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Theme Overview: Water Scarcity, Food Production, and Environmental Sustainability-Can Policy Make Sense?

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On May 27, 2016 in an election rally in Fresno, California, the heart of the agricultural production region of the San Joaquin Valley—which faces severe water problems—Donald Trump vowed to fix the California water crises. According to the Associated Press (Colvin and Knickmeyer, 2016) he declared that "there is no drought," and that the California water problem is created because the water is sent out to the sea "to protect a certain kind of three-inch fish." Whether or not these statements are election rhetoric, they do reflect the confusion about water scarcity and social tradeoff in water allocation. As suggested by Rijsberman (2006), looking globally, it is difficult to determine whether water is indeed scarce in the physical sense or "whether it is available but should be used better." Therefore, it is legitimate to be confused about whether or not water is indeed scarce and whether or not drought prevails.

Articles in this Theme

Dealing with Water Scarcity: Need for Economy-Wide Considerations and Institutions

Adaptation, Climate Change, Agriculture, and Water

Cost-Effective Conservation Programs for Sustaining Environmental Quality

Enhancing Water Productivity in Irrigated Agriculture in the Face of Water Scarcity

Role of Institutions, Infrastructures, and Technologies in Meeting Global Agricultural Water Challenge

Confusion exists about water scarcity, but much more confusion and disagreement prevails about policies and the means to address water scarcity. In an article published at the beginning of the millennium, Glieck (2003) compares 20th century water policies and those needed for the 21st century. Policies developed in the previous century were based on development of physical means, such as pipes and reservoirs. But the fact that many unsolved water problems, including in particular scarcity, remain or even worsened calls for a paradigm shift. Glieck's term "soft path" calls for development and adoption of policies with non-structural means to allow for complementing of physical infrastructure with lower cost management systems, decentralized and transparent decision-making, use of pricing and water markets for water allocation, development and use of technological means, and incorporation of incentives for environmental protection considerations.

While the list of possible routes for a policy reform that addresses water scarcity and its implications is quite long, there have been attempts to follow it, some with more success and some with less success. The five articles in this special theme issue of *Choices* represent a subset of the issues at stake:

- The role of economy-wide policies, policies that consider all types of water, and investment in technological vs. non-structural research;
- Adaptation of the agricultural and water sectors to climate change;
- Incorporation of environmental consideration in cost-effective conservation policies;
- Challenges of agricultural water productivity for coping with scarcity; and
- Role of water institutions

In the opening article of the special theme issue, Ariel Dinar reviews the spatial water scarcity situation across continents and a few countries, using one of several available indices for water scarcity. He argues that there is enough evidence that natural processes, such as population growth, and water mismanagement are by themselves drivers of increased water scarcity in many countries and regions around the world. Fresh water resources are becoming a constraint to economic development and food production. Because water is part of various sectors' well-being, and because different sectors are involved in "producing" and "consuming" various types of the water spectrum, they can be interlinked. The article suggests that a comprehensive approach—the economy-wide approach—can better address the water needs of and impact on a multi-sectoral economy and provide a better tool for assessing water policy interventions. Since a "soft path" is suggested for policies of the 21st century, social investment in research and development should not focus only on technical research leading to technologies, but also on institutions that have to be in place in order to allow such technologies to operate and decision makers to perform better.

Robert Mendelsohn focuses on adaptation as a strategy to allow the agriculture and water sectors to keep future climate change impacts at a modest level. Mendelsohn argues that since irrigated agriculture withdraws the lion's share of available water resources, the growing scarcity of water is likely to have significant impacts on farmers, especially in semi-arid regions. Therefore, he calls upon both water managers and the farming sector to adapt to new scarcity circumstances that will even exacerbate with climate change, by introducing several institutional reforms, establishing the legal framework to allow water trade, providing incentives to switch to higher valued crops, improving the water application methods, and recycling water.

Roger Claassen and Marc Ribaudo review features of conservation programs for maintaining environmental quality under the impact of climate change and agricultural production. The article reviews several conservation programs administered by USDA including financial and technical assistance that are aimed at reducing these damages. However, the article identifies the cost-effectiveness of these programs as a challenge for their success. In particular, the authors suggest that the incentive system for farmers to adopt conservation practices through participation in the program may not be effective and needs to be better understood and improved.

The article by Susanne Scheierling and David Treguer addresses challenges related to enhancing water productivity in irrigated agriculture as a coping mechanism with water scarcity. The authors review several metrics that measure water use efficiency in irrigated agriculture. Obviously, they find that the term irrigation water use efficiency has as many definitions as the disciplines that calculate it. While this could not pose any problem in using irrigation water use efficiency for academic purposes, depending on the discipline, it may lead to major discrepancies when designing, implementing and assessing policy interventions to enhance water productivity in irrigated agriculture. The article provides some examples of how the estimation approaches used for calculation of irrigation water use efficiency may affect the policy recommendation. Omitted considerations may include (1) the scale of the calculation, that is, whether or not at the farm level or at the basin level and if all water involved (including return flows) is considered; (2) the physical and institutional constrains in the locality or region under investigation and the technological, legal, and institutional options. And, (3) whether or not the conserved water can be retained in the system, or will it be used by the water right holder that saved it to increase irrigated area (the expansion effect).

And last but not least, the article by Rathinasamy Maria Saleth, Nitin Bassi and Dinesh Kumar provides an overall institutional framework to deal with possible changes to the system that regulates scarce water resources in countries with large irrigated agricultural sectors. The authors argue that water challenges facing many agricultural countries can be addressed by acknowledging the institutional, infrastructural, and technological aspects—existing and proposed—of the system. The article establishes a framework for institutional linkages and

impact pathways of water demand management that allows for the testing of policy interventions. It provides examples and evidences from different countries, and sketches a water demand management strategy that, the authors believe, can resolve water challenges, including scarcity and climate change impacts both within and beyond agriculture.

The special theme focused on a small list of policy issues associated with climate change and water scarcity in their interaction with agriculture and the environment. The "For More Information" section at the end of each article provides a list of references with more detailed analysis and discussion on this very complicated issue that traps many, including professional analysts, policy makers, and politicians.

For More Information

Colvin, J. and E. Knickmeyer. 2016. "Trump Vows to Solve California's Water Crisis" Associated Press, May 27. Available online: http://bigstory.ap.org/article/fea527c86dfe42c78609619c5ce7fd59/trump-vows-solve-californias-water-crisis.

Gleick, P. H. 2003. "Global Freshwater Resources: Soft-Path Solutions for the 21st Century." *Science*, 302:1524-1528.

Rijsberman, F. R. 2006. "Water Scarcity: Fact or Fiction." *Agricultural Water Management,* 80:5–22.

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