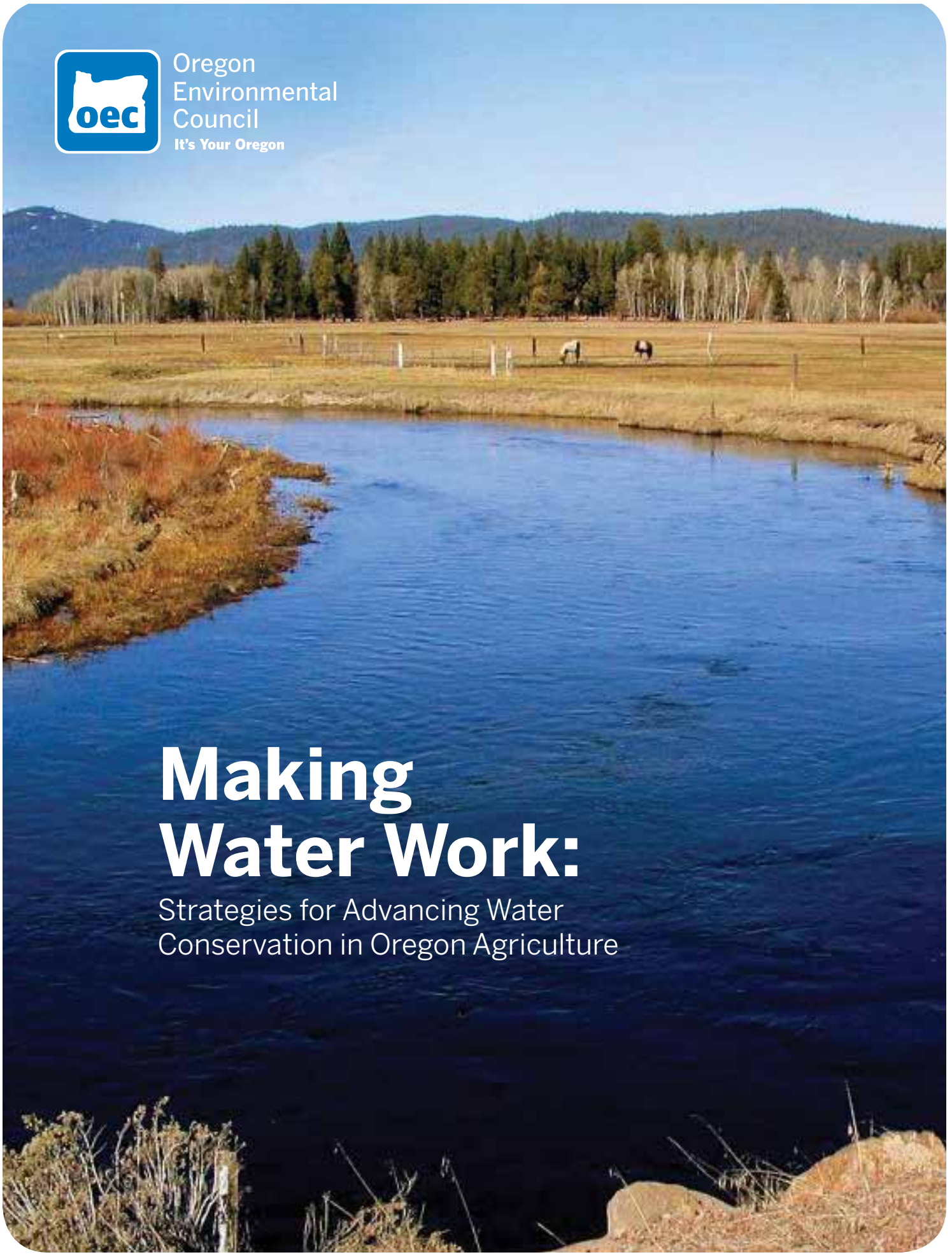
Oregon
Environmental
Council
It's Your Oregon
Making
Water Work:
Strategies for Advancing Water
Conservation in Oregon Agriculture

Acknowledgements

This report was made possible by grants from the Compton Foundation and the Jubitz Family Foundation, and was written by Teresa Huntsinger, Oregon Environmental Council's Clean & Plentiful Water Program Director.

Thank you to the following people who reviewed and commented on drafts of this report.

Merlin Berg, Wy'East Resource Conservation & Development Council
John DeVoe & Kimberly Priestley, WaterWatch of Oregon
Jennifer Coleman, Jared Ishkanian, Allison Hensey and Chris Hagerbaumer, Oregon Environmental Council
Rich Golb, PacifiComm LLC
Bob Levy, Vice Chair of Oregon Board of Agriculture
Jordan Kim, Hood River SWCD
Scott McCalou, Deschutes River Conservancy
David Pilz, Freshwater Trust
Kody Thurgood, Oregon Water Resources Department

Thank you to those who participated in an interview or focus group, or gave us a tour of your operation. Your input was vital to the development of this report.

Bruce Aylward, Ecosystem Economics LLC
Mike Britton, North Fork Irrigation District
John Buckley, East Fork Irrigation District
Suzanne Butterfield, Swalley Irrigation District
Steve Castagnoli, OSU Extension Service
Hollie Cannon, Klamath Water and Power Agency
Cindy Collins, Hood River SWCD
Kate Conley, Fifteenmile Watershed Council
Julie Davies-O'shea, Farmers Conservation Alliance
Sam Doane, J Frank Schmidt & Son
Chuck Gehling, Hood River Watershed Group
Jean Godfrey, Columbia Gorge Fruit Growers
Tod Heisler, Deschutes River Conservancy
Carly Heron, Natural Resources Conservation Service
Nathan Jackson, Klamath Watershed Partnership
Steve Johnson, Central Oregon Irrigation District
Frank Lamb, Lamb Family Fund
Ted Light & Jed Jorgensen, Energy Trust of Oregon
Tracey Liskey, Oregon Farm Bureau
Mehta Loftsgaarden, Natural Resources Conservation Service
Larry Martin, Hood River SWCD
Karl Morgenstern, EWEB, Cascade Pacific RC & D
Brian Nakamura, Hood River SWCD and East Fork Irrigation District
Keith Nantz, Dillon Land and Cattle
Stephanie Page, Oregon Department of Agriculture
Les Perkins, Farmers Conservation Alliance / Hood River County
Shannon Peterson, Klamath Basin Rangeland Trust
Dick Radliff, Bryant Pipe
Anne Saxby, Hood River SWCD
Marc Thalacker, Three Sisters Irrigation District
Robert Wallace, Wy'East Resource Conservation & Development District
Mike Wick, Westland Irrigation District
Fred Ziari, IRZ Consulting

The opinions expressed in this report are those of the author and Oregon Environmental Council, and do not necessarily represent the views of everyone who reviewed the report or participated in an interview or focus group.

Cover Photo: Jan Tik ©

January 2012

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Executive Summary

Photo: David Cosand

Agriculture and Oregon are inextricably linked, shaping the state's identity and sustaining its people.

As Oregon's second largest economic industry, agriculture produces roughly 250 different commodities that employ 234,000 workers in peak season and add $22 billion in annual new state product. While nursery plants, cattle, hay, wheat, dairy and other commodities have remained valuable locally and as exports despite the turbulent economy, their prosperity in Oregon could be threatened by the availability of one of our most basic natural resources: water.

Oregon's water supply is facing increased pressure due to population growth and climate change, stresses experts predict will compound in the coming decades. Our state's climate is often thought of abundantly wet. However, Oregon's summers are dry, even west of the Cascades, making irrigation critical to a productive growing season. In many places across the state, more water has been promised than our rivers can deliver while still sustaining fish habitat. In addition, groundwater levels have declined in several basins.

Using our water resources more wisely will be essential as the state adapts to an uncertain future. Most of the public attention to water conservation focuses on investing in more efficient toilets, appliances, buildings and municipal water delivery systems. However, less than 10% of Oregon's total water withdrawals are used in cities, while agriculture uses 79%. In order to ensure its vitality and help meet the needs of a growing Northwest population as well as wildlife habitat and other water users, the agricultural community must make the most out of the water supplies that are available to it. Advancing water conservation shores up water supplies for irrigators and other users, and can restore flows to dry streams.

Water conservation efforts are currently underway on some farms, ranches and in water delivery systems throughout the state, and public and private resources are helping make projects happen. However, the fact remains that there is ample room for improvement and scaling up of cost-effective programs to protect this critical resource; we have only achieved a small percentage of what's possible, and the state lacks goals or coordinated programs to adequately advance water conservation and efficiency.

Oregon is a national leader in promoting energy efficiency as the best, least-cost approach to energy generation. That same approach can be extended to water: Oregon should prioritize water conservation and efficiency first when planning for the long-term management of our water resources.

Making Water Work aims to help leaders in the agricultural community, as well as elected officials, agency staff, environmentalists and others capitalize on the vast opportunities to maximize Oregon's increasingly limited water supply through water conservation and efficiency measures. Oregon Environmental Council interviewed dozens of stakeholders in Oregon's farming and ranching communities to identify existing obstacles to water efficiency projects and develop solutions.

Our top recommendations include:

Make existing incentive programs more effective. This includes coordinating disparate energy and water conservation programs, identifying stream reaches that can benefit the most from water saved through conservation, and strategically increasing outreach in those areas.

Make conservation a central priority in water resources planning at the state, basin and local scales. Currently the state places greater emphasis on water conservation planning in municipal delivery systems than agricultural water systems. This imbalance needs to be corrected, and conservation should be a central component of any plans for meeting future demand.

Increase funding for water conservation and water resources management through new and existing revenue sources. Funding is needed for conservation cost share programs, water rights field staff and implementation of the state's water measurement strategy.

Build local capacity and knowledge. More conservation projects happen when local organizations provide the education, outreach, technical assistance and support to navigate the incentive programs that irrigators need.

For a more thorough discussion of these recommendations, as well as an overview of the opportunities for agricultural water conservation in Oregon, including case studies, please review the full Making Water Work report.

OEC hopes that the conversations we initiated with the agricultural community during this process are just the beginning. We look forward to working with irrigators, water suppliers, elected officials, conservation groups and others to ensure that our water resources will be ample to support the fish, wildlife, crops, businesses and Oregonians that rely on them for generations to come.

Making Water Work strives to help leaders in the agricultural community, as well as legislators, agency officials, environmentalists and others capitalize on the vast opportunities to maximize Oregon's increasingly limited water supply through water conservation and efficiency measures.

Introduction

Oregon's agricultural community knows better than anyone the importance of our state's water resources.

Our agricultural economy depends on adequate water supplies: 77% of the state's agricultural production value comes from irrigated crops.[1] And yet, surface water withdrawals are stretching many river ecosystems to their limits, and groundwater levels are declining faster than they can recover in several areas. With no new water rights available in much of the state and demand expected to significantly increase in the coming years, our agricultural community is searching for solutions to provide long-term security for their businesses. Water efficiency is a cost-effective solution to this dire problem; a solution that can benefit agriculture and the environment.

While agricultural irrigation accounts for nearly 80% of Oregon's water use, conservation programs have focused more on municipal projects than agricultural ones.[2] What prevents Oregon's farmers and ranchers from taking on business-wise conservation projects, and how can Oregon ease the way to adopting efficiency measures?

Oregon Environmental Council (OEC) spoke with farmers and ranchers, irrigation specialists and agricultural water suppliers to learn more about advances in irrigation efficiency in Oregon, obstacles for farmers, and available resources through state agencies and other organizations. This report details these findings and provides recommendations for improving water conservation in the interest of protecting water instream and benefitting Oregon's agricultural economy as well as the state at large. OEC will work to implement these findings in the coming years, in particular through our involvement in developing the state's first Integrated Water Resources Strategy (IWRS).

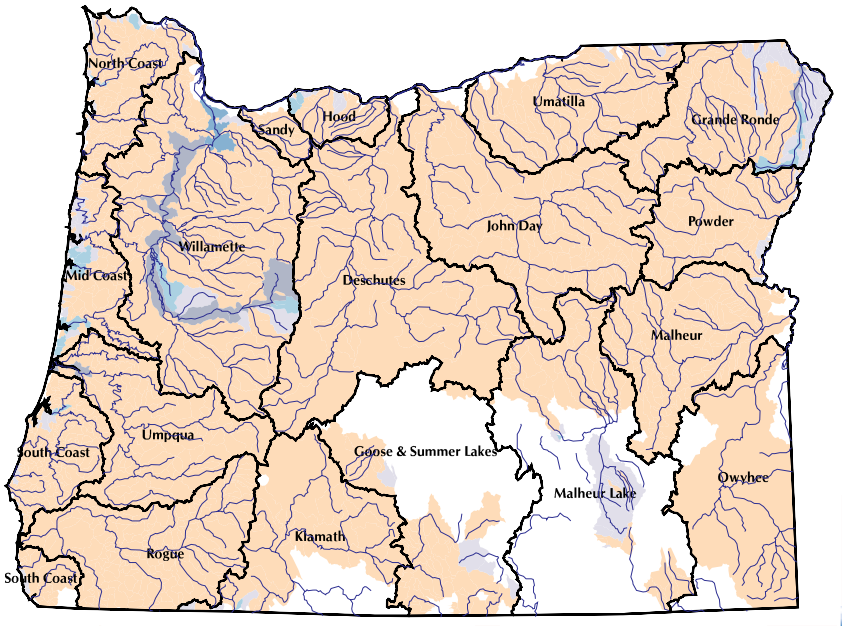
Figure 1:

Limited Summer Streamflow

August available streamflow

New water rights available,
in cubic feet per second (cfs)

- No data
- No water available
- 1 - 10 cfs
- 11 - 100 cfs
- 101 - 1000 cfs
- 1001 - 10000 cfs
- 10001 cfs or greater



The need for water conservation

Ensuring adequate supplies of clean water for healthy rivers, farms and a growing population is becoming one of the greatest environmental challenges facing Oregon. Our state's climate is often thought of abundantly wet. However, Oregon's summers are dry, even west of the Cascades, making irrigation critical to a productive growing season. Water shortages, such as the one the Klamath Basin experienced in the summer of 2001, have already created social, economic and environmental crises. Across the state, most of Oregon's surface waters are already fully appropriated during non-winter months (see Fig. 1) and, in some cases, more water has been promised than the river can deliver while still sustaining fish habitat. Our groundwater levels are also declining faster than they can recover in certain regions. Oregon's Water Resources Department (OWRD) has identified groundwater protection areas in the Umatilla, Hood River, Malheur, Deschutes, Summer Lake, and Willamette basins.

