

Land Use Complete Report

4.2.1 Impacts of Land Use on Climate Change

4.2.1.1 Development Patterns

Since the 1950's, most U.S. cities have been designed and built with automobiles as their primary mode of transportation. As a result, the annual number vehicle miles traveled (VMT) by Americans increases faster than new technology and cleaner burning fuels can reduce CO₂e generated from transportation sources. Data from Louisville Metro's GHG inventory confirms that this trend is occurring locally.

Figure 4-5 presents annual trends in VMT and corresponding tons of CO₂e. Cleaner burning fuels and vehicle technology produced a drop in tons of CO₂e between 1990 and 2006 but steady increases in VMT are projected to negate most of this reduction by 2012.

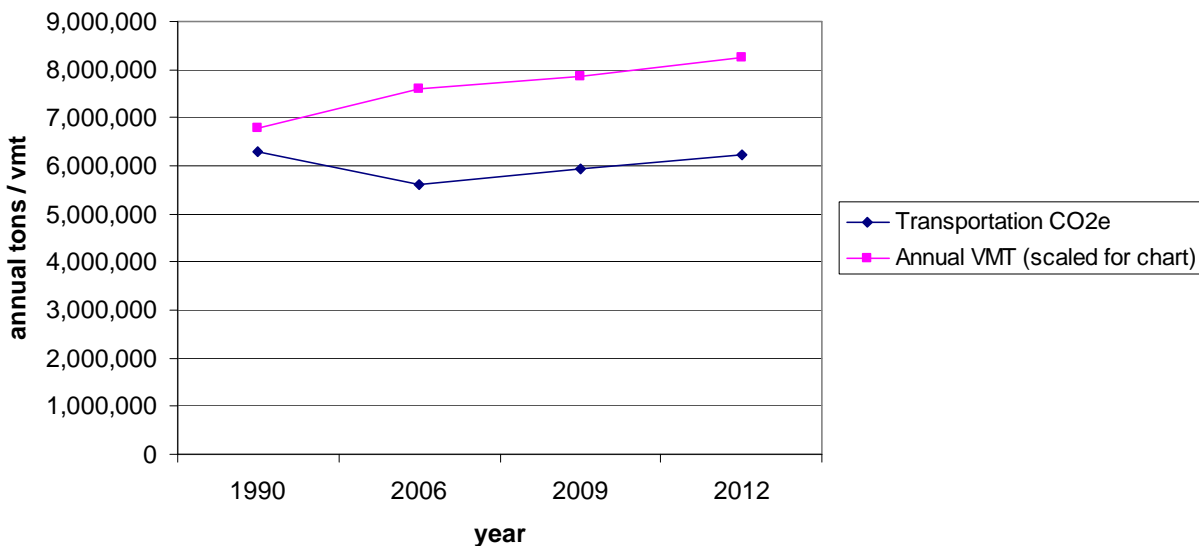


Figure 4-5. Comparison of 2006 CO₂e (tons) and VMT for Jefferson County, KY

Development patterns directly influence transportation options and choices. Research consistently shows that low density development with segregated land uses creates automobile dependence and results in high VMT. Dense development with a mixture of land uses promotes pedestrian activity, supports mass transit and effectively reduces VMT, therefore any effort to reduce VMT and associated CO₂e must contain a land use component. The concept of achieving dense development patterns with mixed land uses is commonly referred to as smart growth.

A recent study published by the Urban Land Institute shows that “it is realistic to assume a 30% cut in VMT with compact development.”¹ The report goes on to say that in conjunction with “reasonable assumptions about growth rates, the market share of compact development and the relationship between CO₂ reduction and VMT reduction,”² smart growth alone could reduce total transportation related CO₂ emissions 7 to 10% by 2050.

Louisville Metro faces the same challenges as other communities dealing with impacts of land use and transportation on climate change. The relatively low cost of gasoline and abundant land has allowed residents to

¹ Reid Ewing and others, *Growing Cooler: Evidence of Urban Development on Climate Change* (Washington, D.C.: Urban Land Institute, 2007).

² Ibid.

live in neighborhoods distant from employment centers, goods and services. In addition, many neighborhoods built since the 1950's lack adequate pedestrian infrastructure and the densities necessary to expand the city's existing mass transit service. These factors create physical and financial challenges in providing automobile alternatives to many of the city's residents.

The GHG inventory shows that transportation is consistently the largest contributor of annual CO₂e. Capping and reducing emissions from this sector is needed to balance future economic growth with CO₂e emissions targets. This cannot be accomplished with vehicle technology and cleaner burning fuels alone. Development patterns will play an important role in determining whether or not the city meets those targets.

4.2.1.2 Land as a Carbon Sink

The two most commonly discussed sources of CO₂ are mobile sources (e.g., cars and trucks) and point sources (e.g., electric plants and cement manufacturers). However, the larger CO₂ picture is incomplete without a discussion of carbon "sinks." A carbon sink is a carbon reservoir that is constantly increasing in size. Carbon sinks are composed of organisms that use photosynthesis to remove CO₂ from the atmosphere, release oxygen and store carbon as biomass. When the organisms die, some of the carbon is released back into the atmosphere through decomposition and some of the carbon becomes stored in the soil as terrestrial organic carbon. Altering land from its natural state reduces its biomass and subsequently its capacity to remove CO₂ from the atmosphere and can also release carbon stored in the soil.³

Building a human environment usually requires disturbance of ecosystems such as the clearing of forests, which has an impact on local and global climate. Kentucky's natural landscape was altered by European settlement beginning approximately 200 years ago. Clearing, farming and urban development has occurred throughout Metro Louisville. As a result, the land's capacity to store carbon in biomass and terrestrial soil organic carbon has been reduced. In some cases, its capacity has been eliminated. However, there are opportunities to improve the land's ability to act as a carbon sink through land preservation, urban forestry, conservation design and low impact agriculture.

Section 4.2.2 Impacts of Climate Change on Land Use

Climate change is affecting land use, just as land use is contributing to climate change. A set of land use policies to reduce or avoid contributions to climate change would be incomplete unless they were integrated with policies adapt to climate change's impacts on land use.

Climate change is already affecting environmental and land use conditions. Moreover, even if communities worldwide were to implement immediate substantial changes in human impact on climate, their effects would not be experienced immediately. Thus, even with serious reforms in human practices (which depend on political, social, economic, ethical, and technological changes), current trends in climate change would likely to continue for some years before tapering off. Attention should be given to five categories of relationship between climate change reduction strategies and climate change adaptation strategies.

1. The effects of climate change on our local environment are likely to counteract or offset some of our climate change reduction efforts. For example, the carbon sequestration benefits of tree planting and tree conservation policies could be offset, perhaps even entirely negated, by the release of carbon and other greenhouse gases (GHG) by trees dying due to extreme flood events associated with climate change. Of course, the overall

³ H.W. Markewich and G.R. Buell, United States Geological Survey, *A Guide to Potential Soil Carbon Sequestration: Land-Use Management for Mitigation of Greenhouse Gas Emissions*, 2001.

climate impact would be worse if we made no effort to plant trees for carbon sequestration, but our predictions of net reductions in GHGs used to consider ecological changes due to climate change.

