

The Health of the Bluegrass: Is the Triangle Really Green?

By Mary Byrd Davis and Al Fritsch

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Introduction

Kentucky has been impacted in many ways by development. Some of the charm and beauty and many environmental and cultural treasures have been lost; others are directly endangered or threatened. As the Commonwealth prepares for the Equestrian games in 2010, we need to consider how green we really are. Quite often environmental criticism has been leveled at Appalachian portions of Kentucky for improper resource extraction (logging and coal mining practices); but the health of the “Golden Triangle,” which frames the Inner and Outer Bluegrass, tends to be overlooked. With the aim of promoting discussion, we present an overview of ten subjects of concern: land use, cultural features, energy sources, air quality, water resources, hazardous waste disposal, endangered species, invasive species, public transport, and nuisances.

We invite comments and additional information, as we hope to revise the report for 2010. Contact the authors at [ecoperspectives \(at\) gmail.com](mailto:ecoperspectives@gmail.com) .

1. Loss of Green Space

Kentucky as a whole and the Bluegrass especially are losing green space. The National Resource Conservation Service, which tracks conversion of natural land to development, reports that in 1992, Kentucky, with total acreage of 25.8 million acres, had 1.5 million acres of developed land. In 2003 it had just over 2 million such acres, an increase of 500,000 acres or some 50,000 acres per year. The pace of change has likely quickened since 2003. Relying on statistics from Kentucky's Division of Forestry, the Land Stewardship and Conservation Task Force, created by the Kentucky legislature, reported in 2008 that Kentucky currently loses an average of 136 acres of forest and 100 acres of farmland per day. This works out to a total of roughly 50,000 acres of forestland and 36,500 acres of farmland per year. Jon Gassett, Commissioner of the Kentucky Department of Fish and Wildlife Resources (KDFWR) reported to the task force that Kentucky loses 47,000 acres of wildlife habitat a year (1).

The Bluegrass has relatively little forestland compared to Eastern Kentucky. As is well known, it has extensive farmland, and the rate of conversion of the farmland can be assumed to be higher than the state average, because the Bluegrass is the location of Kentucky's "Golden Triangle," the metropolitan areas of Lexington, Louisville, and Covington, all pushing to expand outwards. The Task Force refers to the pressure for development in the Bluegrass when it states that "the fastest conversions [of farmland] are occurring in the Bluegrass and Pennyroyal regions" (2). More than 300 square kilometers (116 square miles) of farmland in the Inner Bluegrass were converted to other uses between 1997 and 2002, the World Monuments Fund Watch List states (3).

In 2002 the American Farmland Trust created a map analyzing how land use changes are affecting the United States' highest quality farmland. The map shows in red those mapping units with a greater percentage of high quality farmland (prime farmland as defined by the US Department of Agriculture, and land suitable for growing alternative crops such as berries) and a faster rate of development than the average mapping unit in the state. In the Inner and Outer Bluegrass a semi-circle of counties immediately east of Jefferson County, a group of counties in the Inner Bluegrass, and parts of several counties to their south and east are in red. Based on data from 1992-1997, Kentucky as a whole ranks eighteenth in the nation in rate of loss of prime farmland according to the Trust. Between 1987 and 1992 it lost 50,700 prime acres or 10,140 acres per year and between 1992 and 1997, 80,000 prime acres or 16,000 acres per year (4).

Residents of and visitors to the Bluegrass do not need statistics to tell them what is happening, however. As they drive out any of the major roads from Lexington, drive east from Louisville, or drive south from Cincinnati, they see mile upon mile of new houses and businesses. The very highways are swallowing land. The widening of US 68 from Harrodsburg to Lexington is eating up prime farmland, to name just one instance. Now being discussed is a connector road between Interstate 75 in Madison County and US 27 in Jessamine County, which would cross the Kentucky River.

Among the hot points for sprawl in the Bluegrass is the land east of Louisville and northeast of Bardstown road and the Watterson Expressway. James Bruggers reported in the *Courier-Journal* that the area grew twenty-six percent in the 1990s and is expected to grow an additional 13.4% by 2010 (5). The land around the Georgetown bypass in Scott County is rapidly filling up with buildings. For example, an apple orchard, opened when the bypass was built, will now be “developed.” Scott County anticipates construction of a mixed-use retail center, The Shoppes at Equestrian Crossing, between Wal-Mart and Toyota north of Georgetown. In Madison County, along I-75, north of Richmond the 120-acre Richmond Centre shopping area is scheduled to open in the fall of 2008 (6). The center will undoubtedly attract additional stores and housing to an area that is already becoming unsightly with buildings. For the Maysville area in Mason County a vast development project called the Wyldwood of Kentucky Resort Community, which would include a 2700-acre Hilltop Village, has been proposed (7).

Ironically the Kentucky State Horse Park, host for the 2010 World Equestrian Games, is a symbol of farmland conversion. The 1200-acre Horse Park used to be an actual horse farm. Now the park is being filled up with buildings and grand stands and parking lots.

Apart from the problem of conserving farmland, is the problem of conserving natural areas for the purpose of providing wildlife habitat. The least disturbed area of the Bluegrass is the Kentucky River Palisades, a winding gorge cut by the Kentucky River between what is now Clays Ferry in northern Madison County and Frankfort. Creation of the gorge began 400,000 to one million years ago. Today the limestone cliffs that line it rise as high as 400 feet from the river. Partly because the river winds, causing the banks to face in different directions, the palisades contain a wide variety of habitats, which support hundreds of species. Efforts to conserve the palisades began in earnest in the 1980s. Today more than 10,000 acres enjoy some level of protection. However, much land remains without any protection, and housing developments are being built along the palisades, raising the price of land and making it difficult for conservation organizations and government agencies to make purchases (8).

No river in the Bluegrass has been made a part of the federal or the Kentucky Wild Rivers systems, which would protect the river banks from development. One unit of both systems, nine miles of the Red River, is in the Kentucky River drainage but it is located in Powell and Wolfe Counties. The Bluegrass has no federal lands devoted to conservation. Its only federal lands are military, the Blue Grass Army Depot in Madison County and a corner of Fort Knox in Bullitt County.

In 1999 Fayette County raised the minimum lot size from 10 to 40 acres in its rural area, and in 2000 it established a Purchase of Development Rights (PDR) program, which has become a national model. As of June 2008, the program had permanently protected by means of conservation easements 20,834 acres on 182 farms, donated or bought with a combination of local, state, and federal funds. The program is admirable. However, when one looks at a map of PDR easements and of land protected by private organizations, one can see how far from being conserved rural Fayette County still is. The PDR lands form a sketchy patchwork, with the greatest concentration in the northern part of the county. Given that Fayette County has 128,267 acres in the rural service area, the 21,000 acres in easements represent only 16 % of the county's rural land. The goal of the PDR program is preservation within twenty years of 50,000 acres, less than 40% of the rural service area (9). Unfortunately there is no regional land use planning

in the Inner Bluegrass, and Fayette County's forty-acre lot size has actually helped create sprawl—in other counties. People wanting to build on small lots have simply bought them outside Fayette County. Scott County, tired of the buildings swallowing up its rural land, established a PDR program in 2008, the second county program in the state.

Louisville/Jefferson County has a small conservation easements program, and the state has an easement program for farmland, the Purchase of Agricultural Conservation Easements program (PACE), established by the legislature in 1994. As of November 2007, the state had purchased easements of 20,927 acres on 88 farms; and landowners had donated an additional 4,638 acres on 34 farms. However, the program lacked funding to go forward with purchases, and applications from 667 owners covering 129,000 acres were pending (10).

In Kentucky ninety-four percent of the land is in private hands. Therefore, one could expect private land trusts to play a major role in land protection in the state, the Task Force notes. Actually, according to data provided to the Task Force by the Land Trust Alliance, Kentucky trusts enroll less land than do trusts in any of the contiguous states.

Government agencies and private organizations are working to preserve land in Kentucky, but through lack of coordination and through lack of funding their efforts are falling short. The Land Stewardship and Conservation Task Force found that “Land conservation in Kentucky is fragmented. It is delivered by numerous different state agencies, local governments, universities, and private organizations each focusing on achieving different land conservation goals. This has led to a competition for land acquisition resources and scarce finances.” “The Kentucky Heritage Land Conservation Fund is the principal source of financing for land conservation in Kentucky, but it is insufficient for agencies to make needed land acquisitions.” The Task Force did not make any official recommendations but, in its report, it states that it discussed, among other things, the need for the Kentucky legislature to “identify and dedicate additional sources of funding for land conservation programs, including Purchase of Agricultural Conservation Easements” (11).

The Kentucky legislature needs to establish a dedicated source of funding for land conservation programs, including the state's PACE program, as stated by the legislature's task force.

Furthermore, government leaders, non-profit organizations, and concerned individuals need to encourage the return to food production of land that is within developed areas but that is not itself under concrete or asphalt. To facilitate the reconversion, any regulations that dictate lawns be frequently mowed and that discourage gardening and edible landscaping should be abolished. The community gardens that are beginning to be organized on vacant lots and in city parks, are a way of allowing people without land to grow food and of encouraging people who have never gardened to learn how to grow food. As transportation becomes increasingly expensive and as food prices rise, the need for reverse conversion is becoming obvious.

1. *Report of the Land Stewardship and Conservation Task Force, January 22, 2008*, Research Memorandum No. 502 (Frankfort: Legislative Research Commission, 2008), pp. 3-4.
2. *Report of the Land Stewardship*, p. 4.
3. Kentucky Derby Museum, “Vanishing Bluegrass” [Press announcement], February 7, 2007.
4. American Farmland Trust, Web site, at <http://www.farmland.org>, accessed July 2, 2008.
5. “2 Wastewater Plants Found Lacking,” April 5, 2008, p. 1A.
6. Ashlee Clark, “Richmond Centre to Open This Fall,” *Lexington Herald-Leader*, June 28, 2008, p. A14.
7. Marla Toncray, “Optimism Surrounds Wyldwood Proposal,” *The Ledger Independent*, November 14, 2007.
8. Andy Mead and Greg Kocher, “A Race for Space along the River,” *Lexington Herald-Leader*, January 14, 2007, pp. A1 and A14.
9. Lexington-Fayette Urban County Government, Division of Purchase of Development Rights, updated June 17, 2008.
10. Kentucky Department of Agriculture Farmland Preservation Program, “Current Status of Program,” available online at <http://www.kyagr.com/marketing/farmland/status.htm>, accessed July 16, 2008.
11. *Report of the Land Stewardship*, “Summary,” p. vii.

2. Cultural Losses

Losses of historic and cultural significance have occurred in both the inner and outer Bluegrass region. In fact, the World Monuments Fund (WMF) named the Inner Bluegrass to its 2006 list of the one hundred most endangered cultural sites in the world. In the announcement of the listing, the WMF stated, “The inner Bluegrass Region of Kentucky is one of the world’s most distinctive cultural and agricultural landscapes. Over the past decade, however, the Bluegrass Region has been threatened by rapid development, primarily suburbanization The result is substantial loss of rural farmland, compromising sense of place, undermining traditional industries such as horse breeding, and endangering historic structures” (1).