Oregon's already limited water supplies will face increasing pressure as our population expands and climate change progresses in the coming years. Oregon's population is projected to increase 40% over the next 30 years.[4] Some experts predict that climate change will accelerate Oregon's population growth even further due to mass migration from parched southwestern states. Concurrently, scientists warn that rising temperature trends will lead to earlier snowmelt and reductions in snowpack, reducing stream flows in the late summer months when demand is greatest.[5] Summer water demand will rise due to warmer temperatures, with irrigation demands projected to grow by at least 10% for every 1°C increase on the thermometer.[6] It is crucial that Oregonians learn how to stretch our limited water supplies in order to meet the needs of agriculture, industry, energy development, wildlife and a growing Northwest population.

77% of the state's agricultural production value comes from irrigated crops .

Conservation provides multiple benefits.

For some farmers, water conservation is already an integral part of running an efficient, cost-effective operation that maximizes crop yield and quality while reducing energy costs. Water conservation provides multiple benefits to the farmer and the greater environment in addition to helping remedy low stream flows that jeopardize fish and wildlife populations. Upgrading to more efficient irrigation systems can improve water quality by reducing runoff, it improves crop yield and quality by giving plants just the right amount of water, and it saves money by reducing the quantity of fertilizer that is needed and reducing labor costs associated with moving hand lines and managing flood irrigation ditches. Water efficiency improvements can also provide local jobs and economic development opportunities for professional irrigation specialists, equipment distributors and pipe installers.

For these reasons and more, water conservation provides promise for Oregon's farmers and ranchers to ensure the vitality of their businesses and the environment we all share.

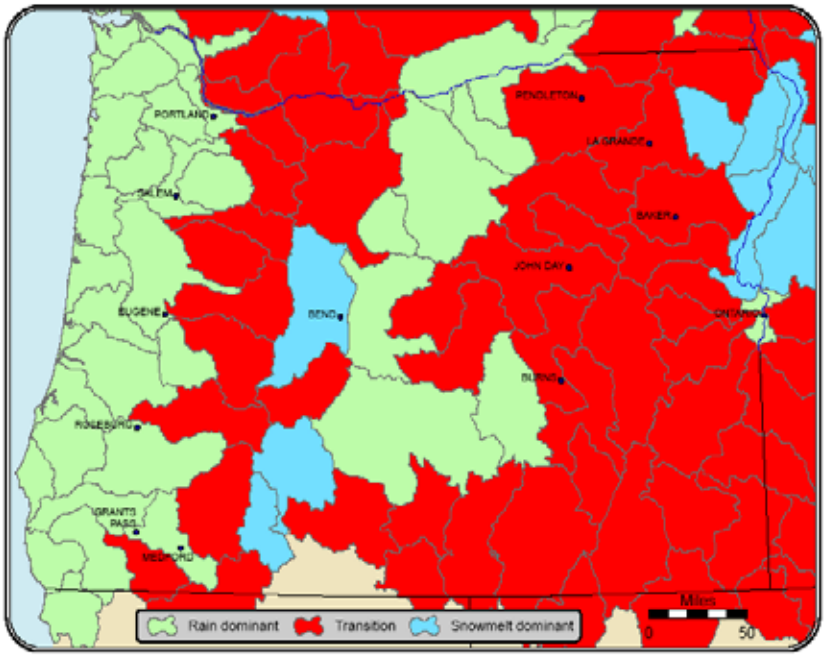
By using our limited water supplies more efficiently, improving instream flows and keeping precious farmland well irrigated, agricultural water conservation can help meet the needs of our farmers and ranchers, as well as cities and industries today and well into the future.

Agriculture's critical role

Water and agriculture are inextricably linked in Oregon: 79% of our state's water withdrawals are allocated to farmers and ranchers. Irrigation is used on roughly half of the state's total crop land (1.7 million acres) by nearly 45% of Oregon growers. This irrigated ground produces over 77% of the value of all harvested crops.[7] Rivers and streams fed by snow pack runoff are the source of most of Oregon's agricultural irrigation water. If Oregon does not use agricultural water more efficiently, the increasing pressure on our water resources will endanger all of Oregon's water users, including farmers and fish, and low water years will have increasingly devastating impacts on Oregon's economy. Many growers and irrigation districts have made significant progress in improving water efficiency, but there is still ample room for improvement.

Figure 2

Climate Change & Water



The red areas are watersheds where water availability is most likely to be impacted by climate change. They are fed by snow, much of which falls near the freezing level. A temperature increase of a few degrees will make a substantial difference in whether precipitation falls as snow and is stored until the spring, or whether it falls as rain and runs off in the winter.[3]

Teresa Huntsinger

Conservation and efficiency

While the words conservation and efficiency are often used interchangeably, they have slightly different meanings. Water conservation means a beneficial reduction in water loss, use or waste—essentially using less water. It has connotations of going without and often involves behavior changes. In the context of energy, conservation conjures the image of President Jimmy Carter wearing a sweater and asking Americans to turn down the thermostat—a sacrifice many people scoffed at until energy prices skyrocketed. Water efficiency is a tool that can result in water conservation. Efficiency uses technology to get the same result while using less water. Returning to the energy analogy, installing a more efficient furnace is another approach to achieving conservation, without sacrificing comfort.

Why rivers need water

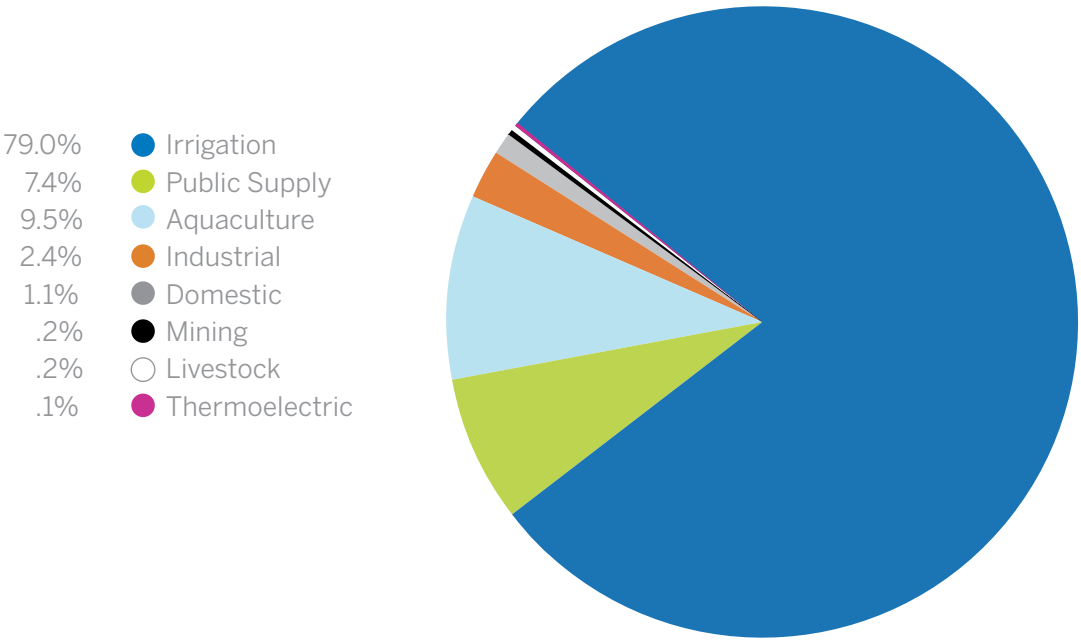
A river without water is no river at all. When water levels get too low, water temperatures increase, pollutants are concentrated, and dissolved oxygen plummets to levels that can kill fish and wildlife—including endangered species such as salmon. Oregon's fishing and recreation industries rely upon adequate instream flows. Some Oregon rivers that have historically had so much water withdrawn from them that fish can't survive are now on the way to recovery, thanks to efforts to protect water instream. But many rivers still do not meet minimum stream flows.

River flows fluctuate naturally throughout the year, so simply keeping rivers above minimum flows year-round would not protect endangered species or intact ecosystems. High winter and spring flows perform ecological functions such as picking up and depositing gravel for spawning beds, and signaling to fish when it is time to migrate. Scientists are learning how much water we can take out at different times of the year while protecting the critical functions performed by "peak and ecological flows."

Figure 3:

How Water is Used in Oregon[8]

Including surface and groundwater



In 2008, the state surveyed agricultural and municipal water providers to identify planned water conservation projects. Of the 135 specific projects detailed by respondents, almost three-fourths were municipal water projects. While important, this disproportionate emphasis on municipal water conservation, a sector that uses less than 10% of Oregon's water withdrawals, reveals a missed opportunity to engage a larger share of Oregon's water user community. Within the minority of agricultural projects submitted, the average annual water savings was 219,500 acre-feet, dwarfing the 6,140 acre-feet maximum annual savings from municipal projects.[9]

The state water demand forecast that was developed in the 2008 Oregon Water Supply and Conservation Initiative found that if water users conserve 0.6% per year over the next 40 years (a total of 25%), we would more than compensate for expected demand increases caused by a warming climate.[10] While many decision makers, environmentalists and farmers agree that conservation and efficiency can potentially provide increased flexibility in an uncertain future, there is a need for practical, strategic recommendations to help Oregon this potential.

Overcoming obstacles

In this report we explore the many opportunities for conserving water in agriculture, and we examine the state's progress to date in adopting more efficient irrigation and water delivery practices. In addition, we explore existing social, economic and political challenges that limit the spread of more efficient practices, and we identify some policy and programmatic changes that will help Oregon accelerate agricultural water conservation on a broad scale, while also improving crop production.

“ Water is the lifeblood of society, and Oregon is faced with the daunting challenge of providing sustainable water supplies for agriculture and a growing economy and population while maintaining and enhancing the environment that Oregonians hold dear.

In the shadow of climate change, providing an adequate water supply to meet all these needs will require new and innovative approaches, such as increasing storage, improving conservation, reusing water, and encouraging ecosystem husbandry. These concepts require commitment of vision, resources, and leadership to move from idea to reality. While current economic conditions may threaten Oregon's ability to dedicate funding to address water supply concerns, facing the issue now will decrease the conflict over a scarce resource in the near term, and keep our economy and environment healthy for the future."[11]

Bob Levy
Vice Chair, Oregon Board of Agriculture

Background

The basics of water law and Oregon's diverse agricultural economy.

An introduction to Oregon water law[12]

Under Oregon law, all water is publicly owned. With some exceptions, cities, farmers, factory owners and other water users must obtain a permit or water right from the Water Resources Department to use water from any source—whether underground, or from lakes and streams (surface water). Oregon's water laws, like those of most states west of the Mississippi, are based on the principle of prior appropriation: the first person to obtain a water right on a stream is the last to be shut off in times of low streamflows. In periods of water shortage, the water user with the oldest water right can demand the water specified in their water right regardless of the needs of junior users. The date of application for a permit to use water usually becomes the priority date of the water right.

Generally, a water right is appurtenant (i.e., attached) to the land described in the right as long as the water is utilized. If the land is sold, the water right goes with the land to the new owner. To make any changes to the point of diversion, place of use, type of use, or to transfer the water to another user, a water user must apply to the Oregon Water Resources Department. Once established, a water right must be used for a beneficial purpose at least once every five years. With some exceptions, after five consecutive years of non-use, the right is considered forfeited and is subject to cancellation. Cancellation requires a legal proceeding to determine whether or not the period of non-use has in fact occurred.

Beneficial uses allowed under Oregon law include irrigation and other agricultural uses, nursery operations, stockwater, industrial, commercial, domestic, municipal, and power development. Environmental uses of water left instream are also recognized by state law, such as aquatic life, pollution abatement, and recreation.

Some water uses don't require a permit. Examples of exempt uses in Oregon include fire control, stock watering, and rainwater collection from an artificial impervious surface (like a rooftop). Groundwater can be used without a permit to water up to half an acre of a lawn or garden and up to 15,000 gallons per day for domestic purposes. This use is often called an exempt well.

The amount of water allowed in a water right may be a rate (such as .85 cubic feet per second, or cfs) and/or an annual volume (such as five acre-feet).

One cubic foot per second is equivalent to:
- 7.48 gallons per second
- 646,272 gallons per day
- 1.98 acre-feet per day

One acre-foot is the volume of water that will cover one acre to a depth of one foot. It is equal to:
- 43,560 cubic feet
- 325,851 gallons
- It would take two acre-feet to fill an Olympic-size swimming pool.

Watermasters are employees of the Water Resources Department who protect the rights of water users and ensure that water laws are obeyed. They respond to complaints from water users, inspect wells and water diversion systems, and determine who has the right to use water in times of water shortage.

If water was used prior to enactment of the 1909 Oregon water code and has been used continuously since, the property owner may have a "vested" water right. The legal process of determining who has the right to use water, the amount and location of use, and the priority date for each right is called an adjudication proceeding. Adjudication proceedings have been completed for most of the major stream systems in eastern and southern Oregon and a few of the larger tributaries to the Willamette River. An adjudication proceeding is currently underway in the Klamath Basin.

Oregon's water laws are based on the principle of prior appropriation: the first person to obtain a water right is the last to be shut down in times of low streamflows.

Photo: Sam Beebe, Ecotrust©

Agriculture in Oregon

The vast differences in geography and climate across Oregon contribute to a diverse agricultural industry, producing about 250 different commodities. As of 2009, Oregon had 38,600 farms operating on 16.4 million acres with an average farm size of 425 acres.[13] Three million acres of Oregon's farmland was harvested for crops in 2007, and 61% of harvested cropland was irrigated (1,845,194 acres), making irrigation a crucial factor in agricultural success. The average value produced per acre in 2009 was $1,800. Cash receipts for all commodities in 2009 totaled $3.8 billion, down 14% from a record year in 2008. In 2009, agriculture was responsible for or connected to more than 15% of all economic activity in Oregon. Although the number of farms and overall land in farming is decreasing, agriculture is credited with adding more than $22 billion to Oregon's net state product in 2009.[14] Agriculture creates more than 234,000 jobs in the state (422,250 if you include food service and drinking).[15]

Photo: Teresa Huntsinger

Small, family farms are still alive in Oregon. 85% of Oregon's farms are owned by families or individuals, as opposed to corporations and partnerships. 53% of Oregon's farms are run by someone whose primary occupation is something other than farming.[16] The fact that we have many small farms run by people who also have jobs off the farm presents challenges for implementing on-farm water conservation projects.

While a growing local food movement is expanding opportunities for small farmers to sell directly to urban consumers, exports remain our agricultural lifeblood. Roughly 80% of Oregon produce leaves the state. Oregon's largest single commodity by value is greenhouse and nursery products, followed by cattle, milk, wheat, hay, grass seed, potatoes, Christmas trees and onions. Oregon ranks first in the nation in production of twelve different commodities, including various berry and grass seed crops, hazelnuts, prunes and plums, Christmas trees and potted azaleas.

