



*Responsible Water Use
in the Garden*

A SYMPOSIUM AT WINTERTHUR, AN AMERICAN COUNTRY ESTATE

Saturday
March 29, 2003



CO-HOSTED BY THE LONGWOOD GRADUATE PROGRAM
AND WINTERTHUR GARDEN DIVISION

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Introduction

As we emerge from a winter that provided us near record precipitation in the form of snow, and as we sit in Winterthur's comfortable auditorium, last summer's drought is somewhat fuzzy in our mind. However, we must not become complacent thinking the shortage of water will not return. Rather we must realize it is only a matter of time before the lack of quality water changes the way we live on a permanent basis.

Delaware Valley residents have been relatively fortunate compared to people in western regions of the United States and other parts of the world. We have been able to go about our daily lives, bathing, cooking, washing cars, filling swimming pools, and irrigating lawns without much fear of the well going dry. But, I believe that Gerald Kauffman is cautioning us when he wonders "whether there is enough water to fulfill domestic and business purposes and yet sustain vision of the mowed, clipped, and fertilized American lawn". Mr. Kaufmann continues, "Globally, the United Nations has stated that water will be the "blue gold" of the 21st century".

The future with abundant water does not appear certain. I am encouraged by the presence of each of you here today that by hearing the messages about water budgets, Xeriscapes, designs, cultural techniques and drought tolerant plants from our speakers, you will be better prepared to help yourself and your friends understand this critical global concern. I hope that you will leave today with at least one new idea about conserving water. I challenge each of you to pass the word about "responsible water use in the garden" as you go about your gardening life.

James E. Swasey
Coordinator
Longwood Graduate Program

The Longwood Graduate Program



The Longwood Graduate Program offers students the opportunity to train for leadership careers in public horticulture. This two-year fellowship program combines thesis research with classroom training at the University of Delaware in Newark, Delaware with practical experience at Longwood Gardens in Kennett Square, Pennsylvania. Graduates receive the Master of Science degree in Public Horticulture and seek employment at arboreta, botanic gardens, and other horticultural institutions across North America.

For more information on The Longwood Graduate Program, call The Program's office at (302)831-2517. You are encouraged to visit our website at: www.udel.edu/LongwoodGrad

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Acknowledgements

The Longwood Graduate Program and the 2003 Symposium Committee thank the following organizations for their generous support:

Delaware Cooperative Extension

Delaware Nature Society

Delaware Water Resource Agency

Longwood Gardens

The University of Delaware

University of Delaware Visiting Women Scholars Award Program

Winterthur Garden Division

Stroud Water Research Center

Pennsylvania Cooperative Extension

Pennock Wholesale Florist Company

Speaker Biographies

Gerald Kauffman is the Delaware State Water Coordinator with the Water Resources Agency at the University of Delaware. He provides technical and policy assistance to governments in Delaware and the Delaware Valley. Gerald teaches courses in Watershed Management and Water Resource Engineering at the University of Delaware.

Jim Knopf is a Landscape Architect in Boulder, Colorado and an expert on the principles of xeriscaping. He authored *The Xeriscape Flower Garden* and *Waterwise Landscaping with Trees Shrubs and Vines*. Jim works with city water departments, universities, and environmental groups to promote water-wise gardening in the community.

Mike McGrath is host of the nationally syndicated Public Radio show "You Bet Your Garden," Editor-in-Chief of the Northeast/Mid-Atlantic edition of *People, Places & Plants* magazine, and garden columnist for the *Philadelphia Daily News*. He was also Editor-in-Chief of *Organic Gardening* magazine for seven years. Mike's newest book is *You Bet Your Tomatoes!* published by Rodale 2002.

Jim Sellmer is a Woody Ornamental Horticultural Extension Specialist at the Pennsylvania State University. He works with landscape and nursery industry professionals and County Extension Agents in the areas of development, propagation, cultural management, and evaluation of ornamental trees and shrubs suited to the diverse climates and environments of Pennsylvania.

Laurence Budd grew up in the Rocky Mountain region and began landscaping in Colorado in the 1970's. He contributes Xeriscape and irrigation articles to *Colorado Green Magazine* and teaches homeowners and contractors about drip irrigation. Laurence served in the Philippines with the US Peace Corps.

David Culp, Past President of the Hardy Plant Society, is a Mid-Atlantic Sales Representative for Sunny Border Nurseries, Kensington, Connecticut. His garden has been featured on the *Home & Garden Television Network*. He also teaches courses at Longwood Gardens and contributes articles to a variety of horticultural magazines.