The nomination to the list was made by the Bluegrass Conservancy, the Bluegrass Trust for Historic Preservation, the Kentucky Heritage Council, and the University of Kentucky College of Design, working together. They have since developed an exhibit “The Vanishing Bluegrass,” which they displayed in 2007 at the Kentucky Derby Museum in Louisville. They hope to show the exhibit in Lexington and in other Bluegrass locations, but doing so will demand funds that, as of June 2008, they did not have available. Because of lack of funds, they have also been able to make little headway towards compiling a database of natural and cultural features of the Bluegrass, the first step towards preservation that they envisaged.

Going beyond the WMF’s statement, a close look at the region would show a host of cultural losses, in part because there was much to lose. The Bluegrass was the earliest settled portion of the Commonwealth and thus has a long post-settlement history. Both urban and rural areas have suffered. Historic urban areas have been marred or destroyed by redevelopment. Rural areas have suffered, in addition to loss of natural features, abandoned homesteads, loss of dry stone structures, neglect of barns, widening of country roads, near total disappearance of covered bridges. What makes the Inner and the Outer Bluegrass unique is indeed vanishing through haste, modernity, and the loss of the sense of the past.

Even battlefield sites do not receive the respect that should be accorded them. The Revolutionary War site at Bluelicks in Robertson County is commemorated by the 148-acre Bluelicks Battlefield State Resort Park. The park has been told that the battlefield site is ineligible for the National Register of Historic Places because of development on the grounds, including a lodge complex, but as a result of discoveries from archeological work at the location in 2008, the park will reapply to be on the Register (2). The Civil War Preservation Trust has placed the site of the Civil War Battle of Perryville in Boyle County on its 2008 list of the Ten Most Endangered [Civil War] Battlefields in the United States. Already 650 acres of the site have been permanently protected, but development and proposed development along the US 150 corridor between Perryville and Danville, land on which the battle was fought, threatens the site’s integrity. The Trust regards Perryville as especially worth preserving, as it is “one of the most pristine Civil War battlefields in the country” (3). The site of the Civil War Battle of Richmond, between Richmond and Berea, is on the trust’s 2008 list of “15 Additional Sites at Risk.” Again development surrounding a transportation corridor is a threat (4).

Other land areas needing special attention include old Afro-American communities created after the Civil War. Only a few of the original buildings, if any, remain at most of these

sites today: Jonestown (Fayette County), Brentsville (Bourbon County), Hometown (Woodford County) among many others. Visitors to Fort Spring west of Lexington, for example, find only a cemetery and a church. There they do, at least, stand on a vantage point from which countryside as well as Versailles Road can still be seen.

Often even when buildings are preserved, they are preserved without enough of the surrounding landscape or streets to give a sense of what the people who lived or worked in the buildings actually experienced. Ward Hall in Scott County has been saved from development, along with forty acres of land, but a subdivision will be built around the forty acres. The state of Kentucky has beautifully preserved Waveland, a Greek Revival home, on two hundred acres of lawns and woods. Visitors leaving the estate, however, are too quickly plunged back into the twenty-first century. Going left they shortly come to Nicholasville Road, one of the main arteries out of Lexington. Going right they pass electrical equipment and then come across a crowded housing development. When built, Waveland was on a 2000-acre tract of land.

The cities in the Bluegrass are struggling to revitalize their downtowns without destroying their cultural heritage. To the extent that Lexington is any indication, the forces of no-holds-barred development are in the ascendancy. In June, 2008, the Lexington Courthouse Area Design Review Board, which is responsible for encouraging “growth and development in the downtown area, while preserving and protecting the unique features and character of the area” (5) gave permission to the Webb Companies to begin demolishing buildings under the Board’s jurisdiction to make way for a thirty-five story hotel-office-condominium complex, Centrepointe. Centrepointe will be built on the block that was once the commercial heart of the city. Fourteen old buildings will eventually come down, twelve of them evaluated by the Kentucky Heritage Society as eligible for the National Register of Historic Places. The Design Review Board, in considering the Webb application, gave much weight to the cost of restoring the old buildings. Could not the old buildings have been replaced, if replaced they had to be, with structures on a more human scale, reflecting aspects of the city’s history and culture?

But the decision on Centrepointe should not come as a surprise. The city destroyed, for example, a viable, diverse urban neighborhood in the 1970s to create the parking lot for the Lexington Civic Center. Construction obliterated houses belonging to numerous members of historic Pleasant Green Baptist Church among others, and left the church looking oddly isolated on the edge of Maxwell Street across from the parking lot.

Numerous ante-bellum homes in rural communities have been abandoned especially since the mid-twentieth century, in part due to repair costs that were too expensive for struggling farm families or because of the high cost of heating, plumbing, and cooling these rather airy sprawling structures. When properties changed hands through sales, the new owners in some cases had little sense of the history of the place. “Placentia,” a historic home of the great grandparents of author Al Fritsch had once entertained General Lafayette on his triumphant 1820s trip to America. Even such a designation could not prevent this place from being destroyed to make way for a development in suburban Fayette County.

According to the non-profit Dry Stone Conservancy “Kentucky is the premier example of the rich dry stone heritage of the United States.” By “dry stone” is meant stone structures built without mortar. Kentuckians built from the native limestone, houses, farm buildings, churches, and kilns. Today these structures are largely gone. Many rock fences remain and are considered

a characteristic of the Bluegrass Region, but, “they are disappearing at an alarming rate,” victims of development, road widening, and simply neglect. Furthermore, few dry stone masons are available to repair them when necessary (6).

Farm buildings likewise add to the flavor of the region. The Bluegrass prior to the Civil war was once a major hemp growing region. Few barns for processing hemp have survived, although one stands at a corner of Iron Works Pike near the Kentucky State Horse Park. The region later became famous for burley tobacco “raising” and this gave two unique structures: tobacco barns and tobacco warehouses.

The tall tobacco barns were generally built on open hill tops to facilitate tobacco curing, and they contained rails for hanging stalks of the harvested tobacco. The demise of the tobacco economy since the turn of this century has led to the abandonment of many of these structures. Some have been recycled for storage of hay, equipment and produce or for use as commercial places and even residences. However, recycling is somewhat difficult because the barns were large and airy (with siding not fitting closely together and many air vents and doors), and targets of lightning, due to their position on elevated land.

Tobacco warehouses were used until a few years ago for auctioning off the loose leaf burley tobacco. The need for natural lighting for the grading and sales led to sprawling structures often near the heart of towns and this included the major sales place in Lexington. In that city and elsewhere the warehouses stood on valuable urban property and thus they have increasingly become the target of developers who have torn them down to make way for town houses and other commercial ventures. Some have been recycled into factories, dance halls, radio stations, craft and arts centers and other facilities. However, the cheap construction of many warehouses has sealed their fate.

Country roads meandered through rural areas of the Bluegrass. These were often tree lined, and the canopy formed a green arch to protect travelers from the hot summer days when the macadamized roads could become quite dusty. Later generations called for more durable tar surfacing and then, with a few crosses sprouting at hairpin turns, the roads were widened and curves removed to accommodate faster moving motor vehicles. With each addition, the roads lost some of their scenic beauty and so did the entire atmosphere of the Bluegrass countryside.

Covered bridges on country roads were once quite frequent in the Buffalo Trace and other parts of the Bluegrass. When the first author was young, there were twenty-two of these, but at the latest count this number had dropped to thirteen (7), as the others have succumbed to needed repairs, floods, road widening, and simply aging. Most likely a reason for covered bridges was that the horses were not as hesitant to trot through a covered bridge as to go over an open one. The bridge offered temporary shelter for travelers and the roofing protected the wood works quite well, but the relics of those other days later lost their significance.

Some restoration is already proceeding in a number of Bluegrass towns and villages. The Buffalo Trace region, which stood out prominently in the early settlement of Kentucky, presents positive examples that other areas would do well to follow. Four miles from the Ohio River is Old Washington, Kentucky, founded in 1775 in what is now Mason County. Today this is an excellent example of local people working together on a significant preservation project. They restored many of the original buildings along the main street, after U.S. 68/62 was moved one

block to the west. This town now has a log bank, post office and other examples of the early settlement homes along with museums and other sites of historic interest. Now including this site is Maysville (formerly Limestone), the heart of which includes a number of historic residences with New Orleans type ironwork. To the west also along the Ohio River is Augusta in Bracken County that has its own riverside architecture going back almost two centuries.

--AF and MBD

1. Quoted in Linda S. Blackford, "Bluegrass Put on Watch List," *Lexington Herald-Leader*, June 22, 2005, p. A8.
2. Paul Tierney, Park Naturalist, Bluelicks Battlefield State Resort Park, Personal communication, July 17, 2008.
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4. "15 Additional Sites at Risk," available online at <http://www.civilwar.org/mebr2008/15AdditionalSites.html>, accessed July 12, 2008.
5. "Development Misses Point," *Lexington Herald-Leader*, June 25, 2008, p. A12.
6. Dry Stone Conservancy, [Home Page of Web Site], <http://www.drystone.org>.
7. "Kentucky Covered Bridges," in *Kentucky Atlas and Gazeteer*, online at <http://www.uky.edu/KentuckyAtlas/>, accessed May 2, 2008.

3. Dependence on Coal for Electricity

In Kentucky as a whole approximately 95% of the electricity generated comes from coal. Six of the state's fourteen large power plants that predominantly burn coal are in the Bluegrass. This is not something for the region to be proud of, since coal-fired plants are major contributors to global warming, and since they emit a host of toxic substances that damage human health and the environment in other ways.

In 2006, the most recent year for which the US Department of Energy's Energy Information Administration (EIA) gives complete figures, Kentucky's electricity industry generated 98,792,014 Megawatt hours (MWh) net of electricity. Of this figure, 91,198,488 MWh came from coal (92.3%); 3,340,898 MWh came from petroleum (3.4%); 1,176,046 MWh came from natural gas (1.2%); 3,836 MWh from other gases (0%); 2,591,701 MWh from hydroelectric sources (2.6%); and 459,390 MWh from other renewable sources (0.5%); other (0%) (1).

Customers in the Bluegrass purchase and receive electricity from the utilities Louisville Gas and Electric (LG&E), owned by E.ON U.S. LLC, a member of the E.ON AG family of companies with headquarters in Germany; Kentucky Utilities (KU), also owned by E.ON U.S. LLC; East Kentucky Power Cooperative, and Duke Energy Company (formerly Union Light, Heat, and Power, owned at that time by Cinergy). However, electricity is transmitted from utility to utility and even from state to state based on need at a particular time and on economic factors. Therefore, it cannot be assumed that residents and businesses in a particular city always consume electricity generated by the company that serves them or by the nearest plants. In 2006, Kentucky's interstate trade in electricity resulted in a net result of 3,133 million kilowatt hours or 3.2% of production being sold out of state (2).

