sustain

a journal of environmental and sustainability issues

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Fall/Winter 2004

The
Kentucky Institute
for the
Environment
and Sustainable
Development

Kentucky's environmental future

The Kentucky Institute for the Environment and Sustainable Development (KIESD) was created in July 1992 within the Office of the Vice President for Research, University of Louisville. The Institute provides a forum to conduct interdisciplinary research, applied scholarly analysis, pubic service and educational outreach on environmental and sustainable development issues at the local, state, national and international levels.

KIESD is comprised of eight thematic program centers: Environmental Education, Watershed Research, Environmental Law, Sustainable Urban Neighborhoods, Pollution Prevention, Environmental and Occupational Health Sciences, Environmental Policy and Management, and Environmental Engineering.

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UNIVERSITY of LOUISVILLE
dare to be great

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Predicting Kentucky's Future

The future of the environment is uncertain. Whether one is optimistic or pessimistic, it is no longer possible to be neutral. From population growth (10 billion worldwide by 2010), urban sprawl, water use, global warming, and poisoned water and air, the natural world is under stress as the footprint of man becomes larger and deeper. The past is measured in billions of years, human civilization in thousands, but the ability to predict the future is measurable in small increments of time and often inexact. But to ignore the future is a recipe for allowing negative trends to continue and to prolong those actions necessary to ameliorate environmental problems.

In this issue of Sustain, we asked a variety of authors with expertise or experience in specific areas of environmental concern to write about the future of that area and what they predict will occur in the Commonwealth of Kentucky. Because conditions seem to change at an ever increasing rate, we asked them to project out only five years into the future, a mere speck of time in the larger scheme of things, but in the current world of sound bites, buzz words, computer chips, the web, and globalization, an eternity. It is always risky if not madness to try to predict the future, but there are signs, trends that suggest what might happen five years down the road. We asked our authors to do just that , and they agreed to with the full awareness that their prognostications could completely miss the mark. In 1996, KIESD's Center for Environmental Policy and Management through Drs. Peter Meyer and Thomas Lyon prepared a report for the state entitled "Forecasting Kentucky's Environmental Future" in which they predicted environmental futures based on no change in Kentucky's economic or political structure, one based on new technologies, and a third based on changes in the state's policies (including improved environmental literacy, pursuit of more sustainable economic development, improved leadership, advanced public works, and changes in energy use).

Contemplating the future requires a review of copious amounts of information, information that is often available, but unless taken in smaller bites, is not easy to assimilate. Increasingly we spend more and more time trying to decide what is good information and what is not. News is old almost as it happens and our knowledge of how things work outpaces our ability to understand it. It is in this whirlwind that we asked our authors to reflect on the future of the environment in Kentucky, to try and shed some light on where we have been and where it looks like we will be five years from now. We did this knowing full well that the future generally, and the future of the environment in particular is uncertain. Uncertainty does not negate the importance of looking forward to understand what technologies or policy changes will be needed now to assure the soundeness of Kentucky's environment in the future.

***Steve Myers**, Ph.D.*
Director, Kentucky Institute for the Environment and Sustainable Development

Kentucky's Environmental Future

Change is the law of life. And those who look only to the past or present are certain to miss the future.
~ John F. Kennedy ~

Leslie Cole

Environmental Quality Commission

What kind of environment will our children inherit two decades from now? Will the quality of Kentucky's environment—our air, water and natural resources—be better or worse? Will the decisions and actions we take today secure our environmental future?

These questions are on the minds of many Kentuckians given the results of a recent survey by the Environmental Quality Commission (EQC). The commission's 2002 online nonscientific poll revealed that 96 percent of the 1,600 people who responded expressed concern about the health of the environment in which they live, work and play.

It is clear that environmental laws and programs enacted during the past three decades have had a significant impact on environmental quality in the state. During the past 30 years, Kentucky has witnessed progress in restoring waterways, reducing air pollution and preserving unique natural areas. Past efforts to make the state a cleaner, healthier place to live have demonstrated that while it is not only important to be responsive to environmental problems, it makes sense to focus on preventing them before they occur.

While no one can predict our environmental future and the legacy that we leave our children, we do have a role in shaping it through proactive environmental policies. To do this it is important to understand:

- What the condition of the environment is both past and present.
- What will drive environmental change.
- What we can do to influence future outcomes.

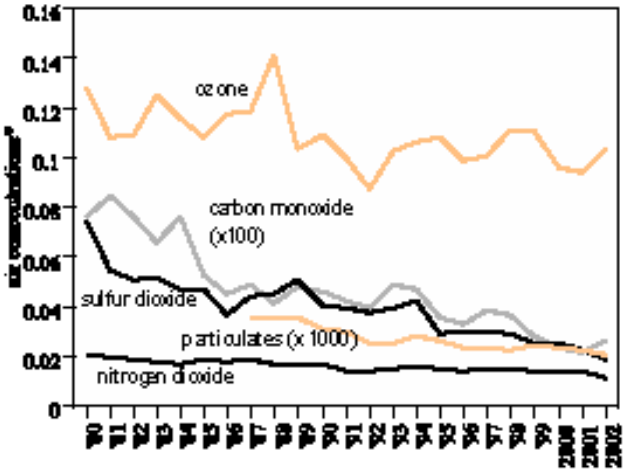
Measuring Environmental Quality

The axiom used in the business community of "what gets measured gets managed" and "what gets managed gets better" rings true for the environment as well. Historically, state environmental and natural resource agencies have measured their environmental successes through program measures—how many permits have been issued, how many forest plans have been written, how many enforcement actions have been taken. However, state policymakers are now demanding more accountability based on performance measures and linking programs to on-the-ground results.

In 1992, the legislature directed the EQC to monitor the status of the environment to assess the state's progress in protecting human health and the environment. During the past 10 years, the EQC has used more than 100 indicators to assess the state of the environment, natural resource sustainability and related human activities. The indicators, for the first time, gave Kentuckians a snapshot of environmental conditions and trends and revealed a number of improvements—from reducing air pollution (Measure 1), improving waste disposal (Measure 2), to restoring water quality (Measure 3). At the same time, these trends leave no doubt that a better environment tomorrow is by no means automatic.

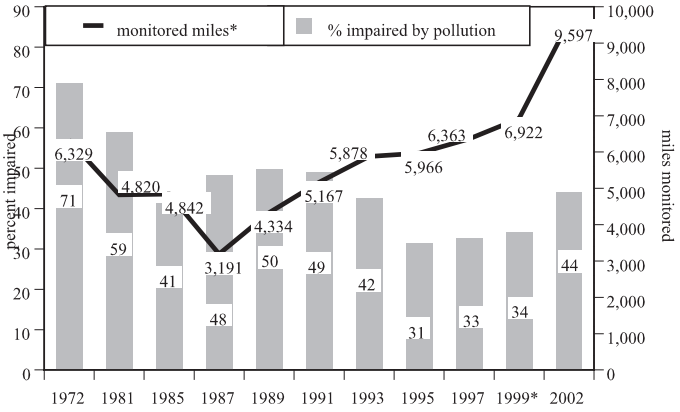
Simply doing more of the same may not achieve the continued environmental improvements that are required to protect those resources in the future. While national policies such as the Clean Water Act and the Clean Air Act will

Measure 1. Statewide Air Concentrations of Pollutants in Kentucky



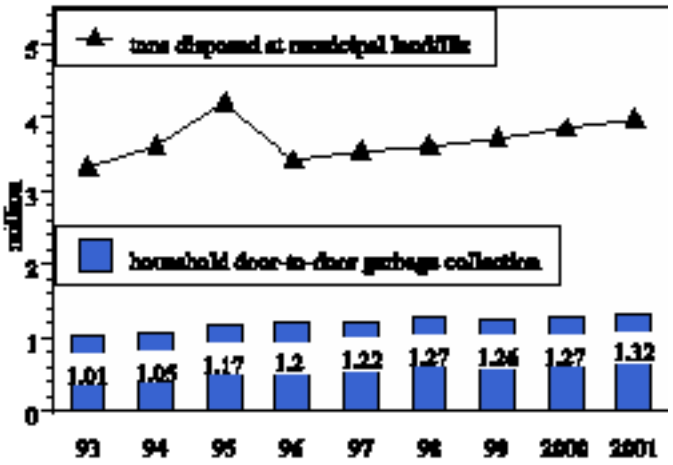
*Concentrations from state-monitored sites based on the following: ozone: averaged second maximum, one-hour standard. Carbon monoxide: second maximum eight-hour average. Nitrogen dioxide and particulates (PM10): annual statewide averages. SO2: second maximum, 24-hour average. Concentrations in parts per million for all pollutants except particulates, which are measured in micrograms per cubic meter. Source: Ky. Division for Air Quality.

Measure 2. Waste Disposal and Households Participating in Door-to-Door Garbage Collection



Note: Household data represents total collection—not broken down for door-to-door for these years for 1993 and 1994. Decline in households participating in door-to-door garbage collection between 1998 and 1999 is attributed to reporting discrepancies by counties.
Source: Ky. Division of Waste Management, County Solid Waste Reports.

Measure 3. Percent of Waterways in Kentucky Impaired by Pollution



1972-1981 data include river and stream miles monitored and evaluated. 1982-1999 based on monitored river and stream miles. Ohio River monitoring data collected by ORSANCO not included. During 1998-99, the Division of Water only monitored waterways in the Kentucky River Basin. *Percent based on 1998-99 monitoring data for the Kentucky River Basin and 1997 monitoring data for the other river basins in Kentucky. Source: Ky. Reports to Congress on Water Quality

remain the backbone of Kentucky's environmental protection framework, new strategies must also be devised to augment traditional regulatory programs if we are to continue to see progress in restoring environmental quality.

Drivers of Environmental Change and Trends

There are many factors that have an impact on the environment. Population growth, urbanization, economic growth, and technologies (such as energy, transport and informatics) are considered among the main drivers of environmental change.[1]

In Kentucky, these factors have affected environmental quality in the past and will continue to do so in the future. Our population will continue to increase, contributing to urban sprawl, loss of farmland and natural habitat, and growing land use conflicts. Logging of Kentucky's forests is now reaching record levels. Small family farms continue to decline while the large agribusiness sector increases. Coal production has moved well into the mature phase of the resource life cycle as reserves are depleted by mining and are redefined and reduced by environmental constraints and market conditions.[2] Consider these facts:

- Kentucky's population is expected to increase 28 percent by 2030.[3]
- On average, 109 acres of land are developed each day in Kentucky.[4]
- Ninety-seven percent of the electricity consumed in Kentucky is produced by coal-fired plants.[5] Fossil fuels are considered a major contributor to global warming.
- The number of coal mines has dropped by one-fifth and mining employment has fallen by more than 50 percent since 1984.[6]
- Logging of Kentucky's forests is at an all time high with more than 1 billion board feet harvested in 1997.[7]
- Broiler production has increased in Kentucky from 43 million in 1992 to 253 million in 2001. Poultry is now ranked second in the state in value of agriculture sales.[8]
- The number of asthma cases in the U.S. has doubled in the past two decades. In Kentucky, more than 70,000 children and 130,000 adults have asthma.[9]
- More than 400,000 people in Kentucky live within a mile of an abandoned mine that poses health and safety hazards.[10]

And the complex environmental problems of nonpoint source pollution, toxic chemicals and waste disposal along with the global issues of climate change and ozone depletion will continue to affect the quality of the environment. The stakes appear to be getting even higher as we struggle to move forward during a lengthy slowdown of the economy and one of the biggest revenue shortfalls seen in Kentucky during the past 20 years. Environmental programs in Kentucky have experienced an 11.8 percent cutback in state general funds in recent years, and further reductions are likely.[11] It is in this setting that Kentucky must be prepared to make some tough decisions about its environmental future.

Moving Toward a Sustainable Future

How can Kentucky address its environmental challenges and shape a future that is desirable and sustainable? Albert Einstein gave us some insight into this question when he said, "The world will not evolve past its current state of crisis by using the same thinking that created the situation."

We must recognize that we are all caretakers of the environment and we must balance the impacts of today's decisions with the needs of future generations. The vision of sustainability—balancing current and future needs to maintain the integrity of our natural environment for future generations—has become more widely recognized as integral to not only saving the planet but as vital to our economic future. Consider the environmental vision of Herman Miller, a furniture company based in Michigan considered among one of the best performing large corporations in America.

> "At Herman Miller we envision a world of economic abundance and ecological balance. To achieve this vision we will build sustainability into every aspect of our business, developing and sharing our knowledge with others inside and outside our industry. Together we will create great places to work for our customers, exceptional returns for our shareholders, and a sustainable, prosperous world for future generations.[12]"

Businesses, like Herman Miller, are embracing the concept of sustainability realizing it is not only the right thing to do, it also makes good business sense when it comes to the corporate bottom line. States are also moving to integrate sustainability principles into policies and establish performance measures to assess progress. Promoting policies that will move Kentucky down a path of sustainability will require a new outlook—one based on a long-term perspective, clear goals, realistic milestones and measurable indicators based on reliable information.

Kentucky's journey toward sustainability is a challenge but one that has been increasingly recognized as critical to the future of our quality of life. Initiatives including the Kentucky Smart Growth Task Force and the redevelopment of brownfields point us in the direction of sustainable growth. Recently, the Kentucky Department of Environmental Protection embarked on a planning process to clarify its long-term vision and document specific outcomes that the department will strive to achieve over time. The Kentucky Environmental Strategic Plan will:

- Focus on environmental outcomes.
- Collect data to determine the quality of the environment.
- Document a consistent business philosophy.
- Set department-level goals and priorities.
- Establish a process that promotes efficient and effective use of resources.
- Promote a public dialogue on environmental issues and priorities.

Over the years a number of different environmental plans have been prepared. Some are required by federal or state law or under the initiative of agency officials, according to Russell Barnett, director of the Kentucky Institute for the Environment and Sustainable Development at the University of Louisville.[13] Many of these plans have had little or no impact on the agency that produced the plan or on the environment. The reasons vary but include inadequate resources available to implement the plan, inadequate public, political, or internal support for the plan, a lack of understanding of the plan by the public or agency, or just unrealistic and unattainable goals.

The success or failure of plans, according to Barnett, depends on setting realistic goals, establishing and tracking benchmarks, developing meaningful indicators and creating accountability within an agency. If accountability measures are not established, the strategic plan will not have any meaningful impact. Success of a plan will also depend on how well a department engages the public in the process. Kentucky's shared environmental future depends on the input and support of the business community, concerned groups and individuals.

Final Thoughts

We live in a world of rapid change—socially, economically and ecologically. The nature of change in the global environment, its magnitudes and rates, is considered unprecedented in human history.[14] What we know about the environment today and our knowledge of the questions still to be answered is much greater than what we knew a decade ago. How we use this information to protect the environment and better understand how the environment, economy and society interrelate will ultimately determine the quality of life we pass on to the next generation of Kentuckians.

Kentucky's Environmental Outcomes

The Kentucky Department for Environmental Protection (DEP) has developed a management plan detailing milestones it hopes to achieve over the next several years. The 2002-03 plan also identifies measures to track progress and evaluate the health of the environment. One of the primary themes contained in the plan is an emphasis on results. Among the desired outcomes listed in the plan are:

Air Quality

- Reduce particulate matter and oxides of nitrogen 25 percent by 2010.
- Attain the 8-hour ozone standard by 2010.
- Improve visibility at Mammoth Cave National Park 3 deciviews by 2010.

Water Quality

- Restore 25 percent of impaired waterways by 2006, 45 percent by 2010, and 100 percent by 2018.
- Restore 25 percent of sites with known groundwater contamination by 2010.

Land Quality

- Eliminate all illegal dumps by 2010.

Pollution Management

- Reduce solid waste disposed in landfills 20 percent by 2007.
- Realize a 50 percent increase in solid waste recycled by 2010.
- Reduce the amount of roadside litter 50 percent by 2010.
- Reduce hazardous waste generated 10 percent by 2007.

Growth and Development

- Reduce the number of households not served by potable water and effective wastewater treatment 25 percent by 2005.

Compliance

- At any given time, 85 percent of facilities will be in compliance with environmental laws and regulations.

Environmental Citizenship

- Decrease water consumption rate per capita 15 percent by 2010.
- Achieve statewide solid waste collection by 2010.
- Encourage a net decrease in average energy consumption per capita by 2010.

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Leslie Cole is executive director of the Environmental Quality Commission, a seven member citizen board, established under state law to advise the governor and other state officials on environmental matters of public concern. Ms. Cole is principal author of the past five editions of the State of Kentucky's Environment Report—a biennial assessment of environmental trends and conditions in the Commonwealth.

Air Quality Management in the Early 21st Century: A Southeastern Perspective

John E. Hornback, Executive Director

Metro 4, Inc. and Southeastern States Air Resource Managers, Inc.
Atlanta, Georgia

The United States continues to face many challenges related to improving and maintaining air quality and the Southeast is no exception. While much progress has been made to clean up the air we breathe, much work remains to be done. And the options available to air quality managers are now somewhat different as our world changes.

The United States population is shifting to the Southeast. All one has to do is look at the current population along the Atlantic and Gulf Coasts and in our larger southeastern cities and compare it to the population one, two, and three decades ago to see how quickly this region is growing. Metropolitan Atlanta is a prime example where three of the ten fastest growing counties in the country are located, including my adopted home county. Further, the growth of second homes in and around coastal areas and the Great Smoky Mountains suggests that a substantial number of additional people are investing in the region and spending significant portions of the year there. Southeastern growth is occurring at a faster rate than critical infrastructures can support. The Southeast is blessed with many assets which have made it a magnet for new businesses and industries. These include highways, rail systems, airports, and waterways but all are becoming stressed as population shifts continue.

As our population grows, the services demanded by each of us grow as well, with resultant increases in air pollution. Thankfully, technology is giving us a chance to grow as a region while reducing pollution generated for each unit of activity. Many industries now use improved and more efficient incinerators, scrubbers, electrostatic precipitators, and other devices to reduce pollution. New technologies have been developed including systems that reduce oxides of nitrogen emissions, one of the key contributors to smog and regional haze. Vehicle emissions are becoming cleaner as new requirements for diesel fuel and gasoline are being imposed. The reduction of sulfur in both diesel and gasoline fuels creates opportunities to develop less polluting engine technologies. Tighter emission standards are now being applied to cars, light duty trucks, SUV's, over-the-road trucks, construction equipment, off-road engines, and portable equipment. As these standards are fully implemented throughout the remainder of this decade, mobile source emissions will reach their lowest per mile and per hour rates ever. But these reductions are being substantially offset by the mushrooming vehicle miles traveled and hours of operation of various engines. In summary, our population is growing but the rates for our most common and substantial emissions - from mobile sources and large emitters like electricity generating utilities - are being reduced, in some cases to fractions of their former levels.

All environmental programs have matured over the past thirty years. Emissions, discharges, and disposal habits have been improved, first by addressing pollutants that could be easily and cost effectively identified, contained, and treated, and second, by applying more refined treatment schemes. Now, water programs routinely evaluate toxicity and total loading on streams, not just the impacts of single dischargers. Waste programs address less apparent impacts on groundwater and behavioral issues like recycling. And air programs are progressing from use of conventional emission controls to more complex systems, from implementing emission control programs solely in local areas to regional approaches, and from being concerned about conventional pollutants to looking at more serious toxic air pollutants.

In the Southeast, there are many air quality issues confronting the populace and regulatory agencies. There are still substantial ozone problems in metropolitan areas and moderate problems in less urbanized portions of the region. Atlanta, to a greater degree than most southeastern cities, has struggled with how to address its ozone problems given its burgeoning population and the combination of mobile and industrial sources and natural pollutants that combine to form urban and rural ozone. The newer 8-hour ozone standard has increased the number of nonattainment areas in Kentucky and other states, the geographical coverage of those areas, and the number of people breathing air that is considered unhealthy. The fine particulate standard that was issued in the last half of the 1990's is one of today's most critical and human-health-impacting air quality issues. The regional haze

problem is well documented in the Southeast and requires our attention as well. And perhaps most importantly, toxic air pollutants are finally receiving more emphasis.

