improving the functioning of water markets could help create the kind of flexibility needed to respond to uncertain changes in future water availability.”

Markets are powerful institutions for resource allocation. They facilitate the allocation of resources to their highest-valued use through voluntary exchange and the generation of information about relative scarcity and demand. Markets take advantage of localized and dispersed information about resource supplies and demands, including subjective valuations and individualized uses for different resources in different places. Such information is virtually impossible to centralize in an administrative agency.

Market institutions are easily adapted to water management. Water markets have been used in many parts of the world for the allocation and distribution of rights in water. In the United States, for instance, water markets emerged in many western states as an outgrowth of the prior appropriation doctrine, which recognized property rights in water. Those rights are usufructary rights — that is, rights to use water rather than rights to the water itself — but they still facilitate the voluntary transfer of water in the marketplace. As elsewhere, recognition of water rights and water markets has encouraged efficient conservation of and investment in water resources.

Property rights in water are the foundation for water markets and can provide substantial incentives for increased efficiency and allocation of rights to their highest-valued use. To be most effective, water rights must be well-defined, enforceable, and transferable. The precise contours and content of the rights

can be quite variable, however. Water rights can be defined in terms of actual water volume, a share of a given water body or water flow, or in terms of the availability of water of a particular quantity at a given place. Water rights can also be consumptive or non-consumptive, and may or may not be held subject to the rights of third parties or other water right holders.

Where an individual is using a transferable resource in an inefficient or wasteful manner, there is an opportunity for an entrepreneur to gain from acquiring the resource and putting it to better use. Where rights to water are transferable, water prices will reflect the value of alternative uses. That gives the rights holder an incentive to allocate the water to its highest-valued use. Transferability also creates substantial incentives for conservation, particularly insofar as rights holders can sell the water they conserve to other users. Such incentives can be quite powerful, particularly given the wide disparity between the prices agricultural users and others pay for water in the United States.

Many agricultural users pay little for the water they use, sometimes nothing more than the cost of pumping the water from a federal irrigation project to the land where the water will be used. The U.S. government has subsidized agricultural water use for decades, encouraging profligate and wasteful water use in irrigation. Simply allowing farmers to sell their water rights to “thirsty cities” would provide substantial incentives to increase water use efficiency in the agricultural sector. The result is a win-win situation: the farmer receives payment for giving up water rights that he no longer needs and the city gets water that it would otherwise not have (or need to pay even more to obtain). The possibility of this type of voluntary transaction resulting from the creation of a water market increases efficiency and produces gains for buyer and seller alike.

THE POWER OF PRICES

Prices are an essential component of any well-functioning market, and water markets are no exception. Price signals provide powerful incentives for conservation while simultaneously communicating information about collective judgments about the relative scarcity of resources across time and space. As market conditions fluctuate, market prices change accordingly. As environmental economist Richard Stroup explains, “market prices adjust constantly to all of the supply and demand variables, providing each buyer and each seller with up-to-date information on changes in relative values in the world around them.” A market system in which users simply pay for the resource that they use enables individual water users to weigh the tradeoff between the cost of obtaining additional water, the cost of reducing or conserving water use, and other relevant factors.

Through the price system, markets incorporate and account for far more information than centralized administrative entities, and at far less cost. This is important because information is both extremely valuable and quite costly to uncover and accumulate. Accumulating and processing the same volume of information through an administrative process would be exceedingly costly and would be difficult (if not impossible) to achieve in as timely a fashion.

A regulatory system that seeks to limit the amount of

water used for various purposes to “appropriate” amounts would require the collection and consideration of myriad amounts of information concerning the relevant information about how water is and could be used within various industries in different places and at different times. Such efforts rarely succeed as planned because centralized decision-makers are not able to collect and process a sufficient volume of information. An adaptive system, such as is required to respond adequately to the threat of climate change, is even more information intensive.

Market pricing for water will encourage consumers to use water more efficiently. Given that most consumers pay artificially low water prices (if they pay for water at all), few have much incentive to economize on their water use. As economists Terry Anderson and Pamela Snyder explain in their book *Water Markets*, “What is seen as a waste or inefficient water use in rural or urban areas is simply the users’ rational response to low water prices.”

It is often assumed that residential water demand is relatively price inelastic and therefore price changes will not produce dramatic changes in water use patterns. Yet actual experience shows that many water users will reduce water consumption when faced with higher prices. The responsiveness of different water users at different times and places will vary, but users will respond. “If the price of water rose, people would carefully examine how they use water, for what purposes, and in what quantity,” claims University of Arizona law professor Robert Glennon. For example, per-capita water use is approximately 300 gallons per day in Fresno, Calif., where water use is not metered. In the neighboring community of Clovis, however, water is metered and per-capita water use is 50 percent lower. Simply requiring users to pay for what they use can produce significant change in water use patterns.