Lolly Tai is Chair of the Department of Landscape Architecture and Horticulture at Temple University at Ambler. She received the MLA degree from Harvard University and PhD from Heriot-Watt University/Edinburgh College of Art in Scotland. She has authored two books, over 40 articles, and received many professional awards in sustainable design.

Water as the Blue Gold for the 21st Century

Presented by Gerald Kauffman, Delaware State Water Coordinator, Water Resource Agency, University of Delaware, Newark DE

Globally, the United Nations has stated that water will be the "blue gold" of the 21st century. In the watersheds of the Mid-Atlantic, drinking water is arguably our most precious natural resource. The multiyear droughts of 1995, 1999, and 2002 have emphasized the fragile nature of the water resource. We reflect on the drought and wonder whether there is enough water to fulfill domestic and business purposes and yet sustain visions of the mowed, clipped, and fertilized American lawn. Today we look at the hydrologic and economic price of water, address the "hydro-politics" concerning water supply in the Delaware River Basin, and how it affects our daily lives in the garden.

The humid continental climate in the Delaware Valley sustains some of the most productive public gardens in the world. Accordingly, it is appropriate that we are assembled this morning to discuss water at the Longwood Graduate Program Symposium on the Winterthur grounds amidst the beautiful Wyeth country in the Brandywine Creek Watershed.

Did you ever glance at the underside of a sugar maple leaf? Or gaze through the bare branches of *Acer saccharum* toward the winter sun? If you think about it there is a natural connection between the structure of a plant and a river system. The veins on a leaf or the twigs in a tree closely resemble the morphology of a watershed such as the White Clay Creek. The Brandywine Creek has a west branch and east branch. The hydro-botanical connection is proof of a natural system at work.

Today you will hear about ways to employ responsible water use in the garden. You will hear about information on water-wise gardening, from selecting beautiful plants and proper garden design to easy maintenance techniques and tips for conserving water. Outdoor water use is the single largest component of our domestic water budget, thus the potential water savings are high. Simple techniques such as cultivating native plants instead of Kentucky Bluegrass go a long way toward linking the natural landscape with the watershed

The plants at Longwood, Winterthur or your garden need at least three things for growth. One is from out of this world - sunlight, and the others come from the earth - soil and water. Our location at 40 degrees north provides the latitude for plentiful sunlight and about a 200-day growing season. Alluvial and geophysical erosion has created loamy Chester soils, which sustain these gardens. Water, drawn in by atmospheric currents from the ocean to moisten our humid continental climate, normally pours down in plentiful quantities of 43 inches per year in these parts.

Water, or the lack of it, was front-page news during the drought of 2002. Indicators of streamflow and precipitation recognize the drought of 2002 as the drought of record in northern Delaware. In August 2002, streamflow along the Brandywine Creek at Chadds Ford reached 21 million gallons per day (mgd), its lowest level since records began in 1911, eclipsing the record of 33 mgd set in 1995. At New Castle County Airport, precipitation between October, 2001 and September, 2002 reached 28 inches, the lowest recorded during this interval since 1894. Hydrologic statistics indicate this was the 100-year drought.

The drought raises many questions regarding the availability of water. Let us look at this question using the water budget process.

Water Budget

Hydrologists study the availability of water using the water budget:

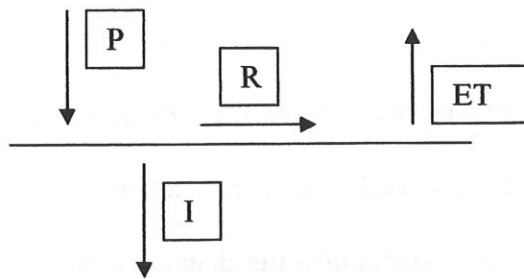
$$P = R + I + ET$$

Where: P = Annual Precipitation (in.)

R = Runoff to streams (in.)

I = Infiltration to groundwater (in.)

ET = Evapotranspiration by evaporation and transpiration by plants (in.)



In a normal year in the Brandywine Creek Watershed with precipitation of 43 inches the water budget would look like this:

$$P = 43 \text{ in.}$$

$$R = 7 \text{ in.}$$

$$I = 14 \text{ in.}$$

$$ET = 21 \text{ in.}$$

The amount normally available for water supply from runoff and infiltration would be 21 inches (50%) and the amount of water used for ET for plants is 21 inches (50%).