Hay is grown on more land than any other crop in Oregon, topping one million acres as feed for dairy cattle, beef cattle, horses and other animals. Wheat is second to hay, grown on more than 970,000 acres in Oregon. Wheat production has increased 8% since 2008 due to rising market prices and a growing need for an alternative crop to grass seed. Much of Oregon's wheat acreage is not irrigated; dryland wheat growers rely on winter rains to produce their crop.

The diversity of Oregon's crops and the high percentage of land dedicated to crops that produce low profit margins (such as hay) shape the strategies in this report for improving water conservation. (Figure 4)

Small, family farms are still alive in Oregon. 83% of Oregon farms make less than $50,000 in annual sales. These small operations manage one quarter of Oregon's farmland.

Figure 4:
Commodities Grown In Oregon

How it Works:
Agricultural water efficiency practices and their use in Oregon

While some water users and suppliers in Oregon have adopted efficient practices, there remain vast opportunities for improvement.

We begin by looking at the ways agricultural water can be conserved in water delivery systems (i.e., irrigation district canals) and on-farm irrigation. While some water users and suppliers in Oregon have wholeheartedly adopted efficient practices, there remain vast opportunities for improvement in both areas. Please note that OEC has not investigated water conservation practices in stock watering or waste management for this report.

Water delivery efficiency

Agricultural water providers (irrigation districts and other special districts) play a significant role in Oregon water management–providing water to nearly half of Oregon's irrigated agricultural lands. According to the USDA, 46% of total irrigated acres in Oregon receive water from an off-farm surface source, while 31% get water from an on-farm surface source and 24% get water from wells (some acres are irrigated from more than one source).[17]

Inefficient delivery systems can lose substantial amounts of water to seepage and evaporation from leaky canals and pipes. Many irrigation districts have invested in efficiency improvement projects throughout the last decade, resulting in substantial instream savings. These large efficiency projects are often considered the "low hanging fruit" for water conservation. Of all the agricultural water conservation projects that were submitted to the OWRD's 2008 survey of conservation opportunities, 92% were supply side projects (i.e., in the delivery system), as opposed to demand side projects (i.e., on-farm).[18] Improvements to district water delivery systems can enable more efficient on-farm water management and irrigation systems.

Efficiency improvements in delivery systems include piping or lining earthen canals and ditches to reduce seepage and evaporation, conversion to pressurized systems, metering water deliveries, and modifying facilities and policies to increase the flexibility of deliveries.

For districts that have already piped or lined many of their canals and laterals, additional water savings may be gained by helping patrons pipe or line their privately owned lateral ditches. Oftentimes these ditches are owned by a few irrigators who could work together to implement a large scale conservation project that benefits the combined stakeholders.

Photo: Central Oregon Irrigation District

Central Oregon's irrigation districts lead the way in demonstrating how delivery systems can be dramatically improved thanks to efficiency measures. Unlined canals in this part of the state are particularly leaky due to the area's unique volcanic soils, with as much as 45% of water in Central Oregon irrigation district canals lost to seepage.[19] Four such districts have piped or lined 58 miles of irrigation canals and laterals, resulting in a savings of 91.5 cfs of water instream in the Deschutes River, Tumalo Creek and Wychus Creek.[20] That water has been legally converted into instream water rights using the state's Allocation of Conserved Water program.

Piping irrigation canals is not without controversy. Some canals provide wildlife habitat for birds and creek-like scenery that neighbors have enjoyed for decades. But lining or piping canals can leave more water instream, which is critical for the survival of endangered fish species. Piping or lining canals also reduces groundwater recharge from the canals. The nature of the connections between groundwater and surface water vary from one region to another. In some instances, neighbors notice a reduction in nearby well levels when irrigation canals no longer recharge the groundwater. A hydrologic assessment can determine the impact of reduced groundwater recharge relative to the benefits of keeping water instream. Such assessments have only been conducted in a few parts of the state. These tradeoffs should be considered when a piping project is planned.

Modernizing irrigation water distribution systems saves water, can enable efficiency improvements for individual water users, and it boosts local economies.

Agricultural water suppliers vary greatly in the sophistication of their delivery and water management systems. Some require their patrons to measure water use and others don't. Irrigation districts with antiquated delivery systems have limited flexibility in their ability to deliver water on-demand. Instead, they deliver water to their patrons on set schedules which may include rotating deliveries to patrons on one lateral ditch. Agricultural water suppliers also vary substantially in the amount of assistance they provide to help patrons improve on-farm water efficiency. Some small districts have very limited staff capacity for planning projects or assisting their patrons.

Modernizing irrigation water distribution systems saves water, can enable efficiency improvements for individual water users, and it boosts local economies. For example, the Three Sisters Irrigation District piping project, which is being installed in phases over a three-year period, purchased 30,000 feet of pipe from a Portland supplier, hired six new full-time employees to install the pipe, and boosted sales of five rental companies, a local auto parts store, and a local construction support firm.[21] Irrigation water distribution systems merit just as much public investment as municipal drinking water systems.

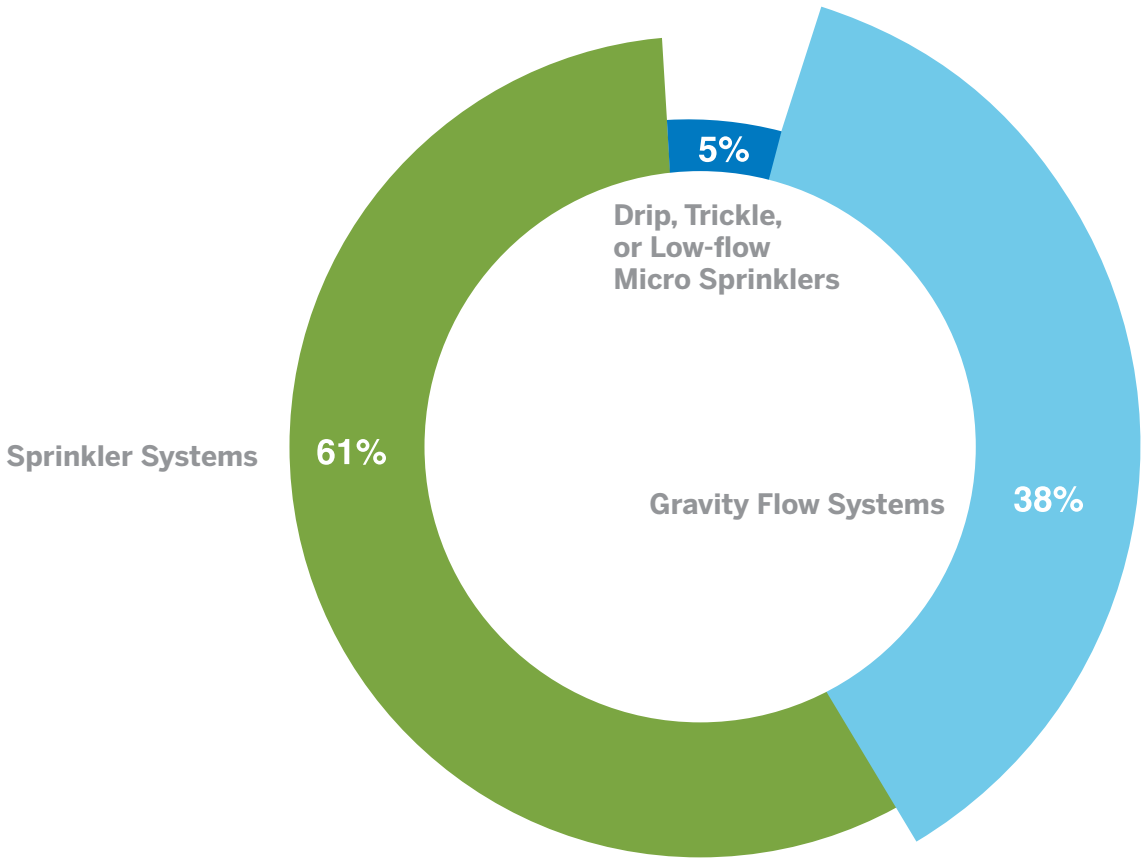
Figure 5:

Typical Irrigation System Efficiencies[22]

System Type	Efficiency (%)
Wild flood	25-40
Border or furrow flood (gated pipe)	60-80
Big gun sprinklers	50-70
Hand line or wheel line lateral sprinklers	60-75
High pressure center pivot sprinklers	65-80
Fixed solid set sprinklers	70-85
Low pressure (drop tube) center pivot or linear move sprinklers	75-90
Micro-sprinklers or drip irrigation	85-95

Figure 6:

Percent of Oregon Acres Irrigated by Each Method (2008)



On-farm irrigation practices

People OEC spoke with around the state acknowledged that many growers can use less than their water right and still yield a productive crop. Most water rights were set according to the amount of water needed to grow crops using flood irrigation. Less water is needed when using more efficient irrigation systems.

An efficient irrigation system delivers an ideal amount of water to plant roots when and where they need it most. Many existing systems use nearly double the amount actually needed for crop growth. Numerous factors affect the efficiency of any irrigation system, including:

System design. Uniform distribution of water ensures that plants throughout a field receive the same amount of water. When distribution uniformity is poor, one part of a field will be overwatered while another part is underwatered. Farmers typically water enough to ensure that the driest part of the field has enough water to sustain the crop, which results in the wetter parts of the field receiving excess water. Distribution uniformity is affected by the spacing of sprinklers and the amount of water they deliver. For flood irrigation systems, uniformity depends on how level the field is and how much "head" or water pressure there is to push water across the field. State of the art systems use infra-red cameras to determine exactly how much water each part of the field needs.

System maintenance. Regular system maintenance includes checking for leaks and replacing worn out sprinkler nozzles.

Irrigation scheduling. The method used to decide when to irrigate and for how long has a significant impact on the amount of water used. Techniques range from a set rotation schedule to checking soil moisture content by look and feel, to advanced measures such as using crop evapotranspiration data and soil moisture monitors.

Soil health. Practices that build up organic matter in the soil and leave crop residue or mulch on the surface enhance the soil's ability to absorb and hold moisture between waterings.

Excess on-farm water can be lost via evaporation, surface runoff, or deep percolation. While surface runoff is visible, deep percolation is invisible and it is often the greatest loss culprit. If irrigation timing is off or the depth of water applied is greater than needed, deep percolation results in water and nutrients infiltrating below the plant root zone where they cannot be used.

The efficiency of Oregon's irrigation practices range from low (flood or furrow irrigation systems that allow water to flow across the surface of the land), to moderate (sprinkler systems with varying levels of efficiency), to high (highly efficient micro-sprinkler and drip irrigation systems). In general, surface irrigation systems allow limited control and poor distribution uniformity, and use water less efficiently than sprinkler or micro irrigation. The efficiency of sprinkler systems, the most widely used irrigation practice in Oregon, varies substantially.

Any system's efficiency will be sub-optimal without proper design, operation and maintenance. Cost, ease of use, the type of crops grown, the layout of the land, whether the water source is pressurized, and the silt content and water quality of irrigation water are some of the many factors farmers consider when determining which irrigation system to use. Silty water sources present unique challenges for micro-sprinkler and drip irrigation systems because the water needs to be filtered to prevent clogging the small pores.

According to the 2008 federal Farm & Ranch Irrigation Survey, 38% of Oregon's irrigated acres still use flood irrigation and 5% are irrigated with highly efficient drip or low-flow sprinkler irrigation (Figure 6). Between 2003 and 2008 there was an increase in the use of more efficient methods, but they are still far from the norm.[23,24] 41% of the irrigators in the 2008 survey said they had invested in efficiency improvements in the past five years. This demonstrates that Oregon is making progress in water efficiency, but there is still ample room for improvement.

Variable frequency drives

Another effective efficiency upgrade that is gaining in popularity is the variable frequency drive. This technology enables irrigation pump systems to work only at the rate necessary to deliver the amount of water needed, providing greater flexibility in matching water volume to plant needs rather than being limited to one water rate. Variable frequency drives allow pumps to operate at varying well depths, as well as at varying flow and pressure, saving both energy and water.

Irrigation scheduling

In addition to irrigation hardware, the method used to determine how much water to apply and at what frequency can have a significant impact on water use. Many irrigators simply irrigate at a fixed rate throughout the irrigation season, or use their best judgment based on crop appearance and soil dryness to determine when to apply water. By using irrigation scheduling, growers can determine when and how much water to apply according to three factors: following watering recommendations for crops at different stages of growth; tracking evapotranspiration, the combined effect of evaporation from the soil surface and transpiration by the plant; and monitoring soil moisture.

Combined, these three factors—crop water use tables, ET data and basic soil probing—are affordable and effective ways to maximize irrigation efficiencies.

Crop water use tables provide advice to growers on how much water crops need at different stages of growth. Oregon's crop water use tables were developed in 1992 by OSU Extension Service. They estimate how much water economically important crops will need each month, including during critical growth stages like seedling establishment and flowering, in 27 agricultural regions of the state. These crop water use tables are combined with information from regional weather stations to provide daily evapotranspiration (ET) information for Oregon crops, which is available free of charge from Agrimet, a satellite-based network of automated agricultural weather stations operated and maintained by the Bureau of Reclamation in the Pacific Northwest's agricultural areas (see usbr.gov/pn/agrimet). ET information and crop water use tables help calculate how much water crops need, and the efficiency of the field's irrigation system must also be factored in to determine how much water to apply. Soil moisture monitoring helps ensure calculations are accurate and informs farmers how much water is available to the plants. Combined, these three factors—crop water use tables, ET data and basic soil probing—are affordable and effective ways to maximize irrigation efficiencies.

Irrigation scheduling can be further improved with highly accurate technology and the advice of irrigation consultants. Oregon is home to leading irrigation scheduling technology developers such as Fred Ziari of IRZ consulting and Jac Le Roux of IrrNet. Their expertise is sought out internationally, making their technologies a significant Oregon export. Yet, these technologies have yet to become widely adopted in-state. Soil sensing devices were used by only 7% of Oregon irrigators in 2008—an increase from 4% in 2003 (Figure 7), and another 7% use daily crop water evapotranspiration data (up from 1%). Nationally, use of these two efficient methods has held steady at nearly 10%. The most used method for deciding when to irrigate is the "condition of crops" (used by 80% of growers). There has been a decrease in the number of Oregon irrigators who water based on their personal calendar schedule (from 23% to 19%), the method least tied to actual crop need.

Through the course of conducting interviews and visits around Oregon, OEC observed that advanced irrigation scheduling is primarily used on high value crops that require consistent soil moisture, such as orchard crops and berries. Agricultural practices tend to spread from farmer to farmer via word of mouth, so preferences vary from one region to another. Scientific irrigation scheduling is more widespread in the Umatilla, Hood River and Rogue basins, and parts of the Willamette Valley, while relatively rare in Central Oregon and the Klamath Basin. Conservation investments in Central Oregon tend to be primarily in irrigation district delivery systems, and in the Klamath Basin investments focus on converting from wild flood to sprinklers or gated pipe flood systems. The more advanced irrigation scheduling systems work best when paired with an irrigation system that can achieve high efficiency, and farms served by irrigation districts need to be able to receive water on demand in order to water based on crop needs and weather rather than on a set schedule.