2. Land use policies to avoid or reduce climate change could face implementation obstacles from changing land use conditions related to climate change. For example, land use policies promoting infill and compact urban development (i.e., to prevent further sprawl) could be undermined by the widening of floodplains in prime areas of infill and compact urban development. Floodplain widening would be a probable result of the increased number and intensity of extreme flood and drought cycles, if unabated.

3. Policies focused on reducing the human contributions to climate change do not address other major environmental and social problems caused by climate change. For example, the likely changes in storm events, precipitation cycles, and stream channels call for a set of policies to address runoff issues, which are not likely to be a part of policies aimed solely at GHGs.

4. Climate change impacts on local environmental, land use, and social conditions will likely result in public demands for policies with adverse environmental impacts. For example, increases/changes in the range and populations of disease-carrying insects are likely to result in increased use of insecticides and similar chemicals to protect human health. This increased use will result in adverse impacts on the environment, including water quality, human exposure to toxics, and harm to non-pest species.

5. We simply do not know enough about the synergistic interactions of climate change impacts and climate change reduction strategies. For example, how will efforts to increase supplies of locally grown foods (thus reducing the impacts of long-distance food transportation and creating stronger agricultural markets for non-development uses of land) relate to the likely climate-related changes in the types, varieties, and health of crops locally?

Established and emerging research show the following impacts that climate change is having, is likely to have, or may have on land use:

1. Water-Related Impacts

Predicted changes in climate patterns will increase the intensity of weather patterns, including the intensity of storm events and storm cycles, the incidence of extreme weather, and the length and intensity of periods of drought and precipitation. This will likely produce several conditions that will affect land use:

First, flood plains will likely widen, resulting in larger geographic areas – including already developed areas and areas in the path of development – that are prone to flooding.

Second, flooding during storm events will increase from the combination of increased storm and precipitation intensity, land development conditions that contribute to urban and suburban runoff (both quantity and velocity of runoff), deterioration of stream beds and banks, and decreased absorption capacity of soils and landscapes due to drought and land use activities.

Third, the effects of urban and suburban runoff on human and natural environments will be heightened by the increasingly intense drought-storm cycles. These effects include not only flooding with accompanying loss of property and human life, but also degradation of water bodies, stream beds and banks, hydrological processes, fish and riparian wildlife habitat, and water quality.

Fourth, the combination of drought periods and decreased replenishment of groundwater will create a series of water scarcity periods, as well as demands for area water from other parts of the Commonwealth or nation.

Thus, while some models show increased levels of precipitation in Kentucky as a result of climate change (and some show decreased levels of precipitation in Kentucky as a result of climate change), the critical measure is not average annual rainfall over a period of several years. Instead, we need to be modeling, measuring, and adapting to conditions that will create periodic periods of drought, followed by periods of intense precipitation. While the Louisville Metro area has not experienced critical shortages of water supply historically, climate change conditions will create a strong potential for periodic constraints on supply, increased costs of water, and demands from other communities for access to Louisville's historic water supply sources. Trends in other local regions in the Eastern United States that have experienced drought- and consumption-related water scarcity issues show that the same thing could happen in Louisville.

2. Heat-Related Impacts

Climate change will likely increase the average temperature in the Louisville area. Even stronger evidence exists that it will increase the number of days over 90 degrees F per year.

This will result in increased risks to human health from heat (including increased numbers of heat-related deaths), increased demands for energy consumption to cool buildings, increased demands for water consumption for pools, lawns/landscape maintenance, and human cooling.

A heat island effect is a temperature increase due to the high concentration of pervious surface area combined with the high concentration of mobile and point source emissions in metropolitan areas. There is also good reason to believe that the heat island effect of urban areas, including the Louisville Metro area, will be exacerbated by the anticipated changes in temperature patterns. Thus, temperatures within the urban area are likely to increase even more than general global increases in temperature.

Moreover, the combination of higher temperatures is likely to increase ground-level ozone in the Louisville Metro area. A warming as little as 2 degrees F could result in an 8% increase in the concentration of ozone, substantially affecting overall air quality, human health, and federal regulatory compliance.

3. Forest-Cover Impacts

Climate change will affect forests, which are adapted to specific climate conditions. These effects include changes to forests' overall composition (variety, numbers, and proportions of species), health and productivity, and geographic range. For example, the extent of forests in Kentucky could decline by as much as 25%, perhaps due to drought and increased numbers of pests to which current trees are not adapted.

More likely, though, is a change in the composition of forests, with eastern hardwoods being replaced by pines and scrub oaks. These changes will affect the productivity of forests for timber, soil stabilization and water runoff control, biodiversity support, carbon sequestration, and human relationship to the landscape (including aesthetics, sense of place, and forest character).

Moreover, increased flooding from climate change (see above) could kill a substantial number of trees, which would in turn have substantial impacts on landscapes, ecosystems, and the release of GHGs into the atmosphere, thus increasing contributions to climate change. For example, a study in the journal *Science* shows that dying vegetation from Hurricanes Katrina and Rita will release as much carbon into the atmosphere as all the forests in the United States absorb for photosynthesis in a given year.

4. Agricultural-Related Impacts

Climate change will likely affect the composition, range, yield, and production of agricultural crops and livestock. Various models for the United States show climate-caused shifts in zones of agricultural production northward, which would change the types, variety, and perhaps even numbers of crops grown in Kentucky and specifically the areas in and surrounding Jefferson County.

Demand for irrigation for crops and water for livestock is likely to rise during periods of drought, at times when other competing demands for water are rising and supplies are falling. Agricultural pests may increase. At the least, we are likely to see periods of agricultural pest infestations for which current crops and agricultural practices are ill suited to adapt in the short-term. This will affect crop production and prices of crop and crop-related products.

Estimated overall changes in crop yields vary according to crops and many different other variables, but the overall picture is one of both global and regional short-term increases in crop yield, followed by long-term decreases in crop yield. These changes could affect the types and locations of lands devoted to agriculture, as well as Louisville Metro regional needs for agricultural land preservation and adaptive management in order to achieve some level of regional food security.

5. Biodiversity Impacts

Changes in temperature, precipitation cycles, and vegetation ranges are likely to result in increased numbers and types of disease-carrying insects. The habitat range of disease-carrying insects is likely to move north, and the resilience of these insects and other pests is likely to be greater under warmer conditions. Moreover, the populations of existing species, such as mosquitoes, would increase under warmer and wetter conditions. These conditions will have important consequences for human health (e.g., malaria, dengue, Lyme disease), as well as local methods for controlling insects and pests.

The changing climate will also likely facilitate the spread of invasive, non-native species of vegetation and wildlife, both in range and population resilience. This will result in the crowding out of native species and significant alterations of ecosystems.

The increased stresses to plants and wildlife from climate-related changes in temperature, precipitation, and habitat are likely to contribute to the decline or even extinction of some rare, threatened, or endangered species of plants and wildlife. For example, increased temperatures overall may lead to increased temperatures in caves, which in turn may lead to higher mortality among endangered Indiana bats. These effects place a high premium on land conservation and management choices to protect biodiversity and critical habitat of species.

Section 4.2.3 Examples of Local Land Use Responses to Climate Change in Other Metropolitan Areas

ULI Rosan article in Urban Land, February, 2008 referencing *Growing Cooler: the Evidence on Urban Development and Climate Change*-argues that land use is key tool in offsetting the detrimental impacts of climate change.