The six power plants in the Bluegrass that generated more than 2 million MWh of electricity each in 2006, all from fossil fuels (i.e. coal, oil, or natural gas), predominantly coal, are:

Facility Name	County	Owner	Nameplate capacity (MW)	Net Generation (MWh) 2006
Ghent	Carroll	KU	2226	12,207,723
Mill Creek	Jefferson	LG&E	1717	9,804,862
H. L. Spurlock	Mason	E KY Coop	1279	7,610,353

Trimble County	Trimble	LG&E	1760	4,526,798
E.W. Brown	Mercer	KU	1720	3,805,154
Cane Run	Jefferson	LG&E	675	3,581,101 (3)

Coal-fired plants are on the increase in the Bluegrass. One coal-fired plant has gone into operation in Kentucky since 2001. It is Spurlock Unit 3, a 268 MW plant near Maysville, which East Kentucky Power Cooperative put into operation in 2005. Three additional coal-fired plants have been approved for construction in the Bluegrass, a 278 MW plant, Spurlock Unit 4, approved for construction by East Kentucky Power Cooperative in Mason County; a 278 MW plant, Smith Unit 1, approved for construction by East Kentucky Power Cooperative in Clark County; and a 750 MW plant approved for construction by Louisville Gas and Electric in Trimble County.

The Bluegrass has only three relatively small hydroelectric plants. E.ON U.S. owns two of them: the Falls of the Ohio Plant at McAlpine Locks and Dam complex in Louisville, currently with a capacity of 80 MW, in the process of being raised to 100 MW; and the Dix Dam Plant near the E.W. Brown Plant in Mercer County, with a capacity of 24 MW. Lock 7 Hydro Partners owns the Mother Ann Lee Plant on the Kentucky River near Harrodsburg. It currently supplies 2 MW, but is being renovated to increase its capacity.

East Kentucky Power Cooperative has five small plants that make electricity from the methane gas given off by landfills. One of them is in the Bluegrass. Bavarian Landfill in Walton (Boone County) has four units which produce a total of 3.2 MW.

As a result of the leadership of Appalachia - Science in the Public Interest, Kentucky has a net metering law that makes it possible for householders to feed back into the grid electricity that they generate by means of solar equipment. Few to date have taken advantage of this possibility, although with the rapidly increasing price of fuel, more will undoubtedly do so in the coming years.

One major problem with plants that burn fossil fuels is that eventually their fuel supply will be exhausted. The shortage of oil is well known, but even coal reserves may not last as many decades into the future as is generally anticipated. The other major problem is that they release pollutants, in particular carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxides (NO_x), and, particularly in the case of coal, heavy metals.

Carbon dioxide is a major cause of global warming, and power plants play a key role in its emission. In the United States as a whole they contributed almost 40% of CO₂ emissions from man-made sources in 2006.

Sulfates from sulfur dioxide and products of the reaction of nitrogen oxides with ammonia, moisture, and other compounds are major sources of fine particle pollution (particles smaller than 2.5 microns in diameter), which damages human health by causing cardiovascular and respiratory problems. (Power plants also put fine particles directly into the atmosphere.) The reaction of nitrogen oxides with volatile organic compounds in sunlight produces the lung irritant ground-level ozone. Furthermore, sulfur dioxide and nitrogen oxides, forming sulfuric acid and nitric acid, acidify rain and other forms of precipitation, damaging forests and killing wildlife in lakes and streams. The precipitation often falls far from the power plant that released the chemicals, and plants in the Ohio River Valley contribute to the acidification of water bodies as far away as northern New England.

Kentucky power plants as a whole emitted a total of 101,784,836 tons of carbon dioxide in 2007, which made it the seventh state in the nation in quantity of carbon dioxide emissions from power plants in that year. In 2006 it emitted 102,289,243 tons, putting it in seventh position for 2006 also (4). Power plants tend to emit approximately the same amount of carbon dioxide per megawatt hour of electricity generated as one another so that there is not a wide spread among them as to rates of emission. However, it can be pointed out that, as calculated by the Environmental Integrity Project, Kentucky in 2006 had the third highest rate of production in the nation: 2071 pounds per MWh.

The Environmental Integrity Project ranked the plants in the United States by total carbon dioxide emissions in 2007. Three in the top hundred in were in the Bluegrass: Ghent (Carroll County) was 42nd with 12,561,781 tons; Mill Creek (Jefferson County) was 54th with 10,918,631 tons, and H. L. Spurlock (Mason County), 92nd with 8,156,402 tons. Next in the Bluegrass were E. W. Brown with 4,302,393 tons; Trimble with 3,912,618 tons; and Cane Run with 3,787,734 tons.

Kentucky power plants as a whole emitted 427,577 tons of sulfur dioxide in 2006. (The EPA Emissions Tracking System does not yet provide totals for 2007.) For total tonnage of sulfur dioxide emissions in 2006, Ghent was 50th in the nation with 49,913 tons. For emissions rate of sulfur dioxide, E. W. Brown was 14th in the nation with 23.75 pounds/MWh generated. Both these plants and Spurlock will be outfitted with equipment to remove most of the SO₂ by 2010. This equipment will reduce mercury emissions as well as sulfur dioxide (5).

Kentucky as a whole emitted 171,857 tons of nitrogen oxides in 2006. Emissions of nitrogen oxides from individual plants in the Bluegrass were not great enough to cause them to be listed among the nation's top polluters. In comparison to other Bluegrass plants only, Ghent

was the top polluter in 2007 with 15,083 tons of nitrogen oxides. Second was Mill Creek with 14,030 tons. Third was E. W. Brown with 7,275 tons.

The list of other pollutants emitted from power plants is varied, as the substances released in 2006 by the Ghent Station in Carroll County owned by Kentucky Utilities, in turn owned by E.On, illustrates. The pollutants reported by Kentucky Utilities to the U.S. EPA include ammonia, antimony compounds, arsenic, barium compounds, beryllium compounds, chromium compounds, cobalt compounds, copper compounds, dioxin and dioxin-like compounds, hydrochloric acid, hydrogen fluoride, lead compounds, manganese compounds, mercury compounds, nickel compounds, polycyclic aromatic compounds, thallium compounds, vanadium compounds, and zinc compounds (6). Each substance is released into the air or water or disposed of on land. Many of the substances go to two or three of these outlets. The only one of the above toxics that has been widely publicized in connection with power plants is mercury. Ghent in 2006 released 419 pounds of mercury into the air and 1 pound into the Ohio River, disposed of 181 pounds on land, and transmitted 814 pounds to a Cincinnati firm for recycling.

The Brookings Institution found in a study of the “carbon footprints” of the nation’s one hundred largest metropolitan areas, that the Lexington area has the largest footprint (3.46 metric tons of carbon emissions per resident per year), the Cincinnati/Northern Kentucky area the third largest (3.28 metric tons), and the Louisville area the fifth largest (3.23 metric tons). The ranking was based on carbon dioxide from residential use of electricity and from highway traffic. It does not include carbon dioxide from the heavy non-highway traffic in the three metropolitan areas or from the industrial use of electricity (7).

The fact that most of the electricity generated in Kentucky is produced in coal-fired plants contributes to putting the Bluegrass at the top of the Brookings list. Another factor is the relatively low price of electricity in Kentucky, which makes residents less likely to conserve than they would be if they lived in a state where electricity is more expensive. As of 2008, the average price per kilowatt hour of electricity in Kentucky was 5.43 cents. The average price in the United States as a whole was 8.90 cents.

Individuals and businesses can assist in reducing Kentucky’s dependence on coal by conserving energy, by participating in “green” programs offered to consumers by utilities, and by installing their own solar and wind facilities. The Kentucky Solar Energy Society/Kentucky Solar Partnership, on the Web at www.kysolar.org is a source of information on solar applications in Kentucky. Another is the book by Al Fritsch and Paul Gallimore, *Healing Appalachia: Sustainable Living through Appropriate Technology* (Lexington: University Press of Kentucky, 2007).

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3. Environmental Integrity Project, *Dirty Kilowatts: America's Most Polluting Power Plants*, (Washington, D.C.: Environmental Integrity Project, July 2007), Appendix A, available online at <http://www.environmentalintegrity.org/pub457.cfm> ; and U.S. Department of Energy, Energy Information Administration, 'Existing Electric Generating Units in the United States, 2005,' available online at <http://www.eia.gov/cneaf/electricity/epa/epat2p2.html>.
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6. Division of Specialized Information Services, National Library of Medicine, *Toxmap*, available online at <http://toxmap.nlm.nih.gov/>
7. Marilyn A. Brown et al., *Shrinking the Carbon Footprint of Metropolitan America* (Washington, D.C.: Brookings Institution, May 2008), available online at www.brookings.edu/reports/2008/05_carbon_footprint_sarzynski.aspx .

4. Air Pollution

The US Environmental Protection Agency (EPA) calculates the Air Quality Index for five pollutants: ground level ozone, particle pollution, carbon monoxide, sulfur dioxide, and nitrogen dioxide. The two most widespread types of pollution in Kentucky are ozone and particle pollution; and the largest sources of ozone and particle pollution in Kentucky, according to the Kentucky Division for Air Quality, are power plants, industry, and open burning, including illegal backyard burning and wildfires in natural areas. In the Bluegrass, in particular, cars and trucks, which cause more than 25% of the air pollution in the United States (1), must be near the top of the list of causes, and perhaps ahead of open burning.

Ozone is formed by a chemical reaction between nitrogen oxides and volatile organic compounds in the presence of sunlight. It is considered to be good or bad depending on where it is. The ozone in the upper atmosphere, protects the earth from harmful rays from the sun and is therefore considered to be good. Ground level ozone irritates the lungs of humans and also may adversely affect plants and animals. It is thus considered to be bad.

Particle pollution consists of microscopic particles in the air. The most dangerous are fine particles, less than 2.5 microns in diameter.

Other air pollutants of particular concern in the Bluegrass are carbon dioxide and toxics. Carbon dioxide was considered in the section on Energy (along with the toxics sulfur dioxide and nitrogen oxides).

Ozone

In 2008 the American Lung Association rated thirty-four Kentucky counties on high ozone days and/or high particle pollution days (based on EPA standards) in 2004, 2005, and 2006. In the Bluegrass, Campbell and Oldham Counties received a “D” each. Jefferson and Kenton Counties each received a “C.” Other counties rated received an “A” or a “B.” (Not all counties collected sufficient data for a grade.) The American Lung Association notes that several counties in the Bluegrass region improved their grade for ozone, but that Oldham County, which is immediately north of Jefferson County, went in the wrong direction, from a “C” in the Lung Association’s 2007 report) to a “D” (2).

March 12, 2008 the US EPA made the primary standard for ground level ozone 11% more restrictive than it was previously. The standard is now “0.075 ppm 8 hour average.” In other words, for levels above an average of 0.075 parts per million (75 parts per billion) in an eight-hour period, the EPA issues an orange or higher alert. Alerts are color coded and orange means that the amount of ozone in the air can harm people in the sensitive population, which includes healthy adults who work outdoors. The stricter standard means that counties that were in conformity with EPA regulations may find themselves out of conformity. In fact, based on monitoring for the past three years, nineteen counties in Kentucky, including those in the Cincinnati, Louisville, and Lexington areas, would have been out of compliance in those years if the standard had then been 75 parts per billion. (The American Lung Association report used the old standard.) Moreover, according to EPA’s own science advisors, whom EPA ignored in setting its new standard, a standard much stricter than the new 75 parts per billion is actually

needed to protect public health (3). Thus the Cincinnati, Louisville and Lexington metropolitan areas are not protecting the public adequately in regard to ozone.

