

# Land Air & Water



Kentucky Energy and Environment Cabinet

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# Land Air & Water

since 1988

Commonwealth of Kentucky  
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## From the Secretary's Desk

As I am preparing this message, the 2015 session of the Kentucky General Assembly is wrapping up. The Energy and Environment Cabinet did not have a large legislative agenda this year—at least not in terms of the number of agency bills. We did, however, have a significant legislative agenda, and a successful one, too, in that we saw the passage of an important bill that modernizes the state's oil and gas statutes. The legislation, which has been signed by Governor Beshear and which had unanimous bipartisan support in both chambers, was the product of a multi-stakeholder workgroup the cabinet convened last year. Rep. Rocky Adkins initially sponsored the legislation as House Bill 386 and the bill that passed—Senate Bill 186—was sponsored by Sen. Julian Carroll. I want to thank both Rep. Adkins and Sen. Carroll and all the members of the legislature for their support and leadership.

I cannot stress enough the importance of this legislation. Most of Kentucky's oil and gas statutes are 30 years old, and they were not equipped to address 21st century production techniques, including hydraulic fracturing at deep well depths. With oil and gas production on the rise—a good thing for the state's economy—we needed appropriate rules that will allow the industry to grow while ensuring protection of human health and the environment. These goals do not exclude one another, and that is why the workgroup of stakeholders who represented oil and gas industry interests, the environmental community and landowners, was so successful.

The main elements of the legislation include:

- Public disclosure of high-volume hydraulic fracturing fluids and additives via Frac-Focus
- Prior public notice of high-volume hydraulic fracturing treatments
- Reclamation of all oil and gas sites
- Creation of the Kentucky Abandoned Storage Tank Reclamation Fund
- Statutory authority for permitting and creating drilling units for horizontal deep wells

This legislation is not the end of our goals to update Kentucky's oil and gas statutes, but it is a very important step. Kentucky's production might not mirror the level of production occurring in some states, but we do have a strong resource base. Our ability to make use of these resources in as environmentally sensitive manner as possible is our priority.

I mentioned the bill had unanimous, bipartisan support, but there were citizens who were concerned about deep well hydraulic fracturing—an activity that is occurring in about 15 states and an activity that is the cornerstone of the growth in natural gas production in the U.S. It's important moving forward that we try to address some of the citizen concerns over deep well hydraulic fracturing. All energy sources, including renewables, have a footprint. It's our mission to minimize those impacts. The unprecedented growth in natural gas development is also a cornerstone of the federal government's greenhouse gas policies. The U.S. Environmental Protection Agency has shown its preference for natural gas for new baseload electricity generation, so it is imperative that we as a nation utilize our shale gas resources effectively.

Visit Land, Air & Water online at  
<http://eec.ky.gov/Pages/LandAirWater.aspx>

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Celandine poppy (*Stylophorum diphyllum*) photographed at Brigadoon State Nature Preserve by Harold Kelley. Read about Brigadoon State Nature Preserve in Barren County on Page 6.



**14 Discover Kentenia**  
Kentucky's first state forest in Harlan County offers endless opportunities for recreation and learning.

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## Monarchs take flight in Oldham County

Conservation district works with local farmers, students to increase monarch populations

By Kimberly Bartley  
Division of Conservation

Shauna Buchert has her car loaded down with everything from caterpillars, books and posters, and the occasional chrysalis, as she heads out to several Oldham County elementary schools. She, as the program coordinator of the Oldham County Conservation District, is working to educate both young and old about the importance and plight of the monarch butterfly.

In 2004, a local farmer brought Buchert a chrysalis. Once she witnessed this miracle of life first hand, she was hooked. Over the winter she researched the monarch, gathering as much information as possible about its lifecycle, metamorphosis and migration. She then started compiling resources for teachers to use in conjunction with a unit of study. Finally, she contacted the schools to find out if they, like her, would be interested in teaching their students about the lifecycle of the monarch. With more than 100 classrooms participating each year, the response has been an overwhelming success.

Monarchs play an integral part in pollination of crops as they travel from flower to flower during their short lifespan. They truly are a miracle, as Buchert explains, showing the many stages of the monarch to thousands of students each year. When a new butterfly is released by a classroom, the response is gratifying.

“No matter how many times you see the process it continues to amaze you—it truly is a miracle. Each summer we look

forward to their return,” said Buchert.

She and her husband have been a part of the push to document monarch presence and their numbers for 10 years. It starts in February and March as the butterflies overwinter in Mexico. They find a mate and begin the migration northward, laying their eggs along the way.

Buchert starts looking for evidence of monarch activity beginning in late June or early July. She walks in the fields and locates milkweed plants—the host plant of the monarch. The butterfly will only lay her eggs on the leaves of milkweed, the sole food source for the monarch while in the larval stage. Milkweed are found anywhere from pastures to roadsides and produces a sticky white substance, thus its name.

Local farmers, at Buchert’s urging, have begun to mow around their milkweed patches, rotate their grazing cattle away from the host plant, and have delayed haying to aid in providing necessary eggs for the monarch program. Once the eggs are collected, they hatch within four days. The emerging caterpillar begins its lifecycle by eating its own egg sack. It will eat, grow rapidly, and form a chrysalis, transforming in approximately 10 days as a beautiful monarch butterfly.

This first-generation monarch will feed on nectar from flowers, mate and then begin the process anew as the female

*Continued on Page 16*



**TOP LEFT and RIGHT:** Shauna Buchert speaks to an Oldham County class about the lifecycle of the monarch. Monarch eggs are prepared by the students for viewing. **ABOVE:** A monarch is released. Photos courtesy of Shauna Buchert

# Energy-efficient upgrades help lower energy costs

*HowSmartKY program offers retrofit services to everyone*



*The HowSmartKY program, along with rebates and incentives from Jackson Energy, helped Cassie Hudson pay for energy efficiency upgrades to her Owsley County home. The upgrades have lowered her energy costs and made her home more comfortable. Photo courtesy of Karen Combs, Jackson Energy Cooperative*

**By Eileen Hardy**  
**Department for Energy Development and Independence**

Last summer, Cassie Hudson turned to Jackson Energy Cooperative, the utility company that delivers power to her community, for help with the energy problems of her 25-year old Owsley County home. She knew energy efficiency upgrades would save her money in the long run, but as most home improvement projects require cash up front, affordability was a factor.

“If it was really hot outside, say 90 degrees, you could set the thermostat on 72 and it would only get down to 80,” Hudson says. “The HVAC ran more than it should. I knew it was too small to handle the addition that was built on the home and insulation levels weren’t where they needed to be.”

With assistance from Jackson Energy and an innovative financing program called HowSmartKY, Hudson was

able to install a new heat pump, add insulation and replace leaky ductwork. Now her home is more comfortable and her utility bills are lower than the pre-renovated rate.

“By offering retrofit services on the electric bill, utilities can provide energy efficiency for everyone,” said Karen Combs, public relations director for Jackson Energy, one of the four rural electric cooperative corporations (RECCs) participating in HowSmartKY.

“So far, we’ve had 70 members participate in the program. It’s a great way for families to finance energy efficiency upgrades and it makes a real difference on their utility bills. Not having to come up with the several thousand dollars all at once is wonderful, too.”

Residential energy ef-

iciency improvements play an important role in helping electric utilities in Kentucky reduce energy consumption, energy supply requirements, and individual consumer costs. Studies have shown that Kentuckians use 24 percent more electricity at home than the national average, largely due to energy efficiency issues related to their homes, such as not enough insulation and inefficient heat pumps.

*“So far, we’ve had 70 members participate in the program. It’s a great way for families to finance energy efficiency upgrades and it makes a real difference on their utility bills.”*

Karen Combs  
Jackson Energy Cooperative

HowSmartKY provides on-bill financing for energy-efficiency improvements to homeowners served by participating RECCs in eastern Kentucky. Developed through a partnership between the Kentucky Department for Energy Development and Independence (DEDI) and the Mountain Association for Community Economic Development (MACED), HowSmartKY is

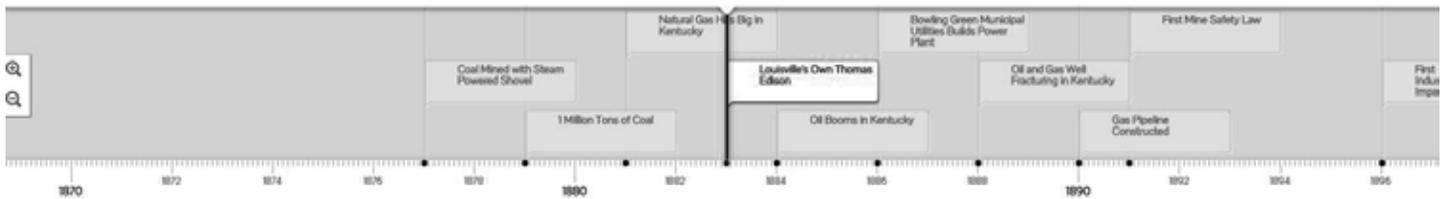
funded by a \$300,000 two-and-a-half-year grant from the Kentucky Energy and Environment Cabinet. DEDI has helped support program start-up and subsidize home improvement projects. MACED is matching the grant award with \$320,000 from other sources.

MACED introduced HowSmartKY as a pilot project in 2011 through a collaborative effort with East Kentucky Power. The program has since been made permanent by the Kentucky Public Service Commission (PSC), which allows utilities to provide retrofits as part of their electric services. In addition to Jackson Energy, Fleming-Mason, Grayson and Big Sandy RECCs have transitioned from pilot programs to permanent tariff programs approved by the PSC. Licking Valley and Farmers RECCs are in the process of seeking PSC approval with other electric cooperatives also expressing interest. The long-term goals of the program are to achieve a net reduction in monthly utility bills and help the utilities shave peak energy demand.