In a drought year with precipitation of 28 inches, the amount of water for ET for plants remains constant at 21 inches leaving less water available for the water supply (7 inches).

$$P = 28 \text{ in.}$$

$$R = 3 \text{ in.}$$

$$I = 4 \text{ in.}$$

$$ET = 21 \text{ in.}$$

The water budget illustrates that as water becomes scarce during drought there is more competition between ground and surface water supplies and the evaporation and transpiration needs of plants. One of the ways to balance the water budget during drought is to reduce irrigation and ET needs by using water-friendly or drought tolerant native plants.

In the watersheds of northern New Castle County the normal water demand is 60 mgd with peak demands reaching 90 mgd, a 1.5 peaking factor. The difference between normal and peak water demand is almost entirely due to outdoor water use, watering for plants and lawns. We measured the fluctuation during the drought of 2002 when water demands declined by 26% from 82 mgd on the day before Delaware Governor Minner set mandatory water restrictions on August 2 to 65 mgd a few weeks later. The decline was due to a ban on outdoor water use, the single largest component of water demand during the summer.

At the domestic level, our personal water use fluctuates between 100 to 150 gallons per day. We need about 8 gallons per day to live. There many opportunities to save water at home. A resident typically has the following daily water needs:

Inside

Sustenance	8 gallons
Showers	50 gallons every 10 minutes
Laundry	40 gallons per load
Toilets	5 gallons per flush
Handwash Dishes	12 gallons per wash

Outside

Lawns, Gardens	600 gallons over 2 hours
Carwash	100 gallons with a hose
Wash Sidewalks	50 gallons in 10 minutes

The single largest water user from our domestic water budget is outdoor watering of lawns and gardens. Some of the largest opportunities for water savings lie in cultivating water-friendly plants that do not need frequent irrigation and are drought resistant.

Economic Budget

Another factor that affects water use is the cost. Drinking water is inexpensive. The price of tap water is several orders of magnitude less than other common fluids, yet one could argue that H₂O is the most precious on the list.

Compare the cost of water to other essential fluids:

<u>Fluid</u>	<u>\$/gal.</u>
Tap Water	0.002 - 0.005
Gasoline	1.59
Ginger Ale	2.60
Milk	3.00
Bottled Water	4.00
Beer	10.60

The annual cost of water is often less than the price of cable television. Residents in Delaware pay anywhere from \$80 to \$300 per year for 60,000 gallons of drinking water.

<u>Utility</u>	<u>Annual Cost</u>
Rehoboth (winter)	\$ 80
Wilmington	\$ 100
Lewes	\$ 100
Dover	\$ 116
Newark	\$ 180
New Castle City	\$ 200
Artesian Water Co.	\$ 280
United Water DE	\$ 290

Since water is so inexpensive, there is a greater propensity to waste it.

Economists argue that based on the laws of supply and demand the cost of water should be increased to induce water conservation. The more water costs, the more people will

conserve according to the theory. Several water companies such as Artesian Water, Newark, and New Castle City have adopted water conservation rates that increase the unit price of water with the quantity of water consumed. An ideal way to save water and money is to use native plants that have low water needs.

Hydropolitics

One of the issues regarding reliable water delivery is hydropolitics. Delaware shares its aquifers and streams with two watersheds (the Chesapeake Bay and Delaware River Basins), four states (Maryland, New Jersey, New York, and Pennsylvania), and more than 20 water purveyors ranging from municipal systems in Wilmington, Dover, and Lewes to the investor-owned Artesian Water Company, Tidewater Utilities, and United Water Delaware.

Political difficulties surface because the boundaries of the watersheds do not match political and water utility boundaries. This Balkanization of political jurisdictions and supply franchises makes the public policy of water management complex.

In a water coordinator's dream, Mason and Dixon would have surveyed the westerly boundary of Delaware along the meandering ridge between the Chesapeake and Delaware watersheds instead of the straight north-south line. Water supply franchises would have been granted based on topographical and aquifer drainage divides. Then the political boundaries of Delaware would have followed the watershed lines and water supply management would have been more efficient.

An example of inefficiency occurred during the early stages of this recent drought (2002) when the Delaware River Basin Commission declared a drought emergency and the four states had different responses, ranging from an emergency to a warning, or no

advisory at all. Later, principles of watershed management were employed to ensure comity among state drought declarations.

