

A Guide To Saving Water

**For the small farm or backyard garden: From A Case Study At Woodvale Farm
University of Rhode Island W. Alton Jones Campus
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Water is a resource that many of us take for granted. When we use the toilet, turn on the faucet, or water our gardens, an unlimited flow of clean and cheap water is what we expect. Unfortunately, population growth, increased development, pollution, and agricultural use increasingly jeopardize the availability and affordability of this precious natural resource. The water conservation program at Woodvale Farm aims to educate the public about various methods homeowners, backyard gardeners, and farmers can use to minimize our effects and reliance on our water supply.

Table of Contents:

Introduction

I. Why Save Water?

II. Who Is Saving Water?

III. How To Implement a Water Conservation Program

a. Setting Goals

b. Assessing Resources

c. Creating a Plan

d. Water Source Options

e. Irrigation Options

f. Livestock Watering Options

IV. Evaluating results

V. Final Observations



Using a watershed vision to achieve sustainability in agriculture

Introduction:

For decades Woodvale Farm has faced an annual water shortage. Some years the crisis became so bad that the farm implemented a "no water usage" rule in the classroom and 2 staff houses that use the farm's well. The safety of the livestock was the top priority, so the gardens unfortunately went underwatered and consequently our yields were greatly reduced.

As an educational farm that is committed to a sustainable form of agriculture, it was felt necessary to protect our water supply and conserve it for the drier years, while simultaneously teaching children about water conservation. A grant was received from the Northeast Regions Sustainable Agriculture and Research and Education (SARE) program.

Located in the northwest corner of the Pawcatuck River Watershed, Woodvale Farm is also operated with an understanding of the connections between communities (human and non-human) that a watershed brings to a place. Students understand quite easily that what the farm does to its water will somehow affect the people, trees, fish, and other life forms further south in Exeter, Hopkinton, Richmond, Westerly, Stonington, and even further in the Atlantic Ocean. The water conservation program has consequently found an important place in the curriculum.

I. Why Save Water?

Less than 1/2 of 1% of all the earth's water is drinkable. The average American uses 1300 gallons of water each day, including population centers in arid regions such as the Southwest. Fortunately for us, the earth is not going to run out of water. In fact, the biosphere still has roughly the same amount of water it did when the dinosaurs roamed Rhode Island. However, the usable freshwater sources that the world relies on are increasingly under assault by the demands of agriculture, an increasing population, pollution, and development.

There are many benefits to saving water. If the satisfaction that your efforts are part of a larger effort to reduce the impact of our society, then these other benefits should be added bonuses to your conservation plan.

Economic benefits

For the 60,785 people who rely on public water within the Pawcatuck Watershed, the costs of having that water treated and delivered can be substantial. Reducing the amount of household water use can mean savings on water, sewage, and energy bills. If you are one of the 26,171 people in the watershed who have a private or well system, conserving water also saves money. The reduction in the use of your water pump will reduce costly repairs and the life of your septic system will be prolonged by reducing the amount of wastewater treated. Also, significant quantities of energy are used to pump, heat, and treat water used in your home. Reducing water use can save energy and reduce your monthly bill.

Time Savings

Reducing the amount of water that you use can also mean a reduction in hours spent watering the lawn or garden and repairing plumbing or irrigation systems. By consuming less, and installing easy to use water saving devices in your home and garden, several hours a week can be saved. See the related data in section IV.

Environmental Benefits

Conservation results in a reduction of wastewater entering sewage treatment plants. Often this means better treatment and cleaner waters being discharge to our rivers and bays. With septic systems, conserving water can prevent drainfield overloads and help assure that a septic system is treating wastewater properly.

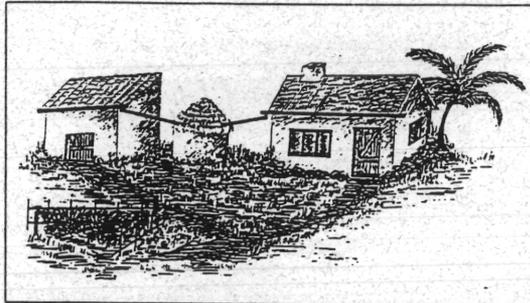
Increased productivity

By limiting the amount of water consumed, you are ensuring a steady supply of irrigation or livestock water for the warmer months, when drought can be a problem. Managing your water supply wisely, and with an eye towards conservation can also mean putting your water where it is most needed, and thus improving the performance of your operation.