## Here’s How it Works

The cooperatives provide energy assessments for their members to identify the best possible energy-saving options, such as insulation,

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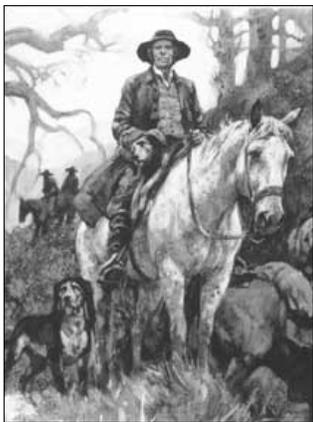


# Kentucky's energy journey

By Kenya Stump  
Department for Energy Development and Independence

When you ask most Kentuckians about energy in Kentucky, the most cited word is “coal.” It’s not surprising; we have songs written about it and museums dedicated to it. Coal is one of the best-known mineral resources that we have, and rightly so. For many years, it has provided Kentuckians with economic stability and helped attract many businesses to the state due to its ability to provide low electricity prices. Recently, however, it has faced strong competition from other resources, resulting in a state of energy transition.

In order to get a clearer picture of the history of energy in Kentucky, let’s take a



**1750**

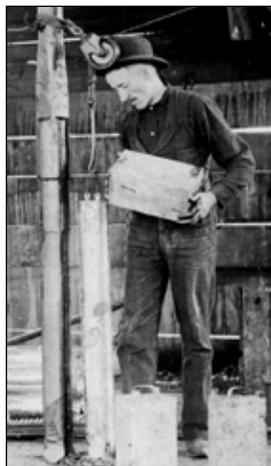
look at a timeline that takes us from the very first days of discovery and use of coal by Dr. Thomas Walker in 1750 to today’s present energy resources.

Following Dr. Walker’s discovery of coal during his trek through what is now southeastern Kentucky, the first commercial coal production didn’t occur until 1790 in Lee County. All this took place prior to Kentucky becoming a state in 1792. But, coal wasn’t the only natural resource being discovered. In 1829, it is suggested that Kentucky Great American Oil Well in Burkesville was one of the earliest commercial oil wells in the United States. Petroleum from that well was bottled and sold for medicinal purposes. In 1858 the first commercial use of shale

gas took place in Meade County, Ky.

**1879**

Nearly 20 years after the start of the Civil War, coal reached a production milestone with 1 million tons mined in 1879. Two years later, gas hit it big with the discovery of the Martin County gas field, which led to the development of natural gas in eastern Kentucky. Around that same time, southcentral Kentucky was experiencing its own oil boom—all of this resulting in significant changes for Kentucky. With such an abundance of natural resources, the city of Bowling Green was one of the earliest examples of producing electric power in 1886.



**1888**

Two years after producing electric power, the Bowling Green Petroleum and Fuel Co. fractured a well five miles east of Bowling Green in 1888 (the first mention of fracturing

in Kentucky). By the end of the 1800s, the nation and Kentucky saw the first

(left to right) Dr. Thomas Walker, photo by Manchester and Clay County History; coal miners in Whitley County, photo by The Republic Professor.com; explosive fracturing in Bowling Green, photo by American Oil and Gas Historical Society; Dix Dam, photo by Kentucky Utilities.



mine safety laws that ushered in an era of federal government regulations, economic collapse, war and industrial development.

**1923**

In a span from 1920 to 1925, the nation and Kentucky moved toward a more centralized control of energy production and operation. The Federal Power Commission was established in 1920. A few



years later in 1923 Kentucky Utilities constructed Dix Dam and in 1924 constructed the first coal-fired, central utility plant near Pineville. In 1925, Harlan County led in coal production at 11.8 million tons in a single year.

**1935**

Fast forward past the Great Depression to 1935 when President Franklin D. Roosevelt created the Rural Electrification Administration and began loaning money to help establish rural electric cooperatives. Henderson County was the first to pioneer rural electrification in 1937 to its first customer Frank T. Street.

*Continued on Page 11*

# The increase and decline of Kentucky coal

By Aron Patrick and Adam Blandford  
Department for Energy Development and Independence

After more than two centuries of commercial mining, Kentucky's domestic supply of coal remains a significant and iconic component of the economy of the Commonwealth. Last year, Kentucky ranked as the third-highest coal producer in the United States at 77.5 million tons, and coal continued to supply a majority of Kentucky's energy and electricity needs. At the end of 2014, coal mines in Kentucky directly employed 11,643 people, with mining contributing billions of dollars to the Kentucky economy. However, coal production has declined by more than 55 percent to the lowest level since 1963 since peaking in 1990 at 173 million tons. Employment at Kentucky coal mines has also fallen by 85 percent since peaking at nearly 75,707 in 1949.

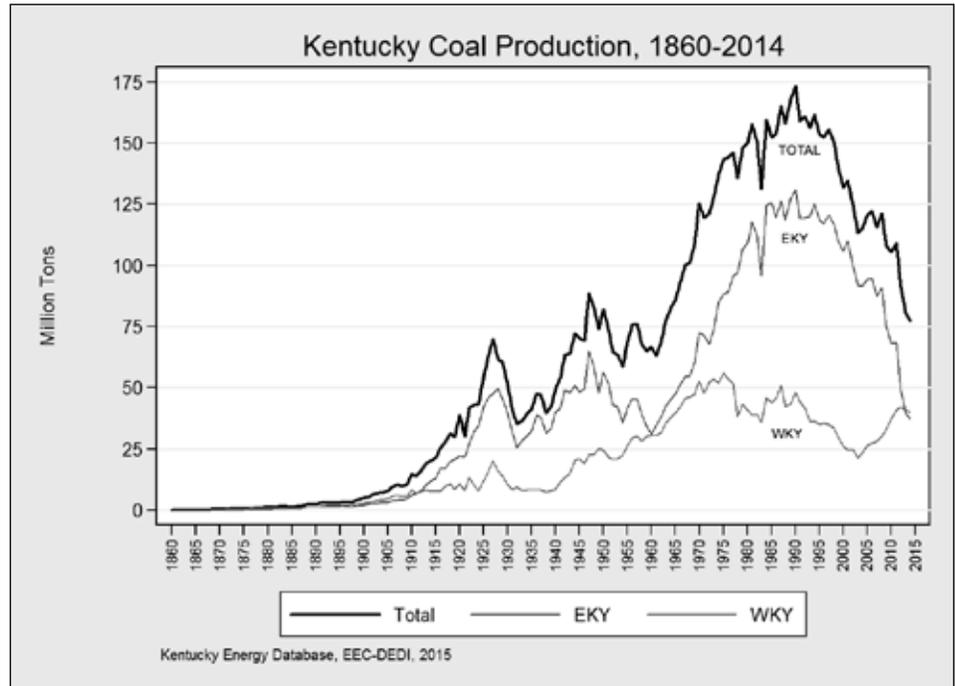
The Kentucky Energy and Environment Cabinet and the Kentucky Coal Association have collaborated since 1989 to produce Kentucky Coal Facts—an all-inclusive report providing the public access to a wealth of data regarding the coal industry in Kentucky.

"Kentucky Coal Facts utilizes data from a variety of state and federal agencies to highlight trends in the industry in order to project its future in the Commonwealth," said Len Peters, secretary of the Energy and Environment Cabinet.

Given the recent declines in production and employment in the state—there are 7,000 fewer jobs in 2014 at Kentucky coal mines than in 2011—Kentucky Coal Facts is particularly useful for anyone trying to keep up with the rapidly changing statistics or in understanding their drivers.

The most recent edition of Kentucky Coal Facts chronicles the coal industry since its first recorded production in Kentucky in 1790, through the industrialization of America, development of large surface mines and peak production, and its recent decline to 80 million tons in 2013. The report shows a comprehensive accounting of coal production, employment, prices, chemical composition, as well as shipments of coal to and from Kentucky.

Kentucky Coal Facts endeavors to



tell the stories of individual coal mining communities across the state. Nearly half of the publication is dedicated to profiling the coal industry in 27 Kentucky coal-producing counties, along with employment figures by county and what percent-

age of countywide employment is made through the extraction of coal. In addition, each county's shipments to individual coal-fired plants are shown alongside the price of coal delivered to those plants and labor productivity over time. Although

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## Videos highlight changing energy landscape in Kentucky

By Eileen Hardy and Aron Patrick  
Department for Energy Development and Independence

From mountains to manufacturing, a new documentary video *Made in Kentucky* highlights the importance of manufacturing to the state's economy and explores how low-cost coal-fired electricity generation has encouraged manufacturing facilities to locate in Kentucky. For more than two centuries, coal mined in Kentucky has stimulated economic growth in the Commonwealth and fueled industrialization, not only Kentucky but across the United States. The documentary takes the viewer inside coal mines, power plants and manufacturing facilities across Kentucky, including Big Ass Solutions, Century Aluminum, Corvette assembly plant, Ford Motor Co., Toyota Motor Manufacturing and North American Stainless.

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# DOW to monitor Kentucky's waters for HABs

By Mark Martin  
Division of Water

As warm weather arrives, recreational use of Kentucky's waterways increases. For the last few years, the U.S. Army Corps of Engineers (USACE) and the Kentucky Division of Water (DOW) have monitored the state's water for algal blooms.

Algal blooms, and the algae that form them, occur naturally in the water. Factors promoting algal growth include a combination of sunlight, warm water temperatures, low turbulence, and elevated nutrient levels of phosphorus and nitrogen. These nutrients can come from many sources including crops, pastures, and urban and industrial areas. The resulting harmful algal blooms, or HABs, are likely the result of heavy spring rains that wash the excess nutrients into the lakes.