Municipal water conservation education programs teach urban water users to only water lawns and gardens in the morning and evening, and to avoid watering on windy days. While this advice applies to agricultural water users as well, it is not always practical to follow. During peak irrigation season, irrigators sometimes need to water 24 hours a day in order to apply water to one piece of land before rotating to the next. Adopting more efficient sprinkler and drip systems reduces the amount of water lost to evaporation, and more mechanized systems can enable growers to irrigate overnight.

Irrigation scheduling can be taken one step further using what is called deficit irrigation. Some studies have found that when crops receive less water at certain growth stages than recommended in the crop water use tables, they still produce a reasonably high yield. The aim of deficit irrigation is maximum profitability rather than maximum yield. Cost savings associated with reduced energy and water use can outweigh small decreases in crop yield, resulting in increased profit.[25]

Recommendation:
Update Oregon crop water use tables, using newer estimating methods and accounting for climate change's impacts on growing seasons and evapotranspiration rates. Extension agents in Washington state are currently updating their crop water use tables using a more accurate model, and finding that in most cases less water is needed than the older tables called for.

Figure 7:

Methods Used to Decide When to Irrigate in Oregon

Methods	2003	2008
Condition of crop	75%	80%
Feel of soil	31%	35%
Soil moisture sensing device	3%	7%
Plant moisture sensing device	0%	1%
Commercial or government scheduling service	4%	6%
Reports on daily crop water evapo-transpiration (ET)	1%	7%
Scheduled by water delivery organization	9%	12%
Personal calendar schedule	23%	19%
Computer simulation models	0%	1%
When neighbors begin to irrigate	8%	6%

Case Study

Fifteenmile Creek: Helping small farms save water and protect fish

In 2009, low water levels in Fifteenmile Creek caused a fish kill that alarmed agencies working to protect threatened species. The Fifteenmile Watershed Council, which is made up primarily of farmers, decided to focus their attention on agricultural water conservation to improve stream flows. The farmers wanted to figure out what they could do to help prevent future fish kills.

Fifteenmile Creek is in northern Wasco County, south of The Dalles. Its tributaries originate in the Mt. Hood National Forest, and 72% of the watershed is in agricultural land—primarily dryland wheat. Irrigators get their water directly from the creek; there is no irrigation district. In most years there is not enough water for junior users to get their full water allocation. The creek is home to the eastern-most run of wild winter steelhead in the Columbia Basin; these steelhead are federally listed as threatened.

As the watershed council worked to help small farms conserve water to preserve stream flows, they found that it required a concerted technical assistance and outreach effort, and the coordination of multiple funding sources and project partners.

The watershed had been identified by OWRD as a priority basin for streamflow restoration and water measurement, so in 2009 the watermaster had already begun working with the watershed council to install measurement devices on all significant diversions. The watershed council received a grant from OWEB to help pay for water meters on private diversions and to add an instream flow monitoring station. The council surveyed growers to find out what irrigation practices they were using and identify opportunities to make efficiency improvements, and they worked with the Wy'East RC&D to apply for funding from the NRCS Cooperative Conservation Project for on-farm water conservation projects. That grant targeted EQIP funding to individual growers in the watershed who adopted scientific irrigation scheduling. The council requested some modifications to the grant so it could also be used to help farmers upgrade from hand and wheel lines to pivot sprinklers. Since those grant funds go directly to farmers, the watershed council had to rely on their watershed council support funds from OWEB in order to conduct outreach and technical assistance.

There was also some federal funding available via the Oregon Department of Agriculture for energy conservation irrigation projects; however those funds could not be used on the same land as the EQIP funds. In addition, The Freshwater Trust was interested in paying farmers to leave some water instream via leases. The watershed council initially held a workshop for irrigators to learn about the various programs that were available to them, but they found that people were overwhelmed and had a difficult time determining what would be best to do on their land and which funding source was the best fit. Eventually the council and partner organizations created one interest form that irrigators could fill out and give to the council coordinator, who would work with the funding organizations like a case manager to navigate the systems. The partner organizations would meet regularly to talk through each irrigator's situation and figure out which

Photo: Teresa Huntsinger

programs they could work with. This method addressed what Watershed Council coordinator Kate Conley calls the greatest barriers to improving water conservation: funding and technical knowledge. Without funding assistance, virtually none of the hay and wheat farmers in the watershed would invest in water efficiency improvements. "It's hard to invest in new equipment when you're not getting much profit from your crop," says Conley. In addition to navigating the various funding programs, individual irrigators needed assistance from experts who could examine irrigation systems and identify the most applicable water savings opportunities. The watershed council did not have that expertise, so they sought technical assistance from the Soil & Water Conservation District.

Keith Nantz(pictured), the ranch manager for Dillon Land and Cattle, a 120-acre operation in Dufur, says navigating government funding programs is one of the greatest barriers for growers interested in improving irrigation efficiency. "I had an idea of what I wanted to accomplish, but I wasn't sure which programs I should or shouldn't apply for. It was confusing and overwhelming at first," says Nantz, who is one of the Fifteenmile Creek irrigators working with the watershed council. "Everyone in the office has been super at helping me work through all that." As a young rancher who is interested in trying new things, the cost share programs helped Nantz achieve efficiency improvements that would have taken him many years to install bit by bit as his finances allowed. He notes that many other farmers in the area are more reluctant to work with government programs. "Consolidating the programs would be helpful. Anything that gets overwhelming or too difficult gets pushed to the side."

As of the writing of this report, the council doesn't yet know how much water they have saved through water conservation improvements, or how much water they need to keep instream to support endangered steelhead. More conclusive information about outcomes of this effort is expected at the completion of the watershed's three-year NRCS grant, in 2013. While preliminary signs point to significant progress, this case study illustrates the need for a consolidation of programs, resources and funding in order to effectively educate and engage farmers about water efficiency improvements. Without a strong, well-established local organization and technical support, efficiency improvements in the Fifteenmile watershed would not have occurred. The challenges that faced farmers in the Fifteenmile watershed are also impeding water efficiency efforts throughout Oregon.

Related Recommendations:

Establish a one-stop clearing house (page 30)

Coordinate existing energy and water conservation programs (page 35)

Increased outreach about the Allocation of Conserved Water Program (page 35)

Building the capacity of local organizations (page 43)

Implement the state's measurement strategy (page 40)

Making It Work:
Challenges and opportunities for advancing water conservation

While some growers and irrigation districts have upgraded to highly efficient systems, the majority have not. Why?

Advancing agricultural water conservation will require understanding the challenges and identifying ways to overcome them.

The 2008 Federal Farm & Ranch Irrigation Survey (FRIS) asked participants whether they invested in irrigation efficiency improvements in the past year and if not, why not. Oregon irrigators participating in the survey overwhelmingly said the greatest barriers were financial. Developing the capital to finance improvements is a significant impediment; in addition, many growers felt that the savings they could realize through water conservation would not be enough to cover the costs of making improvements. OEC's interviews support these findings and further emphasize that costs are the most significant barrier to adoption, making financial incentives critical to success.

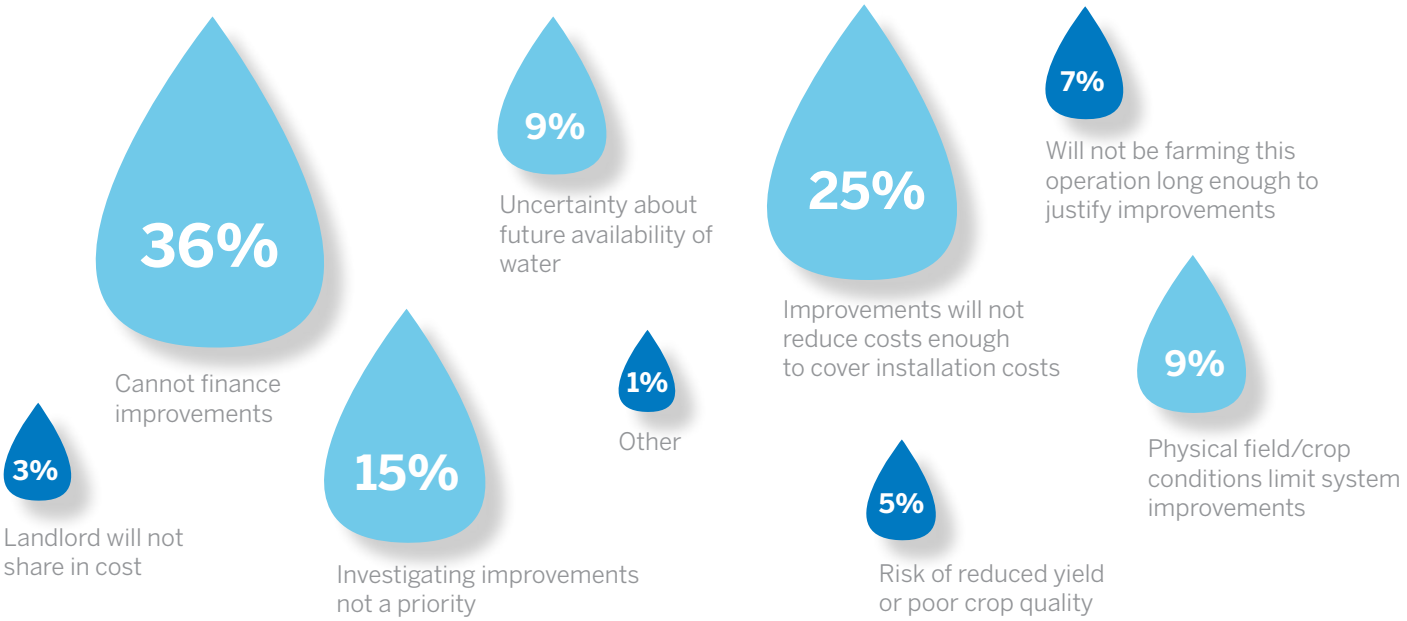
The FRIS survey also found that 15% of respondents stated that investigating efficiency improvement options is not a priority. In addition to this lack of awareness and interest among some growers, and financial concerns among many, OEC found a few other challenges for agricultural water conservation that include the complexities of local hydrology and where conserved water goes, and opportunities unique to Oregon including our Allocation of Conserved Water and instream water rights programs.

Costs and financial incentives

One of the major challenges that restrains water conservation from taking hold to the same extent as energy conservation is the fact that in Oregon, most users pay little or nothing for their water. Portland residents pay about 26 cents for 100 gallons ($1.97 per CCF, or 748 gallons) for treated drinking water.[27] Compare that to the example of an irrigation district that charges $8.50 per acre-foot, which works out to about 26 cents for 10,000 gallons of irrigation water that is not safe for drinking—100 times less than a Portland water user. Many irrigation districts charge their patrons based on how many acres

Figure 8:

Why Oregon Farmers Didn't Invest in Irrigation Efficiency[26]



of irrigable land they own, not how much water they actually use. Irrigators who get their water directly from a stream or a well pay nothing for the water itself, but they may have to pay for the energy to pump the water in addition to the costs of maintaining pipes and other infrastructure.

Because water is cheap or free, there is little or no direct price signal to incentivize water conservation. The cost of the water itself is usually not enough of an incentive to make irrigators want to invest in water conservation. However, there are other financial costs and benefits associated with water conservation that can make it pencil out, and incentive programs help close the gap.

Water pricing

Irrigation districts, like municipal water providers, do not pay the state for their water, but they charge their patrons in order to cover the costs of delivering water, including construction, operation and maintenance costs of pipes, canals, weirs, fish screens, ditch roads and other infrastructure as well as district staff. Many irrigation districts simply charge a universal flat rate per patron; some charge based on the amount of water the patron has a water right for (or the number of acres that have an appurtenant water right); others charge based on the amount of water patrons receive.

Pricing structures based on the amount of water used can incentivize water conservation and discourage using more water than is necessary. We would like to see more agricultural water providers use pricing structures that encourage conservation. Of course, this is only possible if districts measure how much water they deliver, and many do not. Agricultural Water Management and Conservation Plans include an assessment of district pricing structures.

The cost of water conservation

The costs of different water conservation methods vary substantially. Irrigation districts in Central Oregon have developed a water conservation plan that identifies conservation opportunities in delivery systems and on farms. This plan provides a useful illustration of the relative costs of water conservation investments. The Central Oregon districts estimated that the cost of canal piping and lining projects varies from $382 to $1,961 per acre-foot of water saved, with an average cost of $1,115. Planned delivery system piping and lining projects could save a total of more than 110,000 acre-feet of water each year, at a cost of nearly $96 million. Estimates projected an additional 112,410 to 146,698 acre-feet of water savings (36 to 48 billion gallons) if on-farm efficiency were improved to 70-80% across all districts. By comparison, the Portland Water Bureau produces about 38 billion gallons annually.[28] Ultimately, Central Oregon districts decided to implement a fraction of the potential on-farm projects, reducing on-farm savings to only 10,000 acre-feet within the next 20 years at a cost of $496 per acre-foot of water saved—less than half the average cost per acre-foot of canal piping and lining projects.[29]

If on-farm efficiency were improved to 70-80% across Central Oregon, as much water would be saved as the Portland Water Bureau uses each year.

The Central Oregon irrigation district plan demonstrates that on-farm water conservation can save a lot of water in a cost-effective manner, and yet large district piping projects tend to get prioritized over on-farm projects because they are easier to manage. Most irrigation districts don't play an active role in promoting on-farm water conservation. OEC would like to see more irrigation districts follow municipal water providers' leads and actively encourage their ratepayers to conserve water.

Water conservation and crop value

Growers of lower-value crops like hay and pasture are less likely to have the capital to invest in improvements such as a new sprinkler system or soil monitoring probes. Pasture and alfalfa have relatively high water needs and produce relatively low market value per acre. They are reliable crops that contribute to higher value cattle and dairy production, as well horses and other animals raised on many hobby farms. The fact that so much of Oregon's agricultural land—and water—is used for relatively low-value crops impacts our ability to achieve greater water use efficiency. Low-cost efficiency improvements such as improving maintenance of existing irrigation systems are more feasible in these instances.

Conversely, higher-value crops do not necessarily require more water. In fact, many crops that require less water produce greater economic value than relatively thirsty crops. Grapes, onions, and potatoes yield high economic value compared to their water use (see table #), and while tree fruits require high amounts of water they also yield high economic value and are well suited to highly efficient drip irrigation. Generally, growers of high value crops tend to be more likely to invest in water efficiency technologies.

Photo: Teresa Huntsinger

Figure 9.