Some of the air quality problems we face are less acceptable to citizens than others. For instance, many people are stimulated to action and protest by a proposed new power generating facility in their immediate area. Fewer people are concerned about pollutants that have delayed impacts until later in life, that are familiar, or that are voluntarily accepted. As a general rule, citizens do not think about gasoline fumes they breathe while refueling their vehicles, even though such fumes contain very potent carcinogens. Almost anyone will sign a petition and answer a survey indicating support for better air quality even if it costs more money. However, a much smaller number of citizens and even fewer of their elected representatives strongly support such programs when proposed at the local, state, or national level, in part due to the reality that such programs are going to cost them something. These inconsistencies need to be reconciled and the public needs to become more sensitized to the impacts air quality has on their lives. And of course, the scientific community and regulatory agencies must deliver more complete, thorough, and understandable analyses of pollutants and their impacts and must interact with the public in a manner that ensures credibility and believability of the assessments.

Jefferson County Air Pollution Control District Vehicle Emissions Testing Center.

In the Southeast, regulatory agencies can no longer reach air quality goals in isolation. Collaboration is a necessity because the problems are so regional in nature. It is ironic that while there is much clamor in the environmental and political world to push environmental regulation back to states and local communities, many of the solutions to air quality challenges cannot be addressed by the individual work of single agencies. Particulate matter and ozone problems are routinely confirmed in rural areas of states like Kentucky, not just in the cities. This indicates that many states are victims of transported pollution, some from within the region and some from outside the region. We know that improvements in air quality can only be achieved by the combined efforts of local and state agencies to control the most critical emissions in their respective areas, and regional/national efforts to reduce the amount of pollution blown into states by the wind. Kentucky and other states in the Southeast are participating in a regional assessment of the visibility problem and will likely collaborate to address the fine particulate problem. The U.S. Environmental Protection Agency has already mandated substantial reductions in oxides of nitrogen emissions. EPA is contemplating further reductions of nitrogen emissions as well as a new round of sulfur emission reductions if President Bush and Congress are unable to pass the Clear Skies Act. The Clear Skies Act is a piece of legislation designed to address emissions of nitrogen, sulfur, and mercury in a single, comprehensive mandate. An aggressive mixture of national, regional, and local actions will be required to improve air quality to the levels that the Clean Air Act requires and that our citizens deserve.

As stated earlier, perhaps one of the most significant air quality challenges is what to do about toxic air pollutants. It is much easier to mandate protective air toxics controls on new facilities than to accomplish reductions in such emissions for existing businesses and industries. Investigations of toxic air pollutants are occurring on a much more frequent basis across the Southeast these days. Citizens are beginning to learn about potential health impacts and are demanding that regulatory agencies confirm and address them. The challenges for government leaders are how to make realistic assessments, how to communicate risks to the public, and how to address the most serious risks in a responsible and rational manner. The Louisville, Calvert City, and Ashland areas have been subject to intensive studies that have increased our expertise in how to assess air toxics problems. Hopefully, over time, we will all

become more effective in proposing solutions to local risks of the sort recently identified in Louisville. Local agencies like the Air Pollution Control District in Louisville and state agencies like the Kentucky Department for Environmental Protection should be applauded for their commitment of financial resources and staff to conduct studies over the past decade, but there is much more work to do. Everyone needs to learn how best to address identified problems in effective ways and within reasonable timeframes without destroying the economy of areas in which pollution sources operate. Some of the most common and pervasive carcinogenic and toxic risks are related to an area difficult for local and state agencies to regulate – vehicle emissions and fuel dispensing – and will undoubtedly continue to require national action and local/state support of that action.

The serious economic problems faced by the United States over the past two years have added to the difficulty citizens, their elected representatives, and regulatory agencies experience in trying to propose adequately effective emission controls that will address our ongoing air quality problems. It is politically popular today to bash any proposed environmental control without offering alternatives. And while some states clamor for more control over environmental mandates, there is not always adequate internal will or constituent support to ensure that what is needed becomes an enforceable regulation when the authority is returned to the state or local area. Our leaders must become more adept at confirming health impacts from air pollution and the relative contributions that various sources of emissions make to those impacts and at communicating them clearly to the public and the power structures that influence regulation development. They must find ways to balance the political, technological, and financial realities of today's world with the need for legitimate emission reductions that will contribute to a healthier environment for all of us.

Behaviors must change - in the corporate world, the political world, the regulatory world, and within each of us. We should always encourage voluntary emission reductions but we must take leadership roles and figure out ways in today's society to achieve what is needed to ensure adequate human health protection, even when it is not politically popular. And the solutions must start within each of us, one person at a time. It can be done, but it will take time, resources, intelligence, commitment, a rational approach, finesse, some backbone, and perhaps even a bit of luck.

John E. Hornmack is Executive Director of the Metro 4, Inc. and Sountheastern States Air Resources Managers, Inc.

The Demographics of Tomorrow and the End of Urban Sprawl

Ronald T. Crouch

Kentucky State Data Center, Urban Studies Institute, University of Louisville

Introduction

The United States and Kentucky are both experiencing major demographic revolutions. Both the United States and Kentucky are becoming more diverse and at the same time becoming older. These revolutions will require us to rethink how we live and how we work. We will have to develop new rules for housing, transportation, employment, education and other societal issues as we enter a new demographic ballgame.

Squaring the Pyramid

The United States and the rest of the world have always resembled a pyramid shaped population with each younger generation being larger than the preceding generation expanding the base of the pyramid. Nationally, we have begun to square the pyramid and in many areas of the country, including Kentucky, even invert the pyramid with fewer young and more old. Actually, the 2000 Census indicates the largest population cohort in the United States will be the population cohort ages 35 to 44 years old and born between 1955 and 1964 and totaling 45,148,527 persons, the younger baby boom cohort. The older baby boom cohort, born between 1946 and 1954, totals 37,779,952 persons. The entire baby boom cohort was born between 1946 and 1964 and totals 82,826,479 persons. These population counts also reflect growth due to immigration as well as a large indigenous birth cohort. Today's smallest population cohort in the United States ages 50 and under is the population cohort in their twenties, born between 1971 and 1980, and totaling 38,345,337 persons. Many states and regions are concerned about the "brain drain" as their young workforce age population in their twenties has left for greener pastures in other states. Many of these places are actively seeking to bring these young persons back home. I suggest the loss of the younger generation is due much more to a small birth cohort in the United States in the 1970's rather than out migration. It is hard to bring young persons in their twenties back when they don't exist in the first place. As an example, Kentucky bemoans the loss of our young adults, ages 25 to 34, which declined by 6.9% between 1990 and 2000. But what they fail to understand is the young adult population, ages 25 to 34, declined by 7.4% in the United States overall. Remember from the earlier paragraph the largest population in the history of the United States is the younger baby boom cohort, ages 35 to 44. Guess how old they were in 1990? They were between the ages of 25 to 34.

Middle Aging Progressing to Aging

The largest population growth in the United States in the 1990's was the population cohort of older boomers, ages 45 to 54. We are now experiencing the middle aging of the United States, which means the aging of the United States population is only a decade or so off. We are actually experiencing a slow growth in the population turning age 65 this decade. Obviously you cannot get old if you "never got born." The population cohort born between 1930 and 1945, between the Great Depression and the end of World War II, just like the group now in their twenties, was a small population cohort. However, starting in 2011 the first baby boomer turns 65 and "all hell breaks loose" for 20 years. Just fifty years ago, our schools were shocked when a huge bunch of 6 year olds showed up for the first day of school. We ran double sessions and brought in portable classrooms to address the surprise of all these first graders showing up. That is what happened 50 years ago. What will start happening 10 years from now?

Our New Diversity

The United States population ages 80 and above is 87% Non-Hispanic White, the population in their 60's, 79% Non-Hispanic White, the population in their 40's, 73% Non-Hispanic White, the population in their 20's, 62% Non-Hispanic White and those under age 10, 59% Non-Hispanic White. The median age for a Non-Hispanic White in the United States is 38.6 years, for a Black, 30.2 years, for an Asian, 32.7 years and for an Hispanic, 25.8 years. Our older population is growing Non-Hispanic White while our younger population is growing more Black, Asian, and Hispanic.

High rise apartment.

And, for the record, the large "baby boomlet or echo boom" of baby boomers having children just didn't happen. The Non-Hispanic White population of baby boomers totaled 60,188,495 while the Non-Hispanic White "baby boomlet or echo boom"totals 49,228,079 persons, well below replacement levels. The population in their early 20's ages 20 to 24, in the United States totals 18,964,001 compared to the population in their early 40's, ages 40 to 44, which totals 22,441,863, or 3,477,862 larger. The Non-Hispanic White population in their early 20's totals 11,594,742 compared to the population of Non-Hispanic Whites in their early 40's which totals 16,135,362, or 4,540,620 larger. The minority population in the United States in their early 20's is 20% larger than those in their 40's and the Non-Hispanic White population in their early 20's is 30% smaller than those in their early 40's.

Empty playground.

New Rules for the Older and More Diverse Population

According to the 2000 Census, 60 percent of United States households contain 1 or 2 persons and 1 in 4 households are one person households. One in ten households in the United States contain a person 65 or older living alone. While we continue building 3,500 to 5,000 square foot houses with the bedrooms on the second floor along with several full baths, and putting the washer and dryer in the basement, our household size is getting smaller and older with the significant growth in the United States population being ages 55 and over.

Do we realize how many persons are going to be sleeping on their couches, in dirty clothes, and using chamber pots because they cannot go up stairs to the bedroom or bathroom or go down to the basement to wash their clothes? Are we building houses for yesterday or for tomorrow? Are the aging baby boomers going to want 3,500 to 5,000 square foot houses on five acre lots out in the country, a process which is contributing to our current suburban sprawl? Or are they going to want universal design houses on one floor totaling 1,500 to 2,000 square feet with high density, small yards located close to services and public transportation? Do we want all those baby boomers driving their SUV's 30 miles to the grocery store in 20 years when they start entering their 80's. Better yet, will they want that reality?

As we live longer, we will have to work longer and retool and re-educate ourselves over and over again, otherwise, we will likely run out of money before we run out of life. So for older workers and older students it will not just be driving to the grocery store or doctor's office, but driving to work and education facilities for retraining as well.

Long commutes out of step with trends

Remember the growth in the United States population is now entirely Black, Asian and Hispanic. The Non-Hispanic population is in decline in real numbers not just percentages. Is suburban sprawl primarily a Non-Hispanic White reality driven by the large, but soon to decline, middle-age Non-Hispanic White baby boomer population? Is the market for large houses on large lots a fad about to go "South"? Remember that growing minority population tends to be much more urban, has lower income for housing and probably doesn't see mowing a five acre lot as desirable.

The United States is now entering the demographics of tomorrow. Will we rethink housing, transportation, employment, education and other societal issues based on the needs of an older Non-Hispanic White population and a younger growing minority population of Blacks, Asians, and Hispanics? These new realities requiring new rules are not good news or bad news, just different news. Remember, the difference between "perception" and "reality" is that "reality" changes.

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Kentucky Energy Trends and Future Policies

Geoffrey Young, Assistant Director

Kentucky Division of Energy

The energy situation in Kentucky today

- Kentucky mines the third largest quantity of coal of any state, behind only Wyoming and West Virginia.

- Almost all – approximately 96.6 percent – of Kentucky's electricity is generated from coal, 2.7 percent from hydroelectric dams and 0.5 percent from natural gas. This compares to the average for the U.S. of 50 percent coal, 20 percent nuclear power, 18 percent natural gas and 7 percent hydroelectric.

- Kentucky has the lowest electricity prices of any state.

- Kentucky is an energy-intensive state. We rank 7th in the nation on a per capita basis in energy consumption. The industrial sector uses 48 percent of our energy. Low prices coupled with high consumption result in relatively high energy bills. Kentucky's energy expenditure for 2000 was $11.4 billion, 23rd in the nation.

- Large reserves of Kentucky coal remain, but the bulk of it is found in hard-to-mine thin seams, is located below drainage under the bottoms of valleys, or is of poorer quality than the coal now being mined. This means that the cost of Kentucky coal must eventually increase.

- One trend over several decades has been a gradual tightening of environmental regulations that govern the mining and burning of coal.

- Kentucky has good solar, biomass and hydroelectric energy resources, and relatively poor wind resources.

- There is increasing public interest in less-polluting "green" power and in protecting the environment in general.

- Our complex, centralized energy supply and distribution systems are vulnerable to attacks by terrorists.

- Kentucky's traditional regulatory structure rewards utilities with higher profits for selling more energy and penalizes them for helping their customers reduce their energy use. Existing fuel adjustment clauses further reduce the incentive for utilities to help customers improve their energy efficiency. Although the federal Energy Policy Act of 1992 required each state's Public Service Commission (PSC) to address the issue of incentives, this problem has not been solved in Kentucky. The result is that utilities have implemented only limited or token energy efficiency programs and have avoided major initiatives that could save large amounts of energy in a cost-effective manner. Particularly absent are energy efficiency programs for industry.

- The "integrated resource planning" process, in which electric utilities periodically update their 15-year plans for meeting electricity requirements, is merely a paper exercise. The Kentucky legislature and PSC have not required utilities to analyze or implement cost-effective programs to help their customers use energy more efficiently. As a result, strategies for meeting society's energy needs at the lowest total cost (including external environmental costs) have not been developed or implemented.

Kentucky's historically low electricity prices have led most of our businesses, individual citizens, and government agencies to ignore energy efficiency for many years. The result has been higher than average energy use and total energy bills that are comparable to, or in many cases higher than, the national average. However, many energy analysts believe that there are huge potential savings that could be gained by improving the energy efficiency of all sectors of the economy. Possible future rate increases due to changing federal policies place our businesses and economy at risk; energy efficiency provides an excellent mechanism to mitigate this exposure in a cost-effective manner.

Energy expert Amory B. Lovins wrote a Strategic Issues Paper in 1992 titled, "Energy-Efficient Buildings: Institutional Barriers and Opportunities," that focuses on the new commercial construction industry. In the summary he states, "Well over half of the energy used to cool and ventilate buildings in countries like the United States can be saved by improvements that typically repay their cost within a few years." Other analyses have found comparable potential savings in lighting, drivepower, office equipment and other end-uses. The report continues, "To a theoretical economist, these are astounding statements: it is inconceivable that in a market economy, such large and profitable savings would remain untapped. But to a practitioner who knows how buildings are created and run, it is not only conceivable but obvious." The report provides a detailed examination of the process by which buildings are designed, built and operated, and how inefficiencies are introduced at every stage through practices that are widespread in the commercial construction market. Most of the inefficiencies result from a lack of information about proven energy-efficient design techniques, and from various professionals working at cross-purposes to each other. The result is a building that is much less efficient and useful to the final owners and occupants than it could be.

High tension power lines.

Some architects, engineers, developers and building owners are beginning to recognize the potential benefits of designing a building as an integrated system rather than a collection of disconnected components. When a building is designed to increase the use of glare-free daylighting and keep out unwanted heat in the spring, summer and fall, the size of the expensive air conditioning system can be reduced considerably. The net result is that a highly-efficient new building can cost the same as or less than a conventional building to construct, while enjoying reduced energy costs over its entire lifetime. Moreover, the people who end up working in the building are likely to be more contented and productive because of the improved light quality and thermal comfort. The value of increased productivity to the workers' employer can easily outweigh the entire energy bill.

In the transportation sector, Amory Lovins and his colleagues used the whole-system approach to design an illustrative, manufacturable concept SUV that is extremely light and aerodynamically shaped, which they call a "Hypercar." It is powered by electric motors and a fuel cell that runs on compressed hydrogen, gets 84 miles per gasoline gallon equivalent on the highway and 115 in city driving, has a range of 330 miles between refueling stops, and is very safe. More details are available at the Hypercar Web site http://www.hypercar.com/pages/casestudies.php. If such super-efficient vehicles could enter mass production and become a significant fraction of our vehicle fleet, the need for this country to import oil would vanish and the air quality in our cities would improve immediately.

Kentucky's long-term energy situation

- The Commonwealth should introduce financial incentives for vehicles that are highly-efficient and nonpolluting, and impose fees on polluting, gas-guzzling vehicles. In the long run, better urban planning (i.e., "smart growth") and increased use of telecommunications should reduce the need for physical transportation.

- Kentucky should encourage the use of integrated, whole-system design methods for buildings and industrial processes that capture the huge potential for improved energy efficiency from the earliest stages of the process of new construction and major renovation. State-owned and public school buildings should renovate their facilities using energy saving performance contracting. This form of contracting funds energy efficiency improvements through energy savings without incurring capital debt.

- Utility planners should take environmental costs into account when selecting energy technologies, and environmental policies should be amended to prevent polluting industries from freely passing on their exter-

nal costs to the general public. The method by which electric rates are set should be reformed to ensure that the actions most beneficial to consumers and the public at large are also the most profitable for producers and distributors. Thus, when improved energy efficiency or cogeneration is the most cost-effective way to meet an energy shortage, the regulatory structure should make that the most profitable strategy for the utility to promote, even if the quantity of electricity generated and sold decreases as a result.

- Kentucky should reduce the vulnerability of our energy systems by encouraging improved energy efficiency and a more decentralized energy system that depends less on long-distance transmission lines and oil and gas pipelines. Small-scale, renewable energy sources located on or near the customers' premises can improve the reliability of the electric transmission grid and prevent pollution at the same time. More energy-efficient facilities would also be better able to ride out natural disasters and routine supply interruptions as well as terrorist attacks.

We currently have the means to conserve energy and curtail its use but, as always, the question is do we have the will?

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Environmental Futures – Looking Backward to Look Forward

Peter Meyer

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The first formal research project of the Center for Environmental Policy and Management produced a report on *Forecasting Kentucky's Environmental Futures* for the Kentucky Long-Term Policy Research Center. That 1996 study was based on data from roughly 1993-1995, so it's time to reflect and update the report after the passage of almost a decade.

Looking backward helps one to look forward on several levels: first, one can assess the accuracy (most often ***in***-accuracy) of the predictions; second, one can examine the actual trends since the initial observations were made and use that information to correct them, and perhaps most importantly, one can speculate on why the original projections went awry – and think about what trends were ignored that may have affected those that were forecast when the first report was written. I will attempt to do all three with the goal of again looking at Kentucky's environmental future.

The following are the projections that were made in the 1996 study and reflections on their accuracy:

1. "…the Kentucky environment will deteriorate over the next thirty years …" – although easy to say, this broad finding tells us little. The fact is that it has happened.

2. With respect to air quality in particular, 'environmental factors will slow the rate of economic growth …" – ask economic development officials anywhere in the Golden Triangle – or in Padukah – and there's little question about the accuracy of this finding. We also projected decreased air quality in central and western KY due to "merchant" power plants producing for non-Kentucky customers, and that has come about as well.

3. We predicted a growing awareness of the need to "protect the environment in order to permit more economic development," and we appear to have been correct here as well, but we did not anticipate the growing emphasis on smart growth in land use planning, nor the new emphasis on redeveloping old sites such as brownfields.

4. We projected that the increased reliance on the environmental technologies already available in 1995 would affect future environmental conditions more than shifts in attitude, and while we more or less anticipated the emergence of the pollution prevention movement in our observations, we severely underestimated the strength of the sustainable development movement and shifts in household as well as business behaviors, including recycling and energy conservation efforts.

5. Our environmental forecasts compared the 1995 Kentucky economy to a projected alternative that emerged as a consensus change forecast in our advisory group sessions and we projected that the shifts would negatively affect environmental conditions, but the changes in economic activity that people wanted as income generators did not fully materialize, so conditions did not worsen as much as they might have.

6. Coal mining and tobacco growing have declined, but the former by not as much as we anticipated; manufacturing did not develop as hoped-for, nor did tourism volume, but wood (chip, strand) processing has developed a bit more than expected, and power generation has to some extent emerged as a new employer.

7. Energy demands and emissions continue to grow in the Commonwealth; air quality overall is deteriorating, and that is mostly due to growth in emissions in the Central region caused by new power plants and increased volumes of mobile sources such as cars and trucks; municipal solid waste volumes are not growing as fast as originally predicted, and may even be declining in some areas, but this has not been associated with decreases in packaging or altered buying habits, but, rather, to recycling and some re-use efforts, especially for construction and demolition debris.

So, where does that leave Kentucky now, and where might Kentucky be five years from now? Some factors that may influence the outcomes are the following:

- The overall decline in the US economy may account for a lot of the slow change in economic activity, but this decline may reverse itself in the coming years.

Brownfield site.