The proper management of nutrients from stormwater runoff in watersheds and the proper treatment of these nutrients in wastewater play a key role in managing algal blooms of all kinds. The DOW, along with other federal and state partners and stakeholder groups, is developing a nutrient reduction strategy to address nutrient pollution problems in Kentucky.

## What do HABs look like?

The typical green algae, which is not harmful to humans or animals, comes

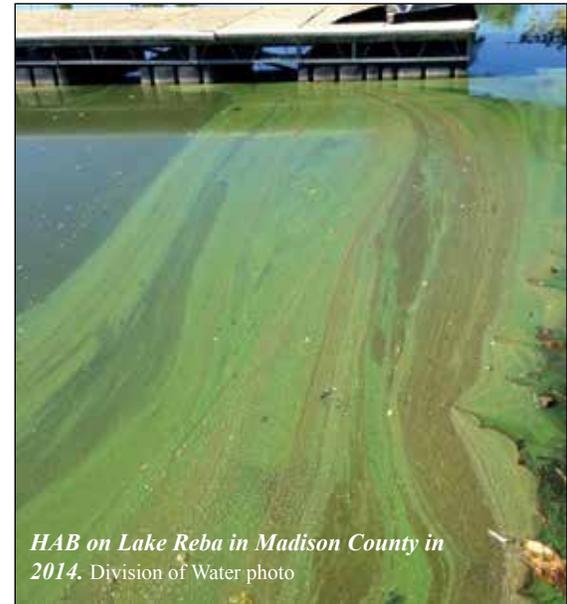
in many forms and looks like underwater moss, stringy mats or floating scum. HABs, or cyanobacteria, are blue-green in color and appear as slicks of opaque, bright-green paint. Upon closer inspection, they often reveal a grainy, sawdust-like appearance of individual colonies of bacteria. The algae can also appear as red or brown.

Some cyanobacteria produce toxins that can be hazardous to animals and humans. Symptoms of exposure to HABs may include gastrointestinal symptoms such as stomach pain, nausea, vomiting and diarrhea; skin and eye irritation; and/or throat irritation or breathing difficulties.

While most Kentucky lakes that contain algal blooms remain open to recreational use, visitors should be aware of the possibility of potential health impacts associated with water contact and take precautions.

The following guidelines are recommended to reduce exposure to HABs:

- Avoid direct contact with affected water, including activities such as swimming, wading, fishing, paddling, diving and water skiing. Avoid contact with water that has unusual color or where blue-green bacteria has been identified, even if the water appears to be clear.
- People who are prone to respiratory allergies or asthma should avoid areas



*HAB on Lake Reba in Madison County in 2014. Division of Water photo*

with HABs. Children may be particularly sensitive.

- Skin exposed to water containing blue-green algae should be washed off with fresh water. In some cases, skin irritation will appear after prolonged exposure. If symptoms persist, consult your local health care provider.
- Fish fillets (not organs) may be consumed after the fillets have been rinsed in clean, nonlake water. Wash your hands

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## Visit Kentucky's new Water Health Portal



Have you ever wondered about the health of a stream? Is it safe to swim in or eat fish from a particular body of water? The new Water Health Portal provides answers to those questions.

Accessing information is easy. Just go to <http://watermaps.ky.gov/> and select Water Health Portal. Type in your location, click on a stream, and learn about the health of the water. Easily identifiable color-coded icons indicate whether a stream or lake supports a particular use, such as swimming, fishing and drinking.

Caring for the state's waterways can be a complex subject and the Kentucky Division of Water is working hard to make water quality easier to understand. Kentucky's waters are divided into five basins, each assigned a coordinator who can answer questions or concerns. If you would like to get involved in protecting Kentucky's waters, go to <http://water.ky.gov/watershed/pages/basins.aspx> or call 502-564-3410.

# Kentucky's Nature Preserves



## Spring hiking plans? *Escape to an enchanted forest*

By Joyce Bender  
Kentucky State Nature Preserves Commission

**B**rigadoon State Nature Preserve in Barren County reflects the 1947 Broadway production for which it is named. The former owners likened their retreat to the mythical Scottish village that appears from the mists once every 100 years. What better way for a busy Glasgow doctor and his wife to rest from their hectic schedules than to escape to a place the Merriam-Webster dictionary defines as idyllic, unaffected by time, or remote from reality? Walking among the towering trees, encountering the rich drifts of trillium at a turn in the trail, listening to the rush of water pouring from a seasonal spring, the preserve easily brings to mind the sense of being someplace enchanted.

The preserve has an interesting past that helps explain its present. It was part of a 1,000-acre land grant given to John Renfro, one of Virginia's Revolutionary War veterans. Renfro and his descendants settled along what was then known as Skegg's Creek (later Skaggs) and made their livings from the heavily forested land. In addition to farming, the family added to their income by making coffins and furniture. The property remained under the ownership of the Renfro family until 1960, when Dr. and Mrs. Russell Starr purchased it. Russell and Faye Starr maintained the property as a private preserve, hideaway and hobby farm until 1983 when they donated 90 acres to the Kentucky chapter of The Nature Conservancy (TNC). The Kentucky State Nature Preserves Commission used federal Land and Water Conservation Funds to acquire the preserve from TNC in 1985. At his death, Dr. Starr bequeathed additional acreage to the commission, which doubled the preserve's size. In all that time, the two families who owned the land cared for it and never took more than was necessary for their basic needs. As a result, we get to enjoy the beauty of a very old forest.

The deep soils on the north-facing slopes and ravines support a diverse forest community known as western mesophytic. It is composed mainly of tulip poplar, beech, northern red oak, sugar maple, walnut and white ash trees, some of which are considered to be old growth. The moist soils support an array of beautiful spring wildflowers sure to delight photographers and hikers. Surrounded on three sides by open lands, the preserve's 180 acres of closed canopy forest is a welcoming stopover for migrating birds. The preserve sits above the banks of the former Skaggs Creek, now a backwater of the Barren River Reservoir. The open water habitat adds to the site's diversity and helps explain the high number (120) of bird species that have been documented within the preserve. In the spring, birdwatchers can catch a glimpse of returning resident species staking out territories or migrants replenishing spent reserves to continue their northward journeys.

Kentucky Heritage Land Conservation Funds were used to acquire a few additional acres to provide public access to the preserve. Its approximately one-mile loop hiking trail is of moderate difficulty as it runs along ridge tops and dips down into scenic ravines.

You don't have to wait every 100 years to visit; the preserve is open to foot traffic from sunrise to sunset every day. Please be respectful of the preserve and follow the rules so that everyone who visits can enjoy it. Pets, horses, picnics, hunting, collecting, fishing, ATV's and camping are not allowed. Peaceful nature observation and appreciation are encouraged.

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**LEFT and RIGHT:** *Kelley's Run, a stream that cascades along mossy rocks in spring. Drifts of trillium grow beneath towering old-growth trees.* Photos by Harold Kelley, Brigadoon volunteer preserve monitor

# The increase and decline of Kentucky coal *Continued from Page 4*

Kentucky's coal industry has witnessed significant shifts in recent years, the seeds of today's change were planted decades ago when federal regulations began affecting the ways coal has been extracted. In 1977, surface mine regulations began pushing coal mining eastward. In 1990, limitations on acid rain causing sulfur dioxide emissions from coal-fired power plants incentivized the use of high-cost, low sulfur coal in eastern Kentucky, while power plants installed billion dollar pollutant scrubbers. As a result, for nearly four decades Kentucky coal was synonymous with the eastern coalfield.

Today, as those sulfur dioxide scrubbers increase in number, coal production is moving westward again—witnessed by Union County extracting more coal than Pike County in 2013. The last time a western Kentucky county extracted the most coal in a year was 1977, when those surface mine regulations were enacted. As eastern production has decreased and western production increased, both coalfields now yield roughly the same amount of production.

Shifts in national demand have also shaped Kentucky coal. In 1990, Kentucky supplied coal to 128 power plants in 26 states throughout the eastern half of the country. In 2013, 97 plants in 17 states bought Kentucky coal. As for international exports, Kentucky shipped its highest amount in 2013 with 1.1 million tons of known exports, though this remains just over 1 percent of annual production in the state.

Secretary Peters hopes that his expansion of the Kentucky Coal Facts publication to include more granular data will help local communities across the state.

“Given the historical significance of the coal industry to Kentuckians and the major challenges on our horizon, we felt that it was important to provide the public with as much information as possible in a simple and easy-to-understand format. Readers now have a profile for each coal-producing county where they learn about production and employment trends, and even see where the coal produced there is consumed. Readers can also learn about the origin of the coal used by their local power plant—it's more information than ever before.”

Last year's 14<sup>th</sup> edition of Kentucky Coal Facts, as well as all editions dating back to 1989, is available for download at <http://energy.ky.gov/Pages/CoalFacts.aspx>.



*This photo was captured from the “Made in Kentucky” video. See article about the video beginning on Page 4.*

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## Videos highlight changing energy landscape in Kentucky *Continued from Page 4*

However, this documentary is not just about Kentucky's history or economy today, rather the purpose of the video is to start a conversation about Kentucky's energy future. It explores how the confluence of market forces, including declining coal production and low natural gas prices, as well as federal environmental regulation, are dramatically changing the Commonwealth's energy landscape. Viewers will hear a diverse group of stakeholders discuss ways that the Commonwealth can navigate these changes and remain economically competitive while protecting the environment.

While Kentucky has traditionally depended on coal for electricity generation, the video explores the benefits and costs of other energy sources available to the state, including natural gas, nuclear, energy efficiency and renewable resources like wind and solar. It concludes with this thought—“the continuing challenge for the Commonwealth is that we must make wise decisions at all levels to address the critical issue of energy, because no matter how you interpret the history, the law and the data, Kentucky needs a commonsense, viable energy strategy to ensure our continued prosperity, our environmental health, and our joint future.”