Production Value and Water Need of Oregon Crops

Crop	Production Value ($1000)	Acres Harvested	$Value/Acre	Relative Water Need
Nursery Crops	$740,000	54,000	$13,704	varies
Onions	$176,003	20,300	$8,670	moderate
Cherries	$83,670	13,150	$6,363	high
Apples	$25,622	4,200	$6,100	high
Pears	$93,636	16,200	$5,780	high
Grapes	$76,782	15,600	$4,922	low
Potatoes	$162,023	37,000	$4,379	moderate
Mint	$43,001	22,900	$1,8778	low-moderate
Filberts (Hazelnuts)	$28,700	28,700	$1,000	high
Berries	$20,000	20,200	$990	low
Corn	$51,438	60,000	$857	moderate
Beans (Dry)	$4,952	6300	$786	low
Grass Seed*	$252,878	403,390	$627	moderate-high
Alfalfa Hay	$221,400	400,000	$554	moderate
Peas	$8,846	19,300	$458	low
Pasture/Hay	$243,432	630,000	$386	high
Grain/Wheat	$223,633	877,000	$255	low - moderate

This table includes actual production data from Oregon's 2010 Agripedia report.
Relative water need is based on the Oregon Crop Water Use and Irrigation Requirements developed by Oregon State University Extension.
*Includes bluegrass, tall fescue, annual and perennial ryegrass.

Case Study

Advanced Drip Irrigation Saves Money and Resources[39]

J Frank Schmidt & Son (JFS) is a bare root tree nursery participating in OEC's Climate Friendly Nurseries program. Even before participating in the program, JFS had already installed underground drip irrigation at two of their farms, and by so doing, harvested savings and time benefits.

The installation of drip irrigation offered an additional opportunity–drip fertigation, applying fertilizer through an irrigation system–which reduced another costly input and diminished the chance for fertilizer to leach out of their farm and into water systems. They continue to look for new ways to save water and energy.

Establishing reliable and trusted drip irrigation and fertigation took many years, diligence, research and patience, and the farm is still working on system improvements. Because the JFS farms in Boring and Canby are located near groundwater limited areas, water efficiency is a priority. When nursery manager Sam Doane noticed that the productivity of new wells was declining, he developed a plan that would save water and money. "Our water supplies were becoming limited. It was pretty clear we needed to conserve resources," says Doane.

While the company didn't pay directly for water, installing a drip irrigation system did mean substantial savings in labor and energy costs. "We were paying a lot of overtime for workers to move irrigation pipe," explains Doane. "Above-ground irrigation is incredibly labor intensive; we were often operating from 5 am to 9 pm." Doane looked into underground drip irrigation and created a labor savings analysis that captivated JFS owners. "The return on investment for the infrastructure costs was two years: three workers could do the work that a crew of up to sixteen did before, and there was a 30% reduction in water use at the end of the third year when the system was fully fleshed out," Doane adds.

With this type of cost-saving analysis Doane received permission to start a pilot project, which was implemented over a five-year period. New mainline pipes were installed in the first and second years, as well as a filtration system to remove particulates. With each planting cycle JFS converted more acreage to drip irrigation until the entire farm was done. The company decided to take on the equipment installation costs themselves, knowing that the payback period would be reasonable. Applying to available cost-share programs would have delayed implementation by as much as a year, although Doane notes that some of those programs have now been streamlined.

Installing the equipment was only the beginning of the project. The next step was to develop an irrigation schedule. JFS worked with Rich Regan at Oregon State University to develop crop coefficients applicable to their diverse group of nursery crops. The crop coefficients help refine data from the AgriMet stations—a satellite network of automatic agricultural weather stations which provides information for near-real-time management of water operations in the Pacific Northwest.

Managing the drip system requires thinking about irrigation in new ways. Doane explains, "The fields look different with drip irrigation—they are dry. This was a major adjustment for everyone in the operation as we were used to seeing wet soil, and with that, came knowledge that the plants had enough water for the near future." JFS experimented with various soil moisture monitoring devices and protocols before settling on a level of data that works for them. Doane notes that simple, non-technical solutions are available for evaluating soil moisture as well; these can be a good option during the learning process.

Photo: J Frank Schmidt & Son

"Our operational efficiency has increased through reduced labor costs and water use; we are able to work and cultivate in a field while irrigating; and we have reduced weed growth by limiting surface water." -Sam Doane, J Frank Schmidt & Son

Once JFS installed the drip irrigation system, they realized that it provided an opportunity to inject fertilizer directly into the irrigation water, which reduced overall fertilizer use by 30%. "Our operational costs are lower and we are responsible for fewer greenhouse gas emissions normally attributed to nitrous oxide emissions," Doane says. "If anyone decides to implement a drip irrigation system, this is a natural next step to investigate."

JFS continues to seek efficiency improvements at their farms. Doane is currently looking for a cover crop that uses less water while still benefiting the soil. To his knowledge, nobody in the Oregon university system is doing that kind of research. JFS doesn't plan to use underground drip irrigation at their Monmouth farm because they've experienced problems with voles in the past. (Voles and other rodents can chew into drip systems, resulting in wasted water and excessive maintenance costs.) Also, some crops like ash trees need the evaporative cooling of overhead watering. Doane uses a combination of drip and overhead watering for those crops. It's important to design any irrigation system to fit with the property. "The end product has been worth the effort," Doane says. "Our operational efficiency has increased through reduced labor costs and water use; we are able to work and cultivate in a field while irrigating; and we have reduced weed growth by limiting surface water. Our owners are happy, and we are taking steps to ensure our competitive advantage and future success."

Figure 10.

Small and Large Farms in Oregon

Adapted from the Oregon Department of Agriculture (2011). State of Oregon Agriculture: Industry Report from the State Board of Agriculture.

Farm size and water conservation

Several of the irrigation district staff and irrigation consultants OEC spoke with noted that small-acreage "hobby farmers," are often much less efficient in their irrigation practices than commercial growers. Hobby farmers typically generate their income from other activities, and are less likely to invest time and money to make their systems more efficient.

For example, Swalley Irrigation District, north of Bend notes in their 2010 Agricultural Water Efficiency Management and Conservation Plan, "Owners of these small acreages tend to irrigate according to what is convenient for them rather than according to irrigation principles agriculturalists would tend to use." 28% of their acreage and 76% of their patrons own properties smaller than 6 acres.[30]

Farms that generate less than $10,000 per year in income make up 15.6% (see figure below) of the state's agricultural lands. While there are a significant number of individual hobby farmers, they use a small portion of the state's land and appurtenant water overall. Some counties are impacted more by hobby farmers than others, and in those areas it could be worthwhile to specifically target outreach, education and incentives for water conservation to hobby farmers. Some Soil and Water Conservation Districts have programs designed to reach this audience.

So-called hobby farms whose primary purpose is not income generation should not be confused with small commercial farms. A 2005 USDA study showed that small farming operations, or adaptive farms, tend to have average gross sales per acre that are about twice as high as the overall average. In Oregon, adaptive farms produce a variety of vegetable crops, berries, and some flower or nursery crops.[31]

Sustainable agriculture certification programs

Certification programs, such as USDA Organic, enable growers to receive a higher market price for their crops from buyers who value sustainable practices. OEC investigated the certifications most commonly used in Oregon to determine whether they promote water conservation. We found that Salmon Safe, Food Alliance and LIVE have specific requirements regarding water use management, and the USDA Organic certification only includes vague guidelines on the topic.

Financial Incentive Programs

Cost share funding for water conservation and efficiency projects is available from federal, state and local sources. Financial incentive programs include:

Programs that promote water conservation but do not require water to be protected instream:

Environmental Quality Incentives Program (EQIP) is a federal program administered by the Natural Resources Conservation Services (NRCS). It provides financial and technical assistance directly to landowners and agricultural operators. EQIP provides up to 75% of incurred costs for certain conservation practices. Applications for EQIP funding are accepted year-round, and funding cutoff dates are announced locally, usually once a year. Priorities are established based on locally identified natural resource needs consistent with state and national priorities. Local Work Groups convened by Soil and Water Conservation Districts (SWCDs) provide advice to NRCS about natural resource issues and priorities within their counties. EQIP applications are evaluated based on these county priorities and are then prioritized for funding. A number of irrigation practices are eligible for EQIP payments.

or.nrcs.usda.gov/programs/eqip/index.html

The Agricultural Water Enhancement Program (AWEP) is another federal program administered by NRCS. Through AWEP, entities such as federally recognized Indian Tribes, states, units of local government, agricultural or silvicultural associations and other such groups may propose partnership agreements to work with NRCS to deliver EQIP funding to landowners and growers in a targeted area. AWEP project partners in 2011 include the Fruitvale Water Users Association, Three Sisters Irrigation District, Klamath Basin Rangeland Trust, Marion SWCD, Vale Oregon Irrigation District, The Dalles Irrigation District, and Talent Irrigation District.

or.nrcs.usda.gov/programs/awep/index.html

Additional federal funding sources include Bureau of Reclamation funds for irrigation districts that receive their water from Bureau projects, and the Clean Water State Revolving Loan Fund, which is administered in Oregon by the Department of Environmental Quality.

The Oregon Water Resources Department Water Reuse, Conservation and Storage Grant Program was established by SB 1069, effective March 5, 2008. The program provides funds for evaluating feasibility of developing water conservation, reuse or storage projects. Up to $500,000 may be awarded for each project, through a dollar for dollar match. In 2008, 14% (5 of 36) of projects awarded OWRD grants were directly related to agricultural water conservation, compared with 23% (5 of 22) in 2010. The program was not funded in 2009.

wrd.state.or.us/OWRD/LAW/conservation_reuse_storage_grant.shtml

Programs that promote energy efficiency through water efficiency (and do not require water to be protected instream):

The Energy Trust of Oregon provides financial incentives for irrigation efficiency projects that save energy as well as water. Their primary criterion for determining which projects receive funding is the amount of energy saved. They offer set dollar amounts for replacing sprinkler heads, upgrading to more efficient irrigation systems, installing variable frequency drives, etc. Energy Trust is developing a new program that will also offer funding for irrigation scheduling systems. Local providers help growers fill out Energy Trust applications, which are readily available in irrigation supply stores. Energy Trust funding is only available for customers of PGE and Pacific Power. It is funded by a public purpose charge paid by energy users. Energy Trust also provides incentives for in-conduit hydroelectric projects.

energytrust.org/industrial-and-ag/incentives/agriculture/

Public Utilities that provide Bonneville Power Administration electricity offer incentives that are similar to the Energy Trust incentives. The programs are slightly different for each energy provider. Resource Conservation & Development Districts are partnering with BPA and local energy providers to administer a "Save Water, Save Energy" program around the state. The program has successfully funded scientific irrigation scheduling efforts as well as irrigation system upgrades and nozzle replacements.

bpa.gov/energy/n/agriculture.cfm

Oregon's Business Energy Tax Credit helps fund some energy efficiency projects that also conserve water. It also funds in-pipe hydroelectric projects that create renewable energy, which are often built as part of district piping projects. Changes to the BETC program are currently underway that will likely shrink the program and reduce the projects that are eligible. Unfortunately, some agricultural water providers have been affected by changes in the administration of the program, and their expected tax credits are being held up. For more information, visit

oregon.gov/ENERGY/CONS/BUS/BETC.shtml

Programs that fund the protection of conserved water instream:

The Columbia Basin Water Transactions Program is administered by the National Fish & Wildlife Foundation (NFWF) and funded by the Bonneville Power Adminstration in cooperation with the Northwest Power and Conservation Council. It provides funding to purchase or lease water rights to place instream, investments in efficiency and other incentive-based approaches to restore stream flows in places where rivers run low due to water withdrawals. The primary aim of the program is to restore streamflows to benefit salmon, steelhead, trout and other wildlife. Using a set of approved criteria, NFWF makes funding recommendations on water project proposals submitted by local entities and obtains BPA approval before funding a project under this program. Oregon's qualified local entities include The Freshwater Trust, Deschutes River Conservancy and the Walla Walla Watershed Alliance.

cbwtp.org

The Oregon Watershed Enhancement Board (OWEB) provides grants for water conservation projects that benefit stream flows via instream water leases and transfers. Projects are funded within the priority areas for streamflow restoration in basins throughout the state that were jointly identified by the Water Resources Department and the Department of Fish and Wildlife.

www.oregon.gov/OWEB/GRANTS

Bonneville Environmental Foundation Water Restoration Certificates empower businesses to take responsibility for their water consumption by returning an amount of water equal to what they've used back to the environment. The concept is similar to carbon offsets, except for water. Businesses purchase Water Restoration Certificates, and BEF uses them to fund projects that restore stream flows. Funded projects are certified by the National Fish and Wildlife Foundation to ensure that water is returned at a time and place that will produce real environmental benefits.

b-e-f.org/business/products/wrcs/

Improving Incentives

While agencies managing instream flow restoration programs coordinate their efforts to maximize effectiveness, OEC's interviews with irrigation specialists brought to light the lack of coordination between the instream flow programs and the energy efficiency programs. Most practitioners are familiar with the federal programs; however, they seem to be aware either of the energy efficiency-driven incentives or the instream protection incentives, but not usually both. As a result, water that is saved via EQIP or energy efficiency incentive programs does not necessarily end up instream. Even within the Bonneville Power Administration, the energy efficiency irrigation incentives program is completely separate from the instream water protection program. Leveraging and coordinating these programs could result in a more user-friendly experience for farmers trying to access them, and a more strategic utilization of resources to achieve environmental objectives, as well as potentially protecting more of the conserved water instream.

Recommendation:
Create a Conservation Clearinghouse, a one-stop resource where irrigators and water providers can find information about water and energy conservation best practices and incentive programs offered by various agencies.

Recommendation:
Increase funding for water management and conservation. We suggest a few funding sources for consideration.

Budget cuts have reduced the number of assistant watermasters around the state, handicapping their ability to protect and enforce water rights. Lack of funding is also a barrier to implementing the state's measurement strategy. The primary federal funding sources for on-farm conservation projects (EQIP and AWEP) are targeted for budget reductions this year. Oregon's Business Energy Tax Credit, which irrigation districts use to finance the micro hydro projects associated with irrigation canal piping projects, is also experiencing significant reductions. Oregon's Water Reuse, Conservation and Storage Grant program is primarily funded by lottery-backed bonds. This funding comes and goes, depending on legislative approval in the biennial budget process. If Oregon is going to seriously advance water conservation, we need a funding source to do it. Investing in conservation today can save the state money in the future by reducing water conflicts and shortages.

Potential sources of funding include:

Water rights management fee. OEC supports proposals to create an annual water rights management fee to fund the water management services the state provides. Many water users recognize the need to fund these critical services and agree that a fee of $100 to $150 per year per user would not be an undue burden, but many surveyed distrust government and fear that the fee could quickly grow larger. To win support of the agricultural community, a water management fee proposal would need to be relatively small in amount per water user, its growth would need to be limited in statute, and there would need to be assurances that the funds would be used only for managing water resources (e.g., not swept away by the legislature for other purposes).