- The price of gasoline for most of the decade has been very low, and is now not much more than it was in relation to other goods and services in the 1960s, but when this condition changes, the large cars, low gas mileage, and long commutes we've seen as the pattern since 1995 are all likely to change.

- Demand for electrical power continues to grow, but at a slower rate than many predicted in the 1990s, but the demand for power generated in places where people are not concerned about air pollution also continues to grow. The price of natural gas and oil continues to increase while coal is mined and used to generate power in close proximity to the mines, so both mining (and the exceptional negative environmental effects of new technologies such as mountaintop removal), and power generating (polluting the air by avoiding the costly scrubbers needed by urban generating plants) are likely to continue to expand in ways not anticipated a decade ago.

- Greater emphasis and reliance on so called home-grown or own-source energy has emerged, caused by the war on terrorism and the other consequences of 9/11, and this may lead to spikes in domestic resource consumption in the absence of any Washington calls for national sacrifice, recycling or re-use or conservation, such as emerged in prior wars, notably World War II.
- A national trend toward income equalization that was growing, albeit slowly, through the early 1990s has been severely reversed, by both economic conditions and national tax law changes, and this means that those at the low end of the economic ladder are less able to spend to conserve or protect the environment while those at the high end can afford to buy the environments they want and protect themselves from the consequences of their waste – environmental inequality is growing, along with economic inequality.

Looking forward, what can Kentuckians expect? Although much has changed, a few trends seem to be emerging:

- Air quality – all around the Commonwealth – will continue to worsen, even in places where the increase in pollution will threaten economic development.

- Gas price spikes – and, eventually, more stringent controls on car emissions and the costs they impose – will impact the increasing sprawl of urban areas that is occurring in most every town over 25,000 in population in Kentucky. This trend will disrupt what has been a steady rise in real estate prices.

- Brownfields and other previously developed sites will become more valuable and profitable as investments, and the pressures on the legislature to encourage such projects with clearer standards and review processes will lead to policy changes (despite stonewalling for the past five years by the NREPC).

- As the schoolchildren who have been in the forefront of much of the expansion of recycling get older and become householders, attitudes towards environmental tradeoffs will change, with quality of life gradually becoming more closely associated with sustainable behaviors than is the case today.

These are of course tentative and limited projections, but they are borne out by what Kentucky has experienced so far. No one can foresee the potential disruptions that can cause forecasts like these to be dramatically altered.

Does any of this add up to substantial change? Perhaps not, but, then, few of the commentators in the media who report weather conditions across the US day in and day out ever tie their reports to "global warming," the supposed consequence of increased levels of CO_2 in the air. The global warming theorists claim that any gradual shift to a new level

of average global temperature will be accompanied by extreme weather instability and anomalies. Whether or not one chooses to believe the global climate is warming, one cannot ignore the signs that the weather instabilities are there.

If the U.S. ever really responds to the reputed global warming trend, then all projections are off: coal may be dead, electricity use may drop, and car efficiencies may actually reach the 50+ miles per gallon that we are already capable of attaining, (that is assuming we continue to use petroleum at all)…but I'll leave those projections for another decade once we see how these forecasts play out.

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Sustaining Biodiversity in Kentucky

William H. Martin

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Biodiversity is defined as the variety of all life and the complex organization, interactions and processes associated with life. Considering the diversity of all life is complicated. Recognized levels of biodiversity are:

- genetic - the genetic diversity of individuals and those of the same species.
- species - the diversity recognized among different species; the commonly-recognized level.
- communities and ecosystems- the diversity of an assemblage of different species sharing common environments and habitats.
- landscape - the diversity of species, communities and ecosystems across an identifiable landform or along a distinct waterway.

A Biodiversity Sketch

Kentucky is famous for its many cultural distinctions such as the beautiful horse farms, the Kentucky Derby, bourbon whiskey, the famous feuds, and the "damndest" politics. Far less appreciated are the natural features, specifically the plant and animal life and the forests, fields and waters that make Kentucky a *center* of biological diversity. Before World War II, Dr. E. Lucy Braun and her sister, Annette, made many long and arduous trips from their home in Cincinnati into eastern Kentucky to document the old-growth forests of the Cumberland Plateau and Mountains primarily because these valuable forests were being logged for the first time. She described these botanically-rich forests in detail, pointing out the diversity of the different layers of the forests from the herbaceous ground cover to the towering canopy trees. The forests of the hollows, ravines and protected slopes were termed "mixed mesophytic" forests with "mixed" referring to the diversity among the dominant canopy trees and "mesophytic" referring to plants that characterize cool, moist environments. She considered these forests to be diverse as a result of millions of years of evolution in the southern Appalachians and the core of forests that provided the seeds of the species that developed the rest of the eastern (North America) deciduous forests following the end of the last ice age.

Research in the latter part of the 20th century reveals that this concept of the "mother forest" has to be revised even though the biological richness of the forests of eastern Kentucky cannot be denied. Dr. Braun also described the remaining old-growth forests across Kentucky pointing out the unique open woodlands of the Bluegrass region "...unlike any existing forest..."; the multitude of oak forests of the uplands of the Knobs, Pennyroyal, and Shawnee Hills regions; and the expansive bottomland forests of western Kentucky. Ecologists following in her wake have continued documenting the diversity of older, mature forests in the state although they are relatively few in number and acreage. The old-growth forest remnants provide examples of the highest richness of forest diversity for their particular forest type because of the diversity of layers of the living forest and the additional variety of habitats provided by the dead logs and snags at various stages of decomposition.

Fifty percent of Kentucky remains in forest but virtually all of these forests have been logged (at least once), grazed by livestock, and burned repeatedly. With protection from grazing, arson, and irresponsible logging, these recovering forests have the potential to reach levels approaching the diversity of older forests. Fortunately, most of the plant and animal species of our forests are amazingly resilient, so they can reestablish if given the time and proper management. Those species that are not as resilient require special management attention because they are often the rare and endangered ones.

At the time of settlement and subsequent extirpation of Native Americans, at least 10 percent of Kentucky's landscape was predominantly grassland, chiefly in southern and western Kentucky. Early explorers, settlers and cartographers called the region "The Barrens" because of the absence of trees and the extensive meadows of native grasses maintained by repeated burning by the indigenous tribes. In a single generation of settlers, these barrens virtually disappeared as fires were suppressed and they were converted to farmland, towns, and villages. Domesticated livestock replaced the native grazers that included bison and elk, and cool-season pasture grasses of European origin replaced the native vegetation that

had been dominated by the warm-season grasses (in recent years, these warm-season grasses have been "discovered" for restoring and creating wildlife habitat and as forage for summer grazing and hay production). Today, barren vegetation exists as tiny, scattered remnants that are much sought after by natural heritage agencies and wildlife organizations because the community type is rare and these are habitats of rare, endangered and threatened species of non-forested lands. Some areas identified as barrens are abandoned agricultural fields that have been invaded by the tenacious native species of the historic barrens. These species have persisted in small, open areas that could not be cultivated because those sites were too rocky, had shallow soils or were infertile. They invaded and established in the abandoned fields by getting there "first with the most" and successfully excluding or competing with introduced weeds.

Urban wildlife habitat.

The streams and rivers of Kentucky provide another historical source of biodiversity. Kentucky has over 85,000 miles of surface water—more than any other state in the lower 48—that supports a rich fauna of freshwater fishes and aquatic invertebrates, particularly freshwater mussels. The rivers are millions of years old and their age, isolation from other drainages, physical features, and flow patterns have served as centers for the evolution of unique and valuable aquatic life. The prevalence of limestone rocks in over half of the state's land area has also led to the development of an extensive groundwater system of aquifers and thousands of underground caves and passages that have also served as evolutionary centers for a cave life that is globally significant for its unique assemblage of cave species, communities, and ecosystems. In spite of the extensive use and pollution of groundwater and the polluting of streams and the damming of free-flowing rivers, the biota of these aquatic and cave areas still persist, although extinction and extirpation have occurred and many surviving elements are endangered. For example, freshwater mussels represent the group of organisms most at risk in Kentucky and the United States. Over one-third of our native mussels are at risk because of degraded habitats resulting from increased sediments, chemical pollutants and an introduced foreign species, the zebra mussel. Even so, Kentucky still ranks third among states (after Alabama and Tennessee) in the diversity of fish and mussel species.

Biodiversity Values

Why should we worry about the future of Kentucky's biological diversity? Because conserving, preserving, and sustaining our native, natural diversity are essential elements of the economic, ecological, and social well-being and security of the Commonwealth. Yes, security and natural diversity are linked. Protecting native biodiversity should be a component of the newly established "homeland security" particularly as the global movement of people and materials makes the exposure to introduced pests and diseases more likely and possible.

The "goods" and "services" provided by our biota are not generally recognized and appreciated, but the value can be documented. For example, the economic "goods" are represented by the forest products industries of the state that exist because of the commercially valuable species of deciduous trees in our forests. These hardwoods of red and white oaks, tulip poplar, maples, ash, hickory and others are the basis of a $5 billion industry that employs over 35,000 people. Also, our beautiful landscapes are in large measure responsible for an $8 billion tourism industry that includes $2 billion spent on hunting and fishing on the land and in the waters. Of course, our domesticated plants and animals, now a part of Kentucky's biodiversity, provide the farm products that contribute to the nation's and state's food supply and sustain rural life. Ecological "services" provided by the various levels of biodiversity include the bees, wasps, ants, and others that serve as pollinators; the wetlands that help control flooding; the birds, bats, and beetles that control insect pests; the forests that prevent erosion and assure clear streams and rivers; the urban forests and trees that remove air pollutants and provide cooling shade; and, of course the songbirds, beautiful wildflowers and other natural assets that improve our quality of life, lift our spirits, and even serve as symbols of our state and nation. Can we imagine an alternative to the bald eagle as our national symbol?

Sustaining Biodiversity & The Challenge

Consideration of the condition and future of Kentucky's biodiversity is at a critical stage in our history. The major threat to native biodiversity is the same one in Kentucky as it is elsewhere in the nation and the world - the loss or fragmentation of natural habitats. Loss of habitat is due to the unrelenting growth of the human population and its demands for space and resources. In the United States, the number of people is approaching 290 million with 3 million added every year (including immigration). Kentucky's population is now over 4 million, with most of us living in urban areas.

To accommodate growth and demand, over 130 acres of Kentucky's forests and fields are being converted into developed land *every day*. This means loss of agricultural lands and wildlife habitats to highways, subdivisions, commercial and industrial development; every week, one square mile has been lost to development. Accelerated development in recent years has been astounding. From 1982 to 1997 Kentucky's rate of growth was second in the nation. Other substantial threats include introduction and invasion of exotic pests and diseases; habitat degradation by pollutants; over use of certain species and ecosystems; and bad resource management practices.

What are we to do? Given the reality that growth and development will not stop, the challenge to preserve and conserve biodiversity only increases with each passing year.

In the long run, sustaining Kentucky's biodiversity—the natural capital of this state — means reduction and, to the extent possible, the elimination of some of the threats just noted. In 2001, Governor Paul Patton established the Smart Growth Task Force in response to the state's increased rate of growth and development. The report recommended taking long-term actions that would reduce the pressure on land and life. Major recommendations for future "smart growth" include community and regional planning to coordinate growth with transportation corridors and other infrastructure needs; revitalization of downtowns and reinvestments in existing residential, commercial, and industrial buildings; redeveloping abandoned industrial sites; and development of smart growth educational efforts at all levels of formal schooling and informal education. Certainly, these recommendations do pave the way for a different and smarter way of growing across the commonwealth in the coming decades provided there is broad support, continued leadership, and funding to support communities in these efforts.

What about the next 2 to10 years? The efforts mentioned above will not immediately address the issues of biodiversity while land conversion and development continue at the current pace. Here are some steps that need to be taken now:

State natural resource agencies need to continue and substantially increase their outreach conservation programs to private landowners. With over 90 percent of Kentucky in private ownership, any realistic biodiversity programs must include implementing conservation practices on private lands. This means actively contacting landowners about existing, voluntary programs and informing them of the need for considering these stewardship programs on their lands.

- Initiate a coordinated, state-wide inventory of biodiversity that addresses all levels of diversity. There are ongoing inventory efforts but they are not sufficiently comprehensive and they are woefully underfunded. In 1995 the Biodiversity Task Force recognized this need as a top priority. It was true 8 years ago and it remains true today. The issue is one of increased and continuing funding, and the scientific and conservation communities need to repeatedly take the issue to the Governor and General Assembly. The 2000 General Assembly authorized a state natural history museum that would coordinate and house the inventory. Those who are interested in a comprehensive inventory effort must become the lobbyists for the biodiversity of Kentucky, an issue that has no political advocate in the halls of government.

- The Smart Growth Task Force recommended that there be "substantial, sustained, and dedicated state funding and tax incentives" to protect and conserve natural resources. Kentucky has the programs in place through the Kentucky Heritage Land Conservation Fund and Purchase of Agriculture Conservation Easements (PACE) to achieve such a conservation effort. The key words to success are "substantial," "sustained" and "dedicated."

- We must be more vigilant about the invasion of exotic pests and diseases. The West Nile virus is a new disease that affects both wildlife and humans. It has spread across the country in less than five years from the time it was first reported. Our forests are threatened by such insect pests as the gypsy moth and hemlock wooly adelgid. Other forest pests that are already a problem in other parts of the nation may be on the way here and we need to be aware of them and be ready to respond.

- Invasive species that are already here need to be identified, located, and monitored. Aggressive campaigns need to be developed to reduce their impacts through educational as well as aggressive eradication programs.

Some biologists assert that the 21st century will be a critical time with the possibility of up to 40% of species going extinct. Regardless of the validity of such a dire prediction, conserving habitats and diversity are never-ending challenges. In Kentucky, we do have the opportunity to sustain the existing diversity of species and ecosystems by working together as agencies, landowners, students, conservationists, and concerned citizens. It is a matter of being willing to work together to recognize that these living resources are renewable and every bit as valuable as the coal, gas, and oil resources that once used, are gone forever.

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The Future of 'Pollution Prevention' (P2) in Kentucky

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Since its inception in the late '80s, pollution prevention (P2) continues to struggle to become the environmental management approach of choice for all organizations that use toxic materials and generate wastes. The objective is to prevent or eliminate environmental problems on the front-end rather than managing them after they've happened. The Pollution Prevention Act of 1990 defines P2 as "any practice that reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment or disposal." P2 can also be defined as source reduction and other practices that reduce or eliminate the creation of pollutants through: increased efficiency in the use of raw materials, energy, water or other resources; or, protection of natural resources by conservation. It is becoming increasingly clear that the P2 community is focusing its efforts on anticipating and meeting environmental problems while they are manageable and preventable. The P2 community is finding new ways to work with organizations in order to create a high level of public awareness and involvement. This is the driving force behind P2 environmental performance results.

Many organizations feel that the easy way to implement cost effective P2 techniques and methodologies are already in place – the "low hanging fruit has been picked." Unfortunately, the reality is very different. There still is plenty of low hanging fruit to be picked and much of it is still lying on the ground rotting. In the future, the challenge for P2 practitioners is training and helping organizations be better and higher fruit pickers. Sustainability will be the over-riding environmental goal for organizations in the future and systemic environmental approaches will be the framework for meeting P2 challenges. Environmental Management Systems (EMSs) have proven themselves to be effective in achieving P2 objectives and targets and they are emerging as the framework for using additional tools for promoting P2. Some of these tools include: environmentally preferable purchasing; energy, water and resources conservation; and environmental management accounting. In many instances, the use of these tools is voluntary and market driven. P2 programs such as the Kentucky Pollution Prevention Center (KPPC) will need to expand and embrace other emerging global environmental concepts such as eco-efficiency and cleaner production to help attain the goal of sustainability. In the future, survival and competitive advantage will increasingly move organizations into product life-cycle assessment, design of sustainable products, and product stewardship. KPPC must begin working with industries to design and develop products that not only result in minimal environmental impact when manufactured, but also have a minimal environmental impact when disposed of. Europe is leading the way in this area and provides us with good examples of what needs to be done. European white goods manufacturers are demonstrating the design-to-disposal life cycle approach by: using paints with no more than 5% (by weight) organic solvents; using no cadmium, chrome, nickel or nickel compound plating; using plastics containing no substances based on cadmium, lead, mercury/mercury compounds, or chlorinate/brominated paraffins; using plastic parts labeled for ease of recycling at end-of-service-life; requiring a plan describing a method and estimating costs of disposing of white goods at end-of-service-life; and packaging materials with no metal-containing additives.

In the future, it will become increasingly important for organizations to understand it is more effective to prevent environmental damage and to prove there is no safer way of proceeding in the production of products. This will require an integrated approach for resource use and consumption and an understanding that environmental risks cannot be shifted between workers, consumers or media, or between land, air and water. This multi-media approach to P2 will ensure that source reduction of wastes is occurring instead of the older cross-media pollution where, for example, pollution control techniques are removing air pollutants only to place them in water or solid waste streams. One organization was able to reduce solids and biological oxygen demand (BOD) loading for cleaning water and saved 3.65 pounds of copper from entering the discharge water stream annually through an equipment modification (dry brushing) and best management practices.

With the exception of environmental activists and citizens directly impacted by industry activities (e.g., those living near chemical or wastewater plants), mainstream America and

particularly Kentuckians are largely unconcerned with environmental issues. Consumers will continue to have little impact on what gets done environmentally from a broader, societal perspective. This is based on the fact that being a driver of change requires a certain level of environmental awareness, interest and effort now largely lacking in the public. This isn't surprising when one considers the range of other significant factors competing for an average American's attention today – from the struggling economy to other pressures of everyday life such as keeping one's job, making sure dinner gets on the table, and taking the kids to soccer practice.

Louisville Metro Recycling Center.

Environmental concerns are just one thing competing for attention and it falls very low on the average American's priority list. This means P2 must establish the public as a target for awareness efforts. The lesson learned for the future is that environmental initiatives that require extra effort, a conscious decision or extra cost on the part of the consumer are not likely to advance very far. More environmental courses with a P2 focus are emerging at all levels in the education system and in the future, people may have a better understanding and appreciation of P2 in their work place and as consumers. However, responsibility for P2 and environmental achievements will rely largely on an organization's ability to transparently incorporate environmental improvements into products and services without a loss in product performance or an increase in cost.

Since 1970, environmental legislation targeted at industrial operations has been the principle approach to promote environmental change and P2 improvement in the United States generally, and Kentucky specifically. However, many regulatory barriers to P2 continue to slow the implementation process. Environmental regulations continue to have an end-of-pipe and media-specific focus for data gathering and management purposes. Regulatory inflexibility and uncertainty continue to slow P2 implementation primarily because a technology may not perform within permit limits initially or a P2 investment might not meet unknown requirements for the future. New environmental laws have traditionally been what drives an organization's interest in preventing pollution and how P2 can help maintain compliance. Few, if any, major pieces of environmental legislation can be expected in the years ahead. If compliance is the most efficient means of achieving the optimal level of environmental protection, effective enforcement of existing laws must go hand-in-hand with continuing efforts in P2. In the future, regulatory agencies will rely more on compliance assistance and voluntary P2 programs to achieve environmental performance not just command and control strategies. However, the most effective change regulatory agencies can implement that will help sustain them will be P2 regulatory integration.

P2 regulatory integration will change an agency's day-to-day command and control operations to incorporate P2 into permitting, inspections, enforcement (compliance assistance), measurement, training and staff evaluations. This will reflect a new agency policy of incorporating P2 review into the rulemaking process and standard permit and compliance correspondence. Agency P2 integration teams will be trained to promote innovative practices such as requiring P2 assessments and planning, making referrals to P2 technical assistance programs and integrating P2 into permitting and compliance assurance. Through P2 regulatory integration, agencies will benefit by needing less staff time and money to implement programs and reduced oversight due to reductions in waste generation, air emissions and water discharges. Organizations will benefit internally with cost savings and some regulatory flexibility to enhance implementation of P2 technologies.

One way the P2 community can promote new technologies is through technology diffusion. Technology diffusion is a method used to achieve adoption of P2 solutions that are commercially available but have not achieved widespread market penetration. For example, paint application equipment such as electrostatic and high-volume low-pressure spray guns that improve paint transfer efficiency reducing costs and decreasing waste are available, but approximately 65% of spray painting is still done with compressed air guns at high pressures. For the future, organizations will need technology education assistance to create P2 technology awareness and promote understanding of technical principles. The Kentucky Pollution Prevention Center (KPPC)

has established technology diffusion as an initiative that extends the P2 assessment phase into more in-depth data gathering, better identification of proven P2 technologies for organizations and continued technical assistance during the implementation phase of a project.