Also, view the first mini documentary titled *Shifting Lines*, preface to *Made in Kentucky*. These documentaries feature interviews with Nathaniel Adams (North American Stainless), Dave Adkisson (Kentucky Chamber of Commerce), Bill Bissett (Kentucky Coal Association), Brenda Brickhouse (Tennessee Valley Authority), Marilyn Brown (Georgia Institute of Technology), Tony Campbell (East Kentucky Power Cooperative), Tom FitzGerald (Kentucky Resources Council), Jim Gardner (Kentucky Public Service Commission), Greg Higdon (Kentucky Association of Manufacturers) and many others.

The videos are linked at <http://energy.ky.gov/Pages/ShiftingLines.aspx> and <http://energy.ky.gov/Pages/MadeInKY.aspx>.

# Energy-efficient upgrades help lower energy costs

Continued from Page 2

air-sealing or heat pump upgrades. Energy upgrades vary, depending on the needs of the home, the homeowner's interests, and best options to save the customer the most energy.

The utility oversees the contractor installing the energy efficiency upgrades and provides assurance that the improvements have been correctly installed.

After the cooperative energy specialist ensures that the improvements are installed successfully, MACED provides the capital for the retrofit to the cooperative. The co-op then reimburses MACED for the investment as it receives payments from the customer as part of their monthly electric bill.

Bill Blair, HowSmartKY program coordinator at MACED's Berea office, reports 174 home retrofit projects have been completed since the pilot project was introduced and represents a total investment of \$1.4 million in energy efficiency projects. The average cost of a home project is \$5,500 with average energy savings of 20 percent.

"Participants make installment payments as part of their monthly utility bills, gradually paying for the upgrades by using part of the energy savings generated by the retrofit," says Blair. "Payments are structured so that the reduced energy bill and loan repayment together are lower than the bill was before the improvements, thus giving the customer a net positive cash flow from the first month."

Since the program is an extension of the utility services, the investment is tied

*"What is most rewarding about this program is actually seeing the impact it has on people's lives, especially those who need the most help saving money on their energy bills,"*

Bill Blair  
HowSmartKY

to the home electric meter rather than the individual. This means financing is not based on the homeowner's credit and if the house is sold, the loan balance stays with the meter and the new owner continues making the payments and enjoys the benefits of the efficiency improvements.

Energy efficiency means less electricity use, which translates to less carbon dioxide released, helping to curb global climate change.

It reduces the burden on a utility's infrastructure and services and on power plants. And, energy efficiency upgrades often create local jobs, such as installing insulation or new windows. The HowSmartKY program is one tool to help homeowners find the resources to invest in energy efficiency and enjoy the many

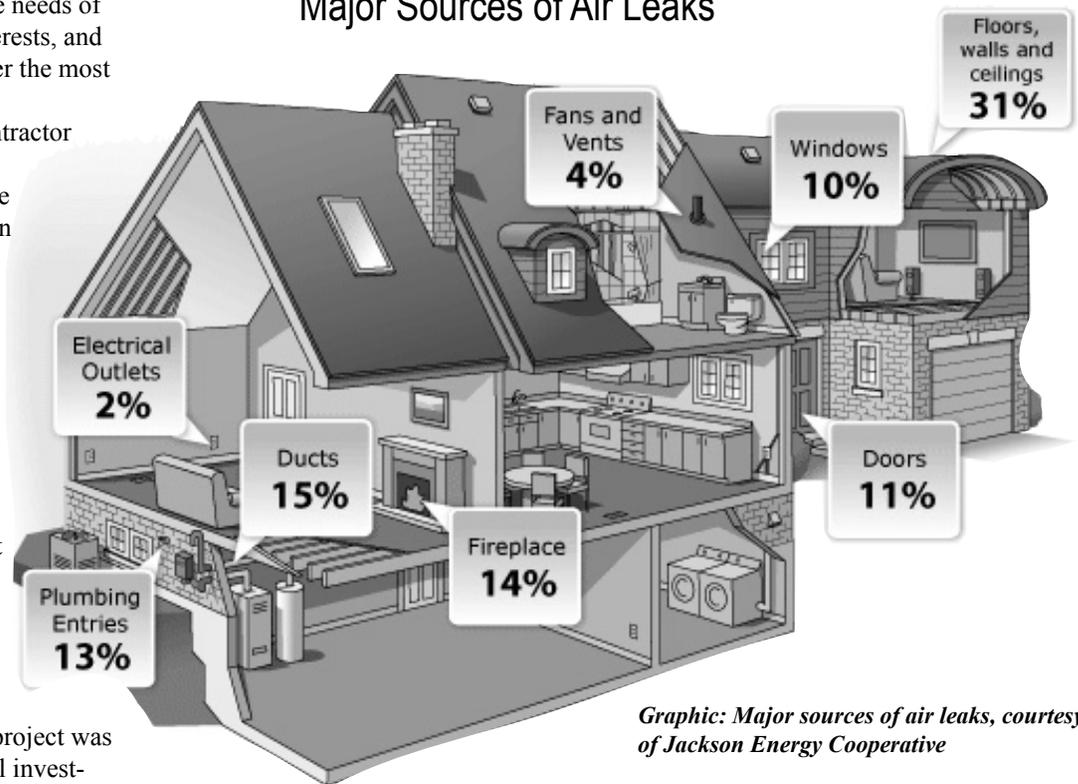
benefits for years to come.

"What is most rewarding about this program is actually seeing the impact it has on people's lives, especially those who need the most help saving money on their energy bills," says Blair. "Because we make several visits to the home, you spend time talking and really get to know people. And when I've gone back to see the finished project and hear how their monthly utility bills have decreased, it's a great feeling."

For more information about HowSmartKY program, visit the DEDI website at <http://energy.ky.gov> or MACED at [www.maced.org](http://www.maced.org).

*[MACED partners with local people to build upon the strengths of Kentucky and central Appalachia; to create economic alternatives and strive to make Appalachian communities better places to live.]*

## Major Sources of Air Leaks



Graphic: Major sources of air leaks, courtesy of Jackson Energy Cooperative

# Ozone gardens

Late spring is the perfect time to start a garden filled with ozone-sensitive plants and natives that are beneficial to pollinators



Your garden can tell you about the air you breathe because, like people, plants need clean air, too. Some plants can even tell you when they have been exposed to air pollution. With a few carefully selected plants, some water and sunshine, you can create your own ozone garden that will help you learn more about the air quality in your neighborhood.



An ozone garden is simply a collection of plants that are known to be sensitive to ozone. When exposed to ozone over time, these plants develop characteristic signs of injury. Plants that serve as a signal of environmental conditions like air pollution are called bioindicators.

## What is ozone?

Ozone is a molecule composed of three oxygen atoms. In the upper atmosphere, naturally-occurring ozone acts as a shield that protects us from the sun's harmful ultraviolet radiation. But in the lower atmosphere, ozone forms through chemical reactions between nitrogen oxides, volatile organic compounds and sunlight. It is most likely to form during the warm months from May through October, otherwise known as ozone season in Kentucky.

Both animals and plants are vulnerable to the highly reactive ozone molecule. For this reason, ground-level ozone is one of the criteria pollutants with health-based standards that is regulated by the Clean Air Act.

In humans, ozone causes breathing problems and aggravates asthma by causing acute respiratory irritation and inflammation. Children are most at risk from ozone exposure because they breathe at a faster rate than adults and they are more likely to spend time outdoors engaged in vigorous physical activity. Developing lungs are also more susceptible to damage.

In plants, gases are exchanged through openings called stomata, which open and close in response to different stimuli such as light, heat and humidity. When the stomata are open, ozone can enter into the plant and cause damage to the cells responsible for photosynthesis. Ozone exposure also weakens the plant,

making it more susceptible to disease and insect damage.

Even very low levels of ozone in the air can cause health problems. The National Ambient Air Quality Standard for ozone is set at 75 parts per billion (ppb). The U.S. Environmental Protection Agency is currently considering revising that standard to a level between 65 and 70 ppb. Ozone-sensitive plant species can show signs of injury at even lower levels of exposure—as low as 40 ppb.

## Getting Started

How much space do you have? An ozone garden can be as small as a few plants in pots or as big as a large garden containing dozens of plants. Regardless of the size, choose a sunny spot for your ozone garden, ideally one that receives six hours or more of sunlight a day. Generally, it's safe to plant outside by early to mid-



May in Kentucky, when the danger of frost is past.

“What plants you grow depends on your space,” said Roberta Burnes, environmental education specialist with the Division for Air Quality. “For smaller gardens, try bush-variety snap beans, milkweed and evening primrose. If you have a little more space, add cut-leaf coneflower, which grows from 2 feet to 8 feet high. Potatoes, soybeans, squash and melons are also sensitive to ozone,” she said. (See sidebar for a more complete list of plants, including some tree species.)

“Many ozone-sensitive plants grow tall and for this reason an ozone garden would be best located in your backyard, a meadow or field,” Burnes continued.

If you’re growing ozone-sensitive vegetables, any variety will do. “For other plant species, especially milkweed, native species are recommended because they are far more beneficial to native pollinators like monarch butterflies,” said Burnes. Several species of milkweed and its cousin dogbane are native to Kentucky. (See informational sidebar on Page 12 for suppliers of native seed and plants in Kentucky. For additional information about monarchs, read *Monarchs take flight* beginning on Page 1.)

## Identifying Ozone Damage

Ozone may be invisible, but the injury it causes to plants is very visible. The first signs of damage resemble tiny specks of pepper on the upper surface of the leaves. These purplish-black spots are known as “stippling,” and they only occur on the upper leaf surface. Stippling never crosses the leaf veins; if you see spots that cross the veins, you’re looking at damage caused by something else.

“As ozone injury worsens, a leaf may begin to turn yellow—a process called chlorosis. In cases of severe injury, the leaf may die and fall off the plant,” explains Burnes. “Ozone damage is cumulative, which means you’re more likely to

These ozone-sensitive plants marked with an asterisk are recommended for smaller spaces. Growing native plants provides an extra benefit to native pollinators and songbirds. Common names can vary, so be sure to use the italicized Latin name when shopping for plants and seeds.

### Vegetables:

- Snap bean\*
- Melons and squash (requires some space)
- Soybean\*
- Potato\*

### Native Kentucky Plants:

- Groundnut (*Apios americana*)—flowering vine with edible pods and tubers
- Dogbane, Indian hemp (*Apocynum cannabinum*)—spreads, best in meadows, fields; excellent nectar source
- Poke milkweed (*Asclepias exaltata*)\*—important food and nectar source for the monarch butterfly
- Swamp milkweed (*Asclepias incarnata*)\*—important food and nectar source for the monarch butterfly
- Common milkweed (*Asclepias syriaca*)—important food and nectar source for the monarch butterfly
- Big-leaf aster (*Aster macrophyllus*)—grows tall; best in meadows, fields
- Redbud (*Cercis canadensis*)—small flowering tree
- Virgin’s bower (*Clematis virginiana*)—vine
- American hazelnut (*Corylus americana*)—spreading shrub, excellent food source for wildlife
- White snakeroot (*Eupatorium rugosum*)—grows tall; best in meadows, fields
- Sweetgum (*Liquidambar styraciflua*)—large tree
- Tulip poplar (*Liriodendron tulipifera*)—large tree
- Virginia creeper (*Parthenocissus quinquefolia*)—vine, common throughout Kentucky
- Winged sumac (*Rhus copallina*)—small- to medium-sized shrub, beautiful fall foliage
- Cutleaf coneflower (*Rudbeckia laciniata*)—grows tall; best in meadows, fields
- American elder (*Sambucus canadensis*)—large shrub, excellent food source for wildlife
- Sassafras (*Sassafras albidum*)—small- to medium-sized tree

**OPPOSITE PAGE: (top)** Signs of ozone damage on a tulip poplar, courtesy of Robert Anderson, Bugwood, UGA; (left) Cutleaf coneflower, courtesy of Barbara Tokarska-Guzik, Bugwood UGA; (right) sassafras tree, courtesy of Chris Evans, Bugwood, UGA.

**THIS PAGE: (top)** A flowering potato plant, courtesy of Shutterstock; (right) monarch caterpillar on milkweed, courtesy of iStock

*Continued on Page 12*

# Kentucky's energy journey

Continued from Page 3

Following World War II, Kentucky saw record coal mine employment hit an all-time high of 75,707 miners in 1949.

**1955** This success brought attention to environmental issues surrounding energy production. For the next two decades beginning in 1955, Kentucky and the nation saw legislation pass that addressed environmental regulations, including the Clean Air Act, Clean Water Act, and federal solid and hazardous waste regulations.



From the 1980s to the end of the 20th century, Kentucky saw industrial growth, highlighted by Toyota Motor Manufacturing, coupled with increased resources devoted to cleaner fuels, renewable energy, and a movement toward energy efficiency. By 1996, Pike County peaked at 36 million tons of coal in a single year, more than any county in Kentucky history while the U.S. started nationwide discussions on greenhouse gas emissions.

**Today** Now 15 years into the new century, the nation has signaled a move toward a lower carbon future, with the Supreme Court ruling on greenhouse gases, the U.S. becoming the leader in natural gas production, and the president creating a Climate Action Plan. As for Kentucky, the most efficient coal-powered power plant is established in Trimble County and the University of Kentucky launches its first carbon capture pilot project, along with an algae program that utilizes waste CO<sub>2</sub>. Kentucky is also seeing a strong trend with renewables and energy efficiency as Fort Knox builds the largest solar array in the state and the Public Service Commission approves a biomass electric generating facility and utility scale solar project. Kentucky also is home to 277 Energy Star schools.

These shifts in energy are like a ripple in a stream. Some businesses have seen dramatic declines, while western Kentucky has surpassed coal production in eastern Kentucky for the first time since 1911. Record coal mining unemployment is also at an all-time high. However, if history teaches us anything, it's that Kentucky is a diverse energy leader and innovator. Energy will remain a central theme to our economy and way of life.

The Commonwealth has not been immune to federal or national events; both have influenced where we are today and for certain will influence us in the future. With every measured and deliberate step, while preserving our independent spirit, we remain watchful for what the future holds—with an eye to the past preserving this Commonwealth.

For more in-depth information on the history of energy in Kentucky, visit the interactive timeline, as well as the 2014 Kentucky Energy Profile, a comprehensive overview of energy production and consumption, at <http://energy.ky.gov>

*Special thanks to the University of Kentucky Center for Applied Energy Research and the Kentucky Geological Survey for their historic resources.*

**TOP: President Lyndon B. Johnson signs the Clean Air Act on Dec. 17, 1963.**  
Photo by Mainmemory.net

# DOW to monitor Kentucky's waters for HABs

Continued from Page 5

or any parts of your body that have come into contact with the fish.

- Pets and livestock should be prevented from making contact with HAB-infested waters.

Last summer, the DOW and US-ACE confirmed the presence of potentially harmful HABs at levels exceeding recommended safety thresholds at several lakes in Kentucky.

“The DOW has developed a predictive model for identifying HAB conditions in Kentucky lakes using available satellite data,” said Andrea Keatley, DOW Water Quality branch manager. “We are working in a collaborative effort with the Corp of Engineers to calibrate that model.”

If HABs are identified in any lake, an advisory will be issued to the public. An advisory is intend to educate potential users about the water so that they may make informed decisions.

Public water systems depending on lakes for their raw water source should monitor for the presence of HABs and adjust treatment of the water accordingly. Algal blooms are easily addressed through water treatment techniques, resulting in water that is safe to drink.

For additional information about HABs, visit <http://water.ky.gov/waterquality/pages/HABS.aspx> or contact [Mark.Martin@ky.gov](mailto:Mark.Martin@ky.gov).

For updates on water levels and HABs at USACE lakes visit <http://www.lrl.usace.army.mil/Missions/CivilWorks/WaterInformation/HABS.aspx>.

For safe water recreation visit [http://www.who.int/water\\_sanitation\\_health/bathing/srwe1/en/](http://www.who.int/water_sanitation_health/bathing/srwe1/en/).

For additional information regarding HABs and public water systems, contact [Eric.sutton@ky.gov](mailto:Eric.sutton@ky.gov).

# Ozone gardens

Continued from Page 10

see it on older leaves that are closer to the ground.” Leaf exposure to sunlight seems to play a role as well. A leaf that is partially shaded by another leaf above it may show no damage to the shaded portion, while the fully exposed part of the leaf may exhibit injury.

“As your plants leaf out and mature, check your garden at least once a week. Taking notes, sketches and pictures of the plants in your ozone garden is a great way to get a better picture of what’s happening throughout the growing season. In fact, you’ll be joining thousands of other ‘citizen scientists’ who observe and record their observations of the natural world in order to better understand the health of their environment,” Burnes said.

## Becoming Ozone Aware

Will you see ozone injury in your garden?

“That depends,” said Burnes, “on the ozone concentration over the growing season, plant sensitivity, and how long the plant has been exposed. Since ozone forms in the presence of sunlight, extended periods of hot, sunny weather can lead to higher ozone levels.”

Human activity also plays a big role in ozone formation since the chemical ingredients for ozone come largely from human activities. Combustion activities such as open burning, driving your vehicle, and mowing your lawn emit nitrogen oxides. Volatile organic compounds are emitted when you pump gasoline and use paints or solvents.

Ozone injury is a symptom of previous exposure, so seeing ozone damage doesn’t necessarily mean the air is polluted right now. For nearly real-time data, use the Air Quality Index (AQI) that tells you how clean or polluted your air is, and what associated health effects you may experience within a few hours or days after breathing polluted air. You can access the AQI at <http://air.ky.gov/Pages/AirQualityIndexMonitoring.aspx>.

“Growing an ozone garden is a way of making the invisible visible,” said Burnes. “By observing your plants through the growing season, as well as keeping an eye on the AQI, you’ll gain a deeper understanding of the connections between chemistry, weather, air quality and living things.”

*A wasp, a natural and essential pollinator, feeds from a swamp milkweed, courtesy of Rob Routledge, Bugwood, UGA*

## Become a citizen scientist

It takes some practice to distinguish ozone damage from other kinds of plant damage. The National Park Service has an ozone injury training web page where you can improve your skills in identifying and quantifying ozone injury on certain plant species. Visit <http://www.nature.nps.gov/air/edu/O3Training/index.cfm> to learn more.

See something you suspect might be ozone injury? Snap a picture and email it to the Aura atmospheric chemistry program, operated by the National Aeronautics and Space Administration. Be sure to include the plant species, location, date of photograph and type of environment (urban, suburban or rural). Visit [http://aura.gsfc.nasa.gov/outreach/garden\\_getinvolved.html](http://aura.gsfc.nasa.gov/outreach/garden_getinvolved.html) for more information on how to report your findings.

Ozone biomonitoring is currently being conducted at universities, schools and national parks across the country. Among these, “Hands on the Land,” coordinates the largest collaborative effort of ozone biomonitoring. Teacher guides, lesson plans and background material are all available at <http://www.handsontheland.org/environmental-monitoring/.html>.

## Suppliers in Kentucky

Sources for native Kentucky plants, including ozone-sensitive species:

Shooting Star Nursery  
160 Soards Rd.  
Georgetown KY 40324  
502-867-7979  
<http://www.shootingstarnursery.com>

Dropseed Native Nursery  
1205 Buckeye Lane  
Goshen, KY 40026  
502-439-9033  
<http://www.dropseednursery.com>

Roundstone Native Seed  
9764 Raider Hollow Rd.  
Upton, KY 42784  
888-531-2353  
<http://www.roundstoneseed.com>

Ironweed Native Plant Nursery  
203 S. High St.  
Columbia KY 42728  
270-384-1352  
<http://www.ironweednursery.com>



# Environmental education benefits the Commonwealth, its citizens

Survey gains insight into Kentuckians' knowledge of environmental problems and concerns

By Lona Brewer

Department for Energy Development and Independence

Your knowledge of the environment will likely influence how you behave towards the environment. And, the same is true for your friends and neighbors. One way in which Kentucky tries to determine how residents stack up with each other is through a statewide environmental education survey.

That's what the Kentucky Environmental Education Council (KEEC) has done in its most recent survey *Kentuckians' Environmental Knowledge, Attitudes, and Behaviors*.

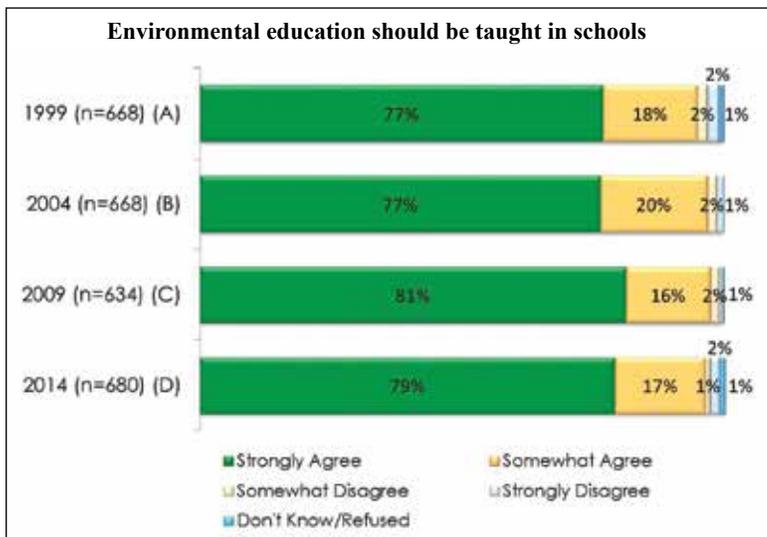
"As in years past, our most recent survey provides insight into how our citizens understand and view the changing environmental landscape, with gains appearing in some sectors, but others declining or staying relatively the same," said Elizabeth

Schmitz, executive director of the KEEC, as their primary environmental problem of concern, mirroring national and global survey responses. However, almost three-quarters of those surveyed were unable to properly identify run-off from lawns and farms as the most common source of water pollution in the Commonwealth. While the percentage that correctly responded has increased (from 16 percent in 2004 to 27 percent in 2014), the results suggest that "although Kentuckians are concerned about water quality and water pollution, they may not connect their own personal actions with impacts on Kentucky's water quality and quantity," continued Schmitz.

The younger population (18-34 years of age), has more consistent environmental behavior and is more apt to take action to improve the local environment, which suggests that younger generations have a stronger understanding of personal environmental impact and responsibility.

The sources from which Kentuckians get most of their environment information were gauged for the first time in 2009. Since then, media (television and radio) has been the most often cited source, with 50 percent of respondents choosing this response this year versus 54 percent five years ago. The Internet was a distant second with only 17 percent; newspapers were cited as the third-most popular source for environmental information in 2014 (14 percent), falling from second place (20 percent) five years ago.

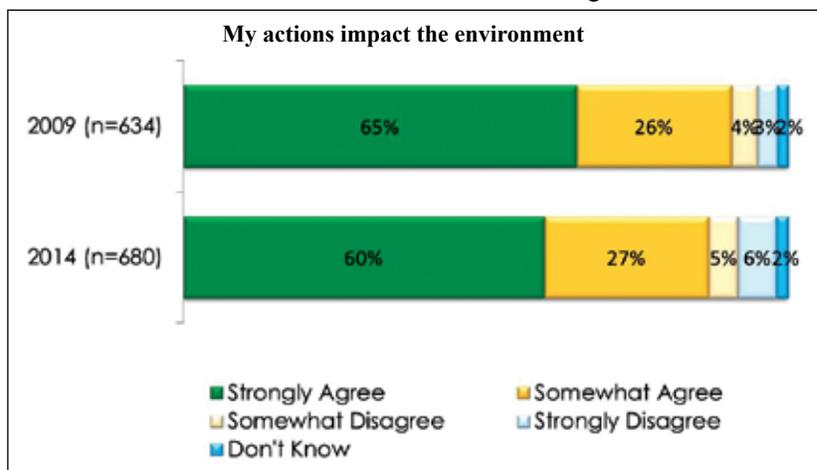
In a multiple choice question offered in 2009 and 2014, survey respondents were asked what they thought was the most important energy strategy for Kentucky's future. In 2009, the top choice was developing alternative energy sources such as solar or wind (52 percent); 23 percent chose developing technologies to help make mining and burning coal better for the environment. Survey results



Schmitz, executive director of the KEEC.

Kentuckians continue to indicate an overwhelming support (96 percent) for teaching environmental education in schools, and almost all Kentuckians (93 percent) believe it is possible to both protect the environment and have a healthy economy.

In response to an open-ended question, Kentuckians listed water pollution, water quality and water conserva-



from 2014 show drastic differences in how Kentuckians view these issues—only 42 percent responded that alternative energy was the most important strategy, with the development of technologies to mine and burn coal cleaner rising to 34 percent.

A new energy-related question was

*Continued on Page 16*

# From hiking to horseback riding

*Visitors to Kentenia State Forest take in scenic views, get an education*

**By Jennifer L. Turner**  
**Division of Forestry**

Recognized as Kentucky's first state forest, Kentenia includes 4,277 acres of maturing oaks, maples and hickories located on Pine Mountain in Harlan County. The property was acquired as a gift from the Kentenia-Cantron Corp. in 1919. Because of its location on Pine Mountain, the forested terrain is rugged and characterized by large rock cliffs on both sides of each stream drainage (branch) on the mountain. "False ridges," or spurs that occur off the main ridge, provide a sense of being on top of the mountain, although the top is actually far away.

## Limitless Recreation

Kentenia State Forest is a hidden recreational gem. Outdoor enthusiasts find endless opportunities for hiking, mountain biking and horseback riding. The Putney Recreation Trail is a favorite for serious hikers. It starts at the old Putney Ranger Station and goes to the crest of Pine Mountain, then onto Goss Park and the top of the mountain. The trail is maintained by the Kentucky Division of Forestry (KDF) and the Harlan County Fiscal Court.

Cupp Lake, a 2- to 3-acre lake on the Pine Mountain Adventure Trail, provides an area for primitive camping, fishing, a place to water your horses and breathtaking scenery. Rebel Rock, a longtime tour-

ist attraction along the trail, rises high into the sky giving hikers miles of cliff line views along Pine Mountain.

Not a hiker? You can also tour the entire area by car, visiting Goss Park, Cupp Lake, Laden Trail and the Little Shepherd Trail. The tour includes unique rock formations and cliffs with embedded pebbles and seashells along the Pine Mountain Adventure Trail.

## Flora, Fauna and Timber

Kentenia plays an important role in

maintaining natural biological diversity and protecting special plant and animal species. The forest is a good habitat for the Indiana Bat; black bears are also prevalent in the area. The American chestnut sprouts naturally from old stumps dating back to the early 1900s; they usually grow to about 5 inches in diameter before they die back and sprout again. All state forests, including Kentenia, are American Tree Farm certified. Money from the sale of timber is returned to the Commonwealth and provides a stable resource base for the forest products industry.

"Timber cut from Kentenia's forests can be marketed with a green label," said KDF Director Leah MacSwords. "This provides an assurance to the end consumer that they are purchasing wood that has been cut from a forest that is managed in an environmentally sensitive manner."

## Public Education and Research

Interpretive signs along the trails describe harvests, timber stand improvements, and forest health treatments such as efforts to control fire, insects, disease and the spread of Hemlock Woolly Adelgid infestations.

The forest is also used for various educational opportunities. Continuing education events are held for the Master Logger Program, and parents and teachers are encouraged to utilize Kentenia and all state forests as outdoor learning centers. Pine Mountain Settlement School has regular nature walks with its children on one of the trails off Little Sheppard Trail. Several universities use the forest for their studies. Virginia Tech has an on-going study on the effects of Hemlock Woolly Adelgid on Kentenia's hemlock populations, and Eastern Kentucky University conducts studies on snail species.

Kentucky's 10 state forests encompass 47,677 acres. To learn more about each one, visit <http://forestry.ky.gov/Kentuckystateforests/Pages/default.aspx>



**ABOVE:** *The fire tower and watchman's chimney at Kentenia State Forest.*

**LEFT:** *Cupp Lake in winter along the Pine Mountain Adventure Trail.* Photos by Brandon Howard, KDF forester



# Saving our waters...one initiative at a time

## Kentucky part of first-of-its-kind interstate program involving water quality trading

By Jamie Ponder  
Division of Conservation

**T**here's a problem in the Gulf of Mexico. The water is dying. The 5,052-square-mile "dead zone" is identified by the conspicuous absence of commercial shrimp and fish populations in its waters. The dead zone is caused by hypoxia, or low levels of oxygen, and can no longer support living aquatic organisms.