Public purpose charge. This program would be similar to the source of funds for the Energy Trust of Oregon, but for water conservation.

Photo: Teresa Huntsinger

The public purpose charge would likely be levied on water utility rates, and it would fund municipal and industrial water conservation projects as well as agricultural projects. This idea would require much more exploration before implementation. Associating the program with the Energy Trust could enable greater coordination of water and energy saving programs. However, because the Energy Trust lacks expertise protecting water instream, funding should be provided via partner organizations that already have experience implementing instream water leases and Allocation of Conserved Water projects.

Water efficiency tax credit. Legislators have floated the idea of a state tax credit for water efficiency programs in the past, similar to the existing energy tax credit. This is an idea that OEC also believes has merit and deserves further exploration.

It's all connected: Energy, water quantity and water quality

The interconnections between water conservation, energy conservation and water quality protection simultaneously create opportunities and challenges for agricultural water conservation. It is important to understand and recognize these relationships in order to design incentive programs that benefit the environment and water users. The siloed nature of our regulatory systems makes it difficult to address these issues in an integrated way. The creation of Oregon's Integrated Water Resources Strategy is a hopeful step toward a more effective, holistic approach, but more still needs to be done.

The energy-water nexus

Saving water saves energy. For growers who pump their water from wells or have to raise it in elevation, energy costs of irrigation are a significant expense. Water conservation reduces the quantity of water needed, which reduces the energy needed to move that water.

In addition to the energy savings that can be gained from improved on-farm irrigation efficiency, farmers also see energy savings when irrigation districts pipe their delivery systems. Having a pressurized water source enables the use of sprinklers and other more efficient irrigation systems without the need to use energy to pressurize and pump the water on-farm.

When the delivery system is not pressurized, converting from flood irrigation to sprinklers requires energy that was not needed previously. This can be a significant cost barrier to increasing irrigation efficiency.

Irrigation district piping projects also create opportunities to generate electricity in addition to saving it. In-conduit hydroelectric projects are a renewable source of energy that uses water already flowing through delivery pipes. The revenue derived from hydro projects can be the key element that makes district piping projects affordable. Once the hydro revenue pays off its own construction costs, that revenue can help fund additional conservation and efficiency projects in the district.

In addition to making more water available for stream flows and/or out of stream uses, water conservation can also improve water quality.

In this way, financial incentives for in-conduit hydroelectric projects that are designed primarily to promote renewable energy (such as the Business Energy Tax Credit) also help fund water conservation. Reductions in these financial incentives makes it more difficult to achieve water conservation goals.

Districts with in-conduit hydroelectric projects will naturally want to run their turbine at full capacity by keeping as much water flowing through delivery pipes as the district is allowed. This can create a disincentive for helping district patrons reduce their water use, making the hydro plants a double-edged sword. However, irrigation remains the primary use of the water and districts are not allowed to withdraw more water from streams than their patrons need.

Oregon has led nationally in developing innovative programs and incentives to promote energy efficiency, placing the state as the fourth most energy efficient in the nation. Many of these lessons, such as establishment of an Energy Trust of Oregon and incentives for energy efficiency, are lessons that can be applied to water conservation.

Understanding what happens to excess applied water

The benefits of agricultural water conservation are complicated by the fact that excess water applied to fields is not necessarily "wasted." The water that isn't taken up by crops goes primarily to three places: evaporation into the air, infiltration into the ground, or runoff back to the stream or to an irrigation ditch. This complexity makes water conservation very different from energy conservation, where energy is only used once and its distribution system is not controlled by gravity.

Return flows often become a source of irrigation water for downstream users, and the water that isn't used by crops or evaporated may be used multiple times as it works its way through a basin. Water that seeps into the ground helps recharge aquifers, which provides water to well users and cool, clear groundwater to surface streams. When irrigators convert to more efficient practices that don't apply more water than the crops actually need, or when irrigation districts pipe their canals to reduce losses, this can create a positive environmental impact by taking less water out of the stream. However, in some cases it can also create the potentially negative impacts of reducing available water from return flows to other users and reducing groundwater recharge.

While conservation is beneficial in most cases, it is important to assess the hydrologic conditions at any given location to understand the impacts of changing water management.

Water quality and water conservation

In addition to making more water available for stream flows and/or out of stream uses, water conservation can also improve water quality.

Photo: Teresa Huntsinger

Where excess applied water returns quickly to the stream, water conservation has little impact on stream flows. The greater benefit in these cases is water quality improvement, because agricultural runoff often carries herbicides and pesticides, nutrients, sediment and high water temperatures into rivers. Efficient irrigation practices can also reduce the amount of fertilizer growers need to apply because fewer nutrients are carried away by runoff or infiltration.

The quality of source water also affects the ability to use certain efficient irrigation practices. When water is silty, it causes micro-sprinklers and drip line emitters to clog or wear out quickly, necessitating frequent nozzle replacement or expensive filters to remove the silt before it enters the irrigation system.

Understanding the relationships between water conservation, water quality, energy conservation, surface flows and groundwater will enable the creation of more effective and environmentally beneficial conservation projects. Ignoring those connections can result in projects with negative impacts.

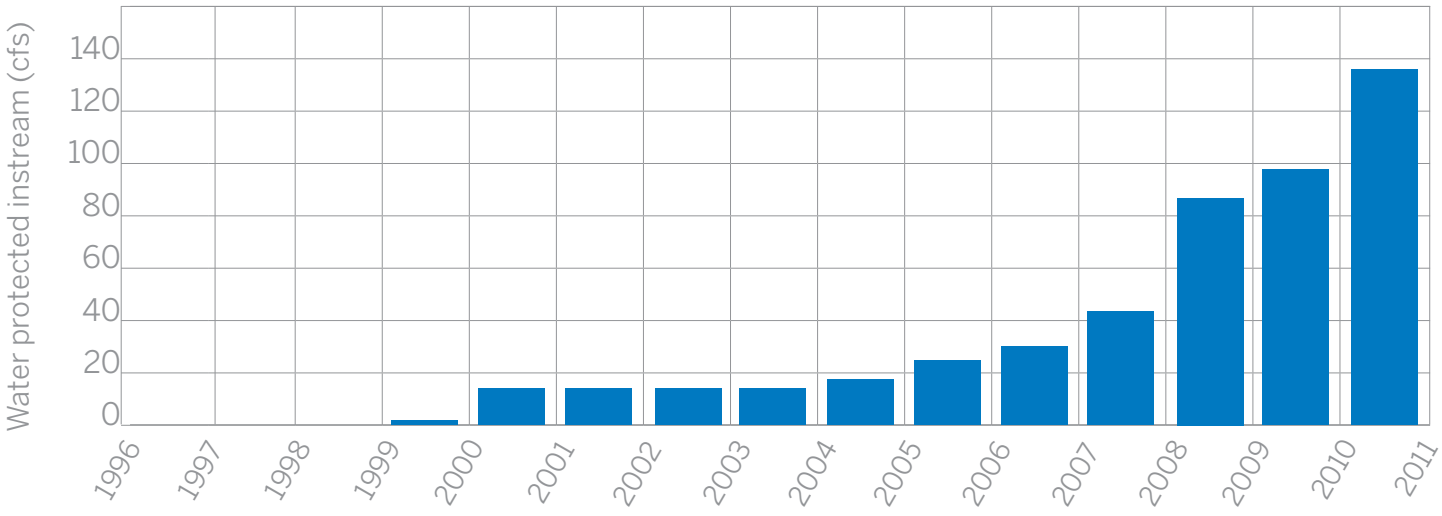
Protecting conserved water instream

Protecting conserved water instream
Water that is saved through conservation and efficiency improvements may not actually improve stream flows if it is not legally protected instream. Fortunately, Oregon has programs that reward water users for saving water and protecting it instream—something many other states do not have. Oregon leads the country in instream flow restoration, with instream transfers, allocations of conserved water, current instream leases and other projects that have restored about 1,800 cubic feet per second (cfs) of streamflow for fish and wildlife, recreation and pollution abatement. This is more than triple the amount for Washington, Idaho and Montana combined.[32] The majority of water protected instream in Oregon through transfers and the Allocation of Conserved Water program is senior water, with certificates predating Oregon's 1909 water code. While use of these programs to protect water instream has increased in the last ten years, many water users are still unaware of the benefits that are available to them when they reduce their water use. The potential of these programs needs to be realized in order to fully restore flows in the many streams where native fish species are at risk.

If conserved water is not legally protected instream, its actual benefit to stream flows depends on whether junior users take the water or not. Under Oregon water law, the original user cannot use the conserved water to irrigate new lands unless they participate in the state's Allocation of Conserved Water program, where they protect some of the water instream and get to use some of it themselves or sell it. Without using that program, the conserved water that is left instream is available to the next user that has an unmet water right (which is the case on most Oregon streams because of over-allocation), or it would be available for future water rights applications if the stream is not yet fully allocated.

Figure 11.

Use of the Allocation of Conserved Water Program



Data from personal communication with K. Thurgood, December 7, 2011

The Allocation of Conserved Water Program

Oregon's Allocation of Conserved Water statute was originally passed by the Legislature in 1987, and since then several changes have been made to make it easier to implement. The law protects water instream for fish, wildlife and recreation, while also benefiting water rights holders and the agricultural economy. Users of the voluntary program can receive the benefit of "spreading" up to 75% of the saved water to new uses or additional lands (or they can sell or lease it to another user), but only if they formally protect at least 25% of the saved water instream. A higher percentage of the water must be protected instream if more than 25% of the conservation project's funding is from federal or state dollars.

Property owners can apply to the Allocation of Conserved Water program up to five years after completing the water conservation project. The Water Resources Department will assess whether the conservation project results in reduced water demand. In addition, the Department assesses the potential for injury to other water rights holders, including instream water rights, before determining how much of the conserved water can be legally protected instream and how much can be spread to other uses. The application review process typically takes 9-12 months.

The conserved water that is protected instream will have the same priority date as the water that the user can apply to additional lands. The user can choose whether that priority date will be the same as the original water right or one minute junior to it. Because instream water rights may not be met if they are junior to out of stream rights, intermediary groups whose goal is stream restoration (such as the Freshwater Trust and Deschutes River Conservancy) often reach out specifically to senior water rights holders to create water conservation projects that will result in senior water rights protected instream.

Photo: Jeff Youngstrom©

When the program began, it was primarily used in the Deschutes Basin for projects carried out by irrigation districts and the Deschutes River Conservancy. Almost all the conserved water was protected instream and very few applicants had taken advantage of the incentive to spread water to new uses.[33] Over time, awareness of the program has spread, but many of the people we spoke with including irrigation consultants and vendors, have still never heard of the program. As of 2011, the Allocation of Conserved Water program has protected 138 cfs instream and 57 cfs have been approved for use on new lands.

Recommendation:
Conduct a hydrologic assessment of which streams can benefit most from the Allocation of Conserved Water program. OWRD and the Oregon Department of Fish & Wildlife have already identified stream reaches most in need of improved stream flows. The next step is to determine which of those stream reaches will receive improved stream flows thanks to conservation practices.

In places where excess applied water already returns quickly to the stream, applications to the Allocation of Conserved Water program have been denied because the water conservation practices did not result in an increase in water left instream. Also, in some places water conservation can negatively impact groundwater recharge. This assessment could enable OWRD and partners to focus outreach and education in areas where water conservation is most likely to benefit stream flows, and where irrigators can successfully use the Allocation of Conserved Water program.

Recommendation:
Coordinate energy and water conservation programs, leveraging their benefits and making them easier to access.

The energy used in pumping water can be significant, and energy savings is often a major motivator for irrigation efficiency. Energy Trust and similar Bonneville Power-funded incentive programs help irrigators save energy by saving water. OEC was surprised to find that many irrigation consultants who are experienced at helping growers apply for these energy-related incentive programs have never heard of the state's Allocation of Conserved Water program. They are unaware that irrigators who conserve water can spread a portion of that water to previously dry lands if they formally protect some of the conserved water instream. In some cases this benefit can be much more valuable than

Many irrigation consultants have never heard of the state's Allocation of Conserved Water program.

the financial incentives provided by the Energy Trust or by BPA-affiliated programs such as the "Save Water, Save Energy" program provided by Resource Conservation & Development Councils. In addition, the energy-driven programs do not ensure that any conserved water actually ends up in-stream. Irrigation consultants and equipment providers, including the trade ally contractors who work with Energy Trust on irrigation efficiency programs, should receive training in the Allocation of Conserved Water program so they can help growers apply to the program, just as they help growers complete applications for energy efficiency incentive programs.

Recommendation:
Expand outreach about the Allocation of Conserved Water program. The OWRD currently lacks capacity to conduct outreach about the program. It is no wonder that many irrigators and technical assistance providers are not aware of its existence. Information could be spread through the people and places irrigators go to when they are updating their irrigation systems.

Recommendation:
Expand the types of irrigation management changes that are eligible for the Conserved Water program.

The Allocation of Conserved Water program is currently targeted toward physical improvements to irrigation systems, such as piping canals or converting to high efficiency sprinklers. It has not been used for changes in water management such as scientific irrigation scheduling or deficit irrigation. These types of management changes offer substantial opportunity for water savings, and they should be included in the Allocation of Conserved Water program. The program's existing measurement and reporting requirements would ensure that the water is permanently conserved.

The staff implementing the program told OEC they would like to include irrigation scheduling, but they thought that would require either some internal changes or administrative rule changes. Our review of the administrative rules governing the program (OAR 690-018) did not find any language that would preclude eligibility of irrigation scheduling projects. It defines conservation as "the reduction of the amount of water diverted to satisfy an existing beneficial use achieved either by improving the technology or method for diverting, transporting, applying or recovering the water or by implementing other approved conservation measures." As OEC interprets the definition, it allows OWRD staff to determine which conservation measures are approved. The needed change could likely take place within the agency.

Case Study

Reducing Irrigation Produces Fatter Cattle: Surprising Results in the Klamath Basin

The Klamath Basin Rangeland Trust (KBRT) was born out of the 2001 water wars, when low water levels in Upper Klamath Lake threatened an endangered sucker species. Due to Endangered Species Act requirements, the federal government shut off water from the lake to irrigators before the end of the irrigation season, setting off protests and a crisis that pitted farmers against fish.

In the following years a few ranchers upstream of Klamath Lake decided to try improving their water use to help growers below.