II. Who is Saving Water?

Water conservation in the home or on the farm is not a new phenomena. In much of New England, water is abundant and readily available year round, but in many parts of the world, people living in arid regions have learned how to survive on very little water. The ingenuity of many African peoples, for example, has provided water conscious Westerners with models of water conservation.

North of Mogadishu, Somalia, in some of the driest rangelands of the area, there are large herds of camel, cattle, sheep, and goats. The secret lies in rainwater harvesting, through runoff control gullies that collect and divert water to a holding area, or water harvesting from rooftops. With erratic rainfall and annual flooding, these water collection systems have evolved over the centuries in response to a critical need. These techniques, and many others, have been applied to homes, farms, and entire communities that aim to save water for economic, philosophical, or practical reasons.



Water harvesting from roofs in Zimbabwe. Drawings: Amanda Mabbet

Currently, the demands of agriculture and urban development are taxing the nations water resources. Bitter feuds have developed in states such as California, where the water often must travel hundreds of miles via canal to the farms and cities of drier regions. Periodic droughts in the Southwest have been so severe that some cities have instituted various regulations in order to conserve their dwindling store of water. In Santa Barbara, Ca, homeowners seen washing their cars or watering their lawns were subject to fines, and water bills were increased dramatically in hopes that the higher cost of water would reduce usage.

Much of the water used in the United States goes to our food production system. The economic and environmental costs of irrigation are immense. The farmers who practice water conservation sometimes are acting less out of principle and more out of concern for the numerous costs of running a farm. While Rhode Island isn't a big agricultural state compared to Iowa or California, there is substantial acreage devoted to farming. (see Figure 1.1) Considering that some farms use tens of thousands of gallons of water each day to irrigate crops and raise livestock, you can imagine the strain that agriculture puts on an area's water resources.

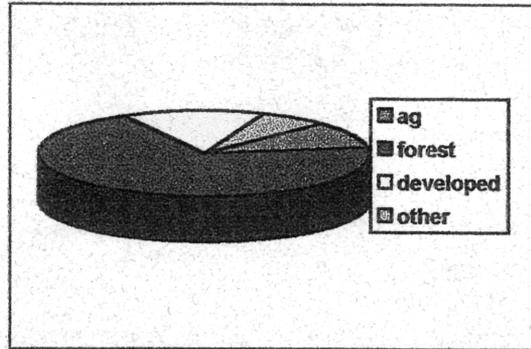


Figure 1.1: Chart of Land Use in the Pawcatuck Watershed (The Pawcatuck Watershed Project)

While you could find numerous farmers, gardeners, and homeowners who are practicing some form of water conservation, there still are millions whose water usage practices reflect the philosophy that the earth's resources are limitless, ours to use, and free of cost.

III. How to Implement a Water Saving Program

Your water system will vary depending upon the scale and purpose of your operation. Due to the unique mission of Woodvale Farm as a small educational working farm, the example of our water conservation program should be helpful to home gardeners, small scale growers, and anyone interested in the basics of installing a low-use water system.

Before rushing out to buy drip tape or a low flow shower nozzle, however, grab a pen and a piece of paper, and jot down your goals and available resources. This preliminary brainstorming will help you articulate your thoughts and plans, which will then determine how you design your system.

- **A. Setting Goals:** The following questions may help you get started, but remember that your situation is unique, and will require an assessment that should be tailored to your site and needs.
 - How intensive do you want your water system to be?
 - How much money are you willing to spend on a water system?
 - Do you want a dramatic reduction in water usage, or just to maximize the efficiency of your operation?
 - Are you raising livestock? If so, at what scale is your operation, and do you want it to grow?

B. Assessing Resources: One of the precepts of sustainable agriculture is one that is especially pertinent to water systems. Work with your surroundings instead of against them. Take a thorough inventory of your site with the following criteria in mind:

- annual rainfall
- slope, soil type and drainage
- existing water source and its status
- water needs of livestock and crops
- advantageous sites that may be of use (nearby creek, plentiful roof space, etc.)

With the character of the site in mind, you can then check your goals against your resources and see in what direction your water system plan must go. For example, if you are on public water and wish to increase your garden from 1/2 acre to 3 acres, then efforts should be directed at figuring out how to best increase the watered areas without incurring the costs associated with public water.

IV. Creating a plan: The Woodvale Farm System

Assuming that present levels of usage would continue, and that the scale of the operation would remain constant, the new water system was carefully designed with the farms resources and goals in mind.

First, we identified the main problems. For the livestock, hundreds of gallons of water were being wasted each week, resulting from water dishes becoming dirty and/or spilled. 17 or more 8-gallon dishes were daily dumped, cleaned, and then refilled.