Uncertainty issues associated with how to implement the P2 technology are resolved through demonstrations and pilot trials in partnership with organizations. Brief demonstrations of technologies can help reduce the perceived complexity associated with new technologies and encourage potential adopters to investigate the technology further. Recently, KPPC worked with a small electroplating operation to install conductivity controls on one of its five plating lines to reduce the amount of rinse water used. The rinse water was reduced 200,000 gallons annually and the simple payback on the equipment was 3.8 months with other operational improvements also occurring. The owner has since added controls to a second plating line and intends to continue as savings in water are now at 300,000 gallons annually and cost savings have reached $40,000 per year. The pilot trials are enabling the adopters to resolve complexity and compatibility issues and determine how they can successfully implement the P2 technology in their specific application.

Many P2 change agents view technology in terms of new equipment and processes (e.g., powder coating and membrane filtration systems). However, in the future, the principles of technology diffusion must also apply to idea-based innovations such as EMSs and chemical management service programs. This new model of P2 technology diffusion is being used in all areas and programs developed by the Center at U of L to help organizations manage change that is long-term instead of just a single P2 project.

KPPC is pioneering other new ways of working with organizations on P2 in the future. For example, P2 has an opportunity to make a unique contribution to Homeland Security. Our flora, fauna, clean air, clean water, clean soil, minerals, and forestlands are National assets and truly deserve our best protective efforts in the War on Terror. Most Americans are likely not aware that these resources are so intrinsically interwoven into our society's sustainability and way of life that damage to them represents a very real source of economic and psychological instability for our Nation – the very sort of target terrorists seek to attack. As our society tightens security on our most visible assets, terrorists are likely to focus increasingly on less defended assets.

The time to design and implement a more preventive, risk-reduction approach based on P2 protecting human health and the environment is now, and KPPC is leading efforts in this new arena of environmental security. Using P2 methods such as substituting less toxic materials in production, environmentally preferable purchasing and process modifications will result in organizations having less hazardous materials and wastes on-site and therefore, a reduction in vulnerability. This preventive approach will gain in popularity in the future as organizations realize that the ability to respond to incidents may not be the best approach for protecting the environment and human health.

We have learned that the job of informing and involving interested stakeholders in P2 requires constant attention and change. Change management is the focus of KPPC's new P2 initiatives starting with EMSs, energy efficiency (E2), design for the environment and environmental security. While we have accomplished a great deal in the Commonwealth, we still have many challenges ahead in defining sustainable development within the context of P2. Through partnerships with P2, we can turn the considerable potential for sustainable development concepts into reality and success. It is now time to get all of our citizens to join our efforts to reduce Kentucky's generation of all wastes, use of toxic chemicals and improvements in resource conservation through P2.

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Water: The Irreplaceable Resource

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In their paper in the journal *Bioscience* in 2000, Robert O'Neill and James Kahn referred to humans as *homo economicus,* the "economic man" and argued that the social science of economics and the science of ecology need to be better integrated to truly understand the impact of humans on the Earth. It is true that economic themes - the development of capital, the harnessing of the earth's resources for human use - have been dominant ones in the history of societies worldwide. As resources are depleted, humans have found alternatives for them; the much discussed "hydrogen economy" for example is supposed to supersede our petroleum-based common energy sector as fossil fuels become scarcer and more expensive. There are resources however, which cannot be replaced. Water is unique in that it is both a valuable commodity and an irreplaceable prerequisite for life on Earth. These two very different ways of looking at water are often in tension, and this tension is likely to increase dramatically in the coming decades.

While we live on a watery planet, less than 3% of that water is "freshwater", water which has low enough salinity for use in irrigation and drinking. Of that 3%, 66% is trapped in icecaps and other long term storage pools. Humans worldwide already use more than 50% of the "available" freshwater, meaning freshwater which flows close enough to human populations to be economically accessed. Sandra Postel, an expert on water policy, predicts that the growing human population will appropriate up to 70% of available freshwater by 2025.

Our use of water takes two general forms: extraction uses and in-stream uses. Extraction includes such activities as withdrawing water for irrigation or for the production of goods; in-stream uses include transportation, dilution of society's wastes, and fisheries. Each use affects the other. For example, the pumping of water from a river for irrigation leaves less water for the dilution of pollutants from a downstream sewage treatment plant.

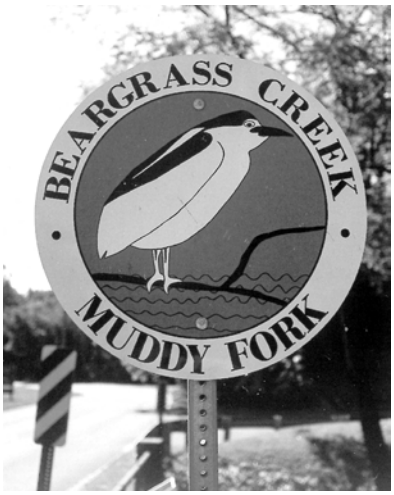
Water also provides us other benefits indirectly from the hydrologic cycle, the pattern of global water movement. The evaporation and precipitation patterns across the Earth influence nutrient transport to the rich coastal fishing areas and control soil moisture, which in turn affects the productivity of our farms and forest lands.

Our mismanagement of water resources and the uneven distribution of water across the continent has led to serious problems in the U.S. About 47% of the endangered species in the United States are freshwater organisms. The Colorado River, one of the largest in the American West, loses so much water to support the agriculture and growing cities of the region that it usually dries up before it reaches its mouth in the Gulf of California. Water use restrictions were common in the southwest and southeast US over the past decade as low rainfall and high demand strained the capacity of the rivers, reservoirs and groundwater sources.

Closer to home, recent statistics remind us of both the progress we have made in improving water quality in the Commonwealth and the challenges that lie ahead. In the 1970's, 70% of the stream miles monitored in Kentucky were unsafe for swimming, boating or as drinking water sources. In 1999, only 34% were listed as impaired. However, only 8.4% of the more than 89,000 miles of Kentucky streams are monitored, so it is difficult to determine how representative this small sample is of water quality statewide. The rate of progress has also slowed; the Environmental Quality Commission reported in 1999 that there had been no significant further reduction in the number of impaired waterways in Kentucky since 1995.

There are many factors which have led to the current situation. According to Postel, South Africa is the only nation which has environmental priorities as an integral part of its water management policy. In the US, responsibilities for various parts of the water cycle are split among 20 agencies, a situation which does not lend itself to developing a unified and coherent strategy for water management. Historically, there has been a distinction between the surface waters and ground waters (those waters in aquifers and other storage areas beneath the surface) with different legal and management priorities for each. While recent research has made it clear that surface and groundwater are intricately linked and influence each other, this fact is still not widely appreciated. In addition, many scientists and policy makers have been

calling for a distinction to be made between "renewable" and "non-renewable" water resources. Up to 2/3 of groundwater resources worldwide are used in a non-renewable way, because water is being withdrawn faster than it is being recharged. Water is being "mined" in a way analogous to mining minerals. In some cases, the aquifer size is being permanently reduced as the ground subsides when the water is removed.



Urban stream.

Jackson and his coauthors, in a paper published in *Ecological Applications*, present a series of recommendations for society to preserve the integrity of freshwater and ensure there is an adequate supply to meet future demands. They suggest that surface and groundwater be legally recognized and managed as a single resource and that an "environmental water reserve" be established to ensure that aquatic ecosystems can continue to provide their "ecosystem services," such as nutrient assimilation and aquatic habitats, to society. They also have called for changes in economic policy such as recognition of the value of watersheds and groundwater recharge areas in providing clean water, better valuation of water and the services that aquatic habitats provide society, and more incentives for efficient water use.

Such measures would require a fairly radical rethinking of our attitudes toward water but may improve the ecological condition of our water bodies and save money as well. New York City, faced with declining water quality in the watersheds which served as its drinking water source, found it was cheaper to buy and restore the land in the watersheds than to build a new filtration plant to improve water quality. The citizens now enjoy improved drinking water sources without the cost of building and maintaining an expensive plant.

Kentucky has responded to its water quality problems in a number of ways. The state has moved toward a watershed framework for their water quality sampling, in which the major watersheds in the state are intensively sampled on a five year rotation. The Kentucky River basin was sampled in 1998-99 and 1/3 of the 1700 miles sampled were found not to be supporting their "designated uses". The Agriculture Water Quality Act has provided resources to assist Kentucky farmers in the development of "ag water quality plans" designed to help them reduce the impact of farming activities on streams and lakes. As of 1999, about 36% of Kentucky's farms had a water quality plan. The state is also actively developing total maximum daily loads or TMDLs, for impaired reaches of stream to help reduce the loading of pollutants into these already stressed systems. As our experience in Kentucky has shown, we as a society need to be open to innovative ideas on how we can better manage our one truly irreplaceable resource.

Many of the examples and ideas in this article were taken from the following articles, which I recommend for more in-depth treatment of the topic of water use and conservation:

Jackson, R.B., S. R. Carpenter, C. N. Dahm, D. M. McKnight, R. J. Naiman, S.L. Postel and S. W. Running. 2001. Water in a changing world. Ecological Applications 11: 1027-1045

Kentucky Environmental Quality Commission. 2000-2001 State of Kentucky's Environment. 172-pages.

Postel, S. 2000. Entering an era of water scarcity: The challenges ahead. Ecological Applications 10: 941-948


Urban stream.

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Current Trends in Kentucky's Forests

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Background

Kentucky is blessed with forests that virtually constitute a mixing zone of northern and southern hardwoods, claiming over 160 different woody species. Although made up of mostly private lands owned in small parcels and difficult to "manage" at the regional or watershed level, Kentucky still has significant lands in forest, and many forest blocks uncut by major roads or disturbances that exceed 1,000 acres in the west and 5,000 acres in the east. An ongoing cycle of cutting and re-growth has been constant since the state was settled. Over the last forty years, Kentucky has maintained 11-12 million acres of "forest land", with a one million-acre difference moving up and down every ten years. The wood products industry, ranging in activities from logging, milling to final products is projected to continue to grow from an estimated five billion dollar industry today. Our wealth of forested land plays a major role in the 'look and feel' of the state, and will play the major role in our future sustainable natural resource-based industry, especially as coal and other "wasting assets" become more costly to access.

Our forests are critical to the maintenance of air quality, or at least to act as buffers to the loss of air quality, which in turn buffers our ability to absorb growth within the increasing limits established by air quality standards. They are critical to our dream of attracting "knowledge jobs" that can support our tax base without new externalities in the form of pollution because higher wage earners would rather work where there are forests outside the window instead of yellow cabs and smog. Forests, especially larger blocks that support interior forests, are critical habitat for much of the state's biodiversity, and provide transportation and filtering for fresh water through the cycle. Forest lands in Kentucky can be had for $300-$1,000 per acre, while much of the rural land in more developed states sells for ten times that price. The "intangible" social and natural resource value of a forest community is many times the tangible value of the trees converted to wood products. When managed well, this renewable asset can provide high economic returns both in the tangible and intangible categories of value.

The value of the trees on a parcel of Kentucky land often exceeds the "appraised" value of the land under a comparative sales analysis. We are at a point in history where the public good of restoring, protecting, maintaining, and improving our state's forests is affordable. This opportunity will probably not be used directly by state and local governments. Public land acquisition funds are some of the lowest in the country here, and a distinct historical preference for private land ownership leaves Kentucky under a system where – by most estimates - 93% of the land is privately held, including all the state and national forest land, state and national park land, state and federal wildlife management areas, U.S. Corps of Engineers property, local parks, and state and private nature preserves. In all likelihood, no substantial amounts of forestland in Kentucky will ever be bought up and managed by public agencies for the common good.

Kentucky will improve or hurt its quality of life to the extent it is dependent on trees through technical assistance, grants and education aimed at helping private landowners get what they need from their land without unnecessarily reducing the public values every tree spared will provide.

A Typical Experience with Forest Management

One of the authors (Archer), has lived on an Anderson County farm along the watershed break between the Kentucky River and Salt River basins for the last twenty years. The topsoil mostly eroded away or moved to the bottoms along the perennial streams from 130 years of logging and farming, then trees (mostly red cedar) grew back into the steep sloping, abandoned fields. Today there are 100 contiguous acres of cedar, oak, hickory, ash, walnut, maple, beech, Kentucky coffee tree, "planted", non-native pine, honey locust, Osage-orange, and many others. This diversity of tree species would impress anyone not living in the rain forests. At the farm, cedars are regularly cut to push the rate of succession back to mixed hardwoods, and keep 40 acres in hay free of invading trees. The water table under the farm has dropped significantly and the soil is more acid than ever before in its occupied history.

Every tree that is cut, out-competed, or dying because of some forest health issue changes the micro and macro growth around it. The first and most significant observation from living with one plot of land for many years , and what is true for most of the rest of Kentucky's forest land for that matter, is that it is very dynamic and changes are driven by human land use. The woods on this farm have never been managed in the past for "sustainability" in any sense of the word, they are the unplanned result of other immediate land use decisions involving the harvest of food and fiber, and this is unfortunately true for the vast majority of Kentucky's forest. We don't get to wait for climate change, Kentucky's forest are the result of the vastly different land use patterns practiced by many different land owners. Most of the trees have been high-graded to the point that Kentucky is loosing its valuable oak-hickory forests to less desirable oak-pine and beech-maple stands.

What reasonable scenario is expected to predict and help us manage the dynamic change in Kentucky's forest over the next 10 to 20 years? What are the implications for Kentucky's economic future, the kind and number of jobs, the quality of life for residents, the preservation of biodiversity? What will be the sustainable volume and range of products available to our wood products industry? Certain trends can be identified and value judgments applied to help us begin to address some of these key questions. The answers may have a great deal to do with our quality of life and whether we establish a sustainable natural resource based economy with appropriate eco-tourism elements, or we squander the opportunity. Management of Kentucky's forestlands is an issue that impacts everyone in Kentucky whether one lives in the city or even "owns" a tree. Isolation of trends is an important step in our search for good forest management decisions, both local and statewide.

Positive Trends

A comforting way to view Kentucky is to see it as having over fifty percent of its land cover in forests. The actual meaning of "forestland" is key to defending this statement, and various inventories oscillate in a range about 40% up or down for such estimates because of different methods used in determining what is a field and what is a forest. The best available information has been derived from the USDA Forest Service (USFS) long-term forest inventory assessment (FIA) sponsored nationally by the USFS research programs. It is based on statistics derived from re-sampling established sites year after year, although formerly it was accomplished only once every 10 years. Good inventory data regarding the distribution, type and changes in land use is critical to seeing trends and making good management decisions. The Kentucky Forest Conservation Act (FCA) followed in the steps of the Kentucky Agriculture Water Quality Act to establish an improved framework for both inventory of our forest resources and standards for mitigating water quality impacts from commercial logging. An on-going inventory is now in place covering at least 20% of the state each year. Improved inventory and change detection information is the critical first step in setting up a program to work with private landowners and take advantage of Kentucky's trees.

a. Forest inventory through remote sensing techniques: Perhaps the most significant improvement to our ability to know the status of Kentucky's forest is the use of remotely sensed data from either satellite or aerial photography based sensors. The "Kentucky Landscape Snapshot" project, a National Aeronautics and Space Administration (NASA) funded update to our state's land cover dataset will provide a more precise, accurate, and better classified map of our state's forest land than has ever been available before (Lambert et al., 2003; Zourarakis et al., 2003). The Anderson level III classification scheme in the Kentucky Land Cover Data Set 2001 (KLCD 01) will provide a greater level of detail than the existing classes in the National Land Cover Data Set 1992 (NLCD 92) (USGS, 2001) and will make possible the generation of forest inventories (Table 1). Forest inventories will provide better decision support for planning good forestland management, but there are many other significant trends besides better inventory to consider.

b. Best management practices and logging: Good trends include the current requirements for trained "master loggers" on commercial logging jobs responsible for the application of mandatory best management practices designed to protect the waters of the Commonwealth from sediment and nutrient loading that can occur from unmanaged logging activities. There is better coordination between state agencies that assist private landowners with land management decisions. Depending on landowner preferences, free management planning services are available for wood products income, fish and wildlife habitat, agricultural use, and combinations.

c. Farmland/forest land protection efforts: Agricultural conservation easement programs funded through the 2002 Farm Bill, tobacco-settlement money, and private donations have purchased development rights from thousands of acres of farm and forest land, although

4. FOREST [1]

1.1 Deciduous Forest [2]
- a. Oak Forest [3]
- b. Yellow Poplar [3]
- c. Mixed Deciduous [3]

1.1 Evergreen Forest [2]
- a. Pine Forest [3]
- b. Red Cedar [3]
- c. Hemlock [3]
- d. Mixed Evergreen [3]

1.1 Mixed Forest [2]
- a. Oak – Pine [3]
- b. Other Mixed Forest [3]

1.1 Woodland [2]
- a. Deciduous Woodland [3]
- b. Coniferous Woodland [3]
- c. Mixed Woodland [3]

1.1 Mined Forested [2]
- a. Deciduous Mined [3]
- b. Coniferous Mined [3]
- c. Mixed Mined [3]

6. WETLANDS [1]

1.1 Lowland Forest [2]
- a. Oak/Deciduous Bottomland Forest [3]
- b. Riparian Forest [3]
- c. Bald Cypress Wetland [3]
- d. Floodplain Forest [3]
- e. Woodland Wetland [3]
- f. Black Willow Wetland [3]
- g. Mixed Shrub Wetland [3]

[1], [2] NLCD 92 [3] KLCD 01 (see text for references)

Table 1. Proposed Forested Classes in the Kentucky Land Cover Data Set 2001 (Lambert et al., 2003)

the demand from willing sellers greatly exceeds the available funds at this time. Membership in Agricultural Districts has grown constantly through a voluntary statutory program that helps protect rural land's historical land use values.

d. Enhanced stewardship and management: The new Forest Land Enhancement Program (FLEP) will provide 2002 Farm Bill subsidies to landowners as incentives for implementation of management plans and other approved practices. The Kentucky Division of Forestry (KDOF) has suffered significant budget cuts, but still maintains a distributed network of two nurseries and nine District offices. The KDOF staff has consistently maintained the best record in the Southeast U.S. for completing "stewardship management plans" for private landowners in Kentucky. Because Kentucky is one of the only states to not roll the tobacco-settlement revenue over to the general fund, there is still some potential for backing up management recommendations with both FLEP and tobacco-settlement funds as cost share sources.

Troubling Trends

a. Lack of local forest product utilization infrastructure: The loss of "value added" opportunities here in Kentucky from the conversion of our local raw timber into final products is significant. Kentucky exports a great deal more wood to North Carolina and other national and international end users than is used here at home. KRS 154 includes the establishment of a Forest Products Council that has the authority to limit opportunities for economic development grants for uses of the state's forest resources that do not support the long-term best management of those resources. However, low interest startup loans for "right sized" wood products industry here in Kentucky have not succeeded historically, and lack of funding and coordination still limit the state's ability to build the secondary wood products industry our resources could and should support.

b. Destruction of forests and property by fires: Arson on one hand and failure to use prescribed burning as a management tool give us fire where it is not good, and no fire where it would help maintain the quality of the forest community. Arson rates in Kentucky are among the highest in the country and wildfire has a constant impact on the value and health of trees and of the associated water quality, not to mention the more obvious air and property damage and the public cost of fighting the resulting wildfires.

c. Forestland conversion: As much as 85% of the private forestland has been high-graded, degraded, compacted, and otherwise mismanaged for the "highest dollar" approach when income was needed, and allowed to grow back without direction from a professional forester resulting in successive cycles of decreasing value. When much of the productive forest value has been allowed to be lost through mismanagement, the value of the forest stops competing with options involving the 'ultimate' land use (i.e., paved with impermeable materials or houses). Recent studies document that

conversion to sprawl type development has been the major culprit for loss of forestland in the Southeast U.S. and is escalating today.

d. Ecosystem degradation by invasive species: The "global economy" and climate change also present their own set of problems for our forests. Viruses and insect vectors have an increasing impact, unbalancing the system in ways previously unrecorded - if not new - over the long term. While pine beetles and chestnut blight attacks are events now in the past, dogwood blight, oak death syndrome, increasing populations of gypsy moths and less-known insects that attack hemlocks and elms are on the rise. Exotics and invasive non-native plants (also thanks to increased global economic activity) have a growing impact on the forests and basic biodiversity that buffers the forest from historically normal threats. The resulting trend is one of combinations of stressors creating forest health threats and issues that produce impacts that the system can't absorb (e.g., acid mist and pine beetles, increased high-grading along with kudzu and a 500-year rain event, etc.). Forests are resilient, but hardly immortal, and the trend should be towards applying new standards for the identification and testing of health stressors on what's left of Kentucky's forests.

Indeterminate Trends

Other trends that are more difficult to judge as good or bad will play a major role in which trends will dominate others.

a. Land ownership patterns: Thousands and thousands of 100-200 acre farms that formerly survived on a tobacco cash crop need to find alternative products or sell out either to development or to larger corporate land managers. Kentucky's native small farm pattern with native small farm stewardship is being lost. In some cases this results in fields growing in with trees (i.e. more forest land in the gross sense), in some more chemically intensive fence row farming of crops or confined animal feeding operations that are not friendly to maintenance of tree cover.

b. Forest and wood product industry: Industry is learning to make large structural wood products out of small trees by shredding, gluing, and forming the "lumber" needed in the market from formerly unmarketable pole timber. Even the corporate ownership patterns are not stagnant, with larger national corporate acquisitions of the formerly largest wood products companies in our state. The Mead Corporation bought Westvaco, while Weyerhaeuser has purchased Willamette Industries and Trus Joist in recent years. Kentucky is entering a new world of dealing with much larger players in the wood products industry than in the past. Timber Management Organizations (TMOs) are starting to become major forest land owners nationally as many of the traditional corporate owners, like the Mead Westvaco Corporation, consolidate their assets around the mills and sell large tracts of land back into the private timber market. So far, Kentucky is logged by thousands of small timber companies, mostly fashioned around the "weekend" or "second job" operations model rather than on the basis of year-round corporate operation, and the loggers are far from organized into a politically effective lobbing force in spite of their potential influence. A secondary wood products organization,

Over 50% of Kentucky's land cover is forests.

the Kentucky Forest Industries Association, is the only industry organization with legislative platforms and staff.

c. Atmospheric stressors and forest health: The Division of Forestry is currently working on the first of the carbon sequestration agreements for Kentucky, which will allow us to afford to reestablish a bottomland hardwood component in one of our state forests. Kentucky's bottomland hardwood forests have largely suffered from conversion to farmland. The Chicago Carbon Exchange and other agreements among utilities to establish and trade "carbon credits" should open up partnership opportunities for funding the rebuilding of this community type across the state as farm land in the bottoms becomes available for conversion back to native tree communities. However, the science and the institutional structure that will support this trend are still in formation, and there are fundamental questions about what works and what counts. Common levels of ozone concentrations may severely reduce the ability of forests to absorb carbon dioxide, according to a recent study. Scientists have long believed that through photosynthesis trees can pull carbon out of the air and store it in the soil, reducing the concentrations of greenhouse gases. In the study, researchers found that two common types of trees—aspen and birch—that were exposed to elevated levels of both ozone and carbon dioxide stored 50 percent less carbon in soil than trees exposed only to carbon dioxide. From these results it follows that future studies should take a closer look at the long-range effects of increased carbon dioxide and ozone in the atmosphere (Revkin, 2003; Toner, 2003).

d. Legislation affecting forest health, logging practices, old growth forests and forest fires: The proposed compromise language to legislation that would enable President Bush's "Healthy Forests Initiative" to receive support from some Senate Democrats is again driving a wedge between environmentalists and their traditional allies in Congress. More than 210 national and regional environmental groups, along with various local political officials, have signed a letter asking the Senate to oppose the compromise language. The authors of the compromise amendment feel they are providing the first legal protection of old-growth trees, trying to enhance and expedite the process when 57 million acres of national forests are at the highest possible risk of serious wildfires. The opponents are concerned that the bill could allow for the opening of old-growth areas in the Southeast and Alaska's Tongass National Forest. No part of the federal forest system in Kentucky is currently targeted for the fuel reduction treatment anticipated in the legislation targeting 20 million acres of federal forest land, but parts of the Jefferson National Forest on our border with Virginia may be subject to treatment under the Act. The amendment proponents state that under the bill, no new land will be 'opened up' to logging, and that all projects must comply with the land designations of existing forest plans, and if any area is off-limits to timber harvest now, it will remain off-limits to timber harvest under the bill. (Sonner, 2002; Berman, 2003).

e. Court rulings on logging, best management practices and water quality plans: Timber companies must obtain federal storm water pollution permits for their logging operations, according to a "first-of-a-kind" ruling issued recently by a federal judge. This is a trend exacerbating existing regulations by which companies must follow "best management practices" for runoff control. Some opponents state that: "under this view, culverts, ditches and other kinds of conveyances on forestlands would be point sources like pipes out of a factory". USEPA is reviewing the decision (Kravets, 2003). Kentucky's Forest Conservation Act established and applied mandatory best management practices to commercial logging operations already with apparently good results. However, this initial indication that the Clean Water Act will be applied to logging nationally seems to be on a slippery slope that will lead to claims of regulatory takings or inverse condemnation claims. In contrast it should be noted that oil and gas operations have gained an express exemption from storm water plans as well as the state Forest Conservation Act. Road construction and tree removal associated with oil and gas production remains generally unregulated and in some areas significantly threatens water quality.

The government agencies and NGO's concerned about the proper use and maintenance of the ecological values provided by Kentucky's forests must constantly monitor these and other trends, use them to plan the strategic application of the limited dollars for acquisition, stewardship incentives, education and technical assistance we have available, and to fight for even more effective investments in this public good. Kentucky's quality of life today and in the future will be directly impacted by the future land use decisions we make that change our forests, and in turn change our lives.

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Thinking About Sprawl in Kentucky

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"I can't define sprawl but I know it when I see it." How often is this phrase heard when discussing unwelcome development patterns in an outlying suburban community? Many have acknowledged this problem trying to define sprawl yet they forge ahead with various land use mechanisms designed to control the very 'thing' they are at a loss to define. Often, they skip any sort of conceptual idea of the problem and instead create some sort of artificial measure, as if to suggest that there is a set way in which any community can define and identify the characteristics of sprawl.

Is sprawl a static, specific item/outcome or is it more a matter of a dynamic process? If it is a process, then what is it about a specific process that makes it sprawl while other processes are simply seen as standard growth and development patterns for a community; or is all growth considered sprawl? These questions and more require examination at the outset if one is to properly capture the essence of a definition of sprawl. Further, the number of ways in which one can examine the concept indicates that a single, operational definition will not capture its multiplicity of meanings.

The purpose behind this article is to explore this concept known as sprawl in the context of what communities can do to address future growth and development in a more thoughtful way. We will begin by exploring the conceptual complexities of sprawl, discussing the many ways in which others have framed the issue. We then follow with an application of these ideas to population growth patterns in Kentucky, ending with some prescriptive thoughts about how communities might begin to assess their own growth and development futures.

Conceptualizing a Process? Maybe…

The answer to the question "What is sprawl and how do we measure it?" is highly contested throughout the political and academic world. There is an absence of a single coherent conceptual definition of sprawl. This term "sprawl" is used to describe many different kinds of development and growth often leading to highly politicized arguments over the legitimacy of specific projects or policies. Critics within the sprawl debate charge that anti-sprawl proponents are little more than no-growth elitists who seek to prevent all growth and development that does not suit them in their community. Meanwhile, those concerned about sprawl charge that the "pro-sprawl" constituency has failed to realize the external costs associated with unfettered development. The debate has become highly charged, as one can witness in any suburban zoning commission hearing. The many different conceptualizations of sprawl have resulted in multiple methods used to identify it.

Much of the time, sprawl is simply characterized as development with bad or no planning, or as uncontrolled, unfettered development that produces negative impacts on our physical, social, political, and environmental well being. This is especially true of how the term is used within the planning community. To them sprawl is often typified by leapfrogging, low density, poorly connected, single use, and ultimately ugly development – obviously a value laden description. While some have tried to take out the normative aspects of the sprawl debate and simply characterize it as growth, others fight to maintain the normative value in the term so that we understand that certain kinds of growth cause different positive and negative results. Sprawl then becomes either a negative or positive kind of growth depending on how it's defined.

Edgeless cities and edge cities are both part of what many have described as sprawl. The term 'edgeless cities' is relatively new, referring to an office location category typified by clusters of office buildings located outside central business districts. They lack boundary definition and seem to morph between suburban communities, connecting and expanding without political jurisdiction (Lang, 2000). Most are familiar with edge cities via the popular description of communities where office space square footage exceeds residential space (Garreau, 1993). So how we think about defining cities, urban areas, metropolitan areas, how we draw boundaries, physically or politically, all influence the way in which we think about what sprawl encompasses.

New apartment construction.

The discussion of sprawl occurs in a variety of contexts that are characterized by the type of problems it is seen to engender. The problems that result from whatever sprawl is are often conflated with sprawl itself. The effects define the cause in too many conceptual and empirical examinations of sprawl. Even so it is useful to explore the main themes that define what kind of problem sprawl is. Doing so allows us to specify which problem needs to be addressed.

Common Issues Identified with Sprawl

Sprawl is typically characterized within the following framework of issues, any of which might and do overlap within policy discussions:

- Land Use Issue: As a land use issue, sprawl is commonly conceptualized as the disappearance of farmland, open space, forests.

- Population Issue: As a population issue, sprawl is represented as a declining density problem where population growth is combined with a decreasing density of human settlement.

- Infrastructure Issue: As an infrastructure issue, sprawl is represented by more homes and retail centers built in outlying communities, generating additional infrastructure needs such as roads, schools, water and sewer systems, and emergency services improvements. These outlying communities are struggling to keep up with the demand while experiencing dwindling resources.

- Environmental Issue: As an environmental issue, sprawl negatively impacts human and environmental health through the destruction of farmland and open space, generating further land, water, and air pollution.

- Social Issue: As a social issue, sprawl leads to a loss of community through the expansion of suburban communities that require accommodation to automobile demands with little regard for human interactions. Residents must drive their cars to reach any destination. Walking or cycling in these communities is not encouraged.

- Urban/Architectural Design Issue: As a design issue, sprawl critics charge that it is represented in the tract development of suburban housing in outlying communities.

- Political Issue: As a political issue, sprawl is a consequence of the political fragmentation and divestment found in most US metropolitan areas. The disinvestment found in the central city is further fueled by the political fragmentation of the surrounding, wealthier communities who see no relationship between their own development outcomes and the declines in the central city.

Sprawl often represents all of these issues and the way in which the discussion is framed often dictates how a community responds. Ultimately, however, all of these issues associated with sprawl gain attention when the discussion is framed within a policy/planning context. As a policy and planning or regulatory issue, sprawl is most successfully discussed as the result of poor planning or uncontrolled growth, generating concern for all of the issues mentioned above. These discussions then lead to the examination of the fiscal problems associated with the result of poor planning – a less dense tax base – generating the need to support the additional infrastructure requirements of unplanned, disconnected, residential, commercial and industrial areas. These needs arise due to a number of factors, most of which stem from an increasingly spread out population. As the

following example will demonstrate, the most comprehensive way to move the sprawl discussion into the policy arena is through planning.

Sprawl issues in Kentucky

As a case example, let's frame sprawl as a population issue and take a look at population changes by county in the state of Kentucky. Figure 1 illustrates the change in population for the state between the 1990 and 2000 census. These changes are based on the state growth average to provide a sense of how growth is distributed around the state. At first glance, you notice several counties where growth is occurring at a considerably more rapid pace than the state overall. Adjacent to them you notice the counties with the central business districts of Louisville and Covington-Cincinnati where population is not keeping up with state growth or is in decline. One could assume these metropolitan areas are dealing with significant urban sprawl, but is that really the case?

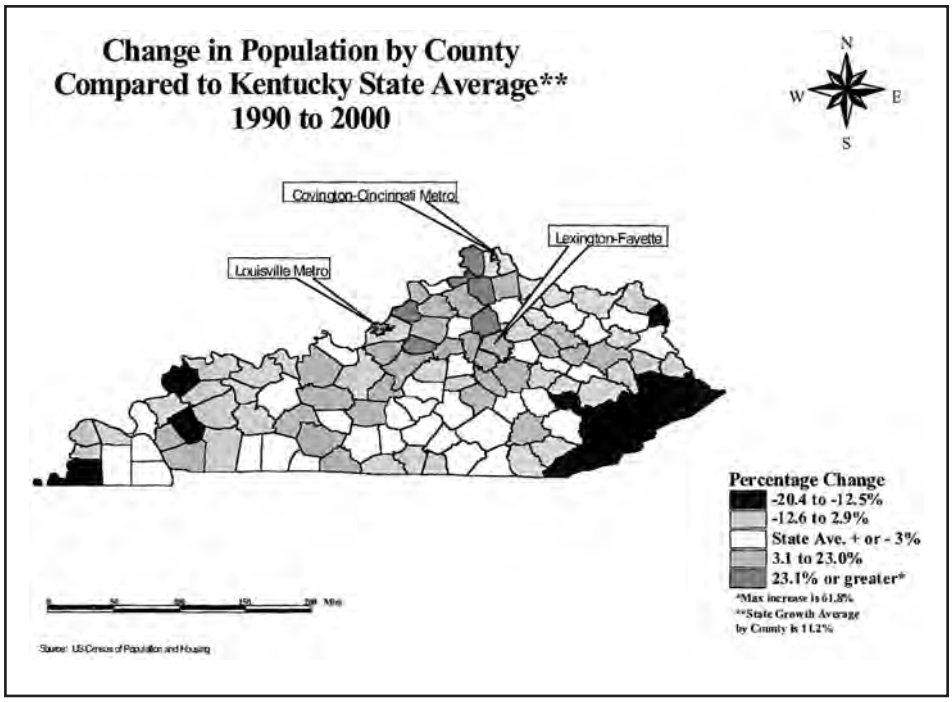

Figure 1

Next you notice that significant growth is also occurring in one of the counties adjacent to the Lexington-Fayette County Metropolitan area but there is not the population loss near that central business district. You know that there is an urban growth boundary surrounding that area and you assume that this area is not dealing with urban sprawl – but what really is happening with the adjacent counties?

Upon further examination, you notice areas where growth is exceeding the state average yet with no major metropolitan area nearby and you also notice large concentrations of serious population loss. What could explain the growth in these counties and the population loss in the others? Again, you might assume that these areas are not dealing with issues of sprawl, but will the growth be beneficial for the area long-term and is it further exacerbating population loss elsewhere? Is this 'leapfrog' development from other, more urban parts of the state? Do the residents want this sort of growth? What are the factors that can be attributed to this population growth and decline?

These are the sorts of questions that this preliminary information should be generating and are what should form the basis for a county's planning process. If a county engages in the comprehensive planning process, then this sort of information should lead the planners to revisit their comprehensive plan. If a county has yet to engage in planning, this sort of information can justify the effort. Planning is essential for all communities, large or small, rural or urban, or somewhere in between. A thoroughly developed, well-implemented (and frequently revisited) plan will assure a community that it is moving in the direction that the residents want, in a way that

Abandoned Shopping Center.

anticipates future growth and development. The comprehensive planning process, if done thoroughly, will uncover the answers to the questions posed here and provide a roadmap for future growth and development in a community.

Some concluding thoughts about sprawl

Defining sprawl becomes a complex process rife with potential biases driven by value judgments made about how communities should grow. People have to define what they think the problem is...what are the negative consequences of particular kinds of growth? The type of growth must be specified…people, buildings, roads... Is the growth planned or unplanned and by whom and for whom is it planned? Environmentally friendly growth, for instance, might be economically or socially unfriendly making collaboration across stakeholder groups a challenging proposition.

Forecasting the future of sprawl in Kentucky, or any other locality for that matter, is possible only if one can simultaneously make some broad assumptions about the future of the economy, population, employment trends, and other key factors specific to the locale in question. Once agreement is reached about these assumptions, then one needs to take into account such things as the effect of a volatile stock market on real investment. Often, investors turn to the more solid real estate market when stock investment risk is on the rise. What are the likely consequences of such a shift in investments? What sort of effect will added real estate investment have on the location of new development? Could such a shift push development even farther away from urban centers? Further, what sort of effect will the current economy have on the preservation of farmland? If farmers, especially tobacco farmers in Kentucky, do not find viable income alternatives, will they sell off farmland to developers, furthering the negative effect that this sort of development is having on community fiscal health and the environment?

The big question is what makes growth positive or negative and for whom is it positive or negative. Is that determination based on the result? Or, is the result defined by a certain type of growth? What are the ultimate issues at stake regarding particular kinds of growth for the locality involved? The answer to THAT question is what will define sprawl in your community.

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Stationary and Mobile Sources of Air Pollution: What the Future Holds

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Introduction

Urban air quality in the United States has shown a steady improvement since the introduction of the Clean Air Act in 1970, and it should continue to get better over the next five years. The magnitude of the improvements, however, will be smaller, and the focus of air pollution control agencies (APCDs) will shift during this period. Since 1970, emissions from on-road mobile sources have been reduced over 90 percent for pollutants that contribute to ozone, carbon monoxide and acid rain. Stationary sources and area sources, actually small stationary sources spread throughout a community, have been rigorously controlled by local APCDs and large reductions have also been achieved in these areas. Future reductions in both stationary and area sources will be smaller in magnitude and more costly to manage. Other sources of emissions, such as off-road mobile sources will be placed under tighter emissions restrictions to achieve the emissions reductions necessary for continued air quality improvement. In addition, the concern about exposure to ozone is shifting from short-term, acute exposure to a longer-term, chronic exposure. New information about particulate emissions and air toxics from mobile sources is resulting in increased scrutiny of the levels of these emissions.

Stationary Sources

For stationary and area sources, the focus has been on ozone precursors, volatile organic compounds (VOCs) and nitrogen oxides (NO_x), hazardous air pollutants (HAPs), and acid rain components, sulfur dioxide (SO_2) and NO_x. For years, the primary focus of ozone control was on the limitation of VOCs, but NOx emissions are now recognized to be equally important. They contribute to both acid rain and ozone levels and they emanate from combustion sources, almost exclusively anthropogenic sources.

The emissions from electric power plants "grandfathered" under the Clean Air Act Amendments of 1990 (CAAA), are a large source of NO_x emissions. These plants are required to reduce the levels of emissions if they have been significantly modified since the passage of the CAAA. Environmental proponents claim that significant modifications have already been made in many cases, but operators of these plants claim that the changes have mostly been ordinary routine maintenance of the facility. A recent federal regulatory ruling supported the operators, but the issue will continue to be a point of controversy until the plants make the necessary emissions reductions. The timeframe for a resolution of this issue, however, is more dependent on the political climate than the technical validity of the opposing arguments.

Hazardous air pollutants will be another issue of increasing importance in the regulation of stationary sources. For a particular facility, these emissions are usually examined independent of mobile emissions in the area. Since mobile sources are a significant producer of air toxics, more consideration of the combined impact of both mobile and stationary sources will be required in the near future. Recent monitoring of air toxics in the Louisville, Kentucky area has revealed high levels of air toxics despite the existence of an approved permitting process for stationary sources in the area. This situation may be present in other metropolitan areas where residential neighborhoods are near urban industrial facilities.

Mobile Sources

The United States Environmental Protection Agency (USEPA) has taken several steps in the last few years that will lead to continually lower levels of on-road vehicle emissions. On-road vehicles comprise cars, trucks, SUVs, and heavy trucks that travel on the nation's streets and highways. The effort to limit these emissions is basically a two-pronged approach that defines fuel requirements and vehicle emissions standards. Fuel sulfur restrictions will reduce sulfur levels in gasoline from 300 ppm to an average of 30 ppm in 2006 and sulfur levels in diesel fuel will be reduced by about 97 percent. The lower sulfur levels will reduce catalyst poisoning in the catalytic converter and will decrease in-use emissions of NO_x and VOCs. In addition, lower vehicle certification standards known as Tier 1 and Tier 2 standards require that new vehicles emit lower levels of VOCs and NO_x. The Tier 2 standards incorporate a fuel-neutral approach that requires

diesel vehicles to attain gasoline-like emissions levels. Also, SUVs will be required to meet the same emissions standards as automobiles. The Tier 1 standards have been required on all new vehicles since 1998, but vehicle replacement is a slow process. It takes seven to eight years to replace half of the on-road vehicle fleet, and even though the Tier 2 standards will come into effect in 2004, they will have very little impact over the next five years.