Particle pollution

For fine particle pollution days, Jefferson County was the only “failing” county among the Bluegrass counties that the American Lung Association rated. It received a “fail” in the categories of twenty-four hour pollution and that of annual pollution. Louisville, in fact, appears in the association’s list of the fifty cities in the United States with the greatest year-round particle pollution. There it moved from 22nd worst (in the Lung Association’s 2007 report) to 18th worst, although it actually decreased its pollution somewhat. The reason for the rise in rank in comparison with other cities was that other cities made greater improvements.

Toxics

In 2002 the US EPA Region 4 published an *Air Toxics Relative Risk Screening Analysis* on the risk to public health from air pollution in each of the 736 counties that make up its the region. The analysis considered potential health impacts (based on data from 1996 and 1999), total population density, and the density of sensitive subpopulations. Overall, Jefferson County ranked highest in the threat to health of all the counties in the region. In other words, the air “had the highest potential risk for adverse effects of all of the counties in the eight southeastern states” (4). Five out of six other counties in the top fifty were also in the Bluegrass area: Kenton (17th), Campbell (23rd), Fayette (27th), Boyd (35th) and Boone (48th) (5). The primary reason for Louisville’s high ranking was the presence of toxic chemicals in the air. The majority of these toxics were released by the chemical plants in what is commonly known as Rubbertown in west Louisville. (Some of the chemical toxics contribute to particle pollution, but some are strictly gases.) As a result of the EPA assessment and other studies and after extensive consultation with the public, the Louisville Metro Air Pollution Control Board in 2005 implemented a Strategic Toxic Air Reduction program (STAR) to assess and address toxic air emissions and improve air quality. The program has three key components. The first establishes the overall methods for determining risk and the general duty not to omit toxic air contaminants in a quantity or duration that is harmful. The second regulates the industrial operations that are responsible for much of the pollution. The third covers other, smaller sources of pollution, such as dry cleaners, cars and trucks, locomotives and airplanes.

The program is already showing dramatic results, as industrial companies are beginning to apply technical pollution controls; or, unwilling or unable to improve, are leaving the city (DuPont Performance Elastomers, for example) or reducing the scope of their operations there (Rohm and Haas, among other). Nevertheless, the air in Louisville is still not healthy and it is not expected to be so until at least 2011, the year by which companies must lower their toxic emissions or prove that they are using the best available technology to lower emissions (6). The chemical of greatest concern in Louisville (of eighteen that have been proven to exceed the health risk goal) is butadiene, which causes cancer. In 2003, three chemical plants in Rubbertown released in total 143,548 pounds of butadiene. In 2006, according to the EPA’s Toxic Release Inventory, they released in total 22,780 pounds (8360 pounds from the American Synthetic Rubber Plant, which achieved an 84% reduction from 141,000 pounds in 2001; 810 pounds from Rohm and Haas; and 13,610 pounds from Zeon Chemicals) (7).

Power plants that burn coal release a wide variety of hazardous materials into the air, as indicated in the section on energy. The toxic substances that in 2006 the Ghent power station spread across the Bluegrass and, in some cases, far beyond included ammonia (3957 pounds), hydrochloric acid in the form of aerosols (5,223,000 pounds), hydrogen fluoride (574,800 pounds), lead compounds (1232 pounds), sulfuric acid in the form of aerosols (1,575,000 pounds), and zinc compounds (4452 pounds) (8).

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3. James Bruggers, "EPA Tightens Standards for Ozone," *Courier-Journal*, March 13, 2008, p. 1A.
4. Metro Louisville, Strategic Toxic Air Reduction Program, Why do we need this program?, available on the Internet at <http://www.louisvilleky.gov/APCD/STAR>.
5. The Kentucky Division for Air Quality summarizes the EPA's report in "Air Toxics," available on the Internet at www.air.ky.gov/programs/airtoxics/.
6. Metro Louisville, STAR Regulation 5.21, General Information, available on the Internet at www.louisvilleky.gov/APCD/STAR.
7. James Bruggers, "Rubbertown Still Hot Spot for Toxic Air," *Courier-Journal*, November 29, 2006, p. 1A; and James Bruggers, "Emissions of Toxic Chemical Fall," *Courier-Journal*, Feb 22, 2008, p. 1D.
8. Division of Specialized Information Services, National Library of Medicine, *Toxmap*, available online at <http://toxmap.nlm.nih.gov/>.

5. Problems with Water Quality and Supply

The Kentucky Division of Water assesses rivers and streams on a rotating basis with attention given to specific water basins in specific years. As stated in its 2008 *Integrated Report to Congress on Water Quality in Kentucky* (1), the division has in recent years assessed for primary contact use, which includes swimming, 4,493 miles of waterways, 3,148 miles of which or 70% were found not to support primary contact use. For warm water aquatic habitat it has assessed 9,170 miles, 4,400 of which or 48% were found not to support aquatic habitat use. For the six uses that it most commonly assessed considered together (aquatic life, primary and secondary contact recreation, and drinking water), it found only 51% of all waters assessed to be fully supporting. Kentucky has some 90,000 miles of rivers and streams, so the assessed segments represent only a fraction of what exists. (Volunteers assess segments of certain rivers and streams, because of the incompleteness of the state program).

The Bluegrass Region encompasses parts of three river basins: the Salt River Basin in the west, the Kentucky River Basin in the center, and the Licking River Basin in the east. For the Salt River Basin as a whole, 472 miles were assessed for primary contact recreation and only 68 miles (14%) were found to be fully supporting; 1071 miles were assessed for aquatic life and only 664 miles (62%) were found to be fully supporting. In the Kentucky River Basin as a whole, 903 miles were assessed for primary contact recreation and only 209 miles (44%) were found to be fully supporting; 1836 miles were assessed for aquatic life and only 1054 miles (57%) were found to be fully supporting. In the Licking River Basin as a whole, 476 miles were assessed for primary contact recreation and only 149 miles (31%) were found to be fully supporting; 756 miles were assessed for aquatic life and only 390 miles (52%) were found to be fully supporting.

The 2008 report lists the leading causes of nonsupport of uses as 1) sedimentation/siltation, 2) fecal coliform + *E. coli* (pathogen indicators), 3) nutrient/eutrophication biological indicators; 4) habitat assessment (streams) (pollution) and 5) unknown causes. The leading sources of these impairments are 1) habitat related (loss of riparian habitat, channelization, stream bank modifications/destabilization, site clearance, dredging, habitat modification other than hydro modification), 2) agriculture, 3) urban or municipal (discharges from municipal separate storm sewer systems, sanitary sewer overflows, etc.), 4) unknown sources, 5) mining, and 6) residential related (on-site treatment systems such as septic systems, etc.). All of these sources except mining are present in the Bluegrass.

Among the many specific streams of concern in the Bluegrass are Banklick Creek and Three Mile Creek in northern Kentucky; Floyds Fork in eastern Jefferson County; and Town Branch and Wolf Run, which both flow north from Lexington to feed South Elkhorn Creek. Fecal coliform bacteria are prominent in the contaminants of each.

Fish advisory

In April 2000, the Kentucky departments for Public Health, Environmental Protection, and Fish and Wildlife Resources issued a state-wide mercury advisory for all fresh-water fish from Kentucky waters, including the Ohio River. Women of child-bearing age and children six years of age and younger should eat no more than one meal a week of freshwater fish. This advisory is still in effect. (The EPA does not issue fish consumption advisories. Those come from individual states.)

In humans, particularly fetuses and young children, mercury appears to impact the nervous system. A recent study conducted by the University of Texas Health Science Center at San Antonio found a statistically significant link between industrial releases of mercury and increased rates of autism (2).

Contamination in Metropolitan Areas

The metropolitan areas of Louisville, Cincinnati/Northern Kentucky, and Lexington make major contributions to the impairment of Kentucky rivers and streams. In recent years the US Environmental Protection Agency (EPA) sued the Louisville and Jefferson County Sewer District (MSD), Sanitation District No. 1 of Northern Kentucky, and the City of Lexington because of water quality problems. In each case unauthorized releases of sewage or of a mixture of sewage and storm water have repeatedly occurred, contaminating rivers and streams.

In Louisville certain “combined” sewers carry storm water and sewage to a treatment plant. Other sewers carry only sewage. In heavy rains both types have overflowed. The volume of contaminated water from the combined pipes has average 4.5 billion gallons annually. Unauthorized discharges of untreated sewage from the separated system have averaged 175 million gallons a year, but in 2004 totaled 500 million gallons. The releases have affected water quality in the Ohio River and tributaries.

The Kentucky Environmental Protection Cabinet, the US Department of Justice, and the EPA reached a settlement with MSD in April 2005. By the terms of the consent decree MSD must propose and implement actions to bring its combined sewer overflows into compliance with water quality discharges and to eliminate unauthorized discharges from its sanitary sewers. The worst discharges, 75% of the total, must be addressed by 2013 at the latest (3).

It appears, however, that this consent decree did not end MSD’s problem with the US EPA. According to the *Courier-Journal*, the EPA is now monitoring overflows of untreated sewage from two sewage treatment plants in eastern Jefferson County, Jeffersontown and Floyds Fork. Apparently as a result of the monitoring, MSD is no longer allowing new hook ups to these plants, thus slowing construction in the area (4).

Northern Kentucky has a similar problem. Sewer District No. 1 is responsible for collecting and treating sewage from thirty-seven municipalities within Boone, Campbell, and Kenton Counties. Sewer systems in the district have been overwhelmed during heavy rainfalls, resulting in discharges of combined sewage and storm water totaling over 850 million gallons annually and overflows of sanitary sewers averaging 82 million gallons annually. As in the Louisville area, the overflows have negatively impacted the Ohio River and its tributaries.

The US Department of Justice and the EPA announced a Clean Water Act settlement with Sanitation District No. 1 of Northern Kentucky in October 2005. District No. 1 will address its problems by developing and implementing plans for each of the four watersheds in its area (5).

Lexington likewise has a problem with releasing untreated sewage into rivers and streams. It also has a problem with raw sewage entering homes within the city. In February 2008 the Lexington-Fayette Urban County Council approved a settlement agreement with the EPA, which had sued Lexington in 2006 over violations of the Clean Water Act. In August 2008 the federal judge who had to approve the agreement before it could be considered final ordered the city and the EPA to reopen negotiations. US District Judge Karl Forester agreed with critics of the agreement who had charged that too much of a \$425,000 civil penalty was to go to the federal EPA and that it was not just to penalize heavily current residents for the mistakes of past city administrators (6).

According to the terms of the agreement as of now, the city will be required in the next eleven to thirteen years to eliminate all sewage overflows, complete a system-wide assessment of the sewer system and turn the Blue Sky Wastewater Treatment Plant in southeast Fayette County, originally a privately-owned facility, into a pump station that will move sewage to one of the city's other treatment plants. The city also must reduce chronic flooding in neighborhoods. Among its other projects, the city has agreed to restore Cane Run Creek in Coldstream Park to help protect Royal Spring, the main source of the city of Georgetown's water (7). Whether the Lexington consent decree solves the city's wastewater problem depends, as do the other consent decrees, on its implementation.

Lack of Regional Cooperation on Water Supplies

The Inner Bluegrass region has long been plagued by droughts and floods. What is now known as the Bluegrass Water Supply Commission, made up of nine municipalities in the region, including Lexington, was formed as the result of a severe drought in 1999, to try to find a regional solution to the matter of supply. The Commission gradually developed a plan to build a plant at Pool 3 on the Kentucky River, north of Frankfort, in Owen County to treat water from the river and a grid of pipes to take the treated water to the various municipalities. Kentucky-American Water Company, which supplies water to Lexington and parts of nearby counties for a time appeared to cooperate with the commission. In 2002 the German utility RWE AG,

Germany's biggest electricity producer, purchased American Water, the parent company of Kentucky-American.