KBRT found that rangelands that were previously irrigated eight to ten times per year might be almost as productive with only one or two correctly timed irrigations. The meadows in the Fort Klamath area are naturally wet until June without irrigation. When irrigation is stopped, the plant species in the meadow transition over time to native species that can tolerate a period of drought. The most difficult part of the change is the first two years, when the number of cattle grazing on the land must be reduced to about 20% of irrigated stocking rates. KBRT helps the ranchers enroll in programs with the Natural Resources Conservation Service (NRCS) to compensate for losses in productivity. This approach allows ranchers to try making the change without any risk. If they decide that reduced irrigation management works for them, they can then transfer their water rights instream with fair-market compensation through the new Klamath Basin Water Transactions program.

Ranchers are able to maintain reasonable productivity while leaving most of their water instream. Research conducted by NRCS and OSU corroborates the ranchers' experience that cattle gain more weight on the dry forage than they did on irrigated rangeland, because the forage in the non-irrigated pastures is stronger, better quality, and more vigorous.[38] Far more participants are interested in permanently transferring their water instream than KBRT staff anticipated. The only limit to protecting that water is finding enough funding to purchase the water rights. Many ranchers are motivated to be involved in the program because they would like to be part of the solution for to water issues in the Klamath Basin. Others are motivated by concerns that their access to water may be reduced when water rights adjudication is completed in the basin.

Photo: Klamath Basin Rangeland Trust

Key components of success for this program are the NRCS funding to compensate ranchers for losses during the transition period, and the state's instream leasing program. Instream leases allow water users to protect their unused water instream temporarily, so they can experiment with using less water before locking themselves into a permanent instream transfer. KBRT has been one of the largest instream leasers in Oregon, responsible for 20-25% of all water leased instream, or about 30 acre-feet of water each year. The organization is ten years old, and it has only three staff people. Support from the National Fish & Wildlife Foundation enabled KBRT to establish the Klamath Basin Water Transactions program. Building the capacity of local organizations that can provide technical assistance to irrigators and facilitate instream water transactions will be essential to the state's ability to adapt to a changing water availability future.

Ranchers are finding that after making the transition to little or no irrigation, their lands are more productive than they expected.

Photo: Teresa Huntsinger

Instream leases and transfers

Instream leases and transfers often occur when land is taken out of agricultural production, or to enable water conservation. For example, the split-season leasing program allows growers to limit their irrigation to one part of the season, and lease water instream for the rest of the season. This can be particularly beneficial when water is protected instream during dry summer months.

Instream transfers permanently convert an out of stream water right to an instream right. The new instream right receives the same priority date that the out of stream right had. Instream leases temporarily convert the water to an instream use on an annual basis that can be renewed. They allow water users flexibility in temporarily protecting their water instream, which benefits stream flows, but the owner still maintains the right to use that water in the future if they choose to. Instream leases are often used by property owners who have not irrigated their land for five years but still want to protect their water right. Conversion to an instream right requires an assessment of whether protecting that water instream would injure any other water rights holders. This assessment is more thorough for permanent transfers than for temporary leases.

Instream leases and transfers are purchased from water rights owners using funding sources such as the BPA's Columbia Basin Water Transactions program and OWEB. In order to facilitate these transactions, an assessment of the monetary value of the water right must first be conducted. Water banks to facilitate water transfers have been established in Central Oregon and in the Klamath and Walla Walla basins.

Recommendation:
Extend split-season leasing program and create a split-season transfer program.

The split-season water rights leasing program is scheduled to sunset in 2014. Split-season leasing has proven to be a useful tool (see the Klamath Basin Rangeland Trust case study, for example), allowing growers to receive financial compensation for leaving water in-stream for part of the year. The split-season leasing program should be continued, and a permanent split-season transfer option should be created so water rights holders who want to can seasonally protect water instream on an ongoing basis without having to re-apply every five years.

Measurement and management

The simple act of measuring water use can raise awareness and encourage conservation. While not all Oregon water rights contain measurement requirements, OWRD and the Water Resources Commission have the authority to require measurement (ORS 540.310). OWRD estimates that there are currently 75,000 existing surface water points of diversion, about 23,000 ground water points of appropriation, approximately 24,000 reservoirs, 4,000 ground water registrations, and around 230,000 exempt groundwater wells, only 8% of which are required to report water measurement. That 8% does, however, represent nearly 46% of the state's water usage.[34] The majority of the state's water withdrawals remain without measurement.

In 2000, the Water Resources Commission approved the OWRD Strategic Measurement Plan for improving statewide water measurement. The plan prioritizes measuring significant diversions in watersheds with the greatest streamflow and fish habitat restoration needs. OWRD and the Oregon Department of Fish and Wildlife (ODFW) collaboratively identified these high priority watersheds, known as "Priority Water Availability Basins."

By 2007 the state identified 2,385 significant diversions in priority basins. By 2011, 761 of those either have measurement devices installed or they are in the process of being installed; 553 are abandoned points of diversion; and 1,071 still need measurement devices.[35] It has taken 11 years to identify priorities and install less than half the number of measurement devices needed. The Department had an initial $30,000 in cost-share money to assist with measuring device installation. This initial cost share money is nearly gone, and there are no additional funds available from OWRD.

Recommendation:
Implement and fund the Oregon Water Resources Commission's Measurement Strategy.

It is difficult to establish conservation targets and measure success without knowing how much water is currently being used.

In 2000 the Oregon Water Resources Commission adopted a strategy that prioritizes the measurement of significant diversions in Priority Water Availability Basins. So far, less than half of those significant diversions have measurement devices installed. The OWRD needs to speed up implementation of this program, and it needs funding to assist water users with the costs of installing measurement devices.

Recommendation:
Restore water resources management field staff. Better enforcement would create a more level playing field for growers that are staying within their water right, and increased technical assistance from watermasters would help irrigators use water more efficiently.

The irrigators and technical assistance providers OEC spoke with across the state consistently stated that people often use more water than they need to, and in some cases more water than their water rights allow. Over the last 30 years, the number of assistant watermasters working in the field has declined. In 1981 there were 19 state-funded watermasters and 37 county-funded assistant watermasters. Today, there are 20 watermasters and 15 assistants, a 38% staffing reduction.[36] During that time the number of water rights in the state has grown, and the creation of in-stream water rights has made the job more complex. As a result, many watermasters only have the time to respond to complaints and aren't able to proactively check to ensure that water rights users are staying within their right. Restoring the Department's capacity to protect and enforce water rights could potentially save substantial quantities of water. The actual amount is unknown since many diversions are still not measured.

Use it or lose it: Water conservation and water rights

Western water law is based on the "use it or lose it" principle. That is, if you don't use your water right it will be subject to forfeiture, notwithstanding certain exceptions such as lack of water availability. In Oregon you must irrigate land that has a water right at least once every five years to protect your water right. However, in 1997 the Oregon Legislature amended the forfeiture provisions to allow water rights holders to use less water and maintain their full water rights as long as they are "ready, willing and able" to make full use of the right. ORS 540.610 states that:

"If the owner of a perfected and developed water right uses less water to accomplish the beneficial use allowed by the right, the right is not subject to forfeiture so long as:

(a) The user has a facility capable of handling the entire rate and duty authorized under the right; and

(b) The user is otherwise ready, willing and able to make full use of the right."

There is great confusion among water rights holders and irrigation technical assistance providers about Oregon's laws regarding forfeiture. Many people we spoke with were not aware of the "ready, willing and able" clause, and believed you must use your full water right every five years or risk losing it. Others were uncertain what would be required to demonstrate a user is "ready, willing and able" to use their full right.

The Oregon Water Resources Department generally only enforces forfeiture when a complaint is made by someone filing an affidavit for cancellation of the unused water right, or if use of the right needs to be assessed when the user applies to make a change to their water right (i.e., a transfer or change in point of diversion). Typically, water rights are only partially reduced if a portion of the land has not been irrigated at all. However, the law does state that the water right may be subject to forfeiture if a facility is downsized to the point that it is not capable of handling the entire water right. This appears to be of concern for growers who implement highly efficient systems that are smaller than the ones they had before. It creates an incentive to make facilities large enough to handle the full water right, even if that much water is not needed. The law maintains a certain level of risk for water users that install systems designed to use less than their full water right.

The "use it or lose it" principle does provide an incentive to protect water instream. If a water user has not irrigated for five years, they may choose to lease their water instream. Because this is a beneficial use, leasing water instream protects their water right. That water is left instream, but the user maintains the right to use that water again at some point in the future.

There is a need for education about what the law does and does not say, and the Water Resources Department needs to develop a clear definition of what it means to be "ready, willing and able."

Recommendation:
Inform water rights holders that they aren't actually required to use their full water right. The Water Resources Department needs to develop a clear definition of what it means to be "ready, willing and able" to use your full water right, and educate water users about what the law does and does not say regarding forfeiture and the "use it or lose it" principle.

Local capacity, education and planning

Water conservation won't happen to the degree that it is needed unless we plan for it and build local capacity to provide technical assistance and practical outreach to irrigators and water providers.

Planning.

Water resources planning usually involves looking at past per capita or per acre water use data, and projecting that demand will increase in the future. But that assumption does not hold true when conservation reduces water use. We need to identify realistic conservation targets and develop programs to achieve them, especially in basins where instream and out of stream needs are not being met. Planning for water conservation must take place at the state level, at the basin or watershed scale, and within irrigation districts.

While the state requires municipalities to develop Water Management and Conservation Plans (WMCPs) as a condition of their water use permits or permit extensions, the plans are voluntary for agricultural water suppliers. A state-approved Agricultural WMCP enables districts to take advantage of statutory provisions that allow the transfer of water rights from one district user to another in order to prevent forfeiture of the rights due to non-use. Districts with ties to the U.S. Bureau of Reclamation (BOR) receive enhanced access to BOR conservation grants if they have an approved WMCP. While the state has received at least 130 municipal WMCPs, it has only received 32 agricultural WMCPs.[37] Only four of the agricultural WMCPs were submitted by districts that are not part of BOR projects.

Oregon Water Resources Department provides detailed guidance on what should be included in municipal and agricultural WMCPs. OEC spoke with managers of several irrigation districts that manage water from BOR projects and had submitted WMCPs. They all said the conservation planning process was very useful, helping them prioritize future projects and develop a plan to share limited resources in times of drought or other supply limitations.

Recommendation:
Require Agricultural Water Management and Conservation plans. Because this planning program has been effective for those agricultural water suppliers who have participated thus far, and to create greater equity with municipal water users, OEC recommends the state explore requiring agricultural WMCPs.

Such a requirement would need to be phased in over time, and just as the department recognizes that municipal water providers serving populations of 1,000 and under have limited resources and different needs than larger communities, exceptions to the requirement should be included for small agricultural water providers. Additional investigation is needed to determine where the cutoff should be drawn, since there is wide variability in the sophistication, financial resources, and current efficiencies of irrigation districts. One approach might be to focus on high priority basins, similarly to the approach OWRD is taking to implement measurement of significant diversions. State Water, Conservation and Reuse planning grant funds could help pay for plan development.

Recommendation:
Establish basin-scale conservation targets. A rejuvenated basin-level planning process should be a key component of the IWRS, with sideboards and guidelines from the state. Basin planning should include local water conservation targets linked to instream flow needs, and implementation plans that identify best management practices for agricultural water efficiency.

The basin planning process would include multiple water uses, not only agriculture, and would be driven by local stakeholders with sideboards, oversight and participation from the state. Periodic monitoring and reporting should inform assessment of progress and adaptive management of the plan over time.

Recommendation:
Conduct a Statewide Water Conservation Potential Assessment. (CPA). A statewide CPA would provide an estimate of how much water savings could be achieved under a range of conservation best practices adopted at a range of rates. The state could then choose a target to aim for. One of the recommendations from the OWSCI Statewide Water Needs Assessment was to conduct a statewide water conservation potential assessment. The work completed under the conservation inventory project is only a starting point for understanding the water conservation potential in Oregon.

Recommendation:
Farmer to Farmer Education. Growers tend to learn from their neighbors, so conservation practices spread from farmer to farmer within basins, but it is difficult for growers to learn about what people are doing in other parts of the state. OEC would like to explore the concept of partnering with trusted agricultural assistance providers to organize farm visits focused on water conservation, and to develop and disseminate case studies. While farm tour programs certainly exist, we are not aware of any focusing on water conservation practices.

Building local capacity.
Local organizations that have relationships with irrigators and experience navigating water conservation incentive programs are key to making more projects happen on the ground. There is a need to build the capacity of local organizations, such as Soil & Water Conservation Districts and watershed councils to work on agricultural water conservation and improving stream flows.

Recommendation:
Build local capacity. Provide training and targeted investment to increase the capacity of local organizations such as Soil & Water Conservation Districts and watershed councils to play a more active role in advancing water conservation and protecting water instream. While statewide organizations like the Freshwater Trust (formerly Oregon Water Trust) and the efforts of the OWRD are making progress, the largest number of applications to the state's Conserved Water and in-stream leasing and transfer programs are in basins where local nonprofit organizations like Deschutes River Conservancy and Klamath Basin Rangeland Trust have made water conservation and instream flow restoration a priority. Similar capacity needs to be established outside the Deschutes and Klamath basins.

Conclusion

These recommendations will help make water work for Oregon by strengthening our agricultural economy and protecting the stream flows that sustain our freshwater ecosystems and the fishing and recreational industries that depend on them. Water conservation is truly a win-win-win solution that policy makers should look to first. OEC plans to continue talking with growers and irrigators around the state as we further refine and implement these recommendations. This report is only the beginning of an ongoing effort to seek collaborative solutions for the challenges facing Oregon's most precious resource: water.

Appendix

Recommendations

We have identified several recommendations that will remove barriers and advance agricultural water conservation and efficiency in Oregon.

Photo: David Cosand ©

Appendix: Recommendations

Incentives

Coordinate energy and water conservation programs.
The energy used in pumping water can be significant, and energy savings is often a major motivator for irrigation efficiency. Energy Trust and similar Bonneville Power-funded incentive programs help irrigators save energy by saving water. OEC was surprised to find that many irrigation consultants who are experienced at helping growers apply for these energy-related incentive programs have never heard of the state's Allocation of Conserved Water program. They are unaware that irrigators who conserve water can spread a portion of that water to previously dry lands if they formally protect some of the conserved water instream. In some cases this benefit can be much more valuable than the financial incentives provided by the Energy Trust or by BPA-affiliated programs such as the "Save Water, Save Energy" program provided by Resource Conservation & Development Councils. In addition, the energy-driven programs do not ensure that any conserved water actually ends up in-stream. Irrigation consultants and equipment providers, including the trade ally contractors who work with Energy Trust on irrigation efficiency programs, should receive training in the Allocation of Conserved Water program so they can help growers apply to the program, just as they help growers complete applications for energy efficiency incentive programs.