In the gardens, the traditional methods of watering the plants were to hose spray each bed by hand, or to set up an overhead sprinkler system. Both systems are inefficient, but for different reasons. Watering each bed by hand could take an individual over an hour to sufficiently cover the gardens. Consequently, this meant that every day a staff member would be taken away from a project or the education program to water the gardens. Sprinklers save time, but waste a large amount of water due to evaporation and runoff.

Next, we explored the options for different elements of a water conservation system, including the water source, irrigation, and livestock watering.

D. Water Source Options

The source of your water supply is primarily dependent upon your location. With a little creativity, hard work and a small investment, however, you can change your water source to fit your needs.

1. Public water:

- advantages: reliable, treated, delivered, and convenient
- disadvantages: expensive, energy intensive to treat and deliver, subject to water shortages

2. Private Wells:

- advantages: can be cheaper than public water, reliable if well placed and dug
- disadvantages: can be expensive to install and operate, sometimes unreliable and/or seasonal

3. Rain water catchment

- advantages: utilizing pre-existing resource (rain and roof space), inexpensive to operate
- disadvantages: initial outlay can be expensive, requires large holding tanks, requires attention

4. Natural Sources (Lake, River, Creek)

- advantages: reliable (if spring fed or otherwise perennial), inexpensive
- disadvantage: requires filtration and transportation system

At Woodvale Farm, a combination of water sources were decided upon: a nearby lake, the roof of a house, and a well. At the nearby Eisenhower Lake, water is pumped into a 500 gallon holding tank, trucked 1/2 mile to our largest garden, and then hooked up to a drip irrigation system. At the head of the drip system is a filter to screen out algae and other material that could clog up the drip lines.

Knowing that a significant amount of water runs off the building roofs during a rain, we attached gutters to one side of a staff house. The runoff flows down the gutter into a two 55 gallon barrels, which are periodically hooked up to another drip irrigation system. Lastly, the well continues to supply water for the livestock, the farm's classroom, 2 staff houses, and periodic garden waterings via a drip system.

E. Irrigation options

The method you choose to irrigate your lawn, garden beds, or row crops largely depends on the scale of your operation. Efficiency and practicality are of utmost concern.

1. Overhead sprinkling (hand moved and solid set)

- advantages: adapts to any field size, shape and slope, can provide frost control, low labor, intermediate initial costs
- disadvantages: can be affected by wind, power requirements can be high, indiscriminate watering, can cause erosion, wets foliage which may cause disease

2. Drip/Trickle irrigation

- advantages: wets only root zone, doesn't wet foliage, low energy and labor required
- disadvantages: high initial costs, lines and emitters can clog, no frost protection,

Due to the shortage of water and previous high labor costs in the garden, a drip irrigation system was decided upon. While no cheaper than a sprinkler system, the financial savings come from reducing water use and labor. If designing the system yourself, it is best to make an initial sketch of your yard or farm and map out the drip system. Decide on the length of tubing and number of emitters needed. Decide how many planting zones you need to irrigate and decide if they will be manually or mechanically operated. With a plan in hand, either visit an irrigation supply company, or consult a detailed catalogue (see sources). One advantage to consulting a company is that you will be told exactly what you need and its cost.

F. Animal Watering options

Livestock require a reliable and clean source of water. Much more responsive to short periods without water than plants, it is crucial that a livestock watering system be well planned and fail-safe.

1. Natural source (Lake, Stream, Pond)

- advantages: inexpensive, can be reliable
- disadvantages: water pollution, bank erosion, seasonal variations (drought, frost)

2. Moveable containers (hose fed)

- advantages: reliable, easy to clean, allows rotation of pastures without concern for water source
- disadvantages: medium initial costs, requires maintenance, can freeze

3. Automatic Waterers

- advantages: reliable, frost free, easy to clean, cannot be spilled
- disadvantages: high initial cost, difficult to install