In 2006, stating that it was tired of waiting for the commission to act, RWE/Kentucky-American stopped meeting with the regional commission, and in 2007 it went to the Public Service Commission with a plan to build a treatment plant on the site that had been chosen by the Bluegrass Water Supply Commission and to pipe the water thirty-one miles to Lexington. It invited other commission members to purchase the water, but they had wanted to build their own plant in order to cut costs. When in 2008 the Public Service Commission authorized Kentucky American to go ahead with its plant and pipeline, Winchester decided to build its own plant to treat water for Winchester; and Frankfort decided to supplement its supply by piping water from Louisville. Thus the consortium and regional plans for cooperation appear to be at an end.

Groundwater in Jefferson County

Withdrawal of groundwater for geothermal heating and cooling systems is lowering the level of an aquifer beneath western and northern Jefferson County. Entities who want to withdraw more than 10,000 gallons of water a day must obtain a permit from the state, which has issued 700 of them. Among them is Galt House. It pumps water for a geothermal system, which it shares with the Waterfront Plaza office towers. The water is at a constant temperature of 60 degrees Fahrenheit. After it has given up its heat or been circulated for cooling, it is released into the Ohio River. (A geothermal system may instead of releasing water above ground, reinject it into the ground after use.) In two years the level of groundwater under Galt House has dropped eighteen feet. The Kentucky Geological survey does not have the funding to track groundwater levels routinely (8).

Rural areas

Rural areas that are not connected to water and sewage lines also have water quality and supply problems. The Kentucky Geological Service maintains a repository of data on groundwater, which can be accessed online, <http://uky.edu/KGS/water/research/bwreposit.htm> . The Service also draws on the repository to answer queries from the public regarding wells and springs, and is preparing a "Summary and Evaluation of Groundwater Quality in Watersheds of the Kentucky River, Salt River, Licking River, Big Sandy River, Little Sandy River, and Tygarts Creek" (9).

Potential sources of contamination of private wells include "the application of pesticides, herbicides and fertilizers to crops and lawns, animal grazing and feeding operations, illegal dumps (such as in a sinkhole) and improperly constructed or maintained septic systems. In addition, some naturally occurring chemicals, such as iron and manganese, can degrade water quality" (10). The Groundwater Branch of the Division of Water offers technical assistance to well owners with water quality problems. As an alternative to wells, cisterns, which were used

in the Bluegrass for many years, are still a viable source of water, if they are properly maintained. Where water is scarce, composting toilets are a means of conservation.

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1. The report is available online at <http://www.water.ky.gov/sw/swmonitor/305b>. In this section we draw on Volume 1, part 4, Appendix A and Volume 1, part 3.
2. “Study Links Autism Risk to Distance from Power Plants, Other Mercury Releasing Sources,” *Medical News Today*, April 25, 2008, online at <http://www.medicalnewstoday.com/articles/105316.php>.
3. Environmental and Public Protection Cabinet. “Governor Ernie Fletcher Announces Settlement on Sewage Overflows in Louisville” [Press release], April 25, 2005.
4. James Bruggers, “2 Wastewater Plants Found Lacking,” *Courier-Journal*, April 5, 2008, p. 1A.
5. U.S. EPA Region 4: Southeast, “Clean Water Act Agreement Announced with the Sanitation District No. 1 of Northern Kentucky” [Press release], October 7, 2005.
6. Andy Mead, “City Sewer Agreement Thrown Out,” *Lexington Herald-Leader*, August 9, 2008, p. 1A.
7. Lexington Fayette Urban County Government, “Consent Decree at a Glance” [Press release], February 19, 2008, available online at http://www.lfucg.com/news_releases/feb08/consent_decree_fact.pdf.
8. James Bruggers, “Scientists Raise Concerns about Louisville Resource,” *Courier-Journal*, November 23, 2007, p. 1A—photocopy.
9. The summary is announced on the Kentucky Geological Survey Web site at http://uky.edu/KGS/water/research/gw_quality.htm, accessed August 1, 2008, as appearing “shortly.”
10. Division of Water, “Water Well Related Concerns,” available online at <http://www.water.ky.gov/gw/gwtech/gwellproblems/>, updated March 11, 2007.

6. Numerous Hazardous Waste Sites

Kentucky as a whole has about one thousand hazardous waste sites. Of these sites 514 are Superfund sites, sites that contain toxic waste and that must be cleaned up in conformity with the regulations in Kentucky Revised Statutes 224.01-400 and 224.01-405. The Bluegrass is the location of 224 of the Superfund sites, according to a list of Superfund sites statewide furnished to us by the Kentucky Division of Waste Management in June 2008. Ninety-five of the Superfund sites in this region, forty-two percent of the total in the Bluegrass, are in Jefferson County. The only other counties in this region with more than ten sites are Madison with thirteen, and Bullitt and Fayette with eleven each. The predominance of Jefferson County reflects the fact that this is the most industrialized county in the Bluegrass Region. The counties nearest to Cincinnati: Boone, Kenton, and Campbell have respectively eight, seven, and six Superfund sites and those along the Ohio River between Jefferson and Boone have a total of fourteen sites.

Kentucky has had twenty sites on the National Priority List (NPL) of Superfund sites. These sites, which are not included in the total of 514 sites discussed above, are sites for which the US EPA supervised/supervises the cleanup, because of the extremely hazardous nature of actual or potential releases. Eight of the NPL sites were in the Bluegrass. Four of those have been removed from the list because all work has been completed, and four are what are called “final” National Priority List sites, i.e. remedial activities at the site are continuing but the sites are in a post-construction phase. Two are in Bullitt County: Smith’s Farm in Brooks and Tri-City Disposal Co. in Sheperdsville; one in Jefferson County: Distler Farm on Blevins Gap Road; and one in Fleming County, Maxey Flats (1).

Numerous Superfund sites are dumps created by municipalities before federal and state regulations for the disposal of hazardous materials went into effect. Many others belong to businesses that have closed down. Today corporations are required to report to the U.S. Environmental Protection Agency (EPA) all releases of toxic materials into the air, water, and land, including waste disposal in landfills. Their reports are available to the general public through the web site <http://toxmap.nlm.nih.gov>.

The danger with hazardous waste sites, apart from the possibility that people in the future will try to raise vegetables on them or drill wells for drinking water in them, is that the toxic materials may spread outside the site. If the hazardous material is not adequately contained, it can contaminate the ground beyond the site’s boundaries, become volatile and cause air pollution, or contaminate surface or ground water. A major source of problems is rain that infiltrates a site and leaches chemicals from it. The University of Kentucky has received a grant from the National Institutes of Health for a study entitled “Nutrition and Superfund Chemical Toxicity.” Researchers will study whether polychlorinated biphenyls (PCBs) can cause obesity and heart disease, try to develop means of detecting very low levels of pollution, and look into whether nutrition can prevent hazardous pollutants from causing disease (2).

The location in the Bluegrass that arguably harbors the greatest risks from hazardous wastes is the Blue Grass Army Depot (BGAD) in Madison County. The depot was established in 1942 “for the receipt, issuance, storage, maintenance, and disposal of ammunition,” both chemical and conventional. Its 14,600 acres include areas for the demolition of ordnance and munitions, areas for the storage of ordnance and munitions, and depot facilities. Land not needed for military purposes is leased to farmers for grazing cattle.

BGAD destroys conventional weapons by means of “incineration, open burning of propellant, and detonation.” The “demilitarization, renovation, maintenance, storage, and disposal of munitions” creates hazardous waste (3). In the words of the site’s fiscal year 2001 *Installation Action Plan*, “Contamination consists mainly of metals, explosives, organics (volatile/non-volatile), mustard

agent/derivatives.” (The last is due to the fact that in the past a chemical agent, mustard, was burned in the open air.) “Groundwater contamination of uncertain impact has been identified. There is no evidence that any contamination has left the boundary of the installation.” Investigation of soil contamination and of water pollution began in 1982, and, as of 2001, remediation was in progress.

Chemical weapons, with the exception of the mustard already dealt with, are to be destroyed by special means. The Depot stores 523 tons of the blister agent mustard, and of the nerve agents GB (sarin) and VX, 1.7% by weight of the U.S. chemical weapons stockpile when it began its weapons destruction program. Nerve agents act by inhibiting the action of acetylcholinesterase throughout the body. This substance normally hydrolyzes acetylcholine. When acetylcholine accumulates, muscles, including those in the respiratory system, cannot contract and relax normally. Paralysis of the muscles used in breathing causes victims to die. The chemical can be absorbed through the skin as well as by breathing. The V agents are more lethal and more persistent than the G agents.

BGAD stores 32,285 projectiles, 8-inch and 155-mm, containing GB, VX, or, more frequently, mustard; 69,449 rockets, “highly explosive assembled weapons” containing GB or VX; and 30 rocket warheads with GB or VX (4). The containers and the weapons are themselves inside subsurface containment structures or “igloos.” At times leaks from the weapons are reported in the press. The possible leak of a nerve agent outside the containment structure is the great danger.

According to the terms of the Chemical Weapons Treaty, which went into force in 1997, nations were to destroy their stocks of chemical weapons by April 2007. The deadline under the treaty has been extended to 2012 but, knowing that this cannot be met, the U.S. Congress has set a deadline for the United States of 2017. The 2017 deadline is unlikely to be met at Richmond or at Pueblo, Colorado. The weapons in Kentucky and in Colorado are to be destroyed by an Assembled Chemical Weapons Alternatives program within the Department of Defense, mandated by Congress in 1996. The method chosen for Richmond is neutralization followed by supercritical water oxidation. A Joint Venture of Bechtel and Parsons has received a contract for the work. As of June 2008 a pilot plant was under construction. However, in July, *USA Today* reported that the Department of Defense was considering shipping the weapons at Richmond and Pueblo to other sites to speed up their destruction (5).

Also highly hazardous, though believed to be contained, is the waste at the Maxey Flats Nuclear Disposal site on the border of the Outer Bluegrass in southern Fleming County. The site originally was 280 acres in extent but today includes a buffer zone of approximately 550 acres. From 1963 to 1977 the state of Kentucky licensed private operators to dispose of so-called low-level radioactive waste, from military and civilian sources, at the site. In the words of the US EPA, “approximately 533,000 pounds of source material (consisting of uranium and thorium or ores containing uranium and thorium), 22 mega curies of by-product materials, and 950 pounds of special nuclear material (plutonium and enriched uranium) were buried” there (6). By the mid-1970s highly carcinogenic plutonium had moved hundreds of feet from the burial site and was appearing in surface soils and drainage streams. Water was entering burial trenches despite their earthen caps. An evaporator to process the seepage was installed. Not only could it not keep up with the water but it released tritium (radioactive hydrogen) in its steam. The state had purchased the site and leased it to the operator Nuclear Engineering Company (NECO, now US Ecology). When the site was closed to commerce in 1977, the state bought the lease rights from NECO and began maintaining the site itself.

Today the site is on the National Priority List of Superfund sites. Initial remediation work was completed in October, 2003. It included removing water from the landfill, solidifying radioactive leachate and storing it and other contaminated materials in reinforced concrete bunkers constructed on the site, installing a drainage system, and placing an interim cap over the facility. The EPA is now evaluating results to determine if a final cap can be installed. The state is still obligated to control access, monitor, and maintain the site, in accordance with US EPA-approved work plans (7).

Coal-fired power plants manage extensive toxic waste sites, as they store fly ash and other coal combustion by-products (CCBs) either as solids in landfills or as sludge in ponds. Kentucky Utilities' Ghent Power Station in Carroll County has two sludge ponds, the first 120-acres in extent. Power plant sites may not be classed as Superfund sites, but their contents, nevertheless, contain an astounding assortment of poisons. According to the Toxic Release Inventory, the Ghent plant sent to its active pond in 2006, 94,470 pounds of arsenic compounds, 17,690 pounds of beryllium compounds, 143,100 pounds of chromium compounds, 125,149 pounds of lead compounds, 181 pounds of mercury compounds, 168,300 pounds of nickel compounds, and 450,500 pounds of zinc compounds, among other toxics (8). Are the toxic substances stored at Ghent and other power plants completely confined in their respective disposal locations?

Fly ash has long been used as a feed material for cement. Heating the raw material for cement at high temperatures in a cement kiln volatilizes some of the toxics in the fly ash, including mercury. Thus fly ash contributes to the large amounts of mercury released by the kilns (9). As regulations force utilities to curb air and water pollution from power plants, an increasing percentage of the plant's toxics are ending up in the fly ash rather than in the air or water. The ash is thus becoming less usable. The University of Kentucky Center for Applied Energy Research is working to find ways to make the ash more suitable in content and size for reuse, and, in fact, recently operated a pilot Advanced Multi-Product Coal Utilization Byproduct Processing Plant at Ghent.

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1. See for more details US EPA, "National Priorities List Sites in Kentucky," available on the Internet at <http://www.epa.gov/superfund/sites/npl/ky.htm>.
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3. *Installation Action Plan for Bluegrass Army Depot, Fiscal Year 2001*, available on the Internet at http://www.globalsecurity.org/military/library/report/enviro/BGAD_IAP.pdf. The description of the site in this and the following paragraph is drawn from Installation Information and Description, pp. 1 and 2, and Contamination Assessment, p. 1 of this document.
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7. US EPA, Region 4: Superfund; and Kentucky Division of Waste Management, *Maxey Flats*, available on the Internet at <http://www.waste.ky.gov/branches/sf/Maxey+Flats.htm>, accessed June 16, 2008; Albert J. Fritsch, Arthur H. Purcell, Mary Byrd Davis, *Critical Hour* (San Francisco: Yggdrasil, 2004), p. 56, available on the Internet at <http://www.earthhealing.info/ch.pdf>.
8. Division of Specialized Information Services, National Library of Medicine, *Toxmap*, available online at <http://toxmap.nlm.nih.gov/>.
9. Earth Justice Environmental Integrity Project, *Cementing a Toxic Legacy?* (Washington, D.C.: Earth Justice, 2008), p. 13, available online at http://www.earthjustice.org/library/reports/ej_eip_kilns_web.pdf.

7. Endangered and Threatened Species

Native biodiversity, the variety of native plants and animals, in the Bluegrass has decreased since the arrival of Euro-Americans. Extensive logging by settlers replaced the forests that had covered the area, with croplands and pasture, and the majority of the wetlands were filled in. The destruction of areas that sheltered wildlife continues today, with the development of highways, residences, and commercial and industrial buildings.

Kentucky as a whole is believed to have provided habitat for fifty-five species of plants and animals that are now extinct or that have been extirpated from the state but survive elsewhere. Not all of the species lived in the Bluegrass but many of them did. The list is made up of six vascular plants, including the Marsh Marigold flourishing elsewhere; twenty-two freshwater mussels with such intriguing names as Leafshell, White Wartyback, and Winged Mapleleaf; one insect, a mayfly; nine fish, three of them darters; one reptile, the Coachwhip snake; eleven birds, including the Passenger Pigeon, doves of which were once a common site in the Bluegrass; and four mammals: the American Bison, the Red Wolf, the Grey Wolf, and the Eastern Cougar (1). The past importance of the American Bison in the Bluegrass is reflected today in such names as Stamping Ground in Scott County and Big Bone Lick State Park in Boone County, also Buffalo Trace, now U.S. 68, which crossed the Ohio River Ford at Maysville and continued to Bluelicks. The bison and their predecessors were attracted to Kentucky by salt deposits.

The disappearance of a species impacts other species that may feed on it, that are hunted by it, or that otherwise interact with it. An increase in the deer population in the Bluegrass is in part a result of the disappearance of the large predators, wolves and cougar, that kept the number of deer in check.

Species are still becoming extinct or being extirpated from the state, and the pace of extinctions and extirpations will inevitably increase with global warming. The Kentucky State Nature Preserves Commission (KSNPC) lists on its Web site, <http://www.naturepreserves.ky.gov/>, 390 plant and 317 animal taxa that as of 2005 were rare, threatened, endangered, or of special concern in Kentucky. Some of the species are also listed by the US Fish and Wildlife Service (USFWS) as Endangered, Threatened, or of Special Management Concern or are Candidates for such a listing. The KSNPC monitors the species on its list.

On the Internet the Commission helpfully breaks down the list of species that it monitors by county. The county lists vary greatly among one another even in the Bluegrass. On the list for Boone County, near Cincinnati, for instance are seven vascular plants, eight mussels, three fish, three amphibians, and seven birds. Jefferson County to its south has on its list seventeen vascular plants, three snails, sixteen mussels, two crustaceans, six fish, four reptiles, twenty-three birds, and three mammals. The county lists depend, of course, on the type of habitat in the county. They may also depend to a degree on the thoroughness with which the county has been studied. Not all areas of the state have been completely inventoried for wildlife. Examples of rare, threatened or endangered species that live in the Bluegrass for at least part of the year, are various freshwater mussels, a few orchids, two beetles, the Indiana Bat, Running Buffalo Clover, and Short's Goldenrod

Mussels are of particular concern in Kentucky. North America has a total of 297 native species of mussels. Kentucky has 103 of these species belonging to 40 genera, one of the most varied mussel populations in North America. State researchers have identified 46 of the state's 103 species as of greatest conservation need. Of these 19 species have also been recognized by the USFWS as Endangered and 2 are Candidates for federal listing.

Mussels are sensitive to changes in the quality of the water in which they live. The degradation of streams has thus greatly impacted them. They also suffer from such factors as commercial harvesting and the invasion of the zebra mussel from Europe and Asia, which encrusts native mussels and competes with them for food and space (2).

Priority areas for mussel preservation and recovery within the Bluegrass include three segments of the Licking River, an area on the South Fork of the Licking River, and the Rolling Fork of the Salt River Basin. Improving the water quality in these watersheds is urgent.

According to Ronald L. Jones, “About 50% of KY’s orchid species are now listed as rare in the state” (3). Many of the orchids in Kentucky live to the south or east of the Bluegrass. Among the few species that have been observed in the Bluegrass in the past or have been found there recently are Grass-Pink (*Calopogon tuberosus*), Sweetscent Ladies’-Tresses (*Spiranthes odorata*), and Shining Ladies’-Tresses (*Spiranthes lucida*). Historic reports describe Grass-Pink, listed by KSNPC as endangered, in Garrard and Boyle Counties and counties immediately to their south and in Lewis County and counties to its south. A bright pink flower as its name indicates, its habitat in Kentucky is “dry sandy pine(-oak) woods and swamps.” Sweetscent Ladies’-Tresses, also a state endangered plant, is found today in swamps and marshes in Woodford County. Shining Ladies’-Tresses, a state threatened plant, grows in wet forests and wet grassy openings in Clark County (4). Orchids are very sensitive to changes in their environment. Orchid seeds cannot germinate unless they are in contact with a symbiotic fungus, and the orchids found in Kentucky cannot live without mycorrhizal fungi in their roots. Many individual orchids have fallen victim to people digging up plants to be sold or for ingredients for herbal medicine (5).

In an agreement to protect two threatened cave beetles, the City of Perryville and the Perryville Battlefield Preservation Association have enrolled a cave in KSNPC’s Natural Areas Registry. More than twenty species of beetles are on KSNPC’s list of endangered, threatened, and rare species. The Old Well Cave Beetle (*Pseudanophthalmus puteanus*) and the Hidden Cave Beetle (*Pseudanophthalmus conditus*) are the subject of the Perryville agreement. Both species live only in Kentucky. The Old Well Beetle is known to survive in only three locations, in Boyle and Mercer Counties; the Hidden Cave Beetle, in four locations, all in Boyle County. Haberson’s Cave in Perryville is home to both (6).

Fourteen species of bats regularly occur in Kentucky, seven of which are listed by the USFWS or by the state as endangered, threatened, or of special concern. The Indiana Bat (*Myotis sodalis*), on the lists of several counties, has been listed as Endangered by the US Fish and Wildlife Service (USFWS). The total number of Indiana Bats in the United States is high, but falling, and the bats are particularly at risk when they are nesting or hibernating. In 1960 the population estimate was 880,000; in 2004 it was around 380,000 (7). The bats spread across the eastern United States in the summer but in the winter they hibernate in caves in Indiana, Kentucky, and Missouri. Maternal colonies are found in the Bluegrass, but, as far as is known, the bats leave the area to hibernate. In 2007 researchers banded Indiana Bats in a maternity colony in Spencer County, southeast of Louisville. They were surprised that two of the females flew in opposite directions to hibernate, one to Breckinridge County to the West and one to Rockcastle County to the East (8).

Running Buffalo Clover (*Trifolium stoloniferum*), another species listed as Endangered by USFWS was once common from West Virginia to Kansas, particularly along buffalo trails. However, it depended on the buffalo to stir up the ground and distribute the seed. With the disappearance of the buffalo from the East, the clover declined. It was presumed to be extinct by 1985 when a botanist discovered a population in West Virginia. Now patches are known to exist in Missouri, Kentucky, and Ohio in addition to West Virginia. One occurs in the lawn at

Ashland, the Henry Clay Estate, in a residential area of Lexington. Running Buffalo Clover bears white flowers and creeps along the ground like white clover, but differs from that species in the structure of the flower heads and leaves (9).

Short's Goldenrod (*Solidago shortii*) is found only in two square miles of Fleming and Robertson Counties and in a small area in southern Indiana. Charles Wilkins Short discovered the species at the Falls of the Ohio near Louisville in the 1840s. The construction of McAlpin Dam at the falls in the 1920s was thought to have wiped the species out, but Lucy Braun rediscovered it near Blue Licks Battlefield in Robertson County in 1939. The patch in Indiana was discovered recently. The plant is now protected within Blue Licks Battlefield State Park and at Short's Goldenrod State Nature Preserve. The goldenrod need open land on which to live, as they do not do well in shade. In the past the buffalo and then the mowing of farmers likely kept areas clear for them. Today staff and volunteers remove Eastern Red-Cedar and hardwoods at the preserves by cutting or burning. Such efforts deserve support.

