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### Innovative Approaches to Irrigation Conservation

Larry D. Simpson

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#### Citation Information

Simpson, Larry D., "Innovative Approaches to Irrigation Conservation" (1993). *Water Organizations in a Changing West (Summer Conference, June 14-16)*.

<https://scholar.law.colorado.edu/water-organizations-in-changing-west/11>

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Larry D. Simpson, *Innovative Approaches to Irrigation Conservation, in WATER ORGANIZATIONS IN A CHANGING WEST* (Natural Res. Law Ctr., Univ. of Colo. Sch. of Law 1993).

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**INNOVATIVE APPROACHES TO IRRIGATION CONSERVATION**

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**WATER ORGANIZATIONS IN A CHANGING WEST**

**Natural Resources Law Center  
University of Colorado  
School of Law  
Boulder, Colorado**

**June 14-16, 1993**

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## OUTLINE

### INNOVATIVE APPROACHES TO IRRIGATION CONSERVATION

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A. Does the irrigator really waste water? Irrigation in Colorado reuses its supplies several times. The only way to impact irrigation with real conservation is to modify the consumptive use of the water through improved irrigation timing, decreased evaporation by improved application practices and decreased transpiration from non-productive plants. Unless the modified methodologies affect the amount of water that is actually consumed, there is no actual conservation. As long as the surface or underground return flows are put to use downstream, decrease in water use without decrease in consumption does not conserve any water.

Many highly advocated municipal conservation practices such as low-flush toilets, low volume shower heads, and drip irrigation of landscaping in fact are energy conservation as opposed to water conservation in that they decrease the amount of treatment capacity needed by the delivering utility. This saves both energy, treatment materials and money. It does not, however, save much water. Water that passes through the waste treatment plant is in fact the water source for agricultural use or groundwater recharge downstream. Where the waste flows are lost to the ocean or are lost to irrecoverable saline sinks such as the Salton Sea, the above practices truly represent water conservation. Fortunately, such losses are rare in Colorado.

B. Improved scheduling can apply the water at critical times in the plant's development. Careful measurement of soil moisture, temperature, relative humidity, and plant development stage can result in fewer, more effective applications of water with resultant high productivity and decreased evaporation.

The use of tensiometers or neutron probes to measure the soil moisture in the root zone of crops and the timing of irrigations to meet soil moisture deficits reduces the loss from evaporation from the surface of the irrigation furrows or the spray from sprinklers as well as the loss from evapotranspiration from adjacent weed coverage. It also schedules the maximum soil moisture availability for evapotranspiration from the crops during the time that the maximum crop needs occur such as the timing of kernel formation and fillout in the instance of corn.

In some instances of very high value annual crops and for perennial crops, the use of drip irrigation can apply the water directly to the root zone and thereby decrease the evaporation from the surface of the soil. This practice does affect the return flow pattern of formerly surplus flows from the field and may necessitate mitigation of damages to downstream users through the release of some of the non-used water to the users downstream. Unless actual consumption is reduced, no water is truly saved. Its pattern of flow is merely rearranged. In a system where adequate storage and regulation structures exist or can be constructed, rearrangement of the management of the water supplies and the flow patterns can result in beneficial results to all users including fisheries and recreation without injury to any users or legitimate water rights.

C. Innovative application methods can result in less deep percolation with resultant savings in the leaching of valuable fertilizers and decreased pollution of the groundwater supplies. These application methods must take into account the effect on the return flow patterns for the downstream water users and, as mentioned above, any water savings should only reflect real decreases in the consumption of water.

The use of nitrogen balancing takes into account the available nitrogen in the applied water, the residual nitrogen in the soil before tillage, and the amount of additional nitrogen and other fertilizers that need to be applied to meet the needs of the crop to be raised. This process is now being utilized in the District's advisory irrigation management scheduling program. When combined with irrigation practices that limit the amount of deep percolation beyond the depth of the root zone, the amount of nitrogen and other chemicals that reach the groundwater without being absorbed by the crops is minimized. This "best management practice" is one of several which can reduce the nonpoint source pollution of the groundwater by agriculture.

A new methodology is being experimented with for high value crops. This involves the detailed survey and sampling of the fields on a square meter basis. This information on soil type and nutrient level is stored through the use of computers and through the use of precise location equipment such as LORAN or precise radar. The application of precise amounts of various fertilizers is then accomplished by the use of highly sophisticated equipment guided by the computer data and the precise and continuous location of the applicator in the field. This practice is also being considered for the application of water through the use of variable volume nozzles on center pivot sprinklers and through the use of locator antenna on the pivots. Obviously, such a system is very expensive. However, the increased yields and reduced fertilizer and chemical application can make the process cost effective in the instance of high value crops such as vegetables. This experimental method is called "prescription farming." It is presently in use in parts of California and Minnesota.

D. Regulation versus incentives and education. The program instituted by the Northern Colorado Water Conservancy District is based upon a voluntary program of education which demonstrates to the farmers that he can achieve valuable production gains while, at the same time, decreasing the loss of expensive fertilizers and lower costs of production. This type of program has a much greater chance of success than one of regulation. The over-all cost of administration and enforcement of a regulatory program on the limited resources of the taxpayer makes such an approach an extremely poor alternative to a voluntary program. The cost to society to assist in the education and adoption of innovative methods is considerably lower than the cost of another layer of bureaucrats involved in irritating and ineffective regulation.