4. Re-fillable buckets

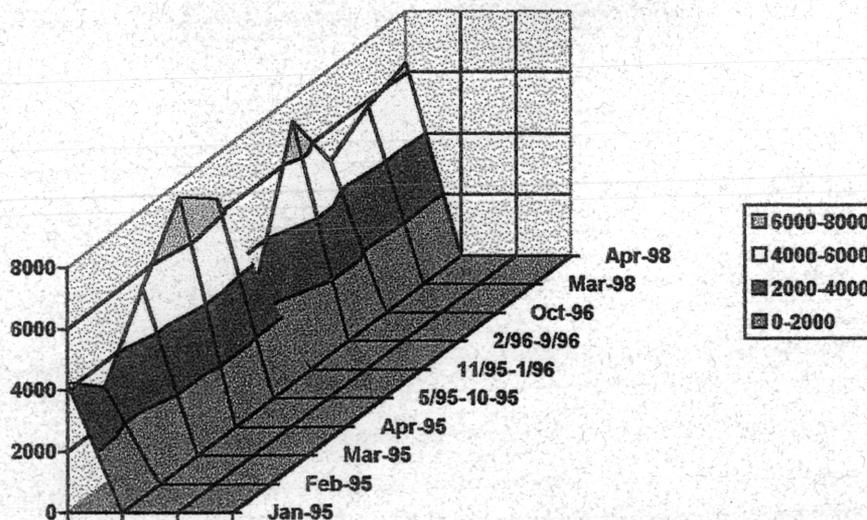
- advantages: easy to move, inexpensive
- disadvantages: can be spilled, requires time to clean and re-fill

In late 1996, 4 automatic waterers were installed at Woodvale Farm. The installation included digging trenches from the waterer sites to the main water pipes. Connecting pipe was then laid and buried, along with electrical wire that connects to the waterers. The system consists of heated sinks that maintain a consistent, low level of water that is drawn off the well.

V. Evaluating Results:

Evaluating the effectiveness of your water conservation program can be achieved by monitoring your water meter, observing the physical effects of the chosen strategies, and by checking your goal sheet against the results. Each of our goals have been met which has led to the overall improvement of the farms operation. The benefits of each element of our water system is seen on a daily basis, in the huge amounts of time and labor saved in watering the livestock and gardens, in the appearance of the livestock pens and the gardens, and finally, in the water conservation curriculum that is offered at the farm.

The following chart reports water usage on a monthly basis from January 1995 to May 1998. Some months are missing due to inconstant readings of the meter, but a general trend is noticeable. The seasonal fluctuations are due to the normal cycles of a farms water usage, but also because of the large amounts of summer visitors who use the farm facilities.



Thousands of gallons used per month from 1/95 to 4/98

While our statistics concerning water consumption do not definitively indicate a substantial savings, the benefits in time saved are incontestable. The following data records the hours spent each week watering the gardens and livestock before and after implementing the water conservation system.

1995 Growing Season : approximately 25 hours a week; no water saving methods

1997 Growing Season: approximately 15 hours a week; automatic waterers installed

1998 Growing Season : approximately 2 hours a week; drip irrigation systems installed

At an average \$7.00/hour rate for labor, this represents an annual savings of \$4844.00.

VI. Final Observations:

Being an educational farm presents unique challenges to resource management. Not having the overriding pressure to produce a crop or sell livestock to maintain the farm's operation has allowed Woodvale Farm to invest in a water system that is efficient, highly visible, and somewhat expensive. The water systems of other farms illustrate the variety of needs and solutions that different farms have.

For example, at Casey Farm in Saunderson RI, Mike and Polly Hutchison use a combination of methods that are mentioned in this booklet. The farm's water sources are deeply dug wells that supply the farm and its household throughout the year. Water is pumped from the well to a series of hoses that lead to an overhead sprinkler, which is on 24 hours a day in the drier months. A small field of strawberries is irrigated with a drip system, and has proven successful, but is deemed impractical in other row crops due to the difficulty in cultivating among the drip tape. The berry plants are heavily mulched to control weeds.

The design that you ultimately choose to irrigate your crops and water your animals will most probably be dictated by the size of your operation, and the available resources. Working within the limits of scale and resources is a first step to running a farm or garden in a sustainable manner.

VII. Resources

For more information about the water conservation methods mentioned in this booklet, feel free to contact:

- Woodvale Farm, W. Alton Jones Campus, 401 Victory Highway, West Greenwich, RI 02817 (401) 397-3304 ext.6055

For information about the water conservation methods mentioned in this booklet, refer to the following sources:

- Gardener's Supply Co: Drip Irrigation - 1-800-863-1700
- Peaceful Valley Farm Supply: Drip Irrigation - (916) 272-4769
- Nasco: Automatic Livestock Waterers - 1-800-558-9595
- Appropriate Technology Transfer for Rural Areas: information on design - 1-800-346-9140

Thanks to Alyson McCann and Arthur J. Gold for permission to use information from their fact Sheet No. 91-1. The Pawcatuck Watershed Project

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