- Intersection of urban land use, infrastructure and best development practices
- Engages all sectors of the economy and all levels of government, as well as all property and project types

City of Denver Climate Action Plan

- Continue compact growth boundary and support additional population growth around transit-denser, more pedestrian, bicycle and transit friendly neighborhoods
- Community-wide high-performing Green Concrete Policy using more fly ash in all public and private construction projects. Use of less concrete through site design/urban design/planning

City of Austin Climate Protection Plan

- The plan will act as the city's blue-print to become the country's leading green city. Few highlights:
 - All of its facilities, fleets, and operations will be carbon-neutral by 2020
 - By 2015, each new house within the city's boundaries will be required to be "zero" net-energy capable. Provides density bonus for buildings that achieve LEED certifications or Green Building program.
 - In 2004, residents voted for introducing 32-mile surface passenger rail service.
 - Infill and neighborhood protection to increase density and mixed use development.
 - Corridor redevelopment opportunities that would connect neighborhoods, mixed use with medium to high density, transit enabled, and accessible for walking and bicycling.
 - 7 new town centers, encouraging growth while preserving neighborhoods.
 - Rail Transit will achieve the regional vision utilizing commuter rail to connect people with jobs, commerce and social centers.

Climate Change, Zoning and Transportation Planning, Urbanization as a Response to Carbon Loading, Nolon and Bacher, Real Estate Law Journal

- Yonkers, New York
 - Waterfront redevelopment adjacent to train station—Government committed to provide urban recreational and design amenities, build impressive central library, renovate historic buildings, clear deteriorated buildings, remediate brownfields...all within walking distance of the central rail station on the river. Use of innovative zoning technique "Master Plan Zone"-as of right status for developments conforming to the plan and compliance with environmental review waived (included in master plan). Pursuant to request for proposal, private redeveloper committed to two redevelopment projects adjacent to train station. Government investment sparked private sector interest.
- Seattle, Washington
 - Three year station area planning program to create a development plan for eight areas, each within ¼ mile of a rail station. City adopted a station area overlay district ordinance-rezoning the land to accommodate higher density development. Developers are assured that conforming building proposals will receive approval. Six zoning designations in the station area district-allowing commercial and residential of varying density, as well as some light industry.
- Austin, Texas
 - Two phase—Transit Oriented Development (TOD) implementation TOD district boundaries established and TOD zoning is identified—Gateway, Midway and Transition Zones are designated and regulations adopted. Sets stage for Phase II, Station Area Plan includes specific design standards and development goals, including affordable housing.

- Vancouver's EcoDensity Initiative

This initiative, launched in 2006, embraces growth within the city limits, done in a way that lowers environmental impact, supports physical and social amenities, and fosters housing diversity and affordability. The plan's foundation rests on 8 pillars:

 1. A completely walkable city
 2. An integrated, low impact multi-modal transportation system
 3. Green Buildings
 4. Flexible Open Space
 5. Green Infrastructure (supply and management of energy, water, materials, wastewater management....)
 6. A healthy food system
 7. Community facilities and programs
 8. Economic Development

- Fairfax County, VA
 - Growth/land-use-transportation-environment connection, strategies designed to promote growth, community development, and the movement of people and freight, not just cars. Cool Counties—a nation-wide program that aims for reduction in vehicle miles traveled. It facilitates multi-modal trips including trails for functional transportation.

- Great Places and Cities designation by American Planning Association (APA)
 - It is defined by policies and initiatives that promote: pedestrian-friendly, bicycle friendly, transit-friendly cities... designed so that GHG emissions are reduced as a result of reduction in the VMT.

- Boulder Colorado
 - The city restricts residential growth to preserve a greenbelt around the city. The bus system uses clean-burning fuels, and 200 miles of trails/paths promote bicycling and walking. The city offers Eco-pass, a transit card, for all downtown workers, in order to promote the use of public transportation. In 2006, Boulder voters approved the country's first city-wide carbon tax.

Suburban Context-develop mechanisms to coordinate state and MPO transportation planning with local land use planning — key to success and arguable required under federal law.

- New York Suburbs
 - NY Metropolitan Transportation Council is coordinating pilot sustainable development studies. Two resulted in land use actions taken by municipalities that link land use densities and modal choices. Vision section of one, Bear Mtn. Parkway, calls for 5 designated business districts to become more pedestrian friendly and a town wide network of bike paths that link business centers, residential areas, regional trails, and parks.
 - Town of LaGrange — Priority Growth Districts where roadways and other infrastructure either exist or can be accommodated in a way to reduce auto trips and/or support transit. Create new hamlet serving new and existing residential development and some retail.

- Arlington, Virginia.
 - Developers are required to include residential development in conjunction with any office development around transit stations. Allows a two-way commute that uses transit system.

Additional Local Standards for Reducing Emissions—Adopt Building and Location Standards

- Town of Babylon, NY-law requiring all newly constructed commercial buildings, office buildings, industrial buildings, multiple residences and some senior citizen residences to comply with Leadership, Energy & Environmental Design (LEED) standards.
- LEED-Neighborhood Development(ND)-pilot stage include reduced automobile dependence, creation of bicycle network, compact development, diversity of uses and housing types, affordability of housing, the proximity of housing and job sites, reduction of parking footprint, proximity to transit facilities and transportation demand management.

Section 4.2.4 Land Use Recommendations

Land use practices that will minimize and mitigate local contributions to climate change and adapt to climate change are integrally related to land use practices that will promote a high quality of life for Louisville Metro region residents, a sustainable regional economy, ecologically sustainable practices, wise and efficient growth and development patterns, and a strong, vibrant community. Where possible, the land use strategies and action items of this Climate Change Action Plan should be linked to other sustainable land use policies.

In addition, the principle of choice is important if new policies are to be effective at achieving more environmentally responsible land use practices and behaviors. Therefore, whenever possible, all requirements, restrictions, incentives, and encouraged actions should contain menus of options with roughly equivalent environmental benefits or harm avoidance or mitigation, allowing developers, landowners, users of land, and community residents to select the options that best fit their own goals and circumstances while achieving comparable minimization, mitigation, and/or adaptation outcomes.

Land development regulations should be clear and offer predictability to developers, land owners, neighbors, and the public. These regulations should be flexible enough to provide incentives when projects exceed basic regulatory standards of environmentally sustainable development, while allowing decision makers discretion in application of standards to each particular place-based and project-specific context. Decisions should be made on the basis of good evidence, careful analysis, and policies of environmental responsibility for the overall public health, safety, and welfare.

Finally, an essential principle is full and effective public participation in – and deliberation about – climate change and land use policies, whether at regional, local, or neighborhood/area levels. This principle is at the heart of democracy, fairness, and community-building at the local level. Moreover, proposed policies will likely face overwhelming barriers to adoption or effective implementation if the public is not fully engaged with and generally supportive of these policies.

Section 4.2.4.1 Alternatives to Automobile-Dependent Development

Land use practices should offer alternatives to automobile-dependent sprawl development and should encourage development that promotes walking, cycling, and the use of public transit as alternatives to vehicle trips.

Recommendation 1:

Adopt land development policies, regulations, and incentives that facilitate compact development, transit oriented development, and pedestrian-friendly development. Discourage low-density sprawling residential and commercial development on the outer edges of the Louisville Metro area.