Gas pumps.

An area of increased focus in mobile emissions is the control of air toxics, which are a subset of HAPs. Since the air toxics of concern are typically one to two percent of VOC emissions, they were initially displaced in importance by the much larger levels of VOCs and NO_x. Recent evidence in urban areas has shown that these emissions in combination with those from industrial sources can result in concentrations that exceed healthy levels. While the new regulations that reduce VOCs will also reduce air toxics, the overall effects on concentrations in an urban environment are not understood at this point. More study in this area will undoubtedly occur in the near future.

In addition to on-road mobile sources, there are many non-road mobile sources that contribute to urban air quality problems. These sources cover a wide range of engines from large diesel equipment like backhoes, bulldozers, forklifts, generators, and pumps to smaller gasoline engines like those on lawnmowers, leaf blowers, and chain saws. Some initial emissions standards have been implemented, but considerably more control is needed in this area. Diesel engines dominate the non-road engine segment, and they emit about 44 percent of diesel particulate matter emissions and 12 percent of NO_x emissions from mobile sources. USEPA is considering a new set of standards along with diesel sulfur controls that will reduce emission levels by 90 percent. As in the case of on-road mobile sources, it will take years for the low-emissions engines to make up a substantial segment of the total non-road engines in use.

Conclusion

There are many new regulations that will come into effect in the next five years that will lower the levels of individual stationary and mobile source emissions in the long run. There will be newer and cleaner fuels for mobile sources, new types of filters and emission controls. There are also new types of alternative fuel vehicles that have few or no emissions. However, all of these efforts take considerable time to have an impact on air pollution levels. In the short-term, emissions levels should continue to decline as a result of the implementation of past emission controls.

Despite the lower emissions per vehicle for mobile sources, long-term predictions still indicate that the total level of emissions will increase because of a continuing increase in the number of miles that are driven each year. Until communities can provide a form of mass transit that equals the comfort, freedom, and independence of the automobile, this trend will continue in urban areas as the population increases.

Gasoline storage facility.

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Environmental Management

"If you don't ask the right questions, you don't get the right answers."

Tony Sholar
Lewis, Corrigan, Sholar LLC

This paper is organized into three categories identified as "Policy", "Politics", and "Process". These are not to be considered as mutually exclusive divisions since the entire public policy debate on environmental management is a function of all three, individually and collectively. I've chosen this categorization based on my involvement in the Kentucky legislative arena for nearly 24 years. I have participated as an advocate on behalf of business and industry and acknowledge the bias with which I approach this subject and all others in which I have been engaged in that capacity. The core principles underlying my advocacy are industrial activities and environmental protection. These are not mutually exclusive because standards for protection of human health and the environment must be based on scientific evidence and technical feasibility. The concepts of risk analysis and risk management as the basis for environmental standards are technically complex and therefore, subject to misinterpretation and misrepresentation. The lack of public understanding of the basis for environmental standards is a contributing factor in the adversarial nature of the relationships between the regulated community and environmental activism. An additional contributing factor is the lack of acknowledgement by the public that individual actions are a significant component of environmental pollution (mobile sources, straight pipe sewage, solid waste disposal, etc.). Perpetuation of the stereotype that industry alone is the problem and that there is an unlimited economic resource that is available to fund increasingly stringent standards is less than conducive to resolution of environmental concerns. To that end, I refer to the opening quote and raise a challenge to those who choose to be involved in the debate on environmental policy at the state level—do not be afraid to ask the "right questions". Failure to treat the true environmental problems because treating the symptoms is easier and more responsive to the loudest voices will give us the "wrong answers" for the long term.

Policy

The following list of policy issues is not meant to be all inclusive, but merely an overview of the issues that will be a part of the near term environmental agenda. Because of the relationship between the U.S. EPA and the state, many of the issues Kentucky will have to address are a function of federal actions. This is true for all three policy areas, air, water and waste. Looking at air quality first, federal initiatives will drive state policy on standards for particulate matter and ozone. In both cases, the focus will be on lowering the numbers; for the former it will be the size of dust particles and for the latter it will be the time frame for measuring emissions. The issue of asbestos standards will be revisited in the context of litigation, primarily class action suits on behalf of defendant's alleged exposure. A new round of proposals will emerge regarding exposure to mold spores and the science available to establish pragmatic standards. One of the more contentious debates will arise over the ongoing battle between the state and Jefferson County regarding the testing of mobile sources. The first issue will be the volume that mobile sources contribute in the overall release of volatile organic compound (VOC) emissions relative to stationary sources. The second issue is that mobile sources are inclusive of not only those who live and work in Jefferson County but those who travel through the county on the federal interstate system, I-64, I-65, and I-71.

In the area of water quality, current review of the states surface water quality standards and stream use designations will be the primary focus. Expect the debate to center on use designation criteria for surface waters, but the real agenda will be whether Kentucky will be the first state to establish a zero discharge standard. This is absolutely critical for Kentucky because the Federal Clean Water Act holds the concept of zero discharge as a goal not a criterion. An emerging program within the division of water is the watershed management strategy. The development of an initiative to manage Kentucky water resources on a watershed basis moves the state towards the concept of cumulative discharges, similar to the air quality program, and beyond the present strategy of point source command and control technologies. This raises a whole new set of questions since the watershed basins cross numerous geo-political boundaries of cities, counties, and states. The issues that will arise are almost imponderable and will challenge the most dedicated of our elected public officials. To follow up, another substantial issue for elected

public officials is the adequacy of public infrastructure for drinking water supplies and sewage treatment capacity. Unfortunately, Kentucky has a history of failure with regard to adequate sewage treatment and proliferation of open pit and straight pipe discharges. The state tends to struggle with this issue in its relationship with local governments about how and who should fund such infrastructure needs. Both levels are reluctant to raise the taxes necessary for the massive infusion of money required to solve a probelm their constituents would rather not think about. Groundwater quality will continue to be a subject of frustration for the division of water. With no money available to develop an inventory of existing groundwater resources, the agency has no basis to propose standards. Past attempts to establish a baseline that all groundwater be suitable as a drinking water resource failed as unrealistic and impractical. The evolving nature of agriculture in Kentucky is creating tension between a heretofore unregulated activity and a regulatory authority without an understanding of the history and culture of that activity. The critical question that appears central to this confrontation is how to define a "family farm". Where is the line between family farming and industrial agriculture?

Rubbertown industry.

The major issue related to waste management is and will be the need to establish a feasible criterion for how clean is clean. This is most evident in the current debate on standards for brownfields management and recovery. The continuing failure of the Cabinet for Natural Resources and Environmental Protection (KNREPC) to meet their statutory requirement to develop a brownfields management strategy only serves to delay the potential cleanup and remediation of numerous contaminated sites statewide. Rhetoric about threats to human health and the environment as a result of inadequate standards ignores the ongoing threats that exist as a failure to remediate known sites with known and unknown exposures. Reluctance by KNREPC to establish criteria for brownfield remediation for fear of weakening the current strategy on environmental releases, demanding cleanups to the "background" condition of nearby areas, is symptomatic of the one-size-fits-all regulatory mind-set. KNREPC struggles with the balance between a definitive cook-book regulatory strategy and a flexible guidelines regulatory approach. Equally important is the fact that the regulated community is divided on a regulatory strategy. They want what best serves them at a given time, be it defined or flexible.

The final issue, electricity generation, crosses all areas of environmental management, air, water, and waste. Everyone appreciates inexpensive electric utility rates for residential consumers and industrial facilities alike. However, there's less consensus on the operation and development of electricity generation among the public at large when cast in the context of environmental implications. The citizenry seems to be of two mindsets, they want abundant, low cost electricity without interruptions, while at the same time expecting electrical generation facilities to implement environmental controls without regard to costs. This duality of expectations in the domain of public opinion is consistent throughout the realm of environmental management policy issues. It is merely more obvious with respect to electrical utilities since this issue touches every life in the Commonwealth. Further complicating the issue is the recent increase in the number of applications for merchant generation facilities that would operate in Kentucky but sell the bulk of their electricity outside the state. The challenge to Kentucky lawmakers is to provide low cost electricity to their constituencies while establishing environmental standards that are protective of health and the environment without unreasonable costs to the generating facilities. Add to this the issue of where to locate generating facilities and under whose authority, the state or local government.

Politics

The changing landscape of the political culture of Kentucky portends significant shifts in the relationships between the Kentucky Legislature and KNREPC and the Governor's Office and KNREPC. In the past these relations have been strained for any number of reasons, but not because of partisan political pressure. Now, environmental policy has the potential of being a significant issue by which both parties will attempt to clarify their philosophical differences. It remains to be seen how the dynamics of long-term merit employees within KNREPC and the policy initiatives of new gubernatorial appointments, of either party, will materialize. Historically, each new administration has encountered the reality of an established workforce that may be less than tolerant of substantive changes in policy initiatives. Till now we haven't seen the implications of that dynamic where there is an actual change in political parties in the Executive Branch, not just a change in political party leadership. Should there be a change in the political party holding the Governor's Office,

it would be unrealistic to expect resignations from those in disagreement with the new administration's policies since that has not been the case in the recent past, even with leadership changes within the same party. Management of environmental policy by the new administration under such circumstances would probably provide the media with a constant source of material for at least four years and possibly as long as eight years. As a practical matter, the more recalcitrant any executive agency becomes, the legislature is inclined to be more specific in the statutory language it promulgates and less flexible in its regulatory authority. This is without regard to partisan politics-it's about separation of powers between the two branches of government. The environmental activist organizations will appear to be confrontational and adversarial in order to mobilize their constituencies and garner media coverage (and maybe their support). One should expect the dialogue to focus on allegations of environmental catastrophe versus economic stagnation. Polarization of the issues appears unavoidable as a function of single issue advocacy on behalf of the environmental activists. The political reality is that any single issue interest group, by definition, is not inclined to accept the complexities of broad public policy outside the scope of their interests. In the final analysis, the politics of "jobs vs. environment" makes for great theatre but over simplifies the relationship between the economy and environmental stewardship. The last two years have taught us that without a healthy private sector economy, government revenues are limited and consequently government services are curtailed. Lest we forget, about one percent (1%) of total state revenues is allocated to KNREPC for environmental oversight and program management.

Process

The legislative and regulatory process will be characterized by the ebb and flow of competing interest's ability to engage their respective constituencies and bring pressure on the Governor and Legislature at any given point. It's more likely than not that the next Governor will serve eight years. It's also reasonable to expect that there will continue to be an active two party system in place within the legislature. The national and state economies will play a significant role in the short term of 3-5 years driving the demand for increased employment opportunities and economic recruitment and retention. This will exacerbate the conflict between citizen activists and industrial and municipal growth. Failure of local governments to implement strategic land use management planning either on a county-wide or regional basis will be a primary factor in the mismanagement of the public hearing process for environmental permitting. The federal and state public hearing process for environmental permitting is for the purpose of public participation and comment on the conditions of the permit under consideration. It is not and never has been for the purpose of siting a facility. That is the purview of the local government under state law providing for local land use planning. Because so few of Kentucky's counties have a land use plan, the KNREPC public hearing process has fallen prey to those who want and need a public forum to debate facility siting rather than permit issues. This leads to a discussion of the ongoing conflict between urban and rural interests in state policy overall. The kinds of economic development that may be appropriate and desired for one community may not be acceptable or desirable for another. Environmental policy becomes a serious point of contention in this debate without some programmatic flexibility. One of the proposed solutions, "Smart Growth" has created additional problems in the process by interjecting new concepts that challenge private property rights, impose urban standards on rural communities, and in general centralize land use planning as a state function over home rule. This is characteristic of a political system where two political philosophies collide over the principle of whether the role of state government is to provide options for local government to use in self governing or is to mandate local government strategies. This hasn't been resolved over the last 200 years and one shouldn't expect a resolution in the next 4-8 years. What one interest may consider an opportunity, almost certainly another will view as a threat. Kentucky will continue to make progress in environmental stewardship as a function of both economics and public policy discourse. For some it won't ever be enough and for others it will be too fast and unproven.

In conclusion, there is good news and bad news. The good news is that when all is said and done in the public policy arena there is one more factor to consider besides the Executive and Legislative branches. There are three branches of government and now we come to the third, the Judicial. The litigation process is very much a part of the system and a recourse to challenge the regulatory and statutory actions of the other two respectively. Likewise, the judiciary is confronted with the challenge of balance not unlike the other two branches. Their consideration of balance has to do with whether they are perceived as applying Constitutional interpretation and principles or establishing public policy from the bench. The future of environmental public policy resolution will be characterized by more vigorous public discourse and calls for more substantive evidence of opportunities and threats, prior to enacting legislation. The appreciation of a democracy in which public policy confrontation is a good process that potentially leads to more reasoned results may be the biggest cultural change affecting environmental policy.

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Public and Environmental Health Concerns in the 21st Century

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Introduction

As we begin the 21st century, issues that deal with public health have become a major concern to many individuals in the U.S. and around the world. Understanding these issues, whether air quality, water quality, or infectious diseases are critical in the development of policies related to protecting the public's health. The causes of insults to public health can best be comprehended by understanding fundamental principals of how chemicals, bacteria, viruses, metals, as well as other extraneous materials affect human health. An important first step is considering the various principals that direct our interpretation of how chemicals and toxins in the environment are judged to be of concern. These commonly used terms, taken together, form the basis of the field of toxicology. Some of the more frequently used terms are shown in table 1.

The traditional definition of toxicology is: ***"the science of poisons."*** A more descriptive definition of toxicology is: ***"the study of the adverse effects of chemicals or physical agents on living organisms"***.

Toxicants	substances that produce adverse biological effects of any nature may be chemical or physical in nature effects may be of various types *(acute, chronic, etc.)*
Toxins	specific proteins produced by living organisms *(mushroom toxin or tetanus toxin)* most exhibit immediate effects
Poisons	toxicants that cause immediate death or illness when experienced in very small amounts

Table 1

As early as 1500 AD, Paracelsus determined that specific chemicals were actually responsible for the toxicity of a plant or animal poison. He also documented that the body's response to those chemicals depended on the dose received. His studies revealed that small doses of a substance might be harmless or beneficial whereas larger doses could be toxic. This early discovery is now known as the dose-response relationship, a major concept of toxicology. Paracelsus is often quoted for his statement: ***"All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy."***

Xenobiotic is the general term used for a ***foreign*** substance taken into the body. It is derived from the Greek term ***xeno*** which means ***"foreigner."*** Xenobiotics may produce beneficial effects *(such as many pharmaceuticals)* or they may be toxic *(such as lead)*. As Paracelsus proposed centuries ago, dose differentiates whether a substance will be a remedy or a poison. A xenobiotic in small amounts may be non-toxic and even beneficial but when the dose is increased, toxic and lethal effects may result. Table 2 illustrates this difference between beneficial versus toxic dosing of substances.

Table 2

Substance	Non-Toxic or Beneficial Dose	Toxic Dose	Lethal Dose
Alcohol *ETHANOL BLOOD LEVELS*	0.05 %	0.1 %	0.5 %
Carbon Monoxide *% HEMOGLOBIN BOUND*	< 10 %	20 – 30 %	> 60 %
Secobaraital *(sleep aid) BLOOD LEVELS*	0.1 mg/dL	0.7 mg/dL	> 1 mg/dL
Aspirin	0.65 gm *(2 tablets)*	9.75 gm *(30 tablets)*	34 gm *(105 tablets)*
Ibuprofin *E.G., ADVIL & MOTRIN*	400 mg *(2 tablets)*	1,400 mg *(7 tablets)*	12,000 mg *(60 tablets)*

Principles of Clinical Toxicology *(T. Gossel and J. Bricker, eds)*

Public Health Impact of Tobacco Exposure

One of the greatest impacts on public health today is smoking. Exposure to tobacco smoke is found in every segment of our population. People are exposed to tobacco through active as well as passive smoke exposure, with serious health related outcomes. One example is women exposed to tobacco smoke during pregnancy. Women who smoke during pregnancy are not only affecting their health but more importantly, are greatly affecting the growth and development of the fetus they are carrying. Numerous studies have shown

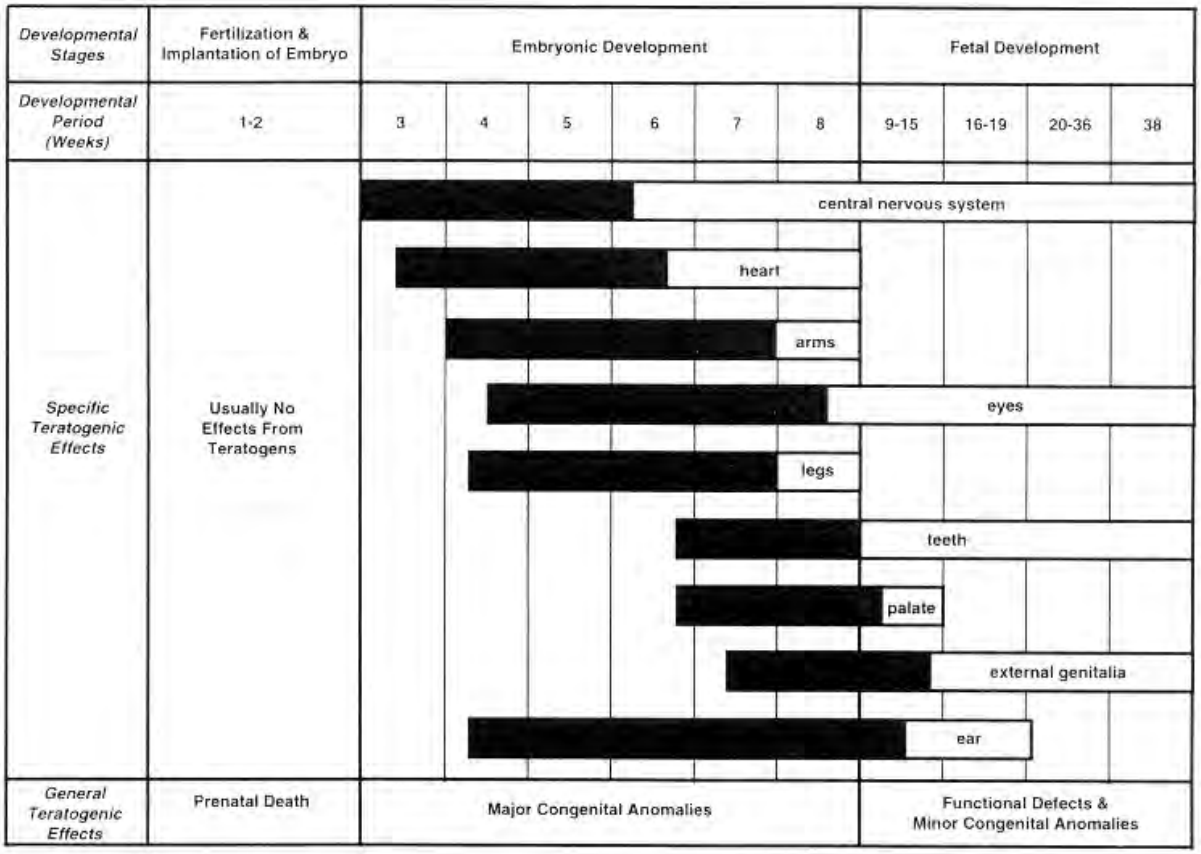

Figure 1

that the fetus is extremely susceptible to many environmental compounds (figure 1) and that many of these insults result in teratogenesis, carcinogenesis, or even death.

Smoking during pregnancy has been linked to a variety of adverse oucomes, including low birth weight, spontaneous abortion, and infant death. Some biological mechanisms such as decreased placental blood flow and an increase in fetal heart rate have been clinically linked to cigarette smoke. Low birth weight shows the clearest and most consistent association with maternal smoking. Evidence suggests that a dose response relationship exists between cigarette consumption, especially during the third trimester and birth weight. The prevalence of smoking among women during pregnancy has been estimated at between 15 and 30% with the percentages varying slightly depending on the source of the data used and with State-to-State variations (Kentucky generally ranks among the highest states in percentage of women smokers). Recently the Centers for Disease Control (CDC) reported that the incidence of state-specific smoking prevalence among U.S. adults varied widely ranging from a low of 14.2 percent in Utah to a high of 30.8 percent in Kentucky. Figure 2 illustrates the percentages of smokers over the last several years.