Water conflicts in Delaware can surface because watersheds and aquifers do not coincide with utility boundaries and the purveyors have differing economic agendas. Not-for-profit municipal purveyors serve democratically elected councils and deliver water to customers for \$70 to \$180 per year. For-profit investor owned purveyors serve at the pleasure of a corporate board and deliver water for \$300 annually.

In northern New Castle County, it is important that the water purveyors cooperate and put aside their individual profit motives because they are tied together in an interconnected system where companies share each other's water. For instance, during the drought, Artesian Water Co., a ground water utility, bought water through interconnections from Wilmington, a stream fed utility. For this reason, drought warnings were issued to the entire interconnected system, not just one area.

Recognizing the policy complexities inherent in managing the water supply in northern Delaware, the Governor and General Assembly unanimously passed a law after the drought of 1999 appointing a State Water Coordinator and Water Supply Coordinating Council. The council serves as a structure to work within a common goal to build 1 billion gallons in reserve storage in northern New Castle County by the end of 2003.

How do we meet the demands of the drought? By counting on reserve water storage and conserving water. Delaware's largest and only reserve water storage facility is Wilmington's nearby Hoopes Reservoir, at 1.8 billion useable gallons. In October 1929, just before the stock market crash that led to the Great Depression, city fathers let

six contracts for the reservoir. Contractors completed work on the Col. Edgar M. Hoopes Reservoir on June 4, 1932 for \$ 3 million (\$33 million in 2002 dollars).

The reservoir work cleared 480 acres of land, making this one of the largest public works projects in Delaware history. Today, Hoopes Reservoir provides more than two to three months reserve storage to meet peak demands during the worst drought of record.

The water purveyors on the Delaware Water Supply Coordinating Council have made many improvements since the droughts of 1995 and 1999. United Water Delaware installed the inflatable Tidal Capture Structure along the White Clay Creek at Stanton, which stored 700 million gallons during the drought of 1999.

On the Council's A list, Newark has let construction bids to build the 320 million gallon Newark Reservoir and the 60 million gallon South Wellfield water treatment plant by 2003. Wilmington has made available 500 million gallons of water from the top wedge of Hoopes Reservoir for surrounding water purveyors who elect to pay for a stake in the water. Artesian Water Company has pumped 100 mg of water into new Aquifer Storage and Recovery wells and is drilling new wells which will provide 120 mg during a 60-day drought. Wilmington and United Water Delaware are preparing plans to raise the elevation of Hoopes Reservoir to create an additional 375 million gallons of storage.

The difficulties during drought lie in the relationship between the governments and water utilities on the Delaware Water Supply Coordinating Council. If the actors in the hydropolitical world continue to cooperate across political and franchise boundaries, then safe and plentiful water will be delivered to residents and businesses, even during a drought of record.

On the demand side, the public has ample opportunities to economize and conserve water:

- Learn about techniques to plant drought tolerant plants such as blueberry or winterberry holly or eggplant. We call these techniques smartyards.
- Save more than 300 gallons by watering the lawn in the morning instead of during the heat of day. Save more than 600 gallons over a few hours by not watering your lawn at all and let the lawn go dormant over the summer.
- Install rainbarrels as a rediscovered water conservation technique. A barrel stores 55 gallons of water, which can be used to sprinkle the garden and save tap water. In contrast to tap water, soft rainwater in barrel is more forgiving to plants because it is at air temperature and retains beneficial minerals.

Conclusion

In closing, I share the thoughts of Dr. McKay Jenkins, keynote speaker at Drinking Water 2001, a public policy forum organized by the University of Delaware in October 2001:

"... What I would like to do today is try and expand our notion of the importance of watersheds to talk about borders and flow in a larger context. Ecologists and drinking water experts have long acknowledged the silliness -- not to say utterly counterproductive, and potentially destabilizing -- notion of political boundaries when it comes to the flow and distribution of water. What does a county line mean to an aquifer? What does a state line mean to a raincloud? What does a national border mean to a river? ... The point I want to make here is that any effort to reject the permeability and flow of boundaries, be they natural or psychological, runs against the natural way of things.

Water wants to flow -- it's in the nature of water. People want to flow -- it's in the nature of people. ... Finally, at least in some places in the country, we are beginning to think in terms not of boundaries, but in terms of watersheds, and flow."

We can get back to the nature of water by using native plants that blend in harmony with our watershed - natural techniques of responsible water use in the garden.

Quod natura non sunt turpia. What is natural cannot be bad.

Notes: