

Land Air & Water

A bald eagle is perched on a thick, dark pine branch. The eagle has a white head and neck, a yellow beak, and dark brown feathers on its body. It is looking to the right. The background is a dense forest of pine trees with green needles and brown trunks.

Kentucky Energy and Environment Cabinet

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Land Air & Water

since 1988

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Department for Energy Development and Independence
Dr. Leonard Peters, *Acting Commissioner*

Editor and Creative Design
Cynthia Schafer

Agency Contributors

Joyce Bender
Roberta Burnes
Karen Cronen
Eileen Hardy
Mary Jo Harrod
Johnna McHugh
Jennifer L. Turner

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Email: Cynthia.Schafer@ky.gov or telephone 502-564-5525 to have your name added to the mailing list. Address changes and deletions should also be addressed in this manner.

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From the Secretary's Desk

As I was reading the stories for this summer edition of *Land, Air and Water*, I reflected on the particular appeal of this magazine—not just this issue, but all issues of *Land, Air and Water*. For me, the magazine reminds me of the cell phone cover one of my grandchildren gave to me—it has the drawing of the glass, half filled with liquid, and the message, “the glass is half full.” My grandchildren, it’s safe to assume, perceive me as being an optimist, and generally I am. When I read each issue of *Land, Air and Water*, I’m always reminded of the many positive things happening in Kentucky regarding our efforts to protect the environment. I’m reminded of the dedication of our employees in the Energy and Environment Cabinet, and I’m also reminded of the many people throughout the Commonwealth who want to do the right thing.

This particular issue also made me reflect on how innovative thinking is essential to addressing environmental and natural resource challenges. There are a couple of stories that especially capture the essence of innovative problem solving. There is the story on Page 5 about the Kentucky Division of Forestry engaging the services of bloodhounds in its efforts to investigate arson wildfire cases.

The story on Page 17 describes how the cabinet’s use of satellite imagery helps in monitoring for harmful algal blooms. Monitoring for algal blooms using conventional methods is not only very expensive, the amount of time needed to monitor all areas of the state makes using conventional methods virtually impossible. By using the satellite imagery, Division of Water staff can more effectively target their monitoring efforts, saving time and money, and ensuring greater protection of human health.

These stories show that many of the problems we confront can be addressed using existing tools in new or different ways. They help show that generally there are many possible solutions to our challenges—and the greater the number of possible solutions, the more likely we are to employ the one that is most effective. So, let’s look for a half-full glass whenever possible so that we don’t limit our innovativeness and our imagination.



SAVE THE DATE

The annual **Governor's Conference on Energy and the Environment** will take place this fall Sept. 8-9, 2015, at the Lexington Convention Center. Mark your calendars and plan to attend. For information and conference prices, visit <http://eec.ky.gov/Pages/conference.aspx>. Online registration opens soon.

Visit Land, Air & Water online at
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Land Air & Water

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Features

Our Cover



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Kenya Stump discusses Kentucky's options for advancing solar energy production.



- 6** **Water Health Portal**
Learn about the health of the Commonwealth's streams, lakes and rivers via this new online tool.



This adult male American Bald Eagle is one of a pair that nests near Kentucky Lake. The photograph was taken in Marshall County in June 2014 by Todd Hendricks, who works at the Division of Waste Management in Frankfort.



- 13** **Bad Branch**
Absorb the breathtaking sights, sounds and scents of this nature preserve located on Pine Mountain.

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ABOVE: Kim Roberts stands beside her tomato crop inside the high tunnel. **RIGHT:** This solar panel was installed on the Roberts farm. Photos courtesy of the Roberts family



Kenya Stump

Q&A | Renewable energy

Options for Kentucky's energy independence

For readers who are new to the term 'renewable energy,' it refers to energy from a source that is not depleted when used. Solar, wind, biomass, water and heat from the earth (geothermal) are all good examples of renewables. Some even classify landfill gas-to-energy projects as renewable.

This is the first of an ongoing series of articles that discusses the state's renewable energy landscape. *Land, Air & Water* magazine recently sat down with Kenya Stump, assistant director of Kentucky's Division of Renewable Energy, to discuss the hot topic of solar energy.

Why do people choose solar for energy production?

KS: What I have seen is that people either choose solar because they have a strong commitment to the environment or they want more control over their own electricity and they see a future with higher electricity prices. The latter sees it as a way to increase consumer choice around a commodity—electricity, but both groups can also be driven by economic reasons to reduce their monthly utility bills.

Look no further than the Roberts family of Franklin, Ky. They installed solar

on their farm for all those reasons. Kim Roberts and her husband Bart own and operate Garden Spot Produce. The Roberts built a high tunnel and grow tomatoes almost year-round. For the Roberts, their solar installation is both economic and it fits into their family values as stewards of the land. Their electricity is a value-added commodity to their produce operations. They do it for their daughter and for the community that they support.

That is one example, but does solar work in other areas around Kentucky?

KS: The simple answer is yes. Kentucky has moderate solar resources compared to other states nationwide. We are not the best state for solar, but we are not the worst state either. Not every location in Kentucky may be suited for solar, but it can and does work here. In fact, people have a choice of using solar for hot water heating or for producing electricity. A solar hot water heater, in some cases, may be a better option.

If solar does work in Kentucky, then where is it?

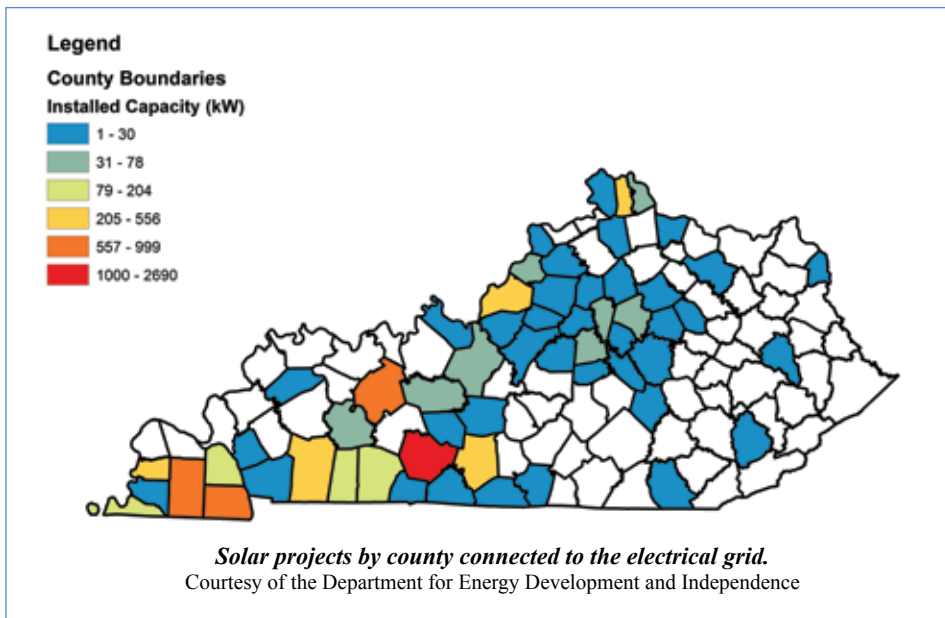
KS: Most people would be surprised to know that it is spread out across the

state (see map on Page 2). Western Kentucky has benefited from Tennessee Valley Authority (TVA) incentives that have promoted solar installation, along with support for the agricultural sector through U.S. Department of Agriculture renewable energy grants. In Louisville and northern Kentucky, it is more a factor of population and socio-economics.

Another great story is with our military operations. Fort Knox, Fort Campbell and the Kentucky National Guard all have been strong proponents of solar, making it part of their mission for energy security. Go take a tour of Fort Knox and see Kentucky's largest solar array.

Do the reasons for using solar change when you look at larger international businesses in Kentucky?

KS: Not really, it's just a matter of scale. It still comes down to the values of that business. For our international businesses, it's about how they position themselves to compete for customers on a



global scale; it's about image, and if they are working to meet corporate sustainability goals.

Wal-Mart, Toyota and General Electric are good examples of how energy and environmental issues play into their business models. In order for states to attract and keep these businesses, they need to have a robust renewable energy landscape. It's now an economic development issue.

Why don't we see more solar in Kentucky?

KS: Well, it's complicated. Kentucky has low electricity prices compared to other states with higher solar potential. Kentucky has the ninth-lowest average retail electricity rate at around 9.5 cents per kilowatt hour. Until recently, the cost of the electricity produced over the lifetime of the solar photovoltaic system far exceeded the retail rate, making a return on investment challenging for a residential customer.

The good news is that Kentucky customers can still get a payback within the lifetime of their solar installation because the costs have decreased significantly, but it may take longer compared to other states with greater solar potential and higher retail rates.

The other good news is that when a local utility installs solar, the electricity it creates becomes more financially competitive compared to residential or commercial installations because it has more resources

at its disposal and the size and scale of the utility make it cheaper to operate. In some cases, these installations are competitive with traditional fossil generation technologies. Louisville Gas & Electric/Kentucky Utilities (LG&E/KU) is slated to install a 10 megawatt solar operation in Mercer County; in Berea, customers who can't afford to install solar in their homes can own a portion of a solar array through a community program offered by Berea Utilities.

So if costs are declining, does that mean there are incentive programs for solar?

KS: The TVA has a Green Power Provider Program in western Kentucky that pays above retail for solar production. It's a basic 'pay-for-production' program that uses two electric meters and provides customers with a direct monetary payout. This program has resulted in a significant number of installations in that area.

For the rest of the state, net metering allows customers to use one meter and any excess electricity can be applied as credits on their utility bill.

Of course, federal and state tax incentives are also available. But, unfortunately, Kentucky's incentives are expected to expire in 2016. For rural small businesses and agricultural operations, the U.S. Department of Agriculture offers a grant program that has performed well in western Kentucky. I hope more rural small businesses will take advantage of it

this year. Finally, we had EPAD (Energy Project Assessment Districts) legislation pass that allows for commercial, industrial and multi-family building owners to take advantage of innovative tax financing for projects.

What are the biggest challenges facing solar growth in Kentucky?

KS: Because solar energy can polarize political parties—those that want clean energy and those that want more consumer choices—you'd think it would be easy to advance solar growth initiatives. However, it's hard to get everyone to agree on the same thing because each side is a proponent of different programs. Another major issue is the benefits and costs of solar to commercial and residential customers and to the utility. Customers that assume the costs to install solar believe they should be compensated because it provides benefits to other customers, as well as the utility. Utilities, on the other hand, recover costs and are guaranteed by law to collect revenue by selling electricity. Consequently, an increase in solar customers means a decrease in electricity sold by utilities, less recovered costs and fewer revenues. Since selling electricity pays for the necessary infrastructure and power plants, the question remains—who is responsible for maintaining that infrastructure and how much should they pay?

What advice can you offer to someone interested in solar?

KS: First, do your research. Talk to a reputable solar installer certified by the North American Board of Certified Energy Practitioners. Check out their previous work and talk to their customers. Make sure they are aware of all Kentucky building codes and provide a safe work environment while on your property.

I would also seek out a solar association in Kentucky for recommendations on projects to visit and other solar resources.

I also recommend using the online PVWatts Calculator at <http://pvwatts.nrel.gov/>. It allows homeowners, small building owners, installers and manufacturers to easily develop estimates of the performance of potential photovoltaic (PV) installations. Finally,

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TOP LEFT: *Letcher County School District Energy Manager Sherry Sexton.* Courtesy of Sherry Sexton. **ABOVE:** *Light transformations—Henderson County students participate in an energy project.* **LEFT:** *Kentucky school energy managers.* Courtesy of Kentucky School Boards Association

Kentucky's school energy managers

To effect change you have to educate

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

On a warm August day, elementary students gathered in the cafeteria of Fleming Neon Middle School in Letcher County in preparation of the first day of the new school year. They were eagerly waiting to hear how much their school's energy team saved the previous year. As part of the districtwide school energy team program, they knew they would receive an incentive check amounting to 10 percent of their energy savings. Sherry Sexton, the district's school energy manager, announced they saved \$25,000 and that means they will have \$2,500 to spend on much-needed instructional supplies. For districts like Letcher that are constrained by tight budgets, students and teachers are excited to conserve energy.

Letcher County is among 82 school districts across Kentucky that employs an energy manager, either independently or

through an energy management partnership. These districts' school energy managers promote sound energy practices and help schools eliminate wasteful energy use.

In 2010, the Kentucky Department for Energy Development and Independence, in partnership with the Kentucky School Boards Association (KSBA), launched an initiative called the School Energy Managers Project (SEMP) to help school districts improve energy efficiency, save costs and support student learning. Together, they knew to effect change you have to educate. Today, KSBA-SEMP provides financial support through state and utility-funded grants to 42 school energy managers and provides administrative, educational and technical support to all of Kentucky's 173 school districts.

Since the program's deployment five years ago, energy-efficiency strategies have redirected more than \$48 million in cumulative avoided costs back into school budgets. That is equivalent to 1,207 teaching positions or the cost of 96,600 computers. And, Kentucky's schools are

using less energy today than they were five years ago, even though the conditioned space has increased more than 5 million square feet.

No matter how large or small, every savings opportunity counts. While energy-efficiency strategies vary across the state, school energy managers are linked and defined by shared goals—to reduce emissions and save energy—thereby saving money to be used in the classroom. For many smaller districts, or districts with budget constraints, raising awareness and focusing on behavior-changing strategies are instrumental in changing the school's energy profile.

"I have been with Letcher County School District for the past five years," says Sexton. "Two years ago, the district formed an energy management partnership with neighboring Harlan County and Harlan Independent. With 21 school buildings, it's a busy job that's for sure. But the energy teams have really gotten involved in energy management practices."

Energy teams include students, teachers and staff members, whose key focus

is raising awareness about energy saving opportunities.

“We decided early behavior-changing strategies driven by an incentive program was the best option to achieve energy conservation goals,” continued Sexton.

Managing building operations is also critical to effective energy management. Monitoring utility bills for accuracy and identifying spikes in energy consumption provide useful information to modify behavior or to implement conservation measures. These activities, combined with cultural changes, resulted in significant energy savings for Sexton’s districts.

Letcher County Energy Team students work on a National Energy Education Development Project.
Photo courtesy of Kentucky School Board Association



Letcher County saw a 14 percent reduction districtwide in energy usage and avoided \$188,917 in energy costs over a five-year period. During the past two years, Harlan County School District energy savings totaled \$30,894 and Harlan Independent Schools totaled \$10,683.

“I am so proud of my districts for their energy conservation,” says Sexton. “Their efforts pay them back. Not only by saving money and energy, but by setting an example of leadership and commitment. Students feel empowered with knowledge and are learning life skills that will be shared with their families and communities.”

Energy costs are the largest expense in school district budgets, second only to personnel. Kentucky’s school districts spent \$148 million in fiscal year 2014 for nontransportation energy expenses. Energy is vital in managing school buildings and optimizing the learning environment for students and teachers. According to KSBA, without attention to energy management, today’s nontransportation costs

could have been 20 percent higher.

Warren County Public Schools in western Kentucky has a long history of energy management and was one of Kentucky’s first districts to hire an energy manager. In Jay Wilson’s first year, the district saved \$560,499 by making small changes.

“That first year of savings inspired the ambitious plans that came next—building Richardsville Elementary, the nation’s first net-zero energy school, a school that

generates as much energy as it uses,” said Wilson.

The school project demanded innovative energy reduction strategies, leadership and collaboration, as well as a renewable energy source. When completed, the building set new standards for school design, building and operation. But what’s also impressive is how the building itself is one large classroom imparting lessons about the environment, energy and health, among other important things.

“I feel like Richardsville is a total learning environment,” said Wilson, “and we’re passing something on to the next generation that they will pass on to their kids. We’re teaching them about sustainability and how to be energy conscious. These students can tell you more about geothermal or solar energy than most adults.”

Analysis by the Kentucky Energy and Environment Cabinet shows that school energy managers have a statistically sig-

nificant association with reduced energy consumption. Districts with an energy manager who focused full-time on energy management have seen 6 percent more savings than districts without an energy manager, which equates to about \$30,000 per year per district.

Jim McClanahan, energy manager for Scott and Woodford county school districts, encourages students to also use energy saving practices at home.

“I think one of the reasons I am so passionate about saving energy is because of my own experience. I grew up on a farm in Grant County, and my parents taught me at an early age the importance of saving. It is very satisfying to me to think that I’ve influenced a whole generation of students with skills they will use throughout their lives, just like my parents taught me.”

McClanahan’s influence has motivated the 4,000 students of Woodford County to save energy, achieving a 10.2 percent reduction last year and earning them national recognition as eighth in the nation and first among Kentucky’s participants in the U.S. Environmental Protection Agency’s national building competition. Energy usage reductions of more than 10 percent districtwide saved more than \$980,000 between 2010 and 2014.

Through the energy in education collaboration, KSBA-SEMP has effectively reduced energy consumption, raised awareness and saved Kentucky’s schools millions of dollars. After all of this work, it is not surprising that Kentucky is a leader in school energy efficiency and is an example nationwide. Kentucky is also ranked above the national average with 277 ENERGY STAR-certified school buildings.

“Kentucky’s school energy managers have proven to be a valuable resource,” says Greg Guess, director of the Kentucky Division for Energy Efficiency and Conservation. “They have the potential to help districts realize significant cost savings, reduce environmental impacts and expand opportunities for student learning and leadership, in addition to the positive effects that extend beyond the immediate school community.”



KDF has gone to the dogs

K-9 wildfire arson units investigate Kentucky fires

By Jennifer L. Turner
Division of Forestry

Chloe and Magic have become real assets when it comes to investigating forest fires in Kentucky, and to say that they work like dogs could not be more accurate. Chloe and Magic are bloodhounds that help the Kentucky Division of Forestry (KDF) track down arsonists. KDF's new Bloodhound Wildland Arson Investigation Program is the result of a partnership with the Kentucky Department of Corrections' Bell County Forestry Camp. Funded through a grant from the U.S. Forest Service, this program has quickly become an effective tool for incident commanders and arson investigators across eastern Kentucky.

The tracking instincts of bloodhounds have been well documented and demonstrated. Whether an arsonist is local or has traveled miles to set a wildfire, most are well within the range of a relentless bloodhound's nose that can track humans as far as 130 miles.

Bloodhounds have 176 times as many olfactory receptor cells as human beings housed inside their characteristically long, slender snout. In fact, the animal's entire anatomy is designed to track scent. The long, swinging ears actually touch the ground and fan residual scent molecules towards the dog's nose as it follows a trail. The thick skin wrinkles on the face and neck capture and concentrate odor molecules in their folds. Even their excessive drool when working serves as an additional odor

trap. Their large, muscular paws and frame give them the strength and endurance needed to track humans across mountainous terrain.

"The K-9s have the ability to survey a variety of terrain in a fire scene in an incredibly short time," says Adam Sloan, an officer with the Kentucky Department of Corrections. "The dogs dramatically increase the investigator's ability to retrieve an accurate reflection of the people present at a fire scene and increase the chances of finding the responsible party."

When KDF receives a call that there is a fire, it dispatches a forest firefighting crew. When possible, a dog team goes with them. Once KDF firefighters control the blaze and locate the origin of the fire, the dog team gets to work. Handlers place a sterile gauze pad on the surface of the fire source for 20 minutes. Then, the gauze is placed in a plastic bag from which the dog sniffs to obtain the 'scent.' The first thing the bloodhound does is smell everyone on the scene to eliminate them from the source. Once it has obtained the scent, the tracking dog takes the officer

from the scene of the fire to the location of the suspect.

Officer Sloan and fellow officer Josh Brock have investigated eight wildland fires with Chloe and Magic since the program began in the fall of 2014.



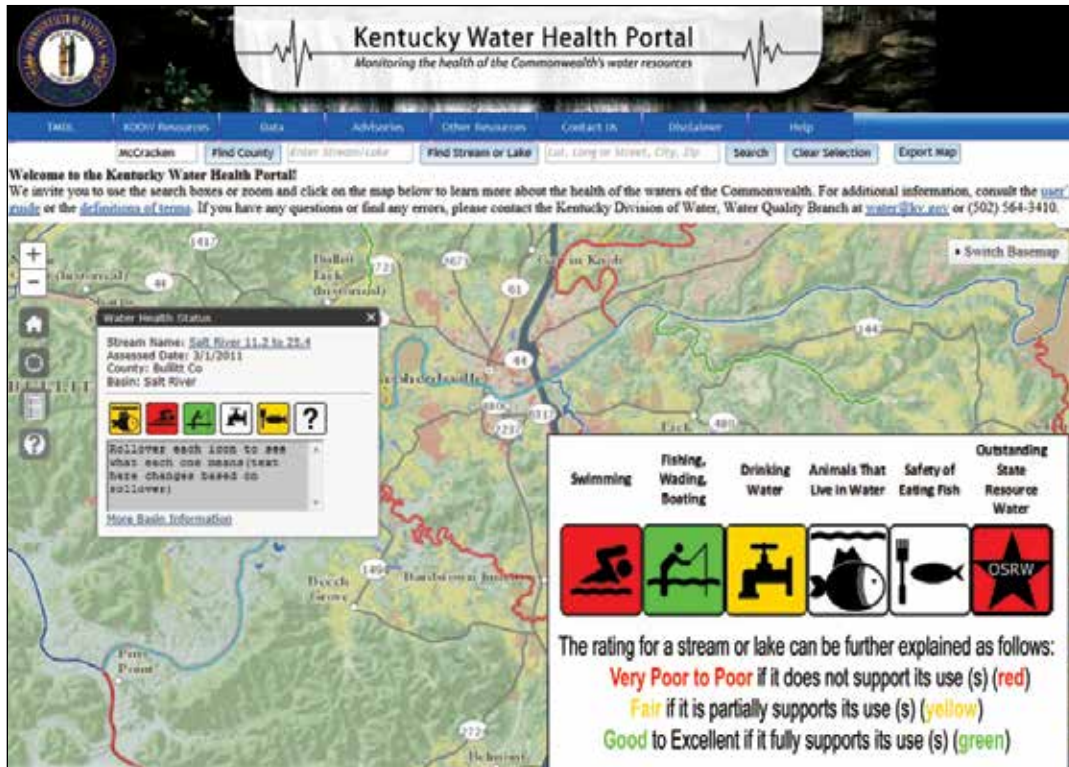
TOP: Chloe tracks a scent on location. **ABOVE:** Officer Adam Stone with Chloe. Photos by KDF

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Kentucky Water Health Portal

DOW monitors health of the state's water resources; information now available at your fingertips

By John Webb and Emily Hogue
Division of Water



Browser Information

The portal is best viewed in Google Chrome, Mozilla Firefox or Apple Safari.

We all need to visit the doctor for a regular checkup to ensure that our bodies are healthy. We know the drill—blood pressure readings, temperature readings, blood work and other standard markers of health are assessed during the normal office visit. Just as our bodies need to be assessed, the Commonwealth's waters also need to be evaluated for their health.

A team of environmental scientists in the Kentucky Division of Water (DOW) is tasked with studying the complex systems that comprise water health. Their results are now available online using the new Kentucky Water Health Portal.

The portal was developed in response to the 2013 House Bill 378, an act related to making the complex and technical data presented in the Integrated Report more transparent to the average citizen. The report, submitted to Congress every two years, includes information based on the health and physical properties of the Commonwealth's waterbodies and assessments of fish and bugs that call the waters home.

"The Division of Water, in an effort to make this information more accessible and easier to understand, worked with a diverse group of stakeholders to incorporate their feedback as the Kentucky Water Health Portal was developed," said

DOW Director Peter Goodman. "The portal is a high-quality communications tool that, we believe, will quickly become a valuable asset to Kentuckians who want to stay informed about their waterways."

How does the portal work?

Think about your favorite place on Kentucky's waters—that spot where you caught the biggest fish or maybe a quiet stream bank where you go to relax. With that spot in mind, visit the Kentucky Water Health Portal at <http://watermaps.ky.gov/WaterHealthPortal/> and type in the area that interests you.

With a few clicks of the mouse, you can learn if your favorite spot is safe to swim in or if the fish are healthy enough for your family to eat. The information is presented through a series of color-coded icons.

If your favorite stream is impaired, you can find ways to help in the efforts to improve water quality by clicking on "more basin information" that provides the basin coordinator's name and any upcoming basin events.

The DOW has had its finger on the pulse of Kentucky's waters since the inception of the Clean Water Act in 1972. Its dedicated environmental scientists have worked tirelessly collecting, studying and interpreting the data. Now with the creation of the Kentucky Water Health Portal, every citizen can have their finger on the pulse of one of Kentucky's most precious resources.

KDF has gone to the dogs

Continued from Page 5



LEFT: Josh Brock and his canine work a fire scene off of Trail 1 at Kentucky Ridge State Forest.

BELOW: Bruiser, the first bloodhound used to investigate arson fires, appears on the KDF state vehicles.
KDF photos

“We had a fire that occurred in Knox County,” said Brock. “We were able to determine the fire’s point of origin—a fence that had been cleared below the black top road. At that point we couldn’t tell if the fire had been started as arson or not.”

Scent swabs were left at the scene for 20 minutes and then Magic went to work. She immediately traced the scent back down the road to a black Mazda truck parked in a shed at a nearby home.

Sammy Faris, a state trooper with the Kentucky State Police (KSP) was first on the scene, followed by Detective Joshua Bunch, an arson investigator for KSP. Bunch questioned several individuals in the area, including the person who had driven the truck. The driver admitted to setting the fire to burn out a fence row. In this particular case, the fire wasn’t arson, but a debris fire that got out of hand. The person who caused the fire was only charged with the cost for putting out the fire and was not arrested.

Though Magic and Chloe have been trained to be professional investigators, to them and other dogs like them the work is just a big, fun game.

“All she’s asking for in return is a pat on the head, somebody to tell her she did a good job,” said Officer Slone.

The costs to state and local resources for fighting wildland fires due to arson is in the millions of dollars, while the damage to forests runs in the tens of millions. Arson is tough to prove, but a bloodhound is a huge asset.

“There is nothing that can equal the scent-ability of the dog that we can take to fire scenes and use,” said Leah MacSwords, director of KDF. “We hope to grow our partnership with the Department of Corrections and Kentucky State Police to find and prosecute wildland arsonists. Our goal is to eliminate wildland arson in the state, and with Magic and Chloe on the job we have one more tool to making that happen.”



Q&A | Renewable energy

Continued from Page 2

learn about what your utility offers. Go to their website and research net metering and other renewable energy programs. By law, utility net metering information should be easily accessible to customers.

Finally, is Kentucky a renewable energy state?

KS: I would have to say yes, both from a historical and technical perspective. Dix Dam was built in 1923 by Kentucky Utilities and today hydroelectricity still represents our greatest percentage of renewable energy production.

Geothermal heating and cooling is so well known that it has become the norm rather than the exception on construction and renovation projects.

Residential solar PV installations continue to grow. Landfill gas to energy got a boost last year with the city of Glasgow and Toyota announcing projects.

Currently, Fort Knox has the largest solar array, and Fort Campbell and LG&E/KU should complete their solar projects by the end of 2016. In addition, American Municipal Power is completing three new hydroelectric power plants on the Ohio River. All in all, Kentucky has a pretty diverse renewable energy mix.

More recently, the Kentucky Public Service Commission announced that a utility can enter into a special contract with energy intensive customers to procure renewable energy for that customer. This is great for those businesses that want to “green” their energy portfolio.

Make an impact—plant a tree

By Jennifer L. Turner
Division of Forestry

Planting one tree can provide many benefits over time—among them abundant shade, which can reduce a homeowner’s or businessowner’s energy costs, and increased property value as mature trees can impact a neighborhood’s stability as well as salability. More importantly, a single tree helps us breathe easier, improving air quality and reducing carbon dioxide.

On average, young trees absorb carbon dioxide (CO²) at a rate of 13 pounds per tree each year. Trees reach their most productive stage of carbon storage at about 10 years, at which point they are estimated to absorb 48 pounds of CO² per year. At that rate, they release enough oxygen back into the atmosphere to support two humans. Trees continue to capture carbon throughout their lifespan and retain that carbon in the products made from the tree.

This spring, Kentuckians planted 671,000 new trees that will absorb approximately 4,361 tons of CO² from the Earth’s atmosphere in one year.

Trees were planted all across the state for a variety of reasons, many as part of community Arbor Day and Earth Day celebrations. Several of these celebrations were part of the Kentucky Division of Forestry’s (KDF) Kentucky Tree Recovery Program. These, along with many more tree planting events, were counted as part of the Kentucky 20/20 Vision for Reforestation.

The Kentucky Tree Recovery Program is a collaboration between KDF, the Arbor Day Foundation, FedEx and Lexmark to reforest areas hardest hit by the devastating tornadoes that swept across the state in 2012. This two-year project got off the ground last year when seedlings were distributed to 10 counties affected by the tornadoes.

This spring, Kenton, Magoffin, Martin, Morgan and Pendleton counties each received 5,000 trees to give away and plant. The seedlings were grown at KDF’s reconstructed Morgan County Nursery that was also destroyed in 2012.

Kentucky’s 20/20 Vision for Reforestation project was proposed last year by Energy and Environment Cabinet Secretary Len Peters and endorsed by Gov. Steve Beshear. The goal of the project is to plant 1 million trees each year for the next 20 years. Kentucky’s Boy Scouts, Girl Scouts, other groups and numerous businesses are assisting with the planting of seedlings on public and private land deemed suitable and available for planting.

Last year’s goal was not reached, but momentum for the project is steadily increasing. To date, this year’s plantings combined with last year’s means Kentuckians have planted more than 1 million trees in the first two years.

“It may take us a few years to reach planting a million trees in one year,” says KDF Director Leah W. MacSwords. “However, we almost doubled what we planted last year with this year’s plantings. It’s an attainable goal.”

As summer unfolds and you find yourself basking in the shade of a tree, give a nod of thanks to the person who might have planted that tree long ago.



Eastern Kentucky University tree planting.
Photo by KDF



ABOVE and BELOW: Arbor Day at Huntertown Elementary. Photos by Jennifer Turner



Lafayette High School tree planting.
Photo by KDF



SMOKE SIGNALS

Heading off to Smoke School

By Roberta Burnes
Division for Air Quality

When I was first hired at the Kentucky Division for Air Quality, I remember hearing about staff going to something called Smoke School.

“Smoke School is a *thing*?” I wondered. Yes, Smoke School is definitely a thing. And if you work for certain types of facilities that emit regulated pollutants—or an air agency that is responsible for regulating those pollutants—you may actually be required to attend Smoke School twice a year.

This spring, I joined dozens of others and attended Smoke School to see for myself what it was all about—and to see whether I had what it takes to pass the test and be a certified “smoke reader.”

At its simplest, Smoke School is where you learn to “read” visible emissions. Usually that means smoke that is emitted from the stack of a power plant, factory or other facility. But it can also mean dust released from grinding, powder



TOP: *Smoke School* students observe visible emissions plumes to identify opacity levels of smoke. **ABOVE** (left to right): Black smoke at opacity levels of 25 percent, 50 percent and 75 percent are used during *Smoke School* to calibrate an observer’s eyes.

Courtesy of Eastern Technical Associates

coating or even painting. Visible emissions are regulated through a facility’s air permit. Air permits are required by the Clean Air Act for everything from major industrial plants to smaller facilities like flour mills and auto paint shops. An air permit details regulated pollutant limits, as well as how a facility must prove it is staying within those limits.

Let’s say you own a factory that has three wood-fired boilers. You have three emission points, or “smoke stacks,” from those boilers. The visible emissions from those stacks must meet certain *opacity* limits that are defined in your air permit.

Opacity is a measure of how much light the smoke is obscuring. So, when you see a smoke plume against the sky or trees, opacity measures how much of the background is being blocked by the smoke. Very thin smoke may barely obscure the background, while thick smoke may block out most color and detail.

Is it smoke or is it steam?

Before attending Smoke School, I thought everything coming out of a smoke stack was smoke. But it turns out that isn’t always true. In fact, most often what we see as billowing white “smoke” is actually



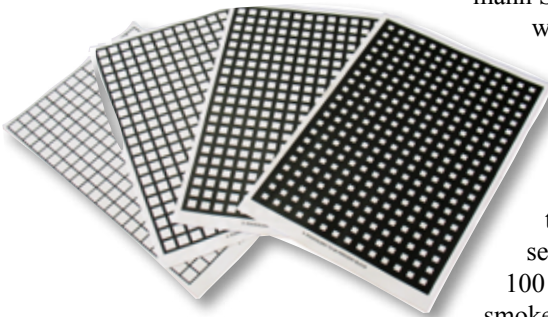
UPPER LEFT: Roberta's score sheet shows her first attempt at reading smoke and her 20 percent error. **ABOVE:** Students check their smoke reading scores on a cold, foggy morning at E.P. Tom Sawyer Park. Courtesy of Roberta Burnes

steam, which is nothing more than water vapor. Steam looks a lot like clouds—three-dimensional with lots of shadows. Actual smoke contains fine particles—products of combustion—known as particulate matter or PM. The microscopic particles in PM can be inhaled deep into the lungs, causing a wide range of serious health problems. These fine particles also scatter light, so smoke that contains high levels of PM will have a higher opacity and thus be harder to see through.

Smoke reading, then and now

Humans have been concerned about air pollution as far back as the 13th century, when King Edward I banned the burning of sea coal in London to protect public health. By the time of the Industrial Revolution, smoke from factories and home heating was darkening the skies on a daily basis in many cities.

To regulate air pollution, communities needed a method for determining how much smoke was too much. In the late 1800s, Maximilian Ringelmann of Paris, France developed a method that became known as the Ringelmann Smoke Chart,



which included a series of black and white grids (see charts to left). The idea was to have an observer stand about 100 feet from the smoke plume while an assistant held the chart

along the same line of site. When viewed from that distance, the lines on each grid would appear gray. The observer would then compare the smoke to the various grid cards to determine visual density of the smoke.

In developing the chart, Ringelmann realized there was a connection between smoke density and combustion efficiency. By adjusting the ratio of fuel to air, efficiency could be increased while smoke was decreased. Less smoke also means less fuel is wasted, and that saves the facility money over time.

Ringelmann's system was used extensively in the U.S. until 1974, when the Environmental Protection Agency (EPA) published procedures for a new method known as Reference Method 9, which allows observers to quantify opacity too, but without charts. Instead, observers are required to attend Smoke School, where they practice by viewing emissions from a smoke machine that has been carefully calibrated to emit smoke at various opacities.

Calibrating the eye

The smoke machine isn't the only thing that is carefully calibrated. At its core, smoke reading is about calibrating the

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SMOKE OR STEAM?

What we think is smoke coming from smoke stacks is quite often steam, or water vapor. Steam has the appearance of clouds and is too thick to see through.



SMOKE SIGNALS

Continued from Page 10

human eye. Smoke School instructors train students to accurately read opacity with no more than a 15 percent error on any one reading, and with an overall standard deviation of no more than 7.5 percent.

The machine is set up in an open area and students are instructed to observe within a specified zone, with the sun to their backs, in order to get accurate readings. Plenty of things can influence the accuracy of opacity readings, including:

- Angle of sunlight
- Observer's position
- Weather conditions
- Wind speed and direction
- Length of time for an observation.

As a steady stream of smoke is emitted, opacity levels are called out via loudspeaker. Rather than focusing on the smoke, I learn to focus on the background *behind* the smoke. How much of the background can I see? How much color and detail in the background are visible? Reading after reading, the brain and the eye begin to build a memory for what opacity looks like at different percentages, from 5 percent (nearly invisible) to 95 or 100 percent (completely opaque).

As accurate as a machine

Is Method 9 accurate? Just ask Jarrod Bell, who has attended and passed Smoke School for 10 years.

"Method 9 works," says Bell. "The fact that so many students pass the test is proof that the human eye can be calibrated to a high level of accuracy. You can't fake it; you either pass or you don't."

EPA conducted extensive field studies to determine the reliability and accuracy of Method 9. The studies conclude that a properly trained and Smoke School-certified observer can, indeed, accurately assess visible emissions.

Bell has compared his own Method 9 readings to a continuous opacity monitor (COM)—a high-tech machine that is used to test emissions from smoke stacks in large, industrial facilities. His readings came within a couple of percentage points of the monitor.

"Some folks are uncomfortable with



Louis Towner, city smoke inspector for Grand Rapids, Mich., is perched in his lookout in the City Hall clock tower making notes on charts as he views a large plume of black smoke in 1911. Courtesy of Grand Rapids Historical Commission

Method 9 smoke reading because there's no machine crunching out hard numbers," says Bell. "If you're properly trained and certified, Method 9 is as accurate as a machine."

So why not just use a machine? Many larger facilities such as power plants are required to use COMs to monitor their emissions. But at a cost of tens of thousands of dollars, such equipment is too much of an economic burden on smaller businesses.

"Method 9 is accurate, cheap and quick," says Bell. "You can have a valid reading in as little as 6 minutes. It's also noninvasive; an inspector doesn't need to climb the stack to make a reading."

All of these qualities make Method 9 a valuable, cost-effective tool for demonstrating compliance with air quality regulations.

Passing the test

The morning of Day 2 at Smoke School was cold and foggy—not exactly the best weather conditions for reading smoke. About 70 students gathered at E.P. Tom Sawyer Park in Louisville to take the test, consisting of 50 readings each of white smoke and black smoke.

Instructors set the smoke machine to a certain opacity level, and then called out "Read!" That was our signal to look up—

for no more than 3 seconds—and mark our test sheets with a number. Was it 20 percent? 50 percent? There was no time to think about it; just rely on our training.

Thirty minutes later, it was time to see who passed. We gave an ungraded carbon copy of our answer sheet to the instructor. One by one, correct answers were called out as we checked our scoring sheets. To pass, students are allowed only a specific margin of error and no single reading can be more than 15 percent off from the correct answer. As the answers were called out, I discovered one 20 percent error on my score sheet. Back to square one!

Typically, Smoke School instructors will run the test three or four times to allow more opportunity for students to achieve a passing grade. Approximately 65 percent of students pass on the first try.

Still, passing the test doesn't mean you're finished with Smoke School. Method 9 requires you to get recertified every six months. The human eye needs to be recalibrated and the training refreshed to ensure accurate readings.

Thankfully, I passed on the second try. Two weeks later, I received my certificate. I am a bona fide visible emissions inspector and a proud Smoke School graduate.



LEFT: OCTC's 1965 Cobra was on display at this year's State Government Earth Day celebration in Downtown Frankfort.

Courtesy of Michelle Shane

INSET: Courtesy of Eileen Hardy

Old-school muscle cars

They don't make 'em like they used to

By Eileen Hardy

Department for Energy Development and Independence

During the 60s, the original intent of the muscle car was to put the most powerful engine into the lightest car possible. However, in response to stricter government regulations on safety and fuel mileage, today's quintessential muscle car includes high-tech amenities and its high-performance engine may be powered, in part, by corn.

This year, during the state's Earth Day celebration in Frankfort, students of the Owensboro Community and Technical College (OCTC) had an opportunity to demonstrate their modern-day muscle car, a Factory Five 1965 AC Cobra. More than 50 community college students built the car and converted the engine to run on environmentally-friendly E85, a biofuel that contains 85 percent ethanol produced from corn and 15 percent gasoline.

The Cobra project marked the beginning of an expanded program in alternative fuels including ethanol, biodiesel and propane technology. Last year, OCTC introduced a new project, "Preparing Vehicle Technicians for Advanced Transportation Fuels," to teach an advanced skill set needed for technicians to compete in the 21st century workforce in Kentucky and the nation. The project is under the direction of OCTC's Southeastern Campus Director Mike Rogers and automotive faculty Keith Nall.

Manufacturers are using advanced technologies to improve fuel economy in many of their vehicles. Along with hybrids, plug-in hybrids, and all-electric vehicles, new technologies are being used to make conventional vehicles more efficient as well. Some of these fuel-saving technologies are start-stop systems, advanced transmissions, improved aerodynamics and lighter vehicles.

"A cleaner environment benefits everyone," said Rogers. "With more organizations and businesses adopting high fuel and efficiency standards, workforce needs are demanding higher standards of training. The future is now, and training vehicle technicians



to repair autos running on any alternative fuel is a unique endeavor."

Kentucky's Department for Energy Development and Independence supports the advanced transportation fuel project and joins a wide-spectrum of partnerships representing academia, industry and government to address the needs of an evolving industry. The college's partnership with the nonprofit organization Kentucky Clean Fuels Coalition (KCFC) has been instrumental in linking Kentucky's providers and users of fuels to the best information and education available about clean energy technologies.

Looking back over the years, it is easy to see how the transportation industry has evolved. What once could be learned by working in a garage today requires high-tech skills and knowledge in science, technology, engineering and mathematics. However, the college's advanced transportation fuels project is not alone in terms of alternative fuels education and outreach.

Since 2009, 30-plus partners have been collaborating on the "longest biofuels corridor on the planet," making the Green Corridor—all 1,786 miles of U.S. Interstate 75—traversable using either of the biofuels E85 ethanol or B20 biodiesel.

About an hour's drive south of OCTC is the town

of Hopkinsville, home to Commonwealth Agri-Energy. The 100 percent, farmer-owned facility produces 33 million gallons of ethanol from 12 million bushels of corn annually. The familiar line 'build it and they will come' from the movie "Field of Dreams" stands to reason that Common-

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Bad Branch State Nature Preserve

A sensory tour on Pine Mountain

By Joyce Bender
Kentucky State Nature Preserves Commission



the velvet softness of moss cloaking the hollowing shell of a beech tree. It is the rich, earthy scent of needle, bark and leaf moldering into soil and the sharp, spicy fragrance of pine needles, blueberry leaves and sandstone baking in the sun at the summit. It is the bracing chill of the spray from the 60-foot waterfall at the head of the gorge, the delicate curve of the ghostly pale Indian pipe, the dash of crimson on the white canvas of the painted trillium. It is the earth meeting sky along the crooked

to the waterfall is less than two miles round trip). A portion of the Pine Mountain Trail passes through the preserve along the crest of the mountain between the Jefferson National Forest property on the east and U.S. Highway 119 to the west.

Bad Branch is one of eight state nature preserves on Pine Mountain. The site's ecological significance led the Kentucky State Nature Preserves Commission in 1992 to seek partners to work on protecting high-quality natural areas along the entire 120-mile length of Pine Mountain. Targeting gaps between existing public lands and with additions acquired in the ensuing years courtesy of The Nature Conservancy, the Kentucky Heritage Land Conservation Fund, Kentucky Natural Lands Trust, Kentucky Department of Parks, the Kentucky Division of Forestry, the Kentucky Department of Fish and Wildlife Resources, the Pine Mountain Trail Conference, the Pine Mountain Settlement School and the U.S. Forest Service, we really have something to show for those early dreams.

Come visit Bad Branch and the other public lands on Pine Mountain and give your senses, as well as your legs, some exercise.

TOP: Indian pipe.
Courtesy of Barry Howard

INSET: Painted trillium.
Courtesy of Ellis Laudermilk



As the manager of Kentucky's state nature preserve system for the past 29 years, I am often asked which preserve is my favorite. I have several that I hold close in my heart, but more often Bad Branch comes into my thoughts ahead of the others when I hear this question. It may be that a girl from Ohio found in the mountains of southeastern Kentucky a landscape so breathtakingly different that her first visit in 1987 made a lasting impression. Or it may be that the sights, sounds and scents of this Pine Mountain paradise stayed with

me and can still be easily conjured up whenever I say its name. Rather than taking leave of my senses over this beautiful place, I truly came into them there.

Bad Branch is the sound of tumbling water rushing down the south face of Pine Mountain on its way to the Poor Fork of the Cumberland River. It is the calls of the black-throated green warbler that follow you through the cool, shady forest. It is the sunlight drifting through the lacy boughs of hemlock trees,

spine of Pine Mountain.

There are many distinctions for Bad Branch. The variety of life protected within the 2,639-acre preserve includes the highest concentration of rare plants and animals known from the 63 state nature preserves. Bad Branch was designated a state wild river in 1986. The 7.5-mile roundtrip trail to the falls and High Rock on the crest is one of the most scenic in Kentucky (a hike just



2015 Earth Day celebration

*State Government hosts exhibits at the
Thomas D. Clark Center for Kentucky History in Downtown Frankfort*

Photographs courtesy of Michelle Shane

1. Joanne Cushard, volunteer conservation interpreter with the Salato Wildlife Education Center, holds an Eastern screech owl. Salato in Frankfort provides native wildlife exhibits, shelters, trails and brochures for nature lovers.

2. Deven Carigan (right) with the Kentucky Division of Water describes how aquatic macroinvertebrates collected from streams (and stored in the bottles) are used to determine stream health.

3. Attendees got a close look at a bee colony provided by the Capital City Beekeepers Association of Frankfort. The association provides mentoring for beekeepers at its monthly meetings.

4. A young rider charges her cell phone battery using a bicycle

provided by Walk Bike Frankfort. Walk Bike Frankfort is dedicated to making the city a safe place to get around without a car.

5. (left to right) Michelle Shane, Department of Agriculture; Steve Meredith, Finance and Administration Cabinet; and Sarah Cummins, teacher at Virginia Chance School in Louisville, hold fresh vegetables from the Governor's Garden to educate about the health and economic benefits of community gardening.

6. A plug-in electric Chevy Volt provided by the Kentucky Division for Air Quality drew large crowds throughout the day.

7. Woods and Waters Land Trust helps landowners find ways to protect their land for future generations.

REDEVELOPING A BROWNFIELD

From assessments to networking—the Kentucky Brownfield Redevelopment Program can help

Mary Jo Harrod
Division of Compliance Assistance

Cleaning up a brownfield property can be a daunting task, but knowing that property will take on a new community purpose can be exciting and rewarding. Before all that can happen, though, the property must undergo assessments to determine if any contaminants are present at the site.

In 2009 and 2011, the Cumberland Valley Area Development District (CVADD) received \$200,000 in U.S. Environmental Protection Agency (EPA) Brownfields Assessment Grants to conduct Phase I and Phase II assessments on potential brownfield properties throughout the district that includes eight counties and 17 cities.

Early in the process, a CVADD Regional Brownfields Committee was formed that included mayors, judges, emergency managers, health department personnel, city building inspectors and interested citizens. It hired Bob Perkins of AMEC Environmental and Infrastructure Inc., as its environmental consultant.

“Bob created an inventory of potential sites throughout our region, and we began



Benham Medical Clinic in Harlan County. Courtesy of Bob Perkins, AMEC Environmental and Infrastructure Inc.

to conduct kickoff meetings throughout the ADD area,” explains Whitney Chesnut, public administration specialist for CVADD. “We had a great turnout and people seemed enthusiastic about the possibility of turning underutilized sites into green space or something that would create jobs.”

During monthly Regional Brownfields Committee meetings, individuals conducted presentations describing their sites of interest. Once the presentations were finished, the Regional Brownfields Committee would rate and rank each site

by completing a score sheet to determine whether it would receive a Phase I and/or Phase II environmental assessment.

Perkins and Chesnut would tally the scores and present the results to the Regional Brownfields Committee. The committee would then vote for the site with the highest scores. By doing this, the sites with the most potential for redevelopment or having the most impact on human health or the environment would be chosen.

As a result, two communities each received \$200,000 in cleanup grants from

UPCOMING EVENTS

Grant Training and Assistance

The Brownfield Redevelopment Program regularly provides assistance to grant applicants. This year, it will provide training in the following locations:

- Sept. 9—Prestonsburg, Big Sandy Area Development District
- Sept. 11—Frankfort, DEP Training Center
- Sept. 17—Paducah, City Hall Training Room

The workshops start with general grant writing skills in the morning and cover brownfield and redevelopment grants in the afternoon. These workshops are free, but there is limited seating. To register for any of these events, visit <http://dca.ticketleap.com>. One-on-one applicant consultation is also available during the proposal writing session.

National Brownfields Training Conference

Sept. 2-4—The National Brownfields Training Conference, co-sponsored by the EPA and the International City/County Management Association, is the largest training and networking event in the nation focusing on environmental revitalization and economic redevelopment. All topics related to brownfield cleanup will take center stage in Chicago. Now in its 16th year, the event hosts:

- More than 150 interactive educational sessions
- Continuing education credits for training workshops
- Networking and volunteer opportunities
- Interactive mobile workshops around Chicago
- An exhibit hall with 200 exhibitors, and much more.

Learn more about the conference and register at www.brownfieldsconference.org.



Lincoln Hall in Jackson County will become a cultural arts center for receptions, after school and summer youth programs. Courtesy of Jake Moss

“Our region has accomplished so much with the assistance of our consultant and these great folks [Kentucky Brownfield Redevelopment Program] in just a few short years. We look forward to continuing our efforts to revitalize the CVADD communities through EPA brownfields funds.”

Whitney Chesnut of CVADD

the EPA. The city of Benham, located in Harlan County, plans to utilize its funds to clean up and reopen the former Benham Medical Clinic, where the community hopes to once again provide medical care to its citizens. Jackson County Ministries will use its funds to clean up Lincoln Hall, part of the Annville Institute, which will be used as a cultural arts center. Last fall, Lincoln Hall also received a \$49,000 Cleaner Commonwealth Fund grant (read about *Funding* in the sidebar). These funds will be used to put two properties into productive reuse, boosting tax rolls, and providing jobs and an economic boost to each community.

“Reach out to the Kentucky Brownfield Redevelopment Program coordinators and your EPA project manager by inviting them to your local brownfield meetings,” says Chesnut. “By having them present, the Regional Brownfields Committee members have been able to receive vital information about this program.

“Our region has accomplished so much with the assistance of our consultant and these great folks in just a few short years. We look forward to continuing our efforts to revitalize the CVADD communities through EPA brownfields funds,” said Chesnut.

Allowing the CVADD Regional Brownfields Committee to rate, score and vote on the sites chosen to receive the Phase I and/or Phase II assessments gave the region a voice in determining where and how the EPA grant monies were spent. Not all sites that receive a Phase I and Phase II assessment end up applying for cleanup funds, but this clear and fair process helps the communities determine what additional sites may need to be considered during the next round of funding.

Overall, the CVADD region was pleased with the outcome.

“We devised a good process to decide which properties had the most redevelopment potential and did assessments on those properties,” Chesnut says, “resulting in two cleanups and demonstrating the effectiveness of an assessment grant. We have had a huge success with this method.”

For more information about the Kentucky Brownfield Redevelopment Program, call 800-926-8111 or email envhelp@ky.gov.

BROWNFIELD REDEVELOPMENT PROGRAM UPDATE

By Amanda LeFevre
Division of Compliance Assistance

The Kentucky Brownfield Redevelopment Program seeks to cleanup and revitalize properties that are abandoned or underutilized due to real or perceived contamination. In 2012, the Kentucky Legislature enacted a law that reduced uncertainty for potential developers while ensuring safe reuse of these properties. The result has been a significant increase in projects that return these formerly idle brownfields to beneficial uses. Read about additional news regarding Kentucky brownfields:

Free Assessments

The Brownfield Redevelopment Program provides free environmental site assessments to local governments and nonprofits. It is important to have an assessment done prior to acquiring the property. This is a necessary step for obtaining Bona Fide Prospective Purchaser liability protection and to be eligible for many brownfield grant and loan programs. Nearly 60 properties have been assessed by the program since its inception in 1997.

Funding

Once a property is assessed, it becomes important to develop and implement a cleanup plan. The Brownfield Redevelopment Program has established the Cleaner Commonwealth Fund to assist with these cleanups. Recently, a second round of grants was announced and loan program applications will be solicited in the near future. Also, the U.S. Environmental Protection Agency has announced its annual brownfield assessment and cleanup grants. This year, there were eight applicants from Kentucky.

For Additional Information

If you have any questions about redeveloping brownfields in Kentucky or any of the services described above, contact Herb Petitjean or Amanda LeFevre at 800-926-8111 or visit our website at www.dca.ky.gov/brownfields.

Monitoring HABs using satellite imagery

By Garrett Stillings
Division of Water

Algae are a vital part of Kentucky's aquatic ecosystems. Algae compose the food and energy base for all organisms living in stationary water systems. An algal bloom is a rapid increase in the density of algae that can occur in response to elevated levels of nutrients. Algal blooms can deplete oxygen levels used by aquatic life, and blue-green algal blooms (Cyanobacteria) have the ability to release toxins that can be unsafe to humans and animals either through ingestion or skin contact. Blue-green algae are not true algae, but rather bacteria that can photosynthesize. These harmful algal blooms (HABs) have become an expanding global problem in recent decades. As late as August 2014, the city of Toledo, Ohio issued a "Do Not Drink" tap water advisory for more than 400,000 residents after a HAB in Lake Erie made water too toxic to drink.

In the 2015 spring issue of *Land, Air and Water*, readers were introduced to HABs as an environmental problem in some Kentucky lakes with the potential to threaten human and animal health. To date, Kentucky waterbodies that have been investigated have not seen toxic levels like that of Toledo; Kentucky has only issued recreational advisories for exposure and not drinking water. Because of the adverse effects of HABs, the Kentucky Division of Water (DOW) has developed monitoring strategies to identify possible areas of

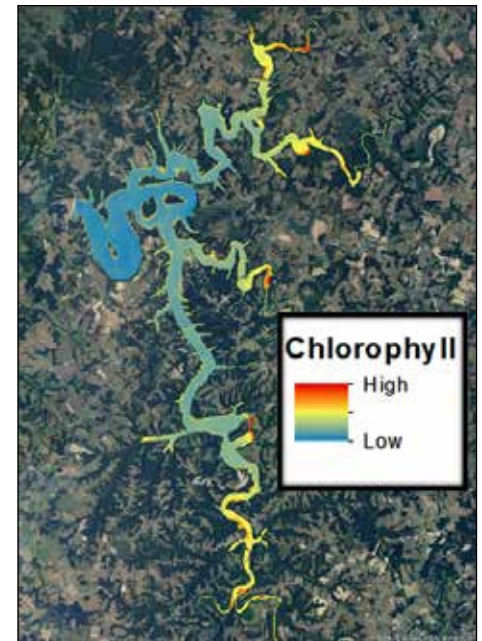
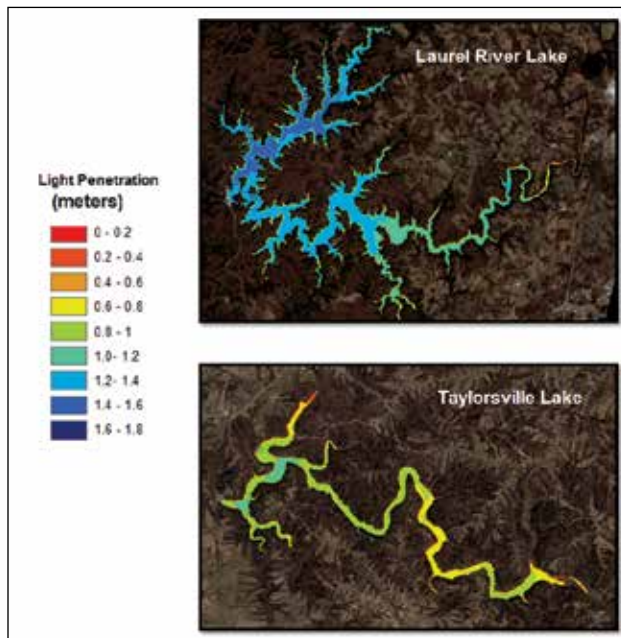
concern in the state's waters and to help mitigate exposure to the public.

Because weather is a big driver as to when and if an algal bloom occurs, persistent sampling is required. However, continuous HAB monitoring with traditional sampling can be both costly and time intensive. As such, DOW is using free Landsat satellite imagery to overcome these obstacles. This process of using satellite imagery to obtain information about distant waters is otherwise known as remote sensing. The Landsat program is a collaborative effort between NASA and the U.S. Geological Survey that began in



LEFT: Landsat imagery of Nolichucky River Lake on Sept. 25, 2014. Algal bloom presence is shown in red highlighted in white boxes.

BELOW: Barren River Lake chlorophyll concentrations showing certain tributaries with an increased probability of a HAB. Landsat image from Sept. 25, 2014. BOTTOM LEFT: A model of lake clarity (Secchi depth). Laurel River Lake shows little concern for a HAB, while areas in Taylorsville Lake show a higher probability of HABs. Landsat image from June 14, 2014. Courtesy of the DOW



1972 and is the longest-running project for acquisition of satellite imagery of Earth. Landsat imagery is comprised of many spectral bands that measure different wavelengths of light and passes over Kentucky every 16 days. Satellite remote sensing is useful for HAB monitoring because the chlorophyll in algae is a photosynthetic pigment that absorbs certain wavelengths of light. The DOW can correlate specific landsat bands with the response of the spectrally active chlorophyll to develop models that can predict the distribution of HABs.

By comparing Landsat imagery with water quality measurements, two models have been developed to help aid in locating HABs. One is a chlorophyll model that directly relates to algal concentration and

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Environmental art

Contest inspires creative works by Kentucky students

By Mary Jo Harrod
Division of Compliance Assistance

The wonderful thing about art is that it speaks to you without saying a word. Creative works of art by 13 Kentucky high school students were chosen as winners of this year's Eco-Art Contest, sponsored by the Kentucky Department for Environmental Protection (DEP). In its fifth year, the contest encourages students to create and submit artwork that inspires others to protect and preserve the environment. View each winning piece of art on Photobucket at <http://tinyurl.com/q4gb3wz>.

Students submitted artwork in a variety of forms, including sculpture, drawing/painting/print, mixed media and photography based on the contest themes of conservation, pollution prevention and environmental protection.

Marina Witt, 16, of J. Graham Brown School in Louisville, created *The Spill* depicting the Earth with trash falling out of one side, fire emerging from the top representing forest fires and black paint symbolizing oil spills.

"I was motivated to do this art piece when I was out at the park and I saw litter everywhere," said Witt. "All I thought about was how much humans pollute this Earth."

Emily Jeter, 17, of Metcalfe County High School, created a sculpture titled *Redneck Taxidermy* made from recycled wood, newspaper, cardboard, tape and paper towels.

"My art was inspired by my love of animals and nature," said Jeter. "I wanted to show that I could make something beautiful out of everyday garbage that would have been thrown into a landfill."

Another winning sculpture representing the human heart was crafted by Miranda Keedy, 14, of North Bullitt High School in Shepherdsville. Keedy said her art titled *Beating Machines* motivated her because "humans are



FROM TOP: Marina Witt holds *The Spill*, depicting litter and forest fires; Emily Jeter's *Redneck Taxidermy*; Mindy Greenwell's *Reflections* made of cans and CDs; Miranda Keedy's *Beating Machines* made from wires and cogs depicting the human heart; Stephanie Stumbur's *Who is Winning?* defines the battle between nature and industry. Photos submitted

so invested in gadgets, and making new inventions and machines that they don't think about the waste left behind. We as humans are polluting our Earth and making it junk."

Another North Bullitt High School student, Mindy Greenwell, 17, created a sculpture from soda cans and CDs she calls *Reflections*.

"I believe that conservation is important in our everyday lives. If we use our imagination we can come up with ways to repurpose objects into both functional and beautiful art."

Stephanie Stumbur, 16, of Paul Laurence Dunbar in Lexington, titled her print work *Who is Winning?*.

"This work personifies the battle between nature and industrial landscape. The natural forms are the ripped paper and mix of colors are modeled after the blooming flowers and trees of Kentucky spring," said Stumbur. "The geometric, sharp cuts of newspaper and swatches of gray represent the dense, uniform structures of a built environment."

Other winning entries were submitted by Peyton Hawks from Pleasure Ridge Park High School in Louisville; Haley Bragg, Rachel Hampton and Kennedy Kincaid from Metcalfe County High School in Edmonton; Christina Howard from West Jessamine High School in Nicholasville; Samara Hall from Newport High School in Newport; and Vicky Lin and Taylor Wilson from Atherton High School in Louisville.

The artwork will be on display at the DEP Training Center in Frankfort. Details about the 2016 Eco-Art Contest will be announced later this year. For information, visit <http://dca.ky.gov/LGGS/Pages/ecoart.aspx>.

Awards

Students, schools recognized for outstanding energy projects

By Eileen Hardy
Department for Energy Development
and Independence

Energy projects from four Kentucky schools earned national awards by the National Energy Education Development (NEED) Project during the 2015 National Youth Awards Program. NEED recognizes our nation's students and teachers for demonstrating their commitment to environmental education.

Students and teachers from across the U.S. gathered in Washington D.C. to receive prestigious honors for their energy education, outreach and community service projects.

Virginia Chance School of Louisville was selected as the national NEED Elementary School of the Year as a result of their student energy team's extraordinary leadership, community outreach and support of sustainability at their school. The student projects, called Bright Ideas, include energy and environmental conservation initiatives like recycling, reducing energy use, sustainable gardening, raising beneficial insects for pest control, constructing rain barrels, and designing and



Students representing Lloyd Memorial High School from the Erlanger-Elsmere Independent School District receive recognition for Senior Rookie Finalist during the NEED National Youth Awards Program.
Courtesy of NEED

building a solar energy pump to transport water from rain barrels to water greenhouse plants. Produce harvested from the greenhouse was made available to the farmer's market, the school community and donated to another school. The student projects raised \$7,800 for environmental education.

Two schools from the Erlanger-Elsmere Independent School District received national honors—Tichenor Middle School was selected as the Junior Finalist, and first-time candidate Lloyd Memorial High School was named Senior Rookie Final-

ist. Hardin County's West Hardin Middle School was selected as the National Junior Rookie of the Year.

In April, 186 students from 18 schools were also recognized for their energy education projects. A total of 29 student projects were submitted to the Kentucky Youth Awards Program and showcased at the statewide event held in Frankfort in partnership with the Kentucky Green and Healthy Schools program. Full details may be found at <http://need.org> or by emailing Karen Reagor at kreagor@need.org.

Monitoring HABs using satellite imagery *Continued from Page 17*

the other is a Secchi depth model (or how far light can penetrate in water) that portrays lake clarity. Through the use of these models, the DOW has been able to accurately predict spatial and temporal HAB trends in Kentucky waters remotely. When remote sensing has indicated a potential HAB, ground reconnaissance is prompted to verify if a public advisory needs to be placed on the waterbody.

The DOW has been using remote sensing to monitor Kentucky's waters since 2013 and has learned which waters, including drinking water reservoirs, are in need of increased monitoring and which have low potential for a HAB. Other than advisories, citizens should avoid areas with visible algae and/or scum. Backwater areas that are shallow and do not receive much flow are areas with the highest probability for a HAB. Waters such as rivers and streams have a low likelihood for a HAB because high

flow is not favorable to algal growth. Waterbodies that receive excessive nutrient runoff or even have large nuisance Canada goose populations can also have a high potential for a HAB. Blooms can have a wide variety of appearances; some appear greenish, purple, red, white or brown and even have the appearance of spilled paint.

To reduce the risk of HAB exposure, be aware of the waters you are recreating in and check for HAB advisories at <http://water.ky.gov/waterquality/Pages/HABS.aspx>. For additional information about HABs or remote sensing, visit <http://water.ky.gov/waterquality/pages/HABS.aspx> or contact Mark.Martin@ky.gov or Garrett.Stillings@ky.gov. For updates on water levels and HABs at U.S. Army Corps of Engineers lakes visit <http://www.lrl.usace.army.mil/Missions/CivilWorks/WaterInformation/HABs.aspx>.

Contest teaches students to respect natural resources

By Johnna McHugh
Division of Conservation

Name one Kentucky nature competition where high school students learn how to identify different soil types and the plants that can grow in them, perform water testing for pH, absorb information about wildlife and their habitats, identify invasive species, and even calculate board feet from lumber. If you answered the Kentucky Envirothon, then congratulate yourself as well as this year's winners who took part in the two-day competition held in May in Jabez, Ky.

Thirteen high school teams competed against each other in the nature-related topics of soils, forestry, aquatics, wildlife ecology and this year's environmental topic "urban forestry."

Paul Laurence Dunbar High School in Lexington won the competition for the fifth time in six years. Their coach, Carly Burton of the Fayette County Conservation District, works with them throughout the year to help them excel in all areas of the competition. The team is made up of 11th-graders Lucy Yang, Jasmine Liu, Jinny Han, Theo Livas and George Simpson.

In addition, the Fayette County team also scored highest in the soils, aquatics and forestry categories. They will now represent Kentucky at the North American Envirothon competition held July 27-Aug. 2, 2015, at Missouri State University.

North Hardin High School was the highest-scoring team affiliated with a local FFA chapter, winning the wildlife category and the oral presentation portion of the competition. The team will represent Kentucky at the Environmental and Natural Resources Career Development Event, which will take place in conjunction with the National FFA Convention in Louisville, Ky. in October. The Montgomery County High School team scored highest in the urban forestry category.

Kimberly Richardson, director of the Kentucky Division of Conservation, feels

Paul Laurence Dunbar High School student winners stand with Jackson Tolle, assistant director of agriculture education, women and young farmer programs of the Kentucky Farm Bureau Federation. Courtesy of David Hargis



the competition has great influence on the future of these young adults.

"The Kentucky Envirothon has been a wonderful competition since 1999. Hundreds of students have learned to respect their natural resources and ways to conserve them. Many students have chosen a natural resources career path due to the explorations they've made through the program," said Richardson.

The Kentucky Envirothon competition is sponsored by Kentucky Association of Conservation Districts, Kentucky Corn Growers Association, Kentucky Small Grain Council, Kentucky Farm Bureau, Kentucky Department of Agriculture, Kentucky Association of Conservation District employees and Kentucky Association of Conservation Districts Auxiliary.

Old-school muscle cars

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wealth Agri-Energy produces the fuel and OCTC students have learned how to use it.

From the OCTC campus in western Kentucky to the Daytona 500, advanced technology fuels set a new standard of performance for the modern-day muscle car. Since 2011, vehicles racing at Kentucky Speedway for the NASCAR Cup series events are fueled with a gasoline blend of 15 percent American, corn-based ethanol. One can only assume that some of those OCTC students dream of working on the advanced fuel vehicles of NASCAR. This program gives them the skills to achieve that dream.

The automotive industry is changing rapidly; however, cutting-edge technology programs such as the OCTC Advanced Transportation Fuels project demonstrate how *Momentum* brings a little nostalgia into the 21st century. Through partnerships and advancing energy education, Kentucky is preparing for the challenges of tomorrow. It is clear, technology will continue to change transportation, and transportation will continue to change our lives.

To learn more about OCTC visit <http://www.owensboro.kctcs.edu/>.



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Seedling nurseries: growing trees for healthy and productive forests



Mockernut hickory is one of several common hickory trees found in our area. It is a medium-sized tree, commonly growing up to 80-feet tall. Trunks can be up to 2-feet wide. The state champion tree is located in Leslie County, measuring 70 inches in circumference and reaching 142-feet tall.

Seedlings are available from early fall to early spring from the Division of Forestry's nurseries. Orders are shipped

at your request for planting during the dormant period throughout winter. To obtain an order form, visit <http://forestry.ky.gov/statenurseriesandtreeseedlings/Pages/default.aspx> or call the Division of Forestry at 1-800-866-0555.

Just the Facts: Mockernut hickory (Carya tomentosa)

- **Growth:** The bark of Mockernut is gray with furrows (deep wrinkles). Mockernut hickory leaves are pinnately compound, which means there are little leaflets (either seven or nine) surrounding a single stem. The whole leaf grows up to 20 inches long, with each leaflet growing up to 8 inches. Leaves are shiny yellowish-green on top and pale green below. The undersides of the leaves are hairy. In the fall, leaves turn bright yellow. Fruits are one and one-half inches to 2 inches long and round or pear-shaped. They are green at first, turning brown as they get older. When the fruit, or nut, matures the sides split apart so that there are four pieces of thick husk surrounding the seed.
- **Range:** Mockernut hickory grows in the Midwest and eastern portion of the United States. It is most abundant southward through Virginia, North Carolina and Florida. It is also abundant in the lower Mississippi Valley and grows largest in the lower Ohio River Basin.
- **Wildlife Uses:** Mockernut hickory nuts are consumed by many species of birds and other animals, including wood duck, red-bellied woodpecker, red fox, squirrels, beaver, Eastern cottontail, Eastern chipmunk, turkey, white-tailed deer, white-footed mice, among others.
- **Tree Trivia:** Mockernut hickory nuts are edible for humans. The tree wood is hard and used for furniture, flooring, tool handles, baseball bats and skis. It also makes great firewood. Smoked hams are usually cooked using Mockernut hickory wood.