In addition, women with mistimed or unwanted pregnancies are more likely to smoke throughout pregnancy as are women who are single and/or teenagers. Smoking cigarettes during pregnancy has been shown to increase the risk of low birth weight, preterm delivery, miscarriage, ectopic (tubal) pregnancy, infant death, low Apgar scores, and early childhood illness (respiratory illness, asthma). Risk of poor outcomes increases with amount smoked and, alarmingly, exposure to passive smoke has shown to increase the risk of poor outcomes as well. The biological mechanisms that cause these effects are unknown.

The causes of child health problems after birth are

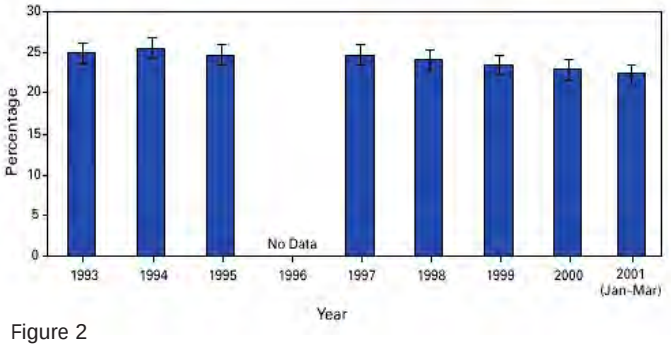

Figure 2

difficult to establish because of the many family, socioeconomic, and environmental factors that confound data. Some research, however, has established that smoking also has adverse health effects on young children. In the April 1996 issue of *Pediatrics* an article entitled ***"The relationship between idiopathic mental retardation and maternal smoking during pregnancy"*** showed that women who smoked were 50% more likely to have a child with mental retardation of unknown etiology (an IQ of 70 or less) than were nonsmoking women. Since an estimated 27.2 percent of reproductive aged women smoke cigarettes, a number that equates to more than 14 million women ages 14 - 44 who smoke,the goal of Health People 2000 to reduce the prevalence of smoking in women of reproductive age to 12 % is far from reachable. Complications related to smoking causes a substantial burden on the nation's health care system. The implications are spelled out clearly in the following:

- Between 1960 and 1990, the death rate from lung cancer among women increased by more than 400%, and the rate is continuing to increase.

Urban hospital complex.

- In 1987, lung cancer surpassed breast cancer as the number one cause of cancer deaths among Women.

- The American Cancer Society estimated that in 1998, lung cancer killed 67,000 women, while breast cancer killed 43,500 women.

- More than 152,000 women died from smoking-related diseases in 1998.

- Smoking has a damaging effect on women's reproductive health and is associated with reduced fertility and early menopause.

- Women who smoke during pregnancy subject themselves and their developing fetus and newborn to special risks, including pregnancy complications, premature birth, low-birthweight infants, stillbirth, and infant mortality.

- Between 8,000 and 26,000 children are diagnosed with asthma every year in the United States.

- The odds of developing asthma are twice as high among children whose mothers smoke at least 10 cigarettes a day.

- Between 400,000 and 1 million asthmatic children have their condition worsened by exposure to secondhand smoke.

- Research suggests intrauterine exposure and passive exposure to secondhand smoke after pregnancy are associated with an increased risk of Sudden Infant Death Syndrome (SIDS) in infants.

- For every dollar invested in smoking cessation for pregnant women, about $6 is saved in neonatal intensive care costs and long-term care associated with low-birth weight deliveries.

Public Health Concerns and Children

Children's health concerns are magnified a hundred times from exposure to various chemicals in the environment. This is because of a child's early stage of development.

Children are exposed to preventable environmental hazards such as lead, solvents, asbestos, pesticides, air pollution, and environmental tobacco smoke on a daily basis. Children are not little adults-they are at greater risk than adults due to their decreased ability to detoxify substances and greater sensitivity during development and growth. Children in poverty and children from racial/ethnic communities often suffer more frequent and direct exposures to many more chemicals and other pollutants, and they are under-protected. Currently there is no policy agenda to address potentially hazardous exposures to children, and there are very few data sources that have information on children's exposures. Regulations for permissible exposure levels are based on data from adult animals and humans. Risk assessments do not routinely differentiate between children and adults and do not consider multiple or cumulative exposures.

In the late 19th and early 20th centuries, miners would send canaries into mine shafts to determine the safety of the air quality. If the canaries died, the environment was known to be unsafe for humans. Since the 1940's, thousands of new chemicals have been produced and integrated into every aspect of our lives. Roughly 300 new chemicals are introduced each year. The production of synthetic materials has increased from 1.3 billion pounds in 1940 to 320 billion pounds in 1980. For the majority of compounds, the health effects on children are unknown. Less than 10% of these chemicals have been tested for their effects on the central nervous system, with the exception of drugs controlled by the FDA. Our children have become the modern day canaries.

Children today face an array of exposures to potentially toxic environmental hazards. Hazardous substances such as lead, PCBs, solvents, asbestos, radon, pesticides, and air pollution have found their way into the homes, schools, and playgrounds of our children. These exposures can have a significant impact on children's health and well-being. All children are at risk of developing learning disabilities, chronic and acute respiratory diseases, cancers, and illnesses caused by damage to the nervous system from hazardous substances. The incidence of chronic childhood diseases such as asthma and bronchitis are increasing. Additionally, cancer rates are increasing, especially childhood cancers such as leukemia.

Children's biological sensitivity (the capacity to be easily harmed) places them at special risk for harm from a toxic exposure. Because a child is a growing, developing organism, she is especially vulnerable to the effects of exposure. Her metabolic reactions-the body's way of processing and excreting toxic substances-are not as developed as those of adults. Children go through several stages of development. Examples of these stages are: fetal, newborn, infant, school-age, and adolescent. Each stage of development creates new windows of vulnerability to the effects of an exposure and may result in long-term subtle or acute health problems. For example, an infant's lung capacity is still increasing, making her especially vulnerable to the effects of environmental tobacco smoke. A child's respiratory rate is more rapid than an adult's, hence she is exposed to more air and air pollutants than an adult. Children are, in a sense, moving targets. Exposures which may go unnoticed or be relatively harmless in an adult, can be potentially devastating to a child.

Fetal exposure occurs through maternal exposure to environmental toxicants, as many substances cross the placenta. Sometimes this is from a mother's self-exposure, such as environmental tobacco smoke. However, lead in a mother's bones which may be harmless to the mother can be transferred to her fetus, causing exposure levels that are potentially harmful. Additionally, maternal and paternal exposures that occur before conception can affect a child. PCBs, for example, bioaccumulate in fatty fish and are stored in the body when eaten. These are passed on to fetuses, newborns and infants through the placenta and maternal breast milk.

Safe levels of pesticides and food additives, which are calculated for the lifetime exposure of an adult, may be grossly underestimated for a child. Children eat a great deal of certain foods, such as bananas. Pesticide tolerances, or maximum residue limits for pesticides in food, are calculated for adults rather than for children, and do not account for individual variations. Such was the case with aldicarb, a pesticide widely used on bananas. Although bananas tested as a crop had acceptable levels of aldicarb, these levels were based on adult tolerances, and were for the entire crop, not for individual "hot" bananas. As a result, there were unsafe levels of aldicarb for children in one bite of the "hottest" banana. Because children have many routes and sources of exposures, they are at risk not only for multiple exposures, but for exposures which may act synergistically. And, because children have a longer "shelf life" than do their adult counterparts, they will face more exposures throughout their lives.

However, little is known about how to add up the effects of multiple chemical exposures-whether they are cumulative or whether they compete with each other, or whether they interact synergistically. For example, tolerances which are set for one chemical within a particular class (such as chlorinated organophosphates) do not consider the effects of exposure to another chemical within that class. Clinicians can play an important role in diagnosing environment-related illness and in providing education for families and communities. For example, clinicians have in the past traced chemical exposures causing illness in children to pesticide spraying in homes and to mercury in teething powders. As a result, the offending chemicals were subsequently removed from the market.

Formal studies and anecdotal evidence suggest that hazardous waste facilities are disproportionately located in African-American and Hispanic communities. According to a survey of toxic areas in Texas conducted by the United Church of Christ's Commission for Racial Justice, 56% of the state's industrial solid waste generators are located in minority communities. These same communities are also the locales for 37% of commercial waste management facilities and 39% of the state's hazardous waste facilities. Fifty-four percent of pending waste management facilities in Texas are

Emergency room entrance.

also slated for these same communities. In the wake of this development, cancer rates have risen among Hispanic and African-American residents of these communities

Air pollution affects children more than adults because of their narrow airways, more rapid rate of respiration, and the fact that they inhale more pollutants per pound of body weight. Common indoor air pollutants include carbon monoxide, radon, environmental tobacco smoke, asbestos, formaldehyde and mercury. Common outdoor air pollutants include ozone and particulate matter. Health effects associated with both indoor and outdoor air pollution include increased perinatal mortality, increased acute respiratory illnesses (e.g., bronchitis and pneumonia), aggravation of asthma, increased frequency of physician visits for chronic cough and ear infections, and decreases in lung function. Researchers are seeking to identify indoor and outdoor air pollutants that serve to exacerbate asthma. Among persons under the age of 20, the prevalence of asthma increased by 42% between 1980 and 1987. A recent study of neonatal mortality found an association between elevated concentrations of fine particulates and neonatal deaths, including sudden infant death syndrome (SIDS). There is little doubt that high levels of air pollution are responsible for increased morbidity, and in some cases mortality, in children.

At least eighty percent of Hispanics in this country live in areas that fail to comply with ambient air quality standards established by the Environmental Protection Agency. Asthma and other respiratory diseases also disproportionately afflict minority communities, particularly Hispanics. Exposures to pesticides are a pervasive health threat to agricultural regions, overwhelmingly inhabited by Hispanic field workers and their families. In one community studied in California's Central Valley, over 50 different pesticides were applied within one mile of the community. Children of agricultural workers suffer frequent exposure to pesticide residues through various exposure routes, including directly in the fields or in the home as their parents track in the toxic residue after returning from work in the fields.

The classic example of children's exposure to an environmental hazard is lead. In low-income communities, the occurrence of this health hazard is particularly striking. Between 1976 and 1980, 9.1% of all preschoolers in the US

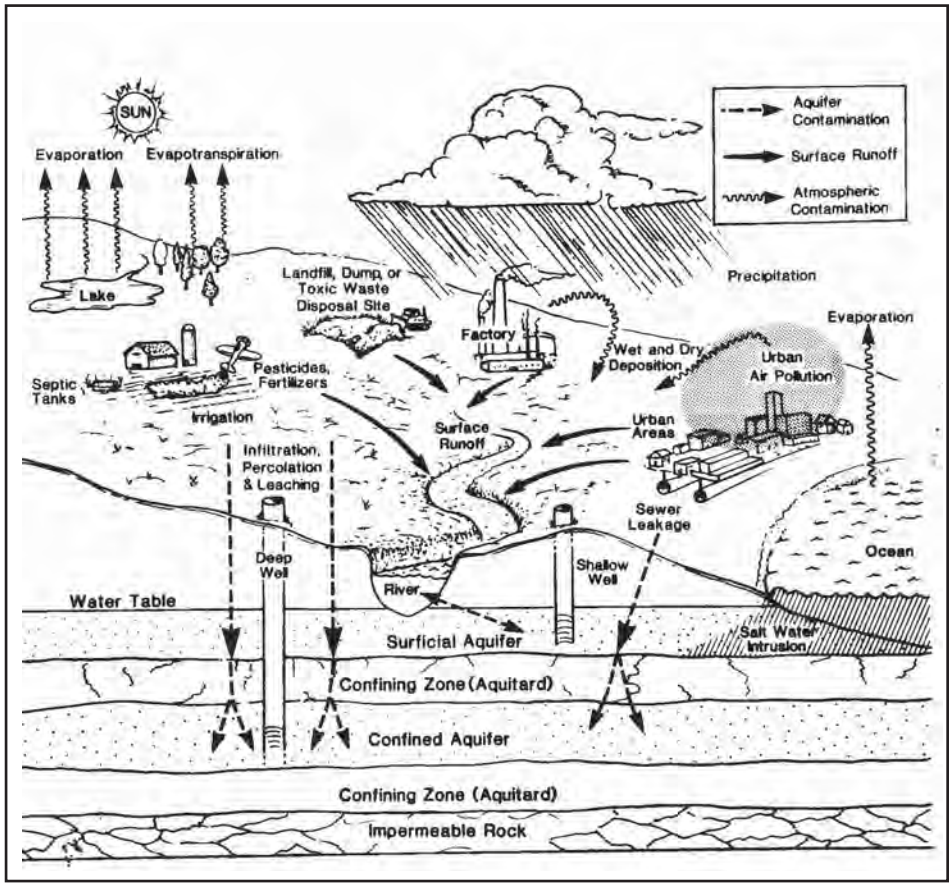

Figure 3

had excessively high blood lead levels; the figure for African-American children in the same age group was 24.5%. A 1988 report by the Centers for Disease Control revealed that while 36% of poor white children were lead poisoned, the figure for poor African-American children was 68%.

Children are often exposed to toxicants through the agricultural and home use of pesticides or the ingestion of pesticide residues on food or in water. Figure 3 illustrates the many ways that public health can be affected by these mechanisms.

Pesticides used today generally fit into five main categories: insecticides, herbicides, fungicides, nematocides and rodenticides. Increased public awareness of pesticide poisoning has led to an apparent decrease in acute episodes of toxicity, and the public's concern has shifted to evaluating the effects of low level chronic pesticide exposures. Again, children may be more vulnerable than adults to experiencing latent or delayed effects over the long course of their lifetime. Researchers have become concerned about the potential associations between chronic pesticide exposures and chemical carcinogenesis, environmental estrogen disruption and developmental neurotoxicity.

Public Health in the 21st Century

In addition to the widespread environmental concerns that affect human health, we are confronted with biological pollution that is just beginning to affect public health. Whether through bacterial, viral, or radiation, biological pollution marks a new point in the 21st century when people must not only be aware of and concerned with the classical public health issues, but a whole new and even more toxic and deadly class of insults that affect their health.

Infectious diseases are a continuing menace to all segments of society, regardless of age, gender, lifestyle, ethnic background, and socioeconomic status. They cause suffering and death and impose an enormous financial burden on society. Because we do not know what new diseases will arise, we must always be prepared for the unexpected. The national emerging infectious disease plan targets specific categories of emerging infectious disease problems and particular groups of people who are at special risk. The nine target areas are antimicrobial resistance; foodborne and waterborne diseases; vectorborne and zoonotic diseases; diseases transmitted through blood transfusions or blood products; chronic diseases caused by infectious agents; vaccine development and use; diseases of people with impaired host defenses; diseases of newborns and pregnant women; and diseases of travelers, immigrants, and refugees.

Because the broad mission of public health is assuring conditions in which people can be healthy, the integration of new genetic information in public health research, policy and program development is unavoidable. Public health leadership is urgently needed to use genetic information to improve health and prevent disease, and to address ethical, legal and social issues resulting from inappropriate use of such information. In the not-too-distant future, disease prevention and health promotion programs will routinely consider whether or not to use genetic information to help target behavioral, medical or environmental intervention activities in order to increase the benefit and reduce the costs and harm to individuals.

As the recent spread of West Nile virus, the SARS epidemic, and the anthrax scare of 2001 dramatically illustrate, the world faces a variety of new health challenges in the 21st century. Promoting and protecting health also has been made increasingly complex by the growing prevalence of chronic conditions influenced by multiple factors, including social, environmental, and behavioral determinants, as well as biological risk factors.

Traditionally, the government has been responsible for providing public health services through a network of federal, state, local, and tribal health departments and clinics. Even as demands on the public health infrastructure have increased, support for public health has languished in recent decades. Unlike personal health care, which directly and visibly affects individuals, the roles that government public health agencies and their private-sector partners play in preventing injuries and illness and keeping communities healthy often are less obvious or take place behind the scenes — and consequently tend to get less attention and funding. According to some estimates, as much as 95 percent of the nation's spending on health — roughly $1.3 trillion in 2000 — goes to personal medical care and biomedical research. Only 1 percent to 2 percent of the health care budget is spent on prevention.

The nation cannot rely on biomedical research and personal health care alone for answers to all health issues, the report says. The United States spends more per capita on health care than any other country — $4,637 in 2000 — yet ranks 37th in a World Health Organization assessment of global health systems. It is also clear that government alone should not carry sole responsibility for protecting public health. The report recommends a new approach to public health in which the health care delivery system, academia, community organizations, businesses, the media, individual

members of society, and others all work as partners with government public health agencies to promote and protect the nation's overall health.

Real improvements in the nation's health will depend on breaking down traditional barriers and building and sustaining partnerships across the public and private sectors. For instance, employers and community organizations, such as faith-based and nonprofit groups, create environments that influence individuals' outlooks and behaviors, and shape the conditions for good health in communities. They should work jointly with state and local health departments and health care organizations to develop and promote workplace and community health education programs and support research into the effectiveness of health-related interventions. Universities must increase their support for faculty and students to engage with communities in addressing health problems as part of their teaching, learning, and research. The private sector could be encouraged to invest in work-based and community health through creation of a corporate investment health award sponsored by the federal government and business leaders.

A great many environmental problems stem from the organization, mode of production and consumption impacts of industrial societies. Broadly speaking, the techno-scientific basis of these societies produces two streams of impacts - in the magnitude of its use and consumption of resources, and the production of vast quantities of pollutants and dangerous technologies - both of which have harmed and debilitated large numbers of people. The environmental problem is an economic and therefore political problem of the highest order. Neither the developed nor developing countries are irrevocably condemned to remain vulnerable to these problems. The challenge is to break with the destructive technological paradigm while orchestrating a just transition within the economic and political spheres.

We are lucky that the global scientific community does not simply produce the conditions for our environmental destruction but has also performed a crucial service in identifying problems that might have otherwise escaped notice: ozone depletion, global warming, persistent organic pollutants (POPs) and the spread and mutating virulence of diseases. Scientists will have to turn their attention to technology assessment especially with regard to biotechnologies such as genetic engineering and the creation of novel lifeforms. With biodiversity and ecosystems under threat from destruction and pollution of their gene pool (by novel lifeforms), biosafety and an effective Biosafety Protocol should be imperatives. Biological weapons, and their intersection with biotechnology, should also form an important aspect of biosafety.

Public Health Issues and Community Action – Environmental Justice

Environmental justice is a movement promoting the fair treatment of people of all races, income, and culture with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment implies that no person or group of people should shoulder a disproportionate share of the negative environmental impacts resulting from the execution of this country's domestic and foreign policy programs. The environmental justice movement is generally acknowledged to have emerged in the early 1980's in response to large demonstrations opposing the PCB-landfill in a predominantly black community in Warren County, North Carolina. Subsequent studies and public attention raised concerns of the fairness and protection afforded under existing environmental programs — concerns that are now receiving increased attention at all levels of government as well as within the private community.

While possible adverse distribution of environmental impacts first became a concern in the 1980s, only in the last few years has there been sufficient information to begin to get a feel for the extent of the problem. At least two different measures of environmental equity have been proposed. A "proximity-based" measure depends upon people's proximity to facilities that pose environmental hazards. It has been found that minorities and low-income groups are more likely to live close to hazardous waste facilities. A "risk- based" measure goes beyond measurement of distance to the site and incorporates other factors such as the probability of an accidental release of chemicals, their toxicity, the level of exposure, the size of the area affected by a release and natural factors, such as wind direction.

A variety of solutions to the environmental justice problem have been proposed. These include: (1) toxics use reduction (pollution prevention), (2) improved stakeholder participation in the public environmental decision-making process, (3) improved access to environmental data and information, (4) increased research on health risks from exposure to toxics, and (5) improved enforcement and compliance assurance through increased sensitivity to potential environmental justice problems in rule-making.

The petrochemical complex generally referred to as Rubbertown is located in the west end of Louisville. It is one of the highest concentrations of chemical plants in the Commonwealth of Kentucky. In addition to the chemical plants are the City of Louisville's main wastewater treatment plant (Morris Foreman), a National Priority Superfund site (Lees Lane), an inert landfill (Kramers), a number of petroleum terminals, and an array of small manufacturing plants and industrial service companies that use and release various environmental pollutants.