1. Louisville Metro should revise the Land Development Code to promote both compact development and transit-oriented development with comprehensive planning provisions, zoning regulations, enhanced planned

development district zoning, form district provisions, development standards, and incentives, such as density bonuses, streamlining/fast-tracking, setback variances, fee waivers, infrastructure subsidies, and/or increased permissible signage. Standards for compact and transit-oriented development, including standards for receiving incentives, should be clear and easy for developers and public participants to understand. Major transit corridors should be identified and properties along these corridors should be rezoned to allow mixed-use, moderate- or high-density development within a ten minute walking distance of transit stops and stations.

2. Substantial capital improvement public expenditures should be invested in bike paths, bike lanes, sidewalks, Transit Authority of River City (TARC), bike racks, rideshare parking, park-and-ride facilities, and new forms of transit such as light rail, high-speed inter-city rail, improved transit connections to Amtrak stations in Cincinnati and Indianapolis, rapid transit bus service, and others.

3. Road standards for new developments should require highly connected streets with small blocks.

4. New development projects should be evaluated by decision makers in the planning, zoning, subdivision approval, and permitting processes for the opportunities they provide to the ultimate users, owners, and occupants to walk, bicycle, or take public transit to likely destinations. The Land Development Code should be modified to allow decision makers to deny approvals for any new development project that does not afford its users adequate alternatives to motor vehicle circulation (e.g., pedestrian and cyclist connectivity, access to TARC routes and other transit options, mixed uses in or near the new development within actual walking distance). Preliminary and final site development plans should be required to identify existing transit routes on abutting streets and to provide a circulation map delineating the location, classification, names, and widths of all major public rights of ways, pedestrian paths, trails, bikeways, and transit routes within 1500 feet of property boundaries.

5. To the extent possible, consistent with other environmental goals, sidewalks and other pedestrian walkways should be attractive, safe, well-lit, maintained in good condition, and lined with mature shade trees so that they are well used.

6. Special attention should be given to crosswalks, pedestrian crossings at street corners, pedestrian crossings at railroad tracks, and vehicular crossings of streets (e.g., parking lot and garage entrances, driveways, etc.) to ensure that pedestrians have safe conditions and are given high priority in shared space with vehicular traffic.

7. Evaluate the Land Development Code, incentives, and other local policies and practices to ensure that compact and transit-oriented residential development occurs across a range of price points and for a variety of housing consumers. Address the potential for compact development to cluster at either end of the spectrum between high-end luxury housing (e.g., condo development downtown and on the Ohio River) and low-income housing projects (e.g., West Louisville high-density housing), leaving a wide gap of opportunities for housing consumers along the spectrum of price choice/affordability.

8. Evaluate and consider revising Land Development Code Form District standards to promote and incentivize wider use of pedestrian-oriented development.

9. Review dimensional standards for non-residential and mixed-use developments in the suburban form districts of the Land Development Code to assure that the standards address safe pedestrian accessibility and promote walkable environments.

10. Decrease maximum front and street-side setbacks for non-residential uses in suburban form districts (Neighborhood, Suburban Marketplace Corridor, Regional Center, Suburban Workplace).

11. Revise mixed-use site design standards to expand Code-related incentives to promote wider use of residential use in development plans.
12. Promote pedestrian-oriented design while allowing design flexibility. These alternatives should be used instead of variances and waivers that are commonly approved today.
13. Use creative parking policies to encourage walking and transit use:
 - a) Create a parking strategy⁴ to encourage trip-chaining⁵ by walking.
 - b) Broker joint-use parking agreements, supported by site plan review process that rewards joint-use parking elements, i.e., expedited review/permitting. Off-set elements to include: 1) joint use parking required when two or more uses on the same or separate properties are located along a transit route and have different peak use times; 2) establish a set aside program taking avoided parking construction costs and redirecting those funds to pedestrian-friendly facilities; 3) develop parking nodes with Freewheelin' Stations⁶ and TARC circulators for employers, pedestrians and transit users; and 4) use developer set asides (see first item above) from reduced parking requirements to pay for pedestrian-friendly facilities.⁷
14. Work with the Governor, State Legislature and the Kentucky League of Cities to legalize impact fee set-aside at the time of development so funds can be used for walkability needs.
15. Use Louisville Metro's form districts to promote mixed-use neighborhoods and centers by formally designating a center for each neighborhood district or traditional neighborhood district, where appropriate, instead of relying solely on adjacent corridors (linear, not compact) to define the districts. Rezone the areas in and around the designated centers for mixed use development with walkable environments. These centers should be coordinated with future transit stops along major routes, whether a Bus Rapid Transit (BRT) or light-rail system. Evaluate potential incentives that could be offered to develop or enhance compact form-district centers.
16. Explore ways by which Floor Area Ratio (FAR) can be used as an incentive measure to increase density bonuses in certain areas. This would not alter the use of Dwelling Unit (DU)/acre currently used to measure density. Consider establishing minimum densities for properties located on transit corridors within a 10-minute walk of transit stops.
17. Use regional comprehensive planning efforts and policy incentives to create and encourage 'transit-ready' development patterns within the Louisville metropolitan region, in areas that do not yet have public transit.
18. Support technology and business practices that enable people to reduce vehicle miles traveled from home to work. These include the use of home offices and technology such as wireless communications and videoconferencing. Louisville Metro should review Land Development Code provisions regarding permitted uses for home occupancy and related regulatory standards and processes to ensure that best zoning and permitting practices are being utilized. Home offices and telecommuting should be allowed by right where traffic and parking impacts on the neighborhood will be minimal (e.g., few to no employees and customers, adequate off-street parking, and limited numbers of deliveries).

⁴ Santa Monica, California's Reforming Parking Policies toolbox offers a different approach to parking: http://www.mtc.ca.gov/planning/smart_growth/parking_seminar/Toolbox-Handbook.pdf

⁵ Trip chaining occurs by combining several errands/destinations into a single trip, regardless of the mode of travel.

⁶ Plans are underway to expand Humana's "Freewheelin'" bike-sharing program for public use. The current program only serves its employees, headquartered in Louisville, Kentucky.

⁷ Currently, developers may defer construction of the required number of spaces, if the applicant commits to implement a traffic demand management plan which eliminates the need for the number of parking spaces being deferred. Deferred costs are set aside for open-space.

19. Explore ways that planned development district zoning/approvals could be better used and made more attractive to developers for mixed-use compact development with pedestrian circulation.
20. Pursue social equity in policies promoting mixed-use, compact, and pedestrian-friendly development in all neighborhoods and communities.
21. Use the Center for Neighborhood Technology's H+T Affordability Index, a web-based interactive mapping tool that measures housing affordability by accounting for both housing and transportation costs. Map the entire Louisville Metro area using this new tool.

Section 4.2.4.2 Efficient Use of Existing Sites, Areas, and Infrastructure

Land use practices should make efficient and effective use of existing developed sites, areas, and infrastructure, often with public sector assistance to address existing site conditions (e.g., environmental contamination, deteriorating structures, barriers to revitalization).

Recommendation 2:

Adopt land development policies, regulations, and incentives that facilitate infill development, effective and efficient use of existing infrastructure, and clean-up, re-use and rehabilitation of already-developed sites.

1. Evaluate the Land Development Code to remove barriers to infill development and to adopt incentives for infill development, such as density bonuses, streamlining/fast-tracking, setback variances, fee waivers, infrastructure subsidies, and/or increased permissible signage. Standards for infill development incentives should be clear and easy for developers and public participants to understand.
2. Create aggressive brownfields remediation and redevelopment policies and public funding, enhancing existing promising local efforts.
3. Develop green infrastructure "best practices" for the redevelopment of brownfields. Support community-based participatory planning processes for areas with substantial numbers of brownfields, such as the Park Hill Corridor planning process.
4. Identify and pursue creative funding, property ownership and management (e.g., trusts), and development opportunities for brownfields redevelopment.
5. Develop a regional network of local governments to promote brownfields redevelopment by incentivizing proponents of outer-ring greenfield development proposals to selective infill brownfields sites for their projects (if appropriate to the type of development) and sharing benefits and costs among the affected jurisdictions (i.e., the brownfield site and the foregone greenfield site).
6. Louisville Metro should develop and fund an aggressive and extensive housing rehabilitation program, in coordination with federal and state housing agencies, local nonprofit housing developers (especially Habitat for Humanity of Metro Louisville, which already has a housing rehab program for affordable home ownership), and for-profit developers and construction companies. Funds, expertise, and coordination should be provided to rehabilitate vacant houses, occupied deteriorating houses, and deteriorating apartment complexes/buildings, making them more energy efficient, improving unsafe or undesirable living conditions, increasing the available utilized housing stock in already developed areas, revitalizing existing neighborhoods, and improving local social conditions (e.g., decreased crime associated with improved neighborhood housing conditions).

7. Coordinate infill development goals to support existing suburban development with mixed uses, instead of focusing all infill development on downtown and central urban core development. Give attention to the potential decline and emptying of first- and second-ring suburbs with development patterns that could move both inward (urban core; downtown) and outward (suburban and ex-urban development outside of Jefferson County), because such development patterns would be wasteful and would likely increase vehicle miles traveled (even if offset to some degree by transit options).
8. Evaluate the use and improvement of existing infrastructure against the creation of new infrastructure for comparative climate change impacts (e.g., VMTs, trip-inducing development, disturbance or removal of existing trees, vegetation, and/or soils, energy expended in construction activities, household energy systems, etc.).
9. Consider how existing transportation infrastructure can be adapted to become multimodal transportation networks. Evaluate the extent to which existing rail lines could be used to develop some type of rail-based transportation for commuters, tourists, or inter-city travelers. Evaluate the potential for rapid bus transit, the use of streetcars or trolleys, and other diverse methods of transit.
10. Improve the ability to identify areas prone to greater risk from climate change and restrict development in those areas. Increase support for mapping and data collection of high risk areas and changes associated with climate change.
11. Explore ways that planned development district zoning/approvals could be better used and made more attractive to developers for infill development, ideally with mixed use, compact, and pedestrian-friendly features.
12. Pursue social equity in policies promoting infill development, redevelopment, and rehabilitation in all neighborhoods and communities. Obtain community input and respect existing community culture and social fabric.
13. Preserve existing buildings/structures with adaptive reuse where possible and where it is not possible, re-use or recycle as much material from the buildings/structures as possible.

Section 4.2.4.3 Energy-Efficient Buildings and Sites

A critical element of any local climate change policy will be to improve energy efficiencies in the built environment, because the Louisville Metro area ranks among the worst large metropolitan areas in the nation for contributions to climate change from coal-generated electricity.

Recommendation 3:

Require all new development, whether by the private or public sector, to meet minimum standards of energy efficiency for buildings, other structures, and infrastructure, while providing incentives, assistance, and public education to owners or users of existing development to retrofit their buildings, other structures, and/or infrastructure for maximum energy efficiency improvements.

1. The Louisville Metro Land Development Code should require all new structures in the Louisville Metro jurisdiction (whether developed by the public or private sector) meet silver LEED standards or local equivalents of energy efficient design and operation. A variance process should be established for small infill development projects that would both achieve important environmental goals (i.e., remediation and redevelopment of brownfields, low-income housing development, conservation design, high-density transit-oriented development) and would suffer a substantial financial hardship if energy efficient design standards were enforced (with the

rebuttable presumption for-profit land development would not meet the level of “substantial” financial hardship needed to qualify for a variance).

2. All new or substantially redeveloped facilities of the Louisville Metro government, Jefferson County Public Schools, and University of Louisville should exceed silver LEED standards or local equivalents of energy efficient design and operation.
3. Design communities, neighborhoods and individual development projects using techniques that reduce heat absorption throughout the community and region. Develop and incorporate pervious surface ratio requirements in the Land Development Code for all developments (not just a Planned Development District). Provide developers and landowners with a menu of options, including green roofs, bio-retention features, reduced amounts of pervious cover, and alternative water retention/detention facilities.
4. Pursue social equity in policies promoting energy efficient structures and development in all neighborhoods and communities.

Section 4.2.4.4 Environmental Impact Information

Decisions about future growth and development, including specific projects, should be made on good information about the environmental impacts of these projects so that: a) appropriate design choices and mitigation strategies can be made; b) all participants (i.e., landowners, developers, government officials, planners, neighbors, and the public at large) can be aware of the likely impacts and any trade-offs involved in continuing to pursue a project or plan with substantial impacts on the environment; c) local progress towards achieving reductions in GHGs, increases in sequestration of GHGs, and mitigation of climate change impacts can be tracked and evaluated; and d) multiple environmental policy goals can be coordinated in rational and coherent ways.

Recommendation 4:

Require all major development plans, projects, and permit applications, submitted by the private or public sector, to complete a basic environmental impact assessment that identifies the likely environmental impacts of the proposed plan or project, including net contributions to green house gasses.

1. Louisville Metro Department of Planning and Design Services should evaluate all major development proposals, including residential subdivisions, for environmental impacts. The impacts include net climate change impacts based on predicted vehicles miles traveled, average daily trips, GHGs emitted from vehicle trips, energy consumption by ultimate land users, and infrastructure-related energy consumption attributable to the project, and any offsetting mitigation or minimization measures, including carbon sequestration. Exemptions should exist for small projects and possibly projects with substantial environmental benefits, such as infill projects, high-density transit-oriented development, low-income housing development, conservation design projects, and the like.
2. The above-described development review process should include participation and comment by the Louisville Metro Air Pollution Control District and the Louisville Metro Department of Public Health and Wellness.
3. The Louisville Metro Department of Planning and Design Services, in coordination with the Louisville Metro Air Pollution Control District, should develop “best practices” for evaluating the likely climate impacts of proposed major development projects, including:

- a) Methods for quantifying predicted GHG emissions, and the types of projects for which qualitative analysis will be sufficient;
 - b) Defined baseline conditions and significance thresholds;
 - c) Acceptable mitigation measures for energy conservation and microgeneration, alternative energy sources, carbon sequestration, trip reduction, and others;
 - d) Criteria for projects that might qualify for stream-lined environmental impact analysis.
4. Research and evaluate existing modeling tools (e.g., see 6 different modeling tools identified on the California Department of Justice Global Warming website, http://ag.ca.gov/globalwarming/ceqa/modeling_tools.php), and develop a modeling tool appropriate to the Louisville Metro context.
 5. Adopt Louisville Metro Development Code provisions expressly authorizing decision makers to deny rezoning requests, subdivision maps, conditional use permits, site plan approvals, and variances for projects for which good-quality environmental impact analysis shows substantial unmitigated contributions to GHG emissions and there are not greater public benefits (in quantity and quality) that justify such substantial unmitigated contributions to GHG emissions.
 6. Pursue social equity in the evaluation of environmental impacts of development in all neighborhoods and communities.
 7. Use the Center for Neighborhood Technology's H+T Affordability Index, a web-based interactive mapping tool that measures housing affordability by accounting for both housing and transportation costs. Map the entire Louisville Metro area using this new tool.

Section 4.2.4.5 Long-Range Planning with Climate Change Scenarios

Long-range land-use and infrastructure planning that considers various climate change scenarios is necessary to achieve targeted reductions in development-related contributions to climate change and to adapt effectively, efficiently, and fairly to the impact of climate change on the local region.

Recommendation 5:

LMG should engage in long-range (i.e., 50 year) comprehensive planning for transportation and land use, land development, infrastructure development (including transportation and green infrastructure), emergency preparedness, growth scenarios, economic development, social equity, and environmental, natural resources, public health, and energy conservation. This planning process should be linked to long-range regional planning with KIPDA and to neighborhood-based planning with Louisville Metro.

1. The Louisville Metro Department of Planning and Design Services should pursue the use of scenario planning. The planning process should consider various climate change scenarios, including climate change impacts on local landscapes, populations, and resources. as well as the potential of increased population migration to the Louisville region from places experiencing strong to severe climate change impacts (e.g., flooding, rising shorelines, drought).
2. Louisville Metro long-range planning should be related to regional long-range planning (see Section 4.2.4.9), which includes involvement by Kentuckiana Regional Planning and Development Agency (KIPDA)‡ and integrates land use and transportation planning for the region. Produce a multi-county land use plan, including a future land use map.

‡ KIPDA provides numerous and extensive services for nine counties and is more particularly the metropolitan planning organization for Kentucky counties Jefferson, Oldham and Bullitt, plus Indiana counties—Clark, Floyd, and 1/10th of a square mile in Harrison.

3. Louisville Metro should integrate principles of sustainable land use, high-density and mixed-use development, smart growth, transit-oriented development, green infrastructure, and resource conservation into long-range planning.
4. The Louisville Metro Department of Planning and Design Services, in coordination with the Louisville Metro Air Pollution Control District, Louisville Metro Department for Public Health and Wellness, and other local government departments, land development stakeholders, and researchers, should develop better traffic models to predict vehicle miles traveled, average daily trips, vehicle starts, and GHGs emitted by vehicles coming from or going to various kinds of land uses and types of development, including high-density and medium-density developments, mixed-use developments, transit-oriented developments, pedestrian-friendly developments, infill developments, and others. These models should develop methods to divide VMTs, average daily trips, vehicle starts, and GHGs generated between points of origin and points of destination.
5. The Louisville Metro Department of Planning and Design Services, in coordination with the Louisville Metro Air Pollution Control District (APCD), Louisville Metro Department for Public Health and Wellness, and other local government departments, land development stakeholders, and researchers, should quantify the difference in GHG emissions and other environmental impacts between business-as-usual development scenarios and alternative growth scenarios, especially those identified in this Climate Change Action Plan. The planning process should consider various climate change scenarios, including climate change impacts on local landscapes, populations, and resources, as well as the potential of increased population migration to the Louisville region from places experiencing strong to severe climate change impacts (e.g., flooding, rising shorelines, drought).
6. Data on the likely impacts of climate change on the local region should continue to be developed. The University of Louisville should make a major investment in a consortium of research centers and academic units to gather, analyze, and disseminate this data, as well as to evaluate policy and planning options and processes for adapting to climate change. Likely candidates for this consortium include the Department of Geography, the Center for Geographic Information System (GIS), the School of Urban & Public Affairs, the State Data Center, the Center for Environmental Policy and Management, the Center for Land Use and Environmental Responsibility, the Center for City Solutions, the School of Public Health and Information Sciences the Department of Biology, the Department of Civil Engineering, the Watershed Restoration Center, the Anne Braden Institute for Social Justice (equity of impacts and policy responses), and others. A possible name is the University of Louisville Climate Change Response Research Consortium (CCRRC).
7. Explicitly recognize and discuss climate impact and considerations in public review and participation process related to comprehensive plans and regional plans. Include education about climate change in community outreach efforts undertaken for long-range planning programs.
8. Improve the ability to identify areas prone to greater risk from climate change and restrict development in those areas. Increase support for mapping and data collection of high risk areas and findings/consequences associated with climate change.
9. Engage in emergency preparedness planning that anticipated climate changes and their impacts on the local population. Avoid reliance solely on past history (e.g., past patterns of flooding) and instead develop new models of worst-case scenarios that include climate change impacts. Consider repeat-event and multiple-event scenarios.

10. Increase the use of and support (financial, staff, political) for community-based assessments and planning for neighborhoods and special areas. Environmental assessments and environmental planning should be included in community-based efforts.

11. Involve members of all communities and social and economic groups in the region in the development of long-range plans.

Section 4.2.4.6 Green Infrastructure and Land Conservation

Sustainable land use practices feature substantial amounts of high-quality green infrastructure, such as trees and vegetation (especially native trees and vegetation), protected surface water and groundwater features, soil conservation and replenishment, parks and recreation areas, greenways and greenbelts, natural or nature-mimicking stormwater runoff features, and protected species' habitats. Sustainable land use practices also require thoughtful conservation of land and related natural resources as natural capital, supporting ecosystem services to society and nature and defining a sense of place in our local communities. Green infrastructure and natural resource conservation sequester carbon and other GHGs, temper the urban heat island effect, reduce energy usage by lowering building temperatures, sustain agriculture and vegetation (e.g., pollination), prevent or minimize flooding, support water supplies and quality, maintain the physical infrastructure of our landscapes, prevent erosion, and support human physical, psychological, moral, spiritual, political, and social well-being by connecting people with nature and one another.

Recommendation 6:

Conserve land and natural resources as natural capital. This supports ecosystem services to society and defines a sense of place in our local communities.

1. Create, protect and manage systems of green infrastructure (i.e., urban forests, parks, recreation areas, and open spaces, natural or nature-mimicking drainage systems, native trees and vegetation, protected surface water and groundwater features, soil conservation and replenishment, greenways and greenbelts, and protected species' habitats) in regions and communities. Fully fund programs that support the development, identification, and maintenance of green infrastructure. Support new research and training for design professionals on the development, incorporation and preservation of green infrastructure. Develop networks of public and private holders of conservation lands and interests (e.g., conservation easements) to map, evaluate, and collaborate on land conservation efforts.

2. Protect important natural assets and areas of communities and regions to maintain their roles as 'carbon sinks'. Louisville Metro should identify and map these assets, and develop a broader set of natural features than are identified by the current official "Environmental Constraints" map.

3. Revise the Land Development Code to increase the number of new replacement trees that developers must plant for each mature tree removed from a development site from, recognizing the various environmental benefits of maintaining existing trees in comparison to planting new young trees (e.g., retaining existing carbon sequestration, soil stability and erosion prevention, absorption of stormwater runoff, mitigation of urban heat island effect). Require each developer to prepare a tree protection plan that identifies trees to be retained, methods of care and maintenance during and after construction, trees to be removed and offsetting mitigation measures, any heritage or champion trees on the site, and special protection methods for heritage or champion trees. Increase enforcement oversight and penalties for developer violation of an approved tree protection plan.

4. Revise the Land Development Code to provide incentives to developers who retain or plant more native, heritage, or champion trees than required by the Land Development Code. Incentives might include density

bonuses, streamlining/fast-tracking, setback variances, fee waivers, infrastructure subsidies, and/or increased permissible signage.

5. A broad-based effort should be developed in the Louisville Metro area to create incentives, education, and support for existing landowners and occupants (residential, commercial, industrial, institutional, governmental, etc.) to plant and maintain trees and shrubs, especially native trees and shrubs. Special attention should be given to maintaining existing tree canopy due to its superior environmental benefits over removal and replacement methods. In addition, enhancement of the existing tree canopy should be encouraged. Incentives might include government-subsidized utility bill credits for a property's overall tree coverage per acre [outcome-based, instead of activity-based], or property tax credit for a property's overall tree coverage per acre.

7. Design communities, neighborhoods and individual development projects using techniques that reduce heat absorption and stormwater runoff throughout the community and region. Develop and incorporate pervious surface ratio requirements in the Land Development Code for all developments (not just a Planned Development District). Provide developers and landowners with a menu of options, including green roofs, bio-retention features, reduced amounts of pervious cover, and alternative water retention/detention facilities.

8. Ensure the equitable distribution of green infrastructure in all communities and neighborhoods in Louisville Metro.

9. Increase the Louisville Metro tree canopy.

10. Retain, protect, restore, and develop natural places and landscapes where children can connect to nature, explore natural environments, and play in and with nature in unstructured ways (i.e., not solely in human-designed and engineered recreation areas). These places contribute to the physical, psychological, moral, spiritual, and social development of children, building strong environmental citizenship and awareness.

11. Increase the amount of land in Louisville Metro and Kentuckiana held in fee title by, or subject to conservation easements held by, public or nonprofit qualified land trusts for conservation purposes.

Section 4.2.4.7 Urban Runoff and Low-Impact Development

The need for minimization and mitigation of runoff and for low-impact development practices will only increase with changing precipitation patterns, watershed processes, and topography due to climate change. Current land use practices contribute to substantial stormwater runoff, degraded quality of surface waters and groundwater, flooding, and degradation of watershed features such as stream channels and banks. Current federal, state, and local policies call for increasing modifications to land development patterns, design, construction methods, and ongoing uses to minimize and mitigate water runoff and to achieve low-impact development standards moved to first sentence above Failure to make major modifications will result not only in serious harm to natural environments but also in flooding that harms property, economic activity, and human life.

Recommendation 7:

Modify land development patterns, design, construction methods, and ongoing uses to minimize and mitigate water runoff and to achieve low-impact development standards.

1. Design communities, neighborhoods and individual development projects using techniques that reduce stormwater runoff throughout the community and region.

2. Promote the use of low-impact development (LID) site design methods. Develop and incorporate pervious surface ratio requirements in the Land Development Code for all developments (not just a Planned Development District).
3. Require developers to use best management practices to limit runoff and promote retention and infiltration of water on-site, both during construction and in post-construction use of the property. Provide developers and landowners with a menu of options, including green roofs, bio-retention features (e.g., bioswales, rain gardens), rain barrels, reduced amounts of impervious cover, use of pervious surfaces and paving, landscaped areas within parking lots and other paved areas (e.g., street islands, cul-de-sac islands), no curbing that prevents water from flowing into grassy or landscaped areas, and alternative water retention/detention facilities.
4. Use land conservation methods and policies, including promotion of conservation design developments, to protect lands that serve as natural water retention and filtration areas within watersheds. Promote the retention, planting, and maintenance of native trees and vegetation, and the chemical-free nurturing/maintenance of such.
5. Educate the public about stormwater runoff issues.
6. Strongly protect wetlands, riparian buffer zones, and sensitive karst features. Review Land Development Code provisions regarding wetlands, riparian buffer zones, and sensitive karst features for adequacy of existing regulatory protections, and increase protections as needed.
7. Improve the ability to identify areas prone to greater risk from climate change, including areas with increased probabilities of flooding. Redefine floodplains. Restrict development in these increased-risk areas. Increase support for mapping and data collection of high risk areas and changes associated with climate change.
8. Continue to develop and maintain public infrastructure to control flooding, while also protecting natural flood control features of watershed, such as wetlands and vegetation.
9. Discontinue spraying roadsides during vegetative growth seasons. Rather, plant with native vegetation, or use other alternatives.

Section 4.2.4.8 Sustainable Local Agriculture and Food Access

Local and regional agriculture focuses on ensuring local and regional food availability, reduces the use of long-distance transportation to bring food to the Louisville Metro and Kentuckiana region, assists in achieving greater food equity in our communities, supports the local and regional economy, supports healthy lifestyles among the public, and often allows for sustainable agricultural practices that can sequester carbon, minimize runoff and erosion, and conserve land and energy.

Recommendation 8:

Develop a comprehensive local and regional food system and sustainable agriculture policy.

1. Develop a comprehensive regional food security policy that promotes local and regional agriculture, the conservation of agricultural lands, and sustainable agricultural practices (e.g., organic farming, soil conservation). Build on existing regional collaborations that have already produced promising policies and practices.
2. Promote events for successful model farmers from surrounding counties to speak to the public.

3. Study other models of regional food distribution networks. Improve the transportation and distribution efficiency of our regional food market. Implement various policy tools to facilitate improved efficiencies in regional food distribution.
4. Low-impact agriculture can serve to sequester carbon, and should be promoted.
5. Study, model, and plan for changing regional agricultural landscapes and crops due to climate change conditions, including changes in temperatures, precipitation, species' range, pollination patterns, and ecosystem composition, functions, and processes.

Section 4.2.4.9 Regional Collaboration

Local land-use contributions to climate change and the impacts of climate change on local conditions and land uses are regional problems, requiring regional solutions and regional collaborative problem-solving.

Land use planning for adaptation to climate change conditions and their impacts should be accompanied by comprehensive long-range planning for water supplies and demand, water conservation, water quality, and watershed health and integrity. The most likely climate change scenarios for the Louisville Metro area will feature increased demand (both local and from other water-scarce communities), periods of scarcity, growing degradation of water quality and watershed features (e.g., stream bed and bank integrity), and higher environmental, energy, economic, and social costs to the extraction and distribution of water supplies, especially if demand increases.

Recommendation 9:

Develop a regional network of Kentuckiana local governments, KIPDA, and stakeholders throughout the region (including major businesses, major institutions, and representative community-based groups) to engage in collaborative problem-solving to address regional issues related to climate change and land development patterns.

1. Form a regional network of Kentuckiana local governments, KIPDA, and stakeholders throughout the region (including major businesses, major institutions, and representative community-based groups) to engage in collaborative problem-solving to address regional issues related to climate change and land development patterns. Participants should come from the Kentucky Counties of Jefferson, Oldham, Spencer, Shelby, Bullitt, Henry, Trimble, Hardin, and the Indiana Counties of Clark, Floyd, and Harrison. The composition and process of this regional effort should be characterized by principles of equity and fairness, including diverse participation, as well as cooperation, problem-solving goals, and evidence-based deliberation. If necessary, the state legislatures of Kentucky and Indiana should expressly authorize this inter-jurisdictional regional collaboration.
2. A regional climate change action plan should be developed by this collaborative partnership. KIPDA must be involved in the development of this regional plan.
3. KIPDA and this regional partnership should integrate regional transportation planning with regional land use planning, and should develop strategies, not just set priorities among projects. The partnership should commission and support a comprehensive study of relationships between where people in the region live and work (and perhaps also study and enjoy recreation/entertainment) and the methods of transportation between these locations.
4. A regional plan for new regional transit systems must be developed by regional partnerships of the region's local governments, other stakeholders (including major businesses, major institutions, and representative

community-based groups), KIPDA, and federal and state agencies. All partners must make substantial financial and political investments in the development of new regional transit systems for the Kentuckiana region. Transit development must become a major budget priority.