Regretfully, public water authorities are reluctant to subject consumers to higher prices, even during drought conditions. Increasing water rates imposes visible costs on their constituents and risks political unpopularity. Public officials would rather impose moratoria on “wasteful” water uses than subject water use to the discipline of price changes that reflect market conditions.

ACCOUNTING FOR UNCERTAINTY

One of the greatest challenges posed by climate change is the uncertainty it magnifies, if not creates, of where and when we will have water. Unfortunately, traditional planning tools are poorly equipped to address climatic effects on water supplies. As Kenneth Frederick of Resources for the Future explains, “planning and justifying expensive new projects are difficult when the magnitude, timing, and even the direction of the climate-induced changes are uncertain. Building for changes that never materialize or failing to build facilities to deal with changes that do occur are both potentially costly.” The high costs created by such uncertainty highlight the need for flexible and adaptive water management institutions.

Water markets can both reduce uncertainty for water users and provide security against the harms that uncertainty can produce. If water users are able to purchase additional water

rights from other users, this can reduce the impact of droughts and other local or temporal supply disruptions. While all water users in a given region may suffer from drought conditions, the costs to some water users may be greater than others. Transferable water rights enable water users to shift those costs to those who are best able to bear them, thereby reducing the overall costs of such unforeseen supply disruptions. In case of drought, for instance, transferable rights ensure that water supplies will go to the highest-valued uses, reducing the economic and ecological costs of such events.

The ability to transfer water rights in advance of potential supply changes further enables water users to reallocate the risk of uncertainty. Water users can acquire options that will enable them to obtain water necessary to address unanticipated changes in future supply. As in commodity markets, such options are an important risk management instrument and help reduce the costs of negative events.

THE MOVE TO MARKETS

There is an urgent need to develop more extensive market institutions to manage water supplies. However, it may well be that the most efficient systems of water markets evolve over time and cannot simply be imposed by government fiat. Yet there are several steps government agencies can take to facilitate the development of water markets and greater reliance upon market institutions in the allocation and management of water resources. These include:

- defining and recognizing the security and transferability of property rights in water resources;
- eliminating government subsidies for water use and distribution;
- moving toward market-based prices for water; and
- identifying and reducing legal and regulatory barriers to water transfers, particularly inter-basin and interstate water transfers.

The single most important step administrative agencies and lawmaking bodies can take is to recognize and protect water rights so as to provide the institutional foundation upon which water markets may be built or evolve. As Stanford law professor Barton “Buzz” Thompson observes, “By providing the legal infrastructure for water markets and actively encouraging such markets, the government can help reduce the harm from uncertainty in water rights and deliveries.”

The University of Colorado’s Charles Howe argues that so-called “salvage legislation” would dramatically increase the efficiency of water use, particularly in agriculture. In many states, farmers and other rights owners operate under a “use it or lose it” regime that only recognizes the validity of water rights for certain uses that are considered “beneficial.” A consequence of such rules is that there is little incentive to improve water use efficiency. Under “salvage legislation,” however, those who conserve water would acquire a valuable commodity: a transferable water right that could be sold or put to other uses. By ensuring those who manage to reduce their consumptive use of water do not suffer reductions in their water rights, “salvage legislation” would provide a substantial incen-

tive to discover and implement water efficiency improvements.

Legal and administrative barriers are not the only obstacles to greater water marketing. In some cases, water transfers are simply too costly to complete because of transportation or other transaction costs. Where there are no legal or institutional barriers to such trades, however, the potential for a wealth-maximizing trade creates incentives for would-be entrepreneurs to uncover ways of lowering such transaction costs so as to make a deal. This does not mean other concerns should be ignored, however. Special accommodations may have to be made for water markets to adequately take account of in-stream flows and sensitive biological resources. But such accommodations should be made in the context of water markets and such concerns should not be an excuse to forestall market reforms. Indeed, water markets have substantial environmental benefits, including increasing opportunities for conservation organizations to, as market participants, directly influence water allocation decisions by purchasing water for in-stream flows and other ecologically valuable uses.

While much ink is spilled over concerns that allowing water transfers could harm those communities from which water is transferred, water markets provide a more equitable means of water transfer than the administrative alternatives. In water markets, water is transferred as a result of voluntary transactions between a willing buyer and a willing seller. Those who had rights to water are compensated for giving up their rights. While there still may be third parties who suffer indirect effects from the water transfer, this is true under any water transfer scenario. Only in the absence of water markets are such losses compounded by the public harms resulting from inefficient water allocation and waste.

CONCLUSION

Climate change presents many challenges, but it also presents opportunities. In the case of water, the need to prepare for the impact of climatic warming creates an opportunity to improve on existing institutions. In particular, the threat of climate change could provide the long-needed impetus to shift away from centralized political management of water resources, toward market-based institutions. Such a shift holds the potential to increase the efficiency and environmental soundness of water use in the United States. So as the world warms, policymakers should warm to water markets. **R**

Readings

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