--MBD

1. Kentucky State Nature Preserves Commission, "Plants and Animals Presumed Extinct or Extirpated from Kentucky, November 2006," in Kentucky State Nature Preserves Commission, *Biennial Report*, January 2007, Appendix 3, pp. 55-56, available online at www.naturepreserves.ky.gov.
2. Kentucky Fish and Wildlife Service, *Kentucky's Comprehensive Wildlife Conservation Strategy*, "2.2.3 Mussels (Class Bivalvia) Overview," updated September 21, 2005, available online from <http://fw.ky.gov/kfwis/stwg/TableOfContents.htm>.
3. *Plant Life of Kentucky: An Illustrated Guide to the Vascular Flora* (Lexington: Univ. Press of Kentucky, 2005), p. 649.
4. Kentucky State Nature Preserves Commission, Rare Plant Database, available online at <http://eppcapps.ky.gov/nprareplants/>, consulted July 8, 2008.
5. Jones, *Plant Life*, p. 649.
6. Kentucky Energy and Environment Cabinet, "Kentucky State Nature Preserves Commission to Present Mayor of Perryville with Natural Areas Certificate" [Press release], July 8, 2008.
7. US Fish and Wildlife Service, "Indiana Bat, *Myotis sodalis*," July 2004, available online at www.fws.gov/northeast/pdf/indianabat.fs.pdf.
8. Brainard Palmer-Ball, "Biologists Answer Some of the Mysteries of Bat Life Histories," *Naturally Kentucky*, Spring 2008, no. 58, pp. 2-3.
9. N. L. Taylor and J. N. N. Campbell, "Buffalo Clover" and "Running Buffalo Clover," available online at <http://www.ca.uky.edu/agc/pubs/agr/agr142/agr142.htm>, posted September 1989.

8. The Onslaught of Invasive Species

In the last one hundred or so years a new enemy of native biodiversity has become obvious, exotic invasive species. Today many believe them to be second only to loss of habitat as a threat in the Bluegrass as in the nation.

Invasive exotic species, like the zebra mussel, are species brought into North America from another country (i.e. “exotic”) that have no natural enemies here and that thus spread aggressively, crowding out or directly killing native species. (Not all exotic species are invasive, but, because so many are, people sometimes use the word “exotic” as though it means the same thing as “invasive.”) Many invasive exotic species were brought into this country on purpose, usually as ornamental plants, and only later were found to pose a threat; other invasive species have come in accidentally, often as part of commercial shipments of agricultural materials.

Japanese Hops (*Humulus japonicus*), which was imported into North America from eastern Asia before 1900, has only recently been recognized as a problem in the Bluegrass. The plant is a bine, i.e. it climbs by means of bristles rather than tendrils as vines do. In 2007 a landowner north of Frankfort on the Kentucky River alerted the Kentucky State Nature Preserves Commission (KSNPC) to the aggressive character of this plant on his land. KSNP staff then found it on a nearby preserve; and, during a ten-mile boat trip on the river to look for other occurrences, identified eighty-three other populations. Japanese Hops is now known to be well established throughout the Kentucky River corridor, from which it is likely to spread to other watersheds. The species crowds out native species and, by doing so, accelerates erosion of the river banks, because it eliminates plants whose roots hold the soil in place and does little to retain soil itself (1).

Kudzu (*Pueraria Montana* var. *lobata*) is found most widely in the southeastern United States, but it has spread into Kentucky and has been identified in Fayette, Franklin, Garrard, and Madison Counties in the Bluegrass. A climbing, perennial vine in the pea family, it smothers trees and other vegetation by completely covering them. Able to grow sixty feet per season, a vine may be as much as one hundred feet in length and have a stem up to four inches in diameter. The fleshy tap roots, from which thirty or more vines can grow, may be seven inches or more in diameter, six feet in length, and weigh four hundred pounds. The plant was deliberately introduced into the United States in 1872 from Asia and was planted in the south for forage and as an ornamental crop.

Other invasive plants that constitute established or increasing problems in the Bluegrass region include Amur Honeysuckle (*Lonicera maackii*), a bush honeysuckle that forms a shade so dense that other plants cannot grow beneath it; Autumn Olive (*Elaeagnus umbellata*), a shrub with silvery-backed leaves and small red fruit which appeal to birds, who scatter the seed; Garlic Mustard (*Alliaria officinalis*), an edible white-flowered, biennial herbaceous plant, found in small to extensive colonies; Japanese Knotweed (*Polygonum cuspidatum*), a semi-woody perennial with virulent rhizomes that allow a plant to regenerate even after it has been almost completely pulled up; Multiflora Rose (*Rosa multiflora*), an import from Asia, now found in

pastures, roadsides, floodplains, woodland edges, and sunny spots in the forest; Purple Loosestrife (*Lythrum salicaria*), a herbaceous species with tall, attractive spikes of purple flowers, which can produce as many as 2.5 million seeds per plant; Tree of Heaven (*Ailanthus altissima*), a tree from Asia, which can grow 2.5 feet per season and spreads by means of sprouts and highly viable seeds; and Winter Creeper/Climbing Euonymus (*Euonymus fortunei*), an evergreen perennial vine that covers the ground and grows up trees in wooded areas. Most unfortunately these and other invasive plants infest many of our parks and preserves.

The Early Detection and Distribution Mapping System of the Exotic Pest Plant Council maps the ranges of exotic plants in Kentucky. Not all the plants shown are highly invasive but the invasive species are included. The Kentucky maps can be accessed at <http://www.se-eppc.org/eddMapS/kentucky.cfm> .

Arguably the most destructive exotic in the history of the Bluegrass was not a plant, but a fungus from China or Japan that caused the Chestnut Blight, a disease that virtually eliminated the American Chestnut from forests in this region and throughout the east early in the twentieth century. The American Chestnut Foundation and other organizations are now working with some success to create and propagate blight-resistant chestnut trees.

Two major current threats are insects, the Emerald Ash Borer and the Hemlock Woolly Adelgid. The borer, an insect from Asia that, as its name suggests, kills ash trees, is moving towards Kentucky from the North and has been found in Cincinnati. Traps to catch and identify the insect should it enter Kentucky have been put in place in Boone, Kenton, and Campbell Counties. If the insect is found, a quarantine will be established. The Hemlock Woolly Adelgid, another insect from Asia, which attacks Eastern Hemlock and Carolina Hemlock, is active in the southeastern part of the state and has been found on urban trees in Oldham County. Researchers are treating the outbreaks as best they can. Hemlocks are a major element in the forests of eastern Kentucky, and are grown as ornamental trees in the Bluegrass.

Some troublesome species are native rather than exotic. Canada Geese have become pests in some areas of the Bluegrass where they congregate in large numbers and have taken to staying year round rather than migrating north to breed. Their droppings and their noise may disturb people living ponds and wetlands. Where ginseng is grown, wild turkeys (which have bred with domestic turkeys) cause a problem because they are voracious understory eaters and destroy the ginseng seeds that they ingest by breaking them in their craws. Deer have become a problem to gardeners in some locations, because of their numbers and their fondness for munching on fruits and vegetables.

Numerous organizations in Kentucky work on ridding specific areas of invasive species. Once an invasive plant has taken over an area, it is usually extremely difficult, if not impossible, to get rid of it, however. Many died-in-the-wool environmentalists find that they have to use herbicides if they hope to root out an infestation; and KSNPC in fact recommends this method for Japanese Hops. The best means of thwarting invasive species is prevention, not allowing an invasive plant or animal to enter an area in the first place.

With plants a simple step that can be taken is not to plant invasive species in a garden or on a farm from which they can spread. Another is to persuade stores to stop selling invasive species. In the last couple of months the author has seen stores in Lexington selling both Winged

Burning Bush (*Euonymus alata*) and Common Periwinkle (*Vinca minor*), which are invasive in Kentucky. Stores should be required to stop selling species of plants and animals that are invasive in the state.

--MBD

1. Andrew Berry, "Japanese Hops Emerges as an Aggressive Invasive plant in Kentucky," *Naturally Kentucky*, Spring 2008, no. 58, pp. 4-5.

9. Lack of Adequate Public Transportation

The Bluegrass boasts three large airports: Cincinnati/Northern Kentucky in Boone County, Louisville, and Lexington. This can be said to be fortunate, if one disregards the expense of flying to the pocketbook and the environment, because flying is the only way to travel by mass transit directly between the three cities that make up what is called the Golden Triangle: Covington, Louisville, and Lexington.

It is possible to travel by Greyhound bus between Louisville and Lexington but only by transferring in Cincinnati. The total bus trip thus takes a minimum of four hours. A spokesperson for Greyhound says that the company is considering reviving the direct bus route between Louisville and Lexington, and that the main obstacle to doing so is a lack of buses (1). Buses travel directly from Louisville and Lexington to Cincinnati and back, but they do not stop in northern Kentucky. Someone wanting to leave or enter Northern Kentucky by bus needs to take a local, TANK, bus between northern Kentucky and the Cincinnati bus station.

In all, the Bluegrass has three Greyhound bus stations, Berea, Lexington, and Louisville. From Lexington, buses travel north to Cincinnati and south to Berea, thence to London and points beyond. From Louisville they travel southwest to Elizabethtown and Bowling Green. There are no routes across the state from east to west.

Amtrak serves only one railway station in the Bluegrass, Maysville. (It also offers service from Cincinnati.) One train line goes through Maysville, the Cardinal/Hoosier Route, which links Chicago to New York City's Penn Station by way of Indianapolis, Cincinnati, and northern Kentucky. Unfortunately the times of trains are impractical. A passenger going to New York must leave Maysville at 4:51 am and arrives in New York at 9:36 pm, for instance. Louisville used to be served directly by the Cardinal/Hoosier Route, but the Louisville station lost its trains in 2003.

The Bluegrass Ultra-Transit Service (BUS) operates buses among eleven Bluegrass counties, aimed at senior citizens and people with medical appointments. Trips are made at the request of passengers and, except in case of emergency, reservations must be requested seventy-two hours in advance. In addition to the custom service, BUS operates a regular intra-city route between Danville and Lexington. The trips are expensive, unless an individual receives reimbursement from government or private insurance: \$1.00 a mile.

The Foothills Development Council operates skeletal local bus services in Berea, Richmond, and Paradise Cove (the latter two in conjunction with the Richmond Transit Service). In Berea there is hourly service between 9:00 am and 5:00 pm Monday through Friday. The service in Richmond and Paradise Cove is roughly equivalent.

Lexington, the Louisville metro area, and Northern Kentucky offer local bus service through, respectively, LexTran, TARC (Transit Authority of River City), and TANK (Transit Authority of Northern Kentucky).

The ridership of TARC, which was over 16 million in 2007 increased approximately 5% annually in 2006 and 2007, and can be assumed to be increasing along with gas prices in 2008.

Incredibly, faced with rising demand for its services, TARC is raising fares, as of July 1, 2008, and cutting back on service as of August 24, 2008. The authorities say that the changes are necessary to balance the 2009 budget, because increases in the number of passengers do not compensate for higher fuel prices and higher health insurance costs. TARC lacks a dedicated source of funding, money that it can depend on year after year.

With a ridership of 3.735 million in 2007, TANK is also cutting back on service this summer, though not, apparently, raising fares. TANK is funded by Boone, Campbell, and Kenton to which it submits a budget and from which it requests subsidies yearly.