But this story doesn't begin in the Gulf. It begins hundreds of miles upstream in the Ohio River Basin where three states—Kentucky, Indiana and Ohio—formed a partnership to reduce nutrient loading, particularly nitrogen and phosphorous, of the Ohio River. Too much nitrogen and phosphorus in the water leads to the rapid growth of algae blooms. These "blooms" deplete oxygen, creating dead zones and harming aquatic life.

The initiative, referred to as the Ohio River Basin Water Quality Trading Project, is led by the California-based Electric Power Research Institute (EPRI), along with a collaboration of power companies, wastewater utilities, national organizations, farmers, and the Kentucky Division of Conservation and their soil and water conservation districts. Their research efforts share a common goal of improving the quality of U.S. waters and the ultimate return of aquatic life to the coastal hypoxic zone near the mouth of the Mississippi River.

### How does water quality trading work?

Water quality trading is a cost-effective method of achieving improved water quality goals by allowing permitted dischargers to purchase nutrient reductions, or "stewardship credits," from another source at lower overall costs.

For the three states involved in the partnership, it begins by setting up a trading system with local farms that fall within the Ohio River Basin. Teams of district conservation staff work with volunteer landowners to implement best management practices that reduce the amount of nitrogen and phosphorous leaving the farm and entering the river. Each pound of nitrogen or phosphorous removed from the water generates a stewardship credit—a quantified reduction of the pollutant. In addition, there are many



**TOP:** *The Mississippi River near the western border of Kentucky.*  
**ABOVE:** *This heavy use area is a gravel lot adjacent to the feed structure on Frank Suttles' farming operation. Surface preparation and geotextile fabric placed beneath the gravel were installed using standards and specifications required by the Natural Resources Conservation Service.* Photos by Jamie Ponder

associated ancillary benefits consequent to the reduction of nitrogen and phosphorous, including greenhouse gas avoidance, carbon sequestration, improved soil health and pollinator habitat, and rare species and habitat enhancement.

Frank Suttles, a lifelong Kentucky farmer and active member of the Kentucky conservation partnership, has been installing best management practices on his farming operation for years.

"The heavy use area I installed as part of the water quality trading initiative is one of the best projects I've ever done," he said. "It's cut down on about 80 percent of the mud on my operation, which will pay good dividends on herd health and help me manage my nutrients. It's a plus for me."

All conservation practices are verified by state agricultural and permitting agencies to ensure that all credits represent real environmental improvements. The credits are then sold at auction to power plants, wastewater plants and other permitted discharge facilities with a vested interest in nutrient reduction along the Ohio River.

*Continued on Page 20*

# Monarchs take flight in Oldham County

*Continued from Page 1*

searches for milkweed plants on which to lay her eggs. The eggs laid by this monarch will produce the second generation of the year. The first three generations have a lifespan of three to six weeks. The fourth generation, born in late August and September, is different. They miraculously know they must migrate; they go into sexual diapause and will not mate until spring. They eat feverishly to prepare for their journey thousands of miles south, roosting along the way in large groups each evening to rest.

This generation of monarchs has never been to Mexico, but they instinctively know where they are going. They overwinter in Oyamel trees where the climate is right for their survival, before starting a future generation in spring.

“No matter how many times I share this project with students, their experience is always priceless,” said Buchert. “It not only teaches them about the miracles in our everyday lives but also about the importance of our roles in conservation efforts.”

The Oldham County Conservation District agrees. This hands-on project is beneficial to students, inspiring some to go out and look for eggs to raise on their own. In the last 10 years, Buchert estimates that students have released more than 1,000 monarchs and that the program has reached more than 22,000 students and adults.

Earlier this year, Buchert learned that federal and state funding have been earmarked to re-grow critical habitat for the imperiled monarch. The Kentucky Department of Fish and Wildlife Resources is committing \$2 million to the plan, while the National Fish and Wildlife Foundation is committing \$1.2 million. The National Wildlife Federation is also involved.

“There is no question on the success of this program,” said Kimberly Richardson, director of the Kentucky Division of Conservation, who oversees the state’s conservation districts. “We hope the Oldham County district and Buchert will continue to keep the program going and encourage others to follow their lead.”

To learn more about milkweed and how to obtain native seeds and plants, refer to Page 12 “Suppliers in Kentucky.”

# Environmental education benefits the Commonwealth, its citizens

*Continued from Page 13*

added to the survey in 2014 that asked participants to choose all of the reasons that they conserve energy. Only 5 percent of Kentuckians surveyed did not make any attempt to conserve energy. The majority (85 percent) was motivated mostly by saving money. However, 59 percent conserved energy in a conscious effort to reduce their environmental impact.

For some questions, there were statistically significant differences in the way various groups responded. For example, women appeared to have slightly lower general environmental knowledge than men; but, women were more concerned about the environment and more likely to modify their behavior to reduce their environmental impact. In line with their better knowledge of environmental facts, younger respondents were statistically more likely to link their own actions to environmental problems, and be strong supporters of environmental education in schools.

## What do the results from the 2014 survey tell us?

“Despite overwhelming support for including environmental education in our school curricula, Kentuckians are not receiving enough environmental education,” said Schmitz. “The average Kentuckian is able to answer correctly only slightly more than half of the survey’s environmental knowledge questions; this minimal environmental understanding leads to a lack of environmental literacy, which may be reflected in Kentuckians’ environmental attitudes and behaviors.

“Kentucky needs environmentally literate citizens to tackle our 21<sup>st</sup> century challenges and ensure that future generations have access to clean air, clean water and clean energy. Providing environmental education in schools and to the general public will benefit the Commonwealth and its citizens,” concluded Schmitz.

KEEC offers environmental education programming for children and adults, and its website (<http://eeinkentucky.org/core/news/list.aspx>) provides environmental education resources, grant listings and events in your area. You can also become a member of the nonprofit Kentucky Association for Environmental Education (<http://kaee.org/>) to gain access to resources and support for environmental education in Kentucky.

KEEC is a state-funded agency whose mission is to support the coordination, delivery and marketing of all environmental education programs across the Commonwealth. Findings from the survey are used to help shape the goals of Kentucky’s 5-year master plan for environmental education. Every five years, the survey results are published along with the master plan in a document titled *Land, Legacy, and Learning*. To view full survey results, visit <http://keec.ky.gov/Pages/default.aspx>.

**About the Survey**—KEEC, working with the University of Kentucky, completed the first survey in 1999, again in 2004, and a third time in 2009. Last year, this survey was conducted for KEEC by Issues & Answers Network Inc. between May 15 and June 1. The survey included 680 interviews, 35 percent via cell phone and 65 percent via land line. Survey methodology was based on random dialing, with interviews sampled proportionally with quotas based on regions established by Kentucky Educational Cooperatives. It is important to note that interviews were held in all 120 counties and the average interview took 12 minutes to complete.



Poster by first-place winner Lilakay Salmons



Poster by state runner-up Julie Park



Poster by third-place winner Anna Kate Alexander

# Life lessons

**G**ood soil is the start of something beautiful. These words, and the colorful drawing of a 10-year-old from Johnson County, describe the importance of soil from the mind of a child. In September 2014, more than 64,000 Kentucky children and youth submitted artistic drawings and essays about their knowledge of soil as they participated in the Jim Claypool Art and Conservation Writing contests.

For seven decades, the yearly contests have provided Kentucky's teachers with an opportunity to present lessons about conservation in their classrooms. The students use what they learn to create posters and essays that are judged at county, area and state levels for cash prizes.

Last year's study guide titled "The Soil Daily Times" addressed soil structure, soil health, organisms and species that live in soil, and the importance of preventing runoff into our lakes and streams. Each year, the guide and the contest rules are available for download from the Kentucky Farm Bureau and Division of Conservation websites. The contests are held in conjunction with the Kentucky Association of Conservation Districts and other partners.

"These contests about Kentucky's soil provide an important foundation for youth to learn about the Commonwealth's resources, and we hope these lessons will be remembered through adulthood," said Kimberly Richardson, director of the Kentucky Division of Conservation.

A total of 47,356 art entries were submitted from 98 counties; 17,028 essay entries were received from 94 counties.

## Jim Claypool Art Contest state winners are:

- First Place: Lilakay Salmons, 10, Johnson County, Central Elementary School
- Second Place: Julie Park, 11, Taylor County, Taylor County Elementary School
- Third Place: Anna Kate Alexander, 8, Barren County, Red Cross Elementary School

## Conservation Writing Contest state winners are:

- First Place: Jason Blake Warrens, 14, Floyd County, Allen Central High School
- Second Place: Benjamin Kinsey, 12, Grant County, Williamstown Junior High School
- Third Place: David Vincent, 13, Nelson County, Bluegrass Christian Academy

The topic for the 2015 contests will be based on forestry. Watch for announcements, along with contest rules, to be announced in September.



## Catlettsburg Refining: A friend to students and wildlife



**TOP and BOTTOM:** *At the Catlettsburg Refining Savage Branch Wildlife Reserve, children participate in nature-based learning activities like planting flowers and observing frogs at Rock Hill Pond.* Photos courtesy of Catlettsburg Refining

**By Mary Jo Harrod  
Division of Compliance Assistance**

**C**atlettsburg Refining is located on more than 650 acres in Catlettsburg, Ky., on the bank of the Big Sandy River. Owned by Marathon Petroleum Co., the refinery operations produce gasoline, distillates, asphalt, heavy fuel oil, aromatics, propane, refinery-grade propylene and sulfur, which are distributed by pipeline, barge, transport truck and rail. Catlettsburg Refining produces more than 242,000 barrels per day and employs approximately 775 regular and 800 contract workers, making it a large presence in the community.

