Agricultural Water Conservation Clearinghouse

Addressing Agricultural Water Security in a Changing Climate

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Introduction

Conservation of agricultural water is complex and today, more than ever, the forces applying pressure and attention to water conservation are many, including: increasing competition for water resources due to a changing climate and population shifts and growth, an array of widely dispersed and contradictory information about agricultural water use and conservation, and mounting pressure to improve agricultural water use efficiency while at the same time increasing agricultural output. Additionally, needs for water for wildlife support and habitat improvement, recreational and leisure-time activities, expansion of domestic energy production as biofuel, and other industrial uses continue to grow and become more vocalized. Today, competition for limited water supplies is evident in the semi-arid and arid West, as well as throughout the United States.

A myriad of factors can influence how the agricultural sector manages its water supplies including availability, timing, quantity, quality of water, water rights, crops, timing of water application, precipitation patterns, pests that can influence crop performance, irrigation equipment availability and performance, labor, farming costs and available finances. Agricultural water conservation is a highly complex issue that is often mistakenly simplified at the public discussion and policy-making level. The complexity of understanding and practicing agricultural water conservation is mainly due to:

- state water laws (or lack of laws and regulations) which limit or provide incentives for agricultural water conservation;
- the variability and inconsistency of policies from state to state, despite water resources transcending geographic and political boundaries;
- research that has far surpassed applicability to practitioners;
- financial barriers and lack of recognizable incentive to practitioners for conservation;
- cumulative basin-scale impacts and the downstream dependency on return flows;
- producer economics and risk management strategies;
- limitations imposed by out-dated irrigation equipment and water delivery infrastructure;
- current approaches to ditch and reservoir system management.

In recognition of the possibility of a drastic change in availability of water and demands of re-allocation and use of water resources in the western U.S., the USDA and the Interior Department recently signed a Memorandum of Understanding to promote improved water management in the seventeen western states, where up to 90% of available freshwater resources are used for food production. Additionally, politicians recognize that water for agriculture holds the key to the future of food security in this region. The arid/semi-arid west is only one region in the U.S. undergoing such changes. There is also increasing competition between agriculture and urban populations for fresh water in the southeast, particularly in Georgia, South Carolina, and Florida. The World Economic Forum predicts that percentage change in demand for water between 2000 and 2030 for industrial and domestic use will crowd out any growth in agricultural water use (WEF 2009). Water demands from urban growth, increases in reservoir evaporation, and increases in crop consumptive use must be accommodated by timely improvements in agricultural water delivery, management practices, and technology (Strzepek et al. 1999).

Because agriculture accounts for over 70 % of the total water used consumptively in the U.S., the public, some natural resource regulatory agencies, and policy makers have started to place an increasing focus on the notion of agricultural water conservation as a partial solution to existing water shortages or those being

forecast as a consequence of climate change predictions, over-appropriate and use of existing water resources, and growing and shifting populations throughout the U.S. Yet, in light of growing emphasis on water conservation, it is estimated that present agricultural water shortages have cost the U.S. agricultural sector $4 billion a year for the past two years (WEF 2009).

There is no shortage of information about agricultural water management available to the public. However, published information and research results are scattered throughout an array of sources that are hard to reconcile. Moreover, the technical language in which most of the research articles and bulletins are published may be a limitation for some audiences seeking information about agricultural water conservation. Hence, there is a great need to compile and make accessible the array of technical information, tools, and water expertise for these audiences.

Agricultural Water Technology

Sustainable agricultural water conservation technologies and practices are not always the cheapest or the least technically complex. In addition, the impact of agricultural water conservation at the river basin scale can be either beneficial or detrimental to the environment, particularly if acreage in response to water made available because of conservation is expanded and consumptive use of water by agriculture is increased. Despite these complexities, the future of U.S. food security and agricultural water security are tightly linked to and dependent to some degree on our ability to use water more efficiently to produce food, fiber, and bioenergy. The impact of a changing climate on agriculture has become tantamount to understanding water and food security. The extent to which the changing climate will impact water availability in the future is uncertain, despite predictions in reports of the Intergovernmental Panel on Climate Change. What is certain is that precipitation variability and increased evapotranspiration (ET) will influence short and long term irrigation water supply and crop water demand, respectively.

Even though there is much effort to accelerate the development of cellulosic biofuels in order to minimize both water and energy consumption, overall water use for energy production is expected to grow by as much as 165% in the U.S. alone (WEF 2009). Recent efforts to use genetic technologies to improve crop water use efficiency may help produce bioenergy and feed crops with less water, but it is not likely that these improvements alone can bridge the coming water gap. These emerging genetic technologies are most likely to become part of new water efficient cropping systems that have improved tolerance to drought and short-term water interruptions.

The Agricultural Water Conservation Project

To help address these various needs, the Northern Plains and Mountain Regional Water Program of the USDA National Institute for Food and Agriculture (USDA-NIFA) National Water Program developed the Agricultural Water Conservation Clearinghouse (www.agwaterconservation.colostate.edu–Figure 1). The Clearinghouse has been instrumental in building partnerships within the academic community. Colorado State University (CSU) Libraries has provided support for the library feature, while the Agricultural Network Information Center (AgNIC) has increased the visibility necessary to build a resource information network for irrigators, agricultural producers, and water resource managers.