LexTran, which enjoys dedicated funding as the result of a transit tax passed by Lexington-Fayette County voters in 2004, is expanding rather than cutting back on services. Ridership was 5.4 million unlinked trips in 2007 (unlinked means that a trip with two segments linked by a transfer is counted as two trips), an increase from 3.7 million in 2006; and in 2008 Lextran is experiencing additional gains. In May 2008 ridership was 15% greater than it was in May 2007 (2). Unfortunately, Lextran still does not make a visible impact on the floods of vehicular traffic that come near to choking Lexington.

The down-town bus terminal in Lexington may be one deterrent to travel on the bus for people who can afford to drive cars. The terminal is dingy and polluted with the exhaust of buses that idle their engines while waiting to start a round trip. Another deterrent is the difficulty of walking across many Lexington streets because of the heavy traffic, which can make it impossible for some people to walk to or from a bus.

In the Bluegrass there is a tendency for local governments to spend large sums of money on short hiking trails, but to overlook the fact that what is really needed is means for residents to walk safely to the grocery store or library. If facilitating walking and cycling, rather than facilitating the movement of cars and trucks, were the primary goal of traffic control, much would change for the better.

Large cities in the Bluegrass are putting varying degrees of effort into improving conditions for cycling. In May 2008, *Bicycling Magazine* named Louisville the third most improved city for cycling in the United States, and the government is creating a one-hundred mile cycling/walking trail around Louisville. However, within cities the existing infrastructure makes the installation of safe cycling lanes and cycling paths difficult. At least in Lexington, the announced mileage of added lanes is no indication of the mileage of truly cyclable roads. Cars often have to cut dangerously across cycling lanes to make turns, and lanes may end abruptly at corners.

As for means of cycling or hiking safely from town to town or city to city, they are almost non-existent in Kentucky. Roads through the Bluegrass horse country would make beautiful cycling trails or hiking trails—were it not for the cars; but, with the general lack of broad shoulders or, in many places, of any shoulders, on country roads, vehicular traffic is an ever-present threat to cyclists.

The Rails-to-Trails Conservancy hopes to link Lexington to Ashland with a cycling/hiking trail built on an old railroad bed. However, at present, Kentucky is forty-fifth in the nation in the number of trails constructed on old railway lines. It has thirty-six miles of what

are known as Rails-to-Trails, and these miles are in short segments (3). The state has roughly 1200 miles of abandoned railroad lines (4).

The relative lack of public transport in the Bluegrass and the difficulty of walking and cycling safely mean that people have to drive to get to their destination. This results in poor—and at times horrendous--conditions for drivers: congested roads and highways and, in cities, frequent and lengthy stops at red lights.

--MBD

1. Dave Morse, "Greyhound Mulls Restoring Lou/Lex Service," June 17, 2008, available online at www.cartky.org/node/120.
2. Anna Tong, "LexTran Enjoying Increase in Ridership," *Lexington Herald*, June 15, 2008.
3. Kentucky Rails to Trails Council, [Home Page of Web Site], at <http://www.kyrailtrail.org>.
4. <http://worldtimzone.com/blog/date/2003/09/26/kentuckys-abandoned-railroad-lines/>, posted September 26, 2003.

10. The Prevalence of Nuisances

The Bluegrass is plagued by several problems that can be characterized as “nuisances,” because, unlike problems such as air pollution, they do not pose obvious risks to life and health. Noise, visual pollution, light pollution, and litter do, however, diminish the quality of life.

Noise

Kentucky law states that cities and towns can have noise ordinances, and many do. They are usually based on decibels, a measurement of sound that the police can obtain with meters; but Covington passed an innovative noise ordinance in 2008. Police there can now cite people in cars and in buildings based on the distance from which the noise is audible rather than on the number of decibels. For a second offence from a vehicle, the law allows the police to impound the vehicle (1). Much of the noise that wears down urban residents is not, however, covered by the ordinances: the roar of trucks, cars, and motorcycles on city streets and highways, the sound of airplanes and medical and traffic helicopters overhead, the din from gasoline-powered lawn mowers and from leaf blowers. The work of a team of garden-care specialists may rival in noise a military invasion, with a large riding mower, hedge clippers, weed eaters, and leaf blowers simultaneously attacking the vegetation. Construction equipment is another source of noise, as are chain saws. Rural areas may experience the same types of noise as urban areas, plus the roar of all-terrain vehicles (ATVs) and, near lakes, motorboats and jet skis.

When people live near a constant source of noise, they may become oblivious to it. If one asks people living near a highway whether the noise of traffic bothers them, they are likely to reply, “No, I never hear it.” However, the noise may be harming their health, whether or not they are conscious of it. The U.S. Office of Consumer Affairs and other governmental agencies have found a causal link between noise pollution and sleep disturbances, increased blood pressure, irritability, and fatigue. Noise interferes with learning. Scientists have found higher math and reading scores among children in schoolrooms where noise was abated than among children in rooms lacking means of abatement (2). The distraction of noise may also prevent people from performing as well as possible in their jobs; and it may slow healing in hospitals and convalescent homes. Hospitals, in fact, illustrate the need to control noise within a building as well as exterior noise. A location away from busy streets, insulation of walls, and heavy draperies can reduce outside noise, but this does not allow patients to gain needed rest unless such noises as TVs, chatter in the halls, buzzers, and loudspeaker announcements are curtailed inside the building.

Noise, moreover, affects animals as well as humans. Cows may not provide milk if they are disturbed by strange and unusual noises. Chickens can be easily frightened and so can horses. In fact, all livestock are sensitive to sounds that they cannot recognize. Wildlife are just as affected by noise as domestic animals are. Noise can adversely affect the natural cycles of wildlife from breeding to feeding and from nesting to migrating. It can also scare animals away from areas thus restricting the habitat available to them (3).

Airport noise poses an acknowledged problem in the Bluegrass, which has three major airports. The number of flights a day at each of these fields gives a rough idea of the noise generated. In 2006 Cincinnati/Northern Kentucky International Airport in Boone County served 16.2 million passengers with more than 500 departures daily; the Louisville International Airport at Standiford Field served 3.9 million passengers with 110 departures daily, and Blue Grass Airport in Lexington served 1.03 million passengers with 41 departures daily. In addition to the passenger flights, there are cargo flights, in particular at Louisville. Standiford Field is the third largest cargo airport in the nation, and the ninth largest in the world, according to Airports Council International (4).

The Cincinnati/Northern Kentucky Airport states that it reduces noise through having corridors to the north along the Ohio River and to the south along I-75 and that most night time flights occur over areas west of the airport with relatively few residents (5). Such steps do not actually reduce the overall noise, which must affect wildlife, particularly in the more rural area to the west.

Standiford Field in the middle of Louisville has to bring planes in and out over urban areas. When, in 1988, the Louisville Regional Airport Authority decided to rebuild the existing airport where it stood rather than move it outside the city, the Authority faced the noise factor squarely. As a result, Louisville is engaged in one of the largest “aircraft-noise residential acquisition and relocation programs ever carried out in the United States” (6). Under the Airport Improvement Program and a Voluntary Residential Relocation Program, almost 4000 families have already been relocated, and noise-impacted families are still offered the opportunity of moving and, if they wish, being reimbursed to build a new home on a 287-acre site purchased by the airport authority. The vacated houses are destroyed, and the area redeveloped with construction of the Kentucky Exposition Center and other businesses.

Visual pollution

Sprawl is a form of visual pollution. Around cities in the Bluegrass, row after row of houses, each looking more or less like its neighbors, are spreading. The houses are usually large and they are usually on lots that are small in relation to the size of the building. Viewed as a group they are ugly, as are the big box-style commercial buildings that are going up. Billboards are one form of visual pollution, but developments are another, particularly when they are built on what were fields and woods.

In the hilly country that edges the Bluegrass another type of visual pollution problem is the isolated house or hotel on a hill. People who can afford to acquire land, try to buy land with a view. Then, the more thoughtless among them, build their house or hotel at the point from which they can best regard the view, no matter that they may thus be spoiling the view for other people.

Light pollution

A college student who has always lived in Lexington, spent the summer of 2008 working on the island of Hilton Head, South Carolina. The feature of the island about which he was most excited was that he “could see the stars.” To protect loggerhead sea turtles that come up on the island to lay their eggs, Hilton Head has passed and enforces ordinances that limit lighting on or near the beach.

In contrast, after dark the towns and cities of the Bluegrass are bathed in the glow from a myriad individual lights, producing what has come to be known as light pollution. Light pollution prevents people from seeing the stars, which are part of our cultural as well as our natural heritage. Only a few of the brightest are visible. It disorients wild creatures that move about at night, as the residents of Hilton Head realize, and it is now also believed to harm human health. Furthermore, excessive and/or misdirected lighting also wastes electricity and by doing so contributes to global warming.

According to an article in the *Kentucky Kernel*, the University of Kentucky in Lexington is attempting to decrease the pollution caused by exterior lighting on campus (7). We are not aware of any municipal or county ordinances in Kentucky aimed at preventing light pollution. If any exist, we should like to hear about them.

The International Dark-Sky Association is lobbying the US Congress to cut light pollution. It also certifies lighting fixtures that are compatible with dark skies. For information, go to <http://www.darksky.org>.

Litter

The Kentucky Revised Statutes 512.070 defines littering as a class A misdemeanor and sets the penalty for perpetrators as a fine of up to \$500 or up to one year in jail or both. Some counties also have anti-littering ordinances. Boone County in Ordinance 50 sets its own penalty, a fine of not less than \$100 or more than \$500 and up to three days in jail. However, one has only to look at the roads in the state to see that the penalties are not levied. Litter accumulates along urban and rural roadsides. On the fringes of cities and in rural areas, illegal open dumps appear. A variety of organizations sponsor cleanups. However, these organizations generally cannot close illegal dumps, and the scope of the litter problem is enormous.

To give specific examples of the scope of the cleanup work, in Madison County in 2007 a road cleanup resulted in recycling 6000 tons of litter and other items (8). The Kentucky River Authority sponsors a cleanup of the banks of the Kentucky River each year. In 2007 thirty-three counties (about half of them in the Bluegrass Region) were involved. The twelve that reported back to the coordinator picked up 1335 bags of litter that had been thrown or washed into the river (9). A 2007 cleanup of Floyds Fork near Louisville, spearheaded by the Floyds Fork Environmental Association and attended by 160 people, netted 4.5 tons of waste (10).

Merely enforcing the existing state anti-litter law would keep the state government functioning well. Ten million pieces of litter at \$500 each would bring in \$5 billion. People would, however, stop littering long before this goal could be reached. An alternative to fining people would be to require people caught littering to spend five days cleaning up roads. This also would put an end to littering.

--AF and MBD

1. Mike Rutledge, "Covington Stiffens Noise Laws," [nky.com/The Enquirer](http://news.nky.com/apps/pbcs.dll/article?AID=/AB/20080528/NEWS0103/305270097), last updated May 28, 2008, on the Internet at <http://news.nky.com/apps/pbcs.dll/article?AID=/AB/20080528/NEWS0103/305270097>.

2. See for example, S. Cohen and N. Weinstein, "Non-Auditory Effects of Noise on Behavior and Health," *Journal of Social Issues* 37, no. 1 (1981), pp. 36-63.
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