Environmental contaminants in the air, soil, ground and surface waters pose potential public health risks to the adjacent populace. The primary pathway of concern for these contaminants is air borne pollutants. Residents in the adjacent urban neighborhoods are subject to a mix of chemicals from point, area, and mobile sources, however, the exact nature and concentration of pollutants in the ambient air is unknown. The west Louisville community has a long history of environmental health concerns dating back five decades. In 1956-57, a Special Air Pollution Study for the area was conducted by the U.S. Public Health Agency, state and local health departments. The study was conducted after air inversions in Great Britain and Pennsylvania resulted in hundreds of deaths. Air was tested for particulate and gaseous pollutants. Acrylonitrile, benzene, butadiene, chloroform, xylene and vinyl chloride were detected in this study at levels that exceed EPA and ATSDR comparison values for both cancer and noncancer effects.

In 1992 the Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned to perform a public health assessment of the west Louisville community. The Agency concluded in 1999 that air and soil contamination in the community pose an ***"indeterminate public health hazard."*** The basis for this conclusion was the lack of available data and uncertainty about ambient concentrations of pollutants and exposure levels. The agency recommended in the report that air toxic data be collected and evaluated and to continue educating the public, public health officials, and local medical community on the ongoing health assessment efforts in the community.

In 1996, the Louisville and Jefferson County Board of Health, in response to community concerns regarding the appearance of disproportionate cancer mortality rates in west Louisville, convened a technical panel to assess the incidence and mortality from cancer in the county. The panel members included staff with the Center for Environmental and Occupational Health Sciences. The study concluded that residents in west Louisville experienced a mortality rate 1.5 times that of the east Louisville area. Age-adjusted mortality rates ranged as high as 285.4 per 100,000 population (compared to 204.4 county-wide, and 192.4 statewide) in the Shawnee and Chickasaw communities. Incidence rates were also higher for west Louisville, with a rate 1.1 times that of the east Louisville area. The west end of Louisville also had the highest rates in the county for liver, oral, cervix, ovary and prostate cancers. The reasons for the high cancer incidence and mortality rates are unknown. Occupational, behavioral, access to health care and environmental factors could all potentially explain differences in cancer rates between geographic areas.

Community environmental health concerns resulted in the Jefferson County Division of Environmental Health and Protection (EH&P) establishing a Task Force to identify the critical environmental issues facing the west Louisville neighborhoods. With funding from the National Association of County and City Health Officials (NAACO) and ATSDR, thirteen citizens were appointed to represent the neighborhoods in the project area, and three at-large members representing environmental justice groups, and four representatives of industry in the Rubbertown complex. Beginning in June, 1996, the Task Force met weekly through the summer collecting information from technical experts, conducted three public meetings to gather community input on environmental issues of concern, and prepared a final report to Jefferson County and City of Louisville officials on their findings and recommendations. The Task Force identified 38 environmental issues of concern, and made recommendations to local officials on what needed to be done to address them.

In 1996 the Kentucky Institute for the Environment and Sustainable Development (KIESD) was awarded an Environmental Justice Through Pollution Prevention grant from the US EPA. The Task Force has been expanded to include any resident with an interest in environmental issues in west Louisville, representatives from all twelve Rubbertown industries, and *ex offico* status representatives of a number of local governmental agencies including the Jefferson County Air Pollution Control District, Planning and Environmental Management, Health Department, and City of Louisville Office of Health and the Environment. Citizens on the Task Force have established an Environmental Information Center within the community, provided grants to industries to implement pollution prevention projects, initiated a cash award system for the industry or organization that has done the most to reduce pollution in west Louisville, conducted public meetings to inform residents in the community of actions that have been taken, gathered information on en-

vironmental concerns in the community, and lobbied the Kentucky General Assembly to conduct air toxic monitoring and sample fish in city park lakes for dioxin.

The Rubbertown industries in 1991 established a Rubbertown Community Advisory Council (RCAC) to provide a forum for dialog between the industries and residents in the Community. The Advisory Council meets on a monthly basis to discuss health, safety and environmental issues. Industries are able to explain their operational plans and answer any questions that residents may have. Residents have requested information and studies, and have been invited to participate in company Board Meetings to provide input on their concerns.

The 21st century starts off as a century of hope and understanding, hope of uncovering the public health concerns of our citizens as well as those of other countries, and understanding the critical health issues which is a necessary condition for improving public health in the future. Together, we will uncover these public health concerns and together we will address the causes as well as solutions to these problems. As the Motto of the Commonwealth of Kentucky states "United We Stand – Divided We Fall", we must apply this to our look forward in the 21st century as we tackle the many problems in environmental and public health.

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Solid Waste Futures

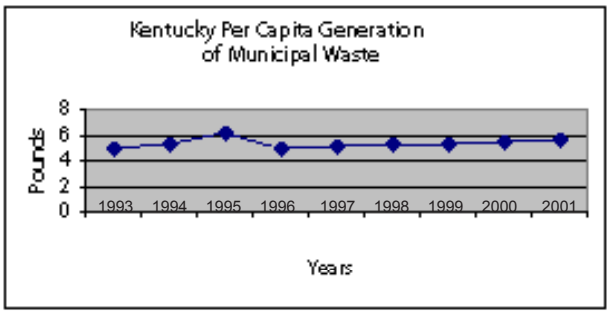
Russell Barnett
Director for Research and Development, KIESD

In the 1991 Special Session of the Kentucky General Assembly, called by Governor Wilkinson to address solid waste issues confronting the state, the legislature adopted as a goal of the Commonwealth "that the amount by weight of municipal solid waste disposed at municipal solid waste disposal facilities shall be reduced by a minimum of twenty-five percent (25%) by July 1, 1997." The state failed to meet this goal. The 2002 session of the General Assembly passed the widely proclaimed environmental legislative act HB174, which quietly eliminated this goal. Although the 1991 Special Session set in motion a dramatic change in the way the state manages its solid waste, the reduction of solid waste has not occurred and likely will not occur in the foreseeable future.

From 1993 to 1997 the amount of solid waste generated in Kentucky instead of decreasing actually increased 6.2%. By 2001, the amount of waste generated in Kentucky and deposited in municipal solid waste disposal facilities had increased by 19% over 1993 levels. Interestingly these increases do not reflect a failure of the solid waste management programs over the intervening years. They reflect a combination of factors that will in the near future continue to result in more solid waste being generated. These factors include:

- increasing population
- decreasing household sizes
- increase in the number of households disposing of their waste in municipal landfills
- increase in per capita income

From 1990 through 2000 the population of Kentucky increased 9.7 percent, reversing trends over the past 40 years of stagnant population changes. The growth over the decade represents over 350,000 people, each generating additional waste loads. At the same time the number of households increased 15.3%, or almost 211,000 more households than in 1990. This is a reflection not only of increased population, but also of smaller households. Over the decade the average size household decreased from 2.6 individuals per household to 2.47, a reduction in household size through the decade by 5%. The construction of new homes and the maintenance of each new home generated additional waste. The increases, as measured by the amount of waste disposed in municipal landfills, is also due to the simple fact that more waste is being collected and disposed of properly. Over the past decade the number of households participating in curbside collection has steadily risen. Twenty years ago only one county, Pike County, had mandatory countywide curbside collection. In many counties, without curbside collection and dependent on poorly managed greenbox collection sites, solid waste was routinely disposed of in illegal open dumps. From 1993 through 2001 the number of households participating in curbside collection increased by over 30% or 308,000 households. The most telling demographic change over the past decade has been in median household income. Annual income rose more than 49% from $22,534 to $33,672, and the State Gross Product rose 73% from $68 to $117 billion. Analyses across countries and over time reveal that the generation of municipal solid waste is positively related to variations in per capita income and total gross product. Increases in economic production over the past decade have pushed waste generation to new levels. At the same time they helped families and communities obtain the economic resources to improve collection systems, changed the composition of waste streams, and provided new incentives for landfill diversion programs. The end result of these factors has been that the public goal to reduce the total mass of solid waste generated has been replaced with goals to improve management capacities. Between 1993 and 2001 the per capita generation rate for solid waste disposed in a municipal landfill has increased from 4.9 to 5.5 pounds per person per day (see Chart 1). This is a 12% increase.



Future projections indicate that increases in waste generation will continue. The Kentucky State Data Center projects that by 2015, there will be almost a half million additional residents in Kentucky. This 12% growth will result in an additional 500,000 tons of solid waste being generated annually by 2015. Most of this additional waste will be generated in concentrated areas of the state—the Louisville-Lexington-Northern Kentucky Triangle, Bowling Green, Richmond, and the Land-Between-the-Lakes area. Landfills in these areas will experience increased volumes and pressures for expansion vertically and horizontally.

Landfills

In the early1980's, there were more than 700 "landfills" across the state. Many of these were more accurately open dumps that were used by public agencies and private entities to dispose of solid waste. Many would be more accurately described as open burning dumps. As the state promulgated new standards and operating requirements for solid waste disposal, the number of landfills decreased to 75 in 1991. After the more stringent state and federal standards were promulgated between1990 and 1993, the cost of constructing and operating a landfill became prohibitively high except for the larger facilities. There are now 26 contained landfills disposing annually over 7.5 million cubic yards of solid waste in Kentucky. The total number of landfills will not significantly change in the future. Kentucky has sufficient landfill space for the next 16.2 years. This figure is based on "permitted" space. Many of the existing landfills have plans to expand their capacity at the same site, either horizontally, vertically, and in some cases between existing waste cells. The difficulty of securing public acceptance to site a new landfill, the economics of developing a new site with its attendant support infrastructure (e.g. scales, leachate controls, methane gas controls, groundwater monitoring, etc.), and market capacity all support the conclusion that the number of landfills over the next decade will remain around the current number.

Essentially all solid waste being disposed of in Kentucky is through landfills. It is the cheapest way to dispose of unwanted waste. Some European countries have banned many wastes from being disposed of in landfills. In the Netherlands, only wastes that cannot be reused or recycled may be landfilled. The law passed in 1995, and by 2010 it is estimated that only 4% of the solid waste generated will be landfilled. Although environmentally preferable, it is unlikely that Kentucky will take this path in the near future. In the past, incineration was also used in Kentucky as a means of reducing the volume of waste, although ash still needed to be landfilled. Air quality concerns and costs have eliminated this as a significant means of solid waste management. The Commonwealth recently permitted Kentucky Pioneer Energy to build a 540-megawatt power plant in Clark County that would be fueled by synthetic gases produced from a mixture of coal and refuse-derived fuel pellets. The plant has not been able to meet its permit conditions and is not yet operational.

Ownership	Facility Name	County	Tons/Day Received(2001)	Remaining Life(years)
City of Glasgow	Glasgow Regional Landfill	Barren	240	.06
Davies County	West Daviess County Landfill	Daviess	384	26.8
Hardin County	Hardin County Landfill	Hardin	709	16.7
Mason County	Maysville/Mason County Landfill	Mason	209	57.3
Nelson County	Nelson County Landfill	Nelson	181	22.8
Ohio County	Ohio County Balefill Landfill	Ohio	698	51.5
Pike County	Pike County Landfill	Pike	224	24.3
Republic Industries	Epperson Waste Disposal	Grant	1428	12.4
	Green Valley Environmental	Greenup	958	3.8
	Valley View Landfill	Trimble	1238	6.6
	Dozit Company	Union	299	36.6
Bavarian Trucking	Bavarian Trucking	Boone	492	71.3
BFI Waste Systems	Benson Valley Area Landfill	Franklin	611	2.6
Cooksey Brothers	Cooksey Brothers Disposal Co.	Boyd	383	3.4
Waste Mang. Inc.	Blue Ridge Recycling & Disposal	Estill	416	29.8
	Outer Loop Landfill.	Jefferson	2837	7.0
Jones Sanitation	West Kentucky Landfill	Graves	193	4.4
Laurel Ridge LCC	Laurel Ridge Landfill	Laurel	731	15.3
Southern Waste Services, LCC	Southern Sanitation Landfill	Logan	551	11.8
LWD Santitary Landfill	LWD Sanitary Landfill	Marshall	295	4.4
Rumpke of KY	Montgomery County Landfill	Montgomery	490	8.6
	Pendleton County Landfill	Pendleton	486	10.2
Local Sanitation Inc.	Local Sanitation of Rowan Co.	Rowan	203	77.0
TriCounty Landfill LLC	Tri-County Landfill	Whitley	220	30.1
		TOTALS	**12,475**	**16.2**

The plant, if it does become operational, will be the sole exception to landfilling in the Commonwealth.

Although landfill costs have risen to approximately $27.50 per ton, costs should not significantly increase in the near future. There is plenty of capacity and competition between existing landfills. Louisville, for example, is disposing of its waste at four different private landfills. Increased costs at one would prompt waste haulers to use one of the other three available landfills. Each of these landfills must work to contain costs to remain competitive.

While costs may remain flat, large waste management companies will continue to grow. They are either buying or swapping assets to gain majority control of particular markets. Two private companies (Republic and Waste Management Inc.) currently dispose of 58% of the waste going to municipal landfills. If regional monopolies are created, there is a potential for prices to rise, but only enough to increase profits without drawing the attention of other companies who might jump in and compete. There is also competition for integrated companies that operate landfills and collection systems to create new markets. There are currently 300,000 households across the state that do not currently have curbside collection and in the next ten years Kentucky will see an additional 170,000 households established. The consolidation of waste management companies will continue into the future. This has advantages and disadvantages. The largest concern is that a monopoly could result in price increases. The greatest advantages are that with economies of scale large waste management companies can invest in research and new technologies; have the economies of scale to capture and market recycled materials, methane gas, and other waste byproducts; have the capital to expand waste collection programs; and, have the resources to improve public awareness and understanding of waste management options. In the past, many Kentucky landfills were operated by individuals and companies whose sole qualifications were the ability to operate a bulldozer. The future of landfill operations will see the employment of new technologies and ideas.

Future Landfills

While landfilling will remain the predominant means of disposing of waste, landfill design and operations will look different in the near future. Landfill economics is based on the volume of material that is disposed. The more waste that can be packed into a landfill, the greater the economic return. Kentucky landfills have already moved to increase compaction rates of waste being disposed. One landfill, Ohio County Landfill, compacts their waste into large bales that are then stacked in the landfill. Other ways to increase capacity is through programs to divert some waste from landfills and the use of bioreactor landfills. Economic benefits of methane gas production to supplement landfill economies will be more prevalent in the near future.

Diversion programs include reuse, recycling and pollution prevention activities designed to reduce the amount of solid waste going to a landfill. Reusing waste materials will continue to account for a minor diversion from solid waste landfills. A number of landfills have diversion programs to remove yard wastes for compost. And recycling will also continue to play a minor role in diverting waste from solid waste landfills. In 2001 a total of 645,000 tons of recyclables were removed from waste that would otherwise be disposed. This represents less than a half day of waste disposed in Kentucky's landfills. Glass markets that have been stable have disappeared recently as a result of shifts from glass containers to plastic and aluminum. Aluminum cans, once the economic backbone of municipal waste recycling programs, have steadily dropped in the amount being recycled. Nationally the recycling rate for aluminum cans is the lowest since 1980. Since 1990 the recycling rate for aluminum cans has dropped from 61% to less than 50%. During that same period the number of curbside waste collection has more than tripled. Paper markets that have widely fluctuated over the years have been depressed. The one recyclable material whose value has increased is plastics. This market has been helped by high demands from China and should remain high. New markets for metals in electronic equipment are developing that will provide incentives for diversion and recycling. Recycling and reuse will continue to play an important role in waste management, but it will not expand significantly in the near future. Ironically it is the consolidation of waste management companies that may be the most significant factor in promoting and implementing reuse and recycling programs. The larger companies have an economy of scale, the resources, and larger incentives to preserve available landfill space to implement expanded reuse and recycling programs.

The biggest impact on waste streams in the future will be through pollution prevention activities to reduce the generation of waste in the first place. The elimination of solid waste in consumer products could significantly reduce waste that is currently being disposed. One of the larger drivers for pollution prevention will come as a result of the globalization of the U.S. economy. International control of trade agreements and foreign requirements on packing could affect material flows and prices. The European Union has adopted directives to prevent the formation of packaging wastes. Landfill disposal costs and critical availability of landfill space has prompted these regulatory requirements. American countries selling products in the EU in order to meet these directives

Urban landfill site.

will be changing their packaging. In a global economy these changes will also be incorporated into products sold in the U.S. and reductions in the volume of packaging material should follow.

Bioreactor Landfills defy current conventional wisdom. Currently landfills are designed to prevent any water from entering or exiting the waste cells. Waste in existing landfills exist in anaerobic conditions, with waste slowly decomposing and reaching only partial stabilization in 19-80 years. Bioreactor landfills use enhanced microbiological processes by introducing and controlling water, heat and air to transform and stabilize the decomposable organic wastes in 5 to 10 years. Moisture is maintained in the waste at approximately 35-65%. Decomposable wastes including paper, yard wastes, and food represent over 50% of municipal solid waste. Their decomposition results in a 15-30% gain in landfill space due to an increase in density of the waste mass. Basically bioreactor landfills are in-landfill composting operations. By accelerating waste degradation, the landfill cells stabilize quicker and additional waste cells can be constructed on top of the old cells, increasing the capacity of existing landfills. Operators, by controlling the amount of water and air introduced into the waste, can choose what rate of decomposition and settling they wish. There are 3 types of bioreactor landfills: aerobic, anaerobic and hybrids (combination of both). In aerobic bioreactor landfills, water and air is injected into the waste using vertical or horizontal wells. Aerobic decomposition almost eliminates the generation of methane gas, a major greenhouse gas. Water injected into the waste can be both recirculated leachate as well as other free liquids. In anaerobic bioreactor landfills, water and microbes are injected into the waste to accelerate decomposition. Methane gas production is enhanced in this process. Hybrid bioreactor landfills use sequential aerobic-anaerobic treatment to rapidly decompose waste near the top of the landfill, while collecting methane gas in the lower portions of the landfill. In all three variations, the use of recirculated leachate reduces the risk of these polluted liquids from contaminating surface or ground waters, and reduces the cost of transporting and treating these liquids. Bioreactor landfills would also have a shorter post-closure management period. Postclosure liquid flow through the waste should not increase methane generation nor result in further release of organic or metal constituents into the leachate. Although these landfills will require increased management and more environmental controls, bioreactor landfills can reduce disposal costs, save space, enhance performance, and reduce environmental risks. Waste Management Inc., at their Outer Loop Landfill in Louisville, is conducting research on this process. In the future this technology will likely be applied in all of the larger landfills within the Commonwealth.

Methane Gas is a natural byproduct of organic solids in the waste stream as they decompose. Methane emissions are a potent greenhouse gas. With a few notable exceptions, including Waste Management Inc. in Louisville where methane gas is collected and sold, Kentucky landfills flare or release methane gas to the atmosphere unused. Regulatory and economic factors will change this process in the near future. The New Clean Air Act New Source Performance Standards and Emission Guidelines (Landfill Rule) are requiring larger landfills to control releases of methane gas. The second source for change is coming as a result of increased costs of natural gas. The cost of natural gas has increased 225% in the last 4 years and prices are expected to rise higher in the future. The sale of methane gas can improve profitability. Methane gas produced at a landfill consists of methane (60%), carbon dioxide, and trace malodorous volatiles. Proposals to capture and use these gases include burning the methane to generate electricity or for other industrial uses, to fuel waste collection vehicles, or to cleanup the gas for distribution through existing natural gas pipelines. Three electric plants are under construction in Boone, Greenup and Laurel counties using methane gas to generate 10 megawatts of electricity. Methane gas begins to form 2 years after a cell in a landfill is closed. In the future, the larger landfills in Kentucky will be collecting and selling methane gas as a fuel.

Kentucky's solid waste future is both dim and hopeful. Dim with respect to ever increasing per capita and total volumes of waste to dispose. Diversion programs will require significant public resources or policy changes to make any significant reduction in the volume of waste being generated. The solid waste systems used in Kentucky over the next decade will not look significantly different. Most of our waste will continue to be deposited in contained landfills. The hopeful side is that although the landfills may not look different, we will see new technologies to improve their performance in terms of both protecting the environment and lowering costs.

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