The Clearinghouse is a comprehensive repository of information and resources with a central focus on agricultural water management and conservation. Our vision is to develop a globally recognized information source and community of practice consisting of technical experts and researchers who will collaboratively address the complex issues of agricultural water conservation and water security. The Clearinghouse's mission is to create a comprehensive, one-stop-shop information resource system on agricultural water conservation by accomplishing two goals: 1) building linkages between water agency partners and experts to share information, research, and outreach activities; and 2) providing the agricultural water community tools and resources to assist them in coping with water management in a changing climate.

Currently, policies applied to saved, conserved, produced, or developed water vary greatly from state to state. Collective and coordinated watershed-scale approaches to managing any conserved water can only enhance national water security. The Clearinghouse has created an online meeting place, where individuals can express ideas, facts, and opinions and where discourse about solutions to agricultural water conservation challenges will open a dialogue between experts, decision makers, and stakeholders. The Clearinghouse supports the development of teams of experts who will be instrumental in discovering information gaps in both technical literature and educational curriculum.

Building partnerships between researchers, educators, practitioners, and industry experts can be instrumental in helping agricultural water users learn about new technologies and how to implement them. These partnerships foster a community of practice that enables communication between different interest groups to share common concerns about agricultural water management and conservation. Connecting water users to the manufacturers of water technologies enhances the possibility of adopting and implementing agricultural water conservation practices in the field, thereby improving farmers' abilities to remain financially solvent and profitable, while at the same time dealing with short- and long-term water scarce circumstances. Such exchange and dialogue furthers the formulation of well-thought-out standards for best management practices in agricultural water conservation. This leads to improved data sharing and a better understanding of agricultural water policy implications on basin scale hydrology.

The Clearinghouse website provides

Figure 1. Agricultural Water Conservation Clearinghouse homepage (www.agwaterconservation.colostate.edu).

current links and contact information to federal and state Agricultural Experiment Stations and Land-Grant Universities, as well as up-to-date information on agricultural water related research centers, irrigation management curricula, workshops, conferences, irrigation tools, software, manuals, guides, calculators, and irrigation schedulers. It features upcoming events and news related to agricultural water conservation at a regional and national scale.

The Clearinghouse is in the form of an interactive website, featuring a searchable library database, an agricultural water expert directory, Frequently Asked Questions (FAQs), and fact sheets. The Clearinghouse library is a comprehensive database which identifies current research and educational outreach publications regarding agricultural water policy, agricultural water recovery and recycling, resource economics, crop water use, cropping systems, drought tolerance, irrigation management and systems, irrigation water conveyance and delivery, phreatophyte management, utilization of marginal water, and water supply, sources and storage. The searchable library database hosts refereed journal articles, books, reports, theses/dissertations, conference proceedings, and easy-to-read fact sheets and bulletins.

The library is populated by contributions from Extension specialists, research scientists, and educators and provides a refined bibliographic review of agriculture water conservation grey literature. Grey literature refers to materials that cannot be found easily through conventional channels such as publishers, however is frequently original and usually recent. Examples of grey literature include technical reports from government agencies or scientific research groups, working papers from research groups or committees, white papers, or preprints. The term grey literature is often, but not exclusively, used for scientific reports. To date, the project has impacted over 7,100 users who have been able to access over 700 entries in the Clearinghouse library. Request for feedback from users helps strengthen the resource system and expand the network of water resource practitioners from local, state, regional, and national organizations instrumental in providing solutions for water management challenges now and in the future.

The Clearinghouse expands outreach and education efforts by initiating virtual online wiki forums for four initial communities of interest: 1) policy makers and administrators, 2) agricultural producers, 3) water educators and practitioners, and 4) research scientists. Wiki forums allow the easy creation and editing of multiple text entries and interlinked web pages via a web browser using a simplified markup language. Online forums enable ongoing dialogue about alternatives and the effects of agricultural water policy, and the impacts of basin scale agricultural water conservation. Additionally, online forums foster and promote interaction between the community of practice and communities of interest.

Conclusion

The outcomes of this project have provided benefits to agricultural water users, natural resource management agencies, policy makers, the general public, and the industries supporting agricultural water users attempting to address the increasing complexity of agricultural water conservation. For example, the Clearinghouse currently performs the following functions:

- Creates a venue for sharing of information regarding agricultural water conservation; advances awareness about and increasing access to new technologies and best management practices; offers a platform which unites researchers, administrators and policy-makers, practitioners, and educator communities with a commonality of focus of addressing the complexities of agricultural water conservation in the future.
- Provides targeted audiences current information about pressing and complex agricultural water conservation and security challenges, helping them to make more informed decisions and to accurately communicate information about agricultural water use and conservation.
- Identifies gaps in current research, education, and outreach related to agricultural water conservation, thereby helping U.S. federal, state, and local natural resource management and policy-making agencies to better target programs to improve water and food security.
- Informs technical experts, support industries, and educators of the latest agricultural water research and technology, allowing them to better inform their clientele.
- Links industry with the research and education communities.
- Links educators to scientists and technical experts to resource materials.
- Helps agricultural water users make better-informed decisions about their cropping systems.
- Enhances resources and information available through eXtension by expanding virtual and live networks to provide extended outreach.
- Provides support and assistance to policy makers by linking them to experts and current research, as well as to the USDA-NIFA National and Regional water programs.

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Additional Resources

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Considerations for Agriculture to Urban Water Transfers. September 2008. Arkansas Basin Roundtable

Water Availability for Agriculture in the United States. November 2009. Council for Agriculture Science and Technology.

Texas Water Development Board – Ag Water Conservation
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California Agriculture Water Stewardship Initiative
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