This community-minded refinery became a master member of KY EXCEL, Kentucky's voluntary environmental leadership program, in 2006. One of its member projects is managing the Catlettsburg Refining Savage Branch Wildlife Reserve nearby. A management plan is in place that is designed to increase biodiversity on the property through the creation of wildlife habitat and monitoring the effects of

*Continued on Page 19*



*A child peeks into a bird box at the wildlife reserve.* Photo courtesy of Catlettsburg Refining

natural succession. The open field restoration project aims to restore three former pasture fields to native vegetation. Native plantings enhance the diversity of food and cover resources for wildlife.

**“The KY EXCEL program is the only venue celebrating these types of efforts in Kentucky.”**

Vernon Marcum  
Catlettsburg Refining

Since 1994, the wildlife team has maintained a nest box monitoring program, which provides shelter to cavity-nesting wildlife on-site and is used as a tool for educational programs. Since receiving the Corporate Lands for Learning certification in 1999, the Catlettsburg team has continued to foster a strong relationship with area schools by offering a variety of educational programs on and off-site. Students are invited to the wildlife reserve where they investigate pond and forest habitats.

On-site lessons are adapted to the visiting group’s needs and encourage students to investigate and observe the world around them. A variety of activities exist, including a scavenger hunt for flora and fauna, a box turtle habitat requirement investigation, web of life activity and an activity booklet on nature’s recyclers and their role in decomposition.

“Our 35-member employee wildlife

**KY EXCEL new members**

KY EXCEL is a voluntary environmental leadership program. Members commit to a variety of projects that go beyond environmental regulations to improve and protect the environment. Join today by calling 1-800-926-8111 or visit <http://dca.ky.gov/kyexcel>

**Advocate Level**

- The Akers Family—Woodford County
- Larry Taylor household—Woodford County
- U.S. Geological Survey—Jefferson County
- Susan Mallette—Franklin County

**Partner Level**

- Sun Products Corp.—Warren County

team annually manages Savage Branch’s entire 360 acres for wildlife habitat,” says Vernon Marcum, who is the health, environmental and safety professional at the refinery.

The economic value of the property to the schools is immeasurable. Students and teachers go to Savage Branch and learn first hand about nature and the ecosystems.

“Not everyone wanting to do a

project like this will have as large an area to manage and may want to start with a butterfly garden at their office complex,” says Marcum. “Working with nature is always a challenge. Being patient with our projects and understanding that replanting is part of the process has been one of our greatest challenges. Resources at the Kentucky Division of Compliance Assistance, Department of Fish and Wildlife, Division of Forestry and Division of Water are available to help.”

In two years, 39 local preschools, elementary and middle schools and adult autistic classes have attended outdoor nature-based learning activities at Savage Branch, totaling 1,819 students. Since 2001, there have been 8,912 recorded visitors to the reserve.

As part of the community outreach efforts, 33 local teachers attended two Project WET (Water Education for Teachers) training classes.

“From the members of the refinery management team who continually find ways to support our KY EXCEL programs to the individual employees who volunteer their time to make those programs happen, we are all very proud that our stewardship efforts have resulted in maintaining a master-level membership,” says Marcum. “The KY EXCEL program is the only venue celebrating these types of efforts in Kentucky.”

Being involved in these projects at work has created a ripple effect. Besides being an example of stewardship for the community, Catlettsburg Refining’s employees also participate in various community and environmental programs, while students and teachers who visit Savage Branch gain a deeper understanding and appreciation for their outdoor environment.

For more information about the KY EXCEL program, call 800-926-8111, e-mail [envhelp@ky.gov](mailto:envhelp@ky.gov) or visit the website at <http://dca.ky.gov/kyexcel/Pages/default.aspx>.

# Kentucky receives grant to study PAHs in urban settings

By Sheri Adkins  
Division of Waste Management

Each year, the U.S. Environmental Protection Agency's (EPA) Office of Research and Development makes funds available via Regional Applied Research Effort (RARE) grants to EPA regions for research topics that are deemed to be of significant interest and/or impact to the region.

Last year, the Kentucky Division of Waste Management's Superfund Branch (SFB) submitted a proposal for a regional study designed to determine the background concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) in urban settings, where long-term anthropogenic, population and industry-driven activities have likely increased the overall levels of PAHs in surface soil that cannot be directly attributed to a specific release.

PAHs are a combination of chemicals that are found naturally in the environment, but they can also be man-made. Most environmental PAHs are products of the incomplete combustion of fossil fuels, such as coal, oil and gas. They can also result from burning trash, cigarette and tobacco smoke, and even grilling meats (overcharring of foods). PAHs can linger for long periods of time in the environment and enter the body through breathing contaminated air, ingesting contaminated food or water, or through skin contact with contaminated soils or products.

The presence of anthropogenic sources of PAHs has a real, but presently undefined, impact on concentrations levels, making remedial and management decisions more complicated in already chemically-complex urban settings.

"Being able to differentiate between something that has occurred due to population over the years, versus a release from a facility or spill, will enable our division to make better site

decisions and may positively affect state and private industry remediation if it can be shown that levels are the result of simply being an urban, more highly-developed area," said Tim Hubbard, assistant director of the Division of Waste Management. "The project should also positively affect the residents of the communities, which will be a part of the project, as it should result in more community education and awareness of environmental conditions in these areas and along with that information, how they and their families can live safely there."

Upon SFB's submittal to EPA for consideration, the project garnered support from the southeast Region 4, as well as the interest and backing of the Science and Ecosystem Support Division. With their input, the proposal also incorporated (1) analyzing for arsenic and lead, both metals that commonly appear in highly urbanized and historically populated locations; and (2) creating a sampling plan and sampling parameters designed to be utilized by other regions or states that serve as the framework for a nationwide database of urban background numbers.

In October 2014, Kentucky's proposal was chosen from among numerous proposals submitted with the second-highest number of votes. SFB was awarded nearly \$174,000 to be dispersed in 2015 and 2016.

The study is anticipated to begin sample collection and analysis this summer, with sampling to continue through 2016 and final reporting to be completed by the end of 2016. The final deliverables of the project are considered to be the study design, quality assurance planning, sampling parameters and baseline network for urban background studies across the United States, as well as the analytical results and statistical review of sample data for PAH, arsenic, and lead concentrations of cities across the southeast region.

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## Saving our waters...one initiative at a time *Continued from Page 15*

The first credit auction will take place April 16, 2015 in New York City. Funds generated through the sale will be used to implement best management practices on more agricultural lands in hopes of further reducing nutrient loading of the Ohio River.

Thomas Jefferson once described the 981-mile-long Ohio River as, "...the most beautiful river on earth. Its current gentle, waters clear, and bosom smooth and unbroken by rocks and rapids," is formed by the confluence of the Allegheny and Monongahela rivers. By volume, it is the largest single tributary of the mighty Mississippi. Water falling on, running through and over the 14 states residing in its

watershed end up in the Ohio River. By default, overapplied fertilizer and animal waste ends up there, too, eventually making its way to the Mississippi and on to the Gulf where it adds to the complexity of problems in the zone of hypoxia—hardly the destiny Thomas Jefferson or any of our forefathers would have wished.

"We have to face the realization that what we do on the land here not only affects the waters of the Commonwealth but eventually everyone and everything living downstream," said Kim Richardson, director of the Kentucky Division of Conservation. "We want to do our part to minimize negative agricultural impacts on the nation's water while supporting the

sustainability of our food supply and local farms. The Water Quality Trading Project has afforded us another opportunity to do just that."

### Dead Zones

Dead zones have been increasing for the past several years. It's estimated that more than 550 now exist worldwide, with the Louisiana coastal hypoxic zone ranking second largest in the global ocean, stretching from the mouth of the Mississippi River to the coastal waters of Texas and sometimes east of the mouth of the Mississippi.



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## Seedling nurseries: growing trees for healthy and productive forests



A tropical-like fruit in Kentucky, really? Yes, pawpaws are the only temperate member of a tropical family of trees. Although not found in stores, the pawpaw fruit has found its way to Kentucky farmers markets. It's sort of mango-meets-the-banana ... with a little hint of melon. The pawpaw is the largest edible fruit indigenous to the United States.

Seedlings are available from early fall to early spring from the Division of Forestry's nurseries. Orders are shipped at your request for planting projects during the dormant period throughout the winter. To obtain an order form, visit <http://forestry.ky.gov/statenurseriesandtreeeedlings/Pages/default.aspx> or call the Division of Forestry at 1-800-866-0555.

### *Just the Facts: Pawpaw (*Asimina triloba*)*

- **Growth:** The pawpaw is a large shrub or small tree growing to a height of 35 feet with a trunk 8 to 12 inches or more in diameter. The large leaves are clustered symmetrically at the ends of the branches, giving a distinctive over-lapping appearance to the tree's foliage. When fully grown the leaves are smooth, dark green above, and paler beneath. In autumn the leaves turn a rusty yellow.
- **Range:** The pawpaw is native to the eastern, southern and midwestern United States and adjacent southernmost Ontario, Canada, from New York west to southeastern Nebraska, and south to northern Florida and eastern Texas.
- **Wildlife Uses:** The fruit of the pawpaw is a large, yellowish-green to brown berry, 2 to 6 inches long and 1 to 3 inches broad, containing several brown seeds one-half inch to 1 inch in diameter embedded in the soft, edible fruit pulp. The conspicuous fruits begin developing after the plants flower; they are initially green, maturing by September or October to yellow or brown. The fruits are eaten by a variety of mammals, including raccoons, gray foxes, opossums, squirrels, black bears and people.
- **Tree Trivia:** Larvae of the zebra swallowtail, a butterfly, feed exclusively on young leaves of *Asimina triloba* and various other pawpaw species. Chemicals in the leaves confer protection from predation throughout the butterfly's life, as trace amounts of acetogenins remain present, making them unpalatable to birds and other predators.