Expand outreach about the Allocation of Conserved Water program.
In concert with the need to coordinate water and energy conservation programs, there is a need to increase awareness of the state's Allocation of Conserved Water program. The OWRD currently lacks capacity to conduct outreach about the program. It is no wonder that many irrigators and technical assistance providers are not aware of its existence. Applications to the program should be provided to irrigation equipment and technical assistance providers, so they can make them available to potential applicants. Information could be spread through the people and places farmers go to when they are updating their irrigation systems.

Photo: Teresa Huntsinger

Create a Conservation Clearinghouse.
Create a one-stop resource where irrigators and water providers can find information about water and energy conservation best practices and incentive programs offered by various agencies.

Expand the types of irrigation management changes that are eligible for the Allocation of Conserved Water program.
The Allocation of Conserved Water program currently is targeted toward physical improvements to irrigation systems, such as piping canals or converting to high efficiency sprinklers; it has not been used for changes in water management such as scientific irrigation scheduling or deficit irrigation. These types of management changes offer substantial opportunity for water savings, and they should be included in the Allocation of Conserved Water program. The program's existing measurement and reporting requirements would ensure that the water is permanently conserved. The staff who implement the program told us they would like to use the program for irrigation scheduling, but they thought that would require either some internal changes or administrative rule changes. Our review of the administrative rules governing the program (OAR 690-018) did not find any language that would preclude eligibility of irrigation scheduling projects. It defines conservation as "the reduction of the amount of water diverted to satisfy an existing beneficial use achieved either by improving the technology or method for diverting, transporting, applying or recovering the water or by implementing other approved conservation measures." As we interpret the definition, it allows OWRD staff to determine which conservation measures are approved. The needed change could likely take place within the agency.

Extend split-season leasing program and create a split-season transfer program.
We recommend continuation of the split-season water rights leasing program, which is scheduled to sunset in 2014, and creation of a permanent split-season transfer program. Split-season leasing has proven to be a useful tool (see the Klamath Basin Rangeland Trust case study, for example). It allows growers to receive financial compensation for leaving water in-stream for part of the year. The split-season leasing program should be continued, and a permanent split-season transfer option should be created so water rights holders who want to can seasonally protect water instream on an ongoing basis without having to re-apply every five years.

Split-season leasing has proven to be a useful tool. It allows growers to receive financial compensation for leaving water in-stream for part of the year.

Clearer Implementation of Existing Laws and Policies

Inform water rights holders that they aren't actually required to use their full water right.
The Water Resources Department needs to develop a clear definition of what it means to be "ready, willing and able" to use your full water right, and educate property owners about what the law does and does not say regarding forfeiture and the "use it or lose it" principle.

Restore water resources managment field staff
The irrigators and technical assistance providers OEC spoke with across the state consistently stated that people often use more water than they need to, and in some cases more water than their water rights allow. Over the last 30 years, the number assistant watermasters working in the field has declined. In 1981 there were 19 state-funded watermasters and 37 county-funded assistant watermasters. Today, there are 20 watermasters and 15 assistants, a 38% staffing reduction.[40] During that time the number of water rights in the state has grown, and the creation of in-stream water rights has made the job more complex. As a result, many watermasters only have the time to respond to complaints and aren't able to proactively check to ensure that water rights users are staying within their right.

Restoring the Department's field presence to protect and enforce water rights could potentially save substantial quantities of water. The actual amount is unknown since many diversions are still not measured. Better enforcement would create a more level playing field for growers that are staying within their water right, and increased technical assistance from watermasters would help irrigators use water more efficiently.

Implement and fund the Oregon Water Resources Commission's Measurement Strategy.
It is difficult to establish conservation targets and measure success without knowing how much water is currently being used. In 2000 the Oregon Water Resources Commission adopted a strategy that prioritizes the measurement of significant diversions in Priority Water Availability Basins. So far, less than half of those significant diversions have measurement devices installed. The OWRD needs to speed up implementation of this program, and it needs funding to assist water users with the costs of installing measurement devices.

Restoring the Department's field presence to protect and enforce water rights could potentially save substantial quantities of water.

Research

Conduct a hydrologic assessment of which streams can benefit most from the Allocation of Conserved Water program. OWRD and the Oregon Department of Fish & Wildlife have already identified stream reaches most in need of improved stream flows. What is needed now is an identification of which of those stream reaches are places where conservation practices are likely to directly benefit stream flows. In places where excess applied water already returns quickly to the stream, applications to the Allocation of Conserved Water program have been denied because the water conservation practices did not result in an increase in water left instream. Also, in some places water conservation can negatively impact groundwater recharge. This assessment could enable OWRD and partners to focus outreach and education in areas where water conservation is most likely to benefit stream flows, and where irrigators can successfully use the Allocation of Conserved Water program.

Conduct a Statewide Water Conservation Potential Assessment. One of the recommendations from the OWSCI Statewide Water Needs Assessment was to conduct a statewide water conservation potential assessment (CPA). The work completed under the conservation inventory project was only a starting point for understanding the water conservation potential in Oregon. A statewide CPA would provide an estimate of how much water savings could be achieved under a range of conservation best practices adopted at a range of rates. The state could then choose a target to aim for.

Update Oregon crop water use tables, using newer estimating methods and accounting for climate change's impacts on growing seasons and evapotranspiration rates. Extension agents in Washington state are currently updating their crop water use tables using a more accurate model, and finding that in most cases less water is needed than the older tables called for.

Photo:David Cosand

Planning

Establish basin-scale conservation targets. A rejuvenated basin-level planning process should be a key component of the IWRS, with sideboards and guidelines from the state. Basin planning should include local water conservation targets linked to instream flow needs, and implementation plans that identify best management practices for agricultural water efficiency. The basin planning process would include multiple water uses, not only agriculture, and would be driven by local stakeholders with participation and oversight from the state. Periodic monitoring and reporting should inform assessment of progress and adaptive management of the plan over time.

Require Agricultural Water Management & Conservation plans. Because this planning program has been effective for those agricultural water suppliers who have participated thus far, and to create greater equity with municipal water users, we recommend that the state explore requiring agricultural WMCPs. Such a requirement would need to be phased in over time, and just as the department recognizes that municipal water providers serving populations of 1,000 and under have limited resources and different needs than larger communities, exceptions to the requirement should be included for small agricultural water providers. Additional investigation is needed to determine where the cutoff should be drawn, since there is wide variability in the sophistication, financial resources, and current efficiencies of irrigation districts. One approach might be to focus on high priority basins, similarly to the approach OWRD is taking to implement measurement of significant diversions. State Water, Conservation and Reuse planning grant funds could help pay for plan development.

Education

Build local capacity.
Training and targeted investment could increase the capacity of local organizations such as Soil & Water Conservation Districts and watershed councils to play a more active role in advancing water conservation and protecting water instream. While statewide organizations like the Freshwater Trust (formerly Oregon Water Trust) and the efforts of the OWRD are making progress, you see the largest number of applications to the state's Conserved Water and in-stream leasing and transfer programs in basins where local nonprofit organizations like Deschutes River Conservancy and Klamath Basin Rangeland Trust have made water conservation and instream flow restoration a priority. Similar capacity needs to be established outside the Deshutes and Klamath basins.

Farmer to Farmer Education.
Growers tend to learn from their neighbors, so conservation practices spread from farmer to farmer within basins, but it is difficult for growers to learn about what people are doing in other parts of the state. OEC would like to explore the concept of partnering with trusted agricultural assistance providers to organize farm visits focused on water conservation, and to develop and disseminate case studies. While farm tour programs certainly exist, we are not aware of any focusing on water conservation practices.

Funding

Increase funding for water management and conservation. Budget cuts have reduced the number of assistant watermasters around the state, handicapping their ability to protect and enforce water rights. Lack of funding is also a barrier to implementing the state's measurement strategy. The primary federal funding sources for on-farm conservation projects (EQIP and AWEP) are targeted for budget reductions this year. Oregon's Business Energy Tax Credit, which irrigation districts use to finance the micro hydro projects that help make irrigation canal piping projects pencil out, is also experiencing significant reductions. Oregon's Water Reuse, Conservation and Storage Grant program is primarily funded by lottery-backed bonds. This funding comes and goes, depending on legislative approval in the biennial budget process. If Oregon is going to seriously address water conservation, we need a funding source to do it. Investing in conservation today can save the state money in the future by reducing water conflicts and shortages. Potential sources of funding include:

- **Water rights management fee.** OEC supports proposals to create an annual water rights managment fee to fund the water management services the state provides. Many water users recognize the need to fund these critical services and agree that a fee of $100 to $150 per year per user would not be an undue burden, but many surveyed distrust government and fear that the fee could quickly grow larger. To win support of the agricultural community, a water management fee proposal would need to be relatively small in amount per water user, its growth would need to be limited in statute, and there would need to be assurances that the funds would be used only for managing water resources (e.g., not swept away by the legislature for other purposes).
- **Public purpose charge.** This program would be similar to the source of funds for the Energy Trust of Oregon, but for water conservation. The public purpose charge would likely be levied on water utility rates, and it would fund municipal and industrial water conservation projects as well as agricultural projects. This idea would require much more exploration before implementation. Associating the program with the Energy Trust could enable greater coordination of water and energy saving programs. However, because the Energy Trust lacks expertise protecting water instream, funding should be provided via partner organizations that already have experience implementing instream water leases and Allocation of Conserved Water projects.
- **Water Efficiency Tax Credit.** Legislators have floated the idea of a state tax credit for water efficiency programs in the past, similar to the existing energy tax credit. This is an idea that OEC also believes has merit and deserves further exploration.

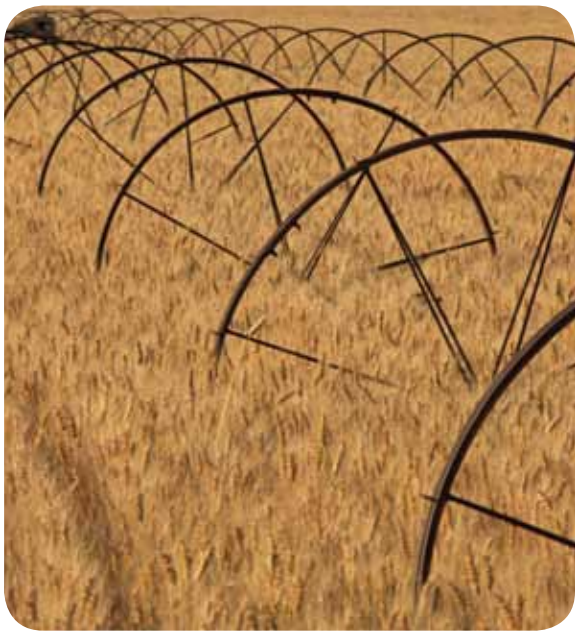


Photo: Ian Sane

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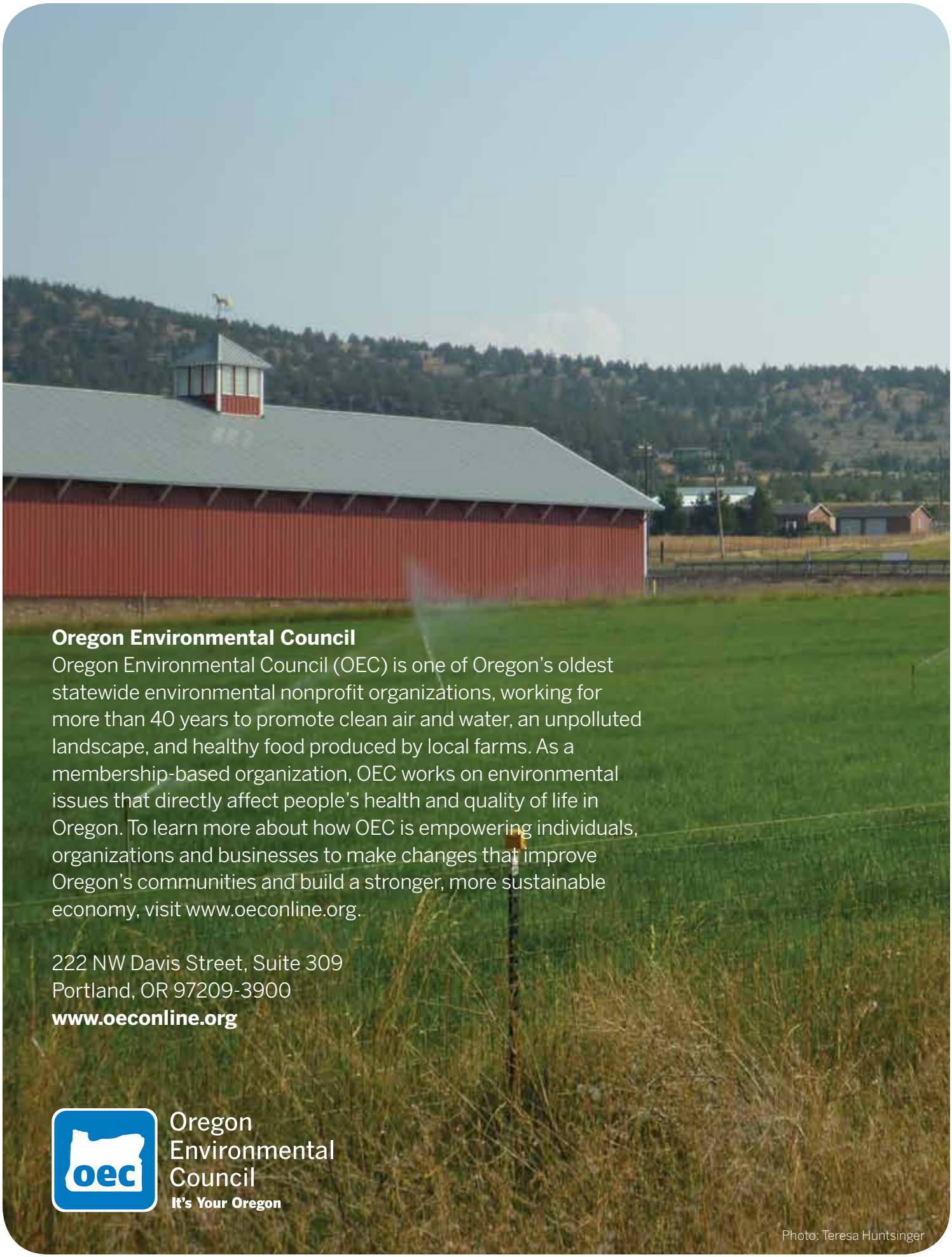

Oregon Environmental Council

Oregon Environmental Council (OEC) is one of Oregon's oldest statewide environmental nonprofit organizations, working for more than 40 years to promote clean air and water, an unpolluted landscape, and healthy food produced by local farms. As a membership-based organization, OEC works on environmental issues that directly affect people's health and quality of life in Oregon. To learn more about how OEC is empowering individuals, organizations and businesses to make changes that improve Oregon's communities and build a stronger, more sustainable economy, visit www.oeconline.org.

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