5. Methods for sharing of resources and benefits for regional land-use, transportation, and infrastructure planning should be developed, and if necessary the state legislatures of Kentucky and Indiana should expressly authorize such sharing.
6. Continue and enhance regional collaboration on regional food security and sustainable agricultural practices, discussed in Section 4.2.4.8.
7. Develop a comprehensive long-range water plan. The plan should cover water supplies and demand, water conservation, water quality, and watershed health and integrity, using climate change scenarios. The most likely climate change scenarios for the Louisville Metro area will feature increased demand (both local and from other water-scarce communities), periods of scarcity, growing degradation of water quality and watershed features (e.g., stream bed and bank integrity), and higher environmental, energy, economic, and social costs to the extraction and distribution of water supplies, especially if demand increases.
8. Require that all new development proposals show firm supplies of sufficient quantities of water to serve the new development for 50 years.
9. Develop a comprehensive water conservation plan with multiple stages of water conservation, storage, and reclamation for conditions of: 1) normal demand and supply; 2) drought, shortages due to degraded quality or overdrawn supplies; 3) increased demand locally and/or from other regions; and 4) both decreased supply and increased demand. Require all new land development to use water conservation methods for landscaping, toilets, shower heads, faucets, dishwashers, water heaters, swimming pools, and landscape watering.
10. Monitor and seek any needed regulations to control the use of geothermal heating to the extent that it threatens groundwater supplies, even if only from the cumulative effect of many geothermal facilities.

Section 4.2.4.10 Improved Enforcement Tools

The land use requirements and restrictions (including conditions of land development approvals) needed to achieve the goals of this Climate Change Action Plan and environmentally, economically, and socially sustainable land use practices will be effective only if they are enforced adequately. Fairness to the vast majority of developers, landowners, and land users who comply with local codes and conditions also requires adequate enforcement mechanisms. Enforcement provisions should be designed to strongly deter non-compliance and fully mitigate any harm to the public, community, and neighbors from non-compliance.

Recommendation 10:

Increase and enhance enforcement mechanisms for local land use requirements, restrictions, and land development approval conditions sufficient to strongly deter non-compliance, assure those who comply of the fairness of the system, and fully mitigate any harm to the public, community, and neighbors from non-compliance. Increase penalties for non-compliance, and improve both governmental and public oversight of compliance with land development laws and regulations.

1. Research KRS statutes to determine tools that can be used for increased enforcement.

Section 4.2.4.11 Public Education & Engagement about Sustainable & Responsible Land Use

Any meaningful achievement in the minimization or mitigation of local contributions to climate change will require widespread public support and engagement, as well as substantial changes in individual, institutional, and social behaviors. Lasting policy changes and cultural changes occur only with public engagement, deliberation, and understanding. The legitimacy of land use planning and regulation in democracies is premised on broad, deep, and meaningful opportunities for public participation and deliberation. A necessary (yet insufficient) element of change in land use practices requires widespread public and stakeholder knowledge about the impacts of our land use practices on our environment and methods of avoiding, minimizing, or mitigating these impacts.

Recommendation 11:

Develop public education and engagement programs about sustainable and responsible land use, the impacts of our land use practices on our environment (especially climate change), and methods of avoiding, minimizing, or mitigating these impacts. Develop specific programs for land developers, the construction industry, other real estate professionals, land use planners, homeowners, businesses, landscape architects, vegetation/food growers, and others. Increase the quantity and quality of public participation in – and thoughtful deliberation about – land use planning, policy, and practices.

1. Include education about climate change in community outreach efforts undertaken for long-range planning programs and development review processes.
2. Explicitly recognize and discuss climate impact and considerations in public review and participation process related to comprehensive plans, regional plans, and development review processes.
3. Develop an educational program to help the Planning Commission, Planning staff, Board of Zoning Adjustments (BOZA), Metro Council, and other agencies to address climate change in ways that are appropriate and successful in diverse local settings.
4. Louisville Metro should adopt a strong, dynamic, well-funded campaign to educate the public about the many environmental and community-enhancing values of trees (including reduction of mitigation of the area's carbon footprint), methods of maintaining existing trees, the need for replacing trees lost to disease, storm events, and the like, methods of tree replacement (including identification of native trees). A Louisville Urban Forest website should be developed, public workshops and presentations should be organized, school curriculum should be developed and implemented at area schools, information tables and booths should be included at various public events, and brochures should be printed and disseminated. These educational tools should include: a) URLs of/links to Kentucky Division of Forestry website information on best practices for planting and maintaining trees and other helpful websites; b) information on research, education, and public events involving neighborhood tree planting, maintenance, and enjoyment; c) lists of native trees and shrubs for planting by the public and developers; d) lists of non-native trees and shrubs that should be avoided because of their especially harmful impact on local vegetation and/or biodiversity; e) cautions about mail-order tree purchases; and f) a list of local nurseries (and in surrounding counties) where owners are committed to non-GM vegetation and trees. This urban tree public education campaign should be expressly linked to public education campaigns about the roles of trees, native vegetation, and rain gardens in minimizing and mitigating stormwater runoff.
5. [Use the Center for Neighborhood Technology's H+T Affordability Index, a web-based interactive mapping tool that measures housing affordability by accounting for both housing and transportation costs. Map the entire Louisville Metro area using this new tool.]

6. Increase the use of and support (financial, staff, political) for community-based assessments and planning for neighborhoods and special areas. Environmental assessments and environmental planning should be included in community-based efforts.

7. Use a variety of methods to enhance public participation and engagement, including:

- Physical tours of communities
- Visual surveys presented through PowerPoint or other electronic display, an Internet page, or photographs
- Surveys of community residents, as well as business owners, operators, and employees and other major stakeholders
- Community or neighborhood visioning exercises with a diverse range of community residents; visioning should identify important community values and goals
- Planning and design charrettes with community residents
- Interactive games, map-drawing exercises, picture-drawing exercises, and other similar activities with community residents
- Focus groups for identifying and discussing particular issues
- Advisory boards and task forces from the community
- Multi-stakeholder, collaborative, problem-solving groups or task forces, using negotiation and/or mediation techniques to address particular problems or conflicts
- Open “conversations” among community residents, government officials, and industry and business representatives to share in an unstructured way their respective interests and concerns; establish ground rules to focus the dialogue on sharing concerns rather than making accusations or assessing blame
- Metro Council, Planning Commission, and BOZA meeting procedures, times, locations, and general policies that encourage, rather than discourage, broad public participation on land use matters
- Accessible opportunities for community members to comment on drafts of plans, proposed zoning, project/permit applications, and environmental impact assessments through written comments, e-mail comments, phone messages, and oral comments at advertised public meetings
- Continued and enhanced use of a “planning academy” to provide information and training to community residents on planning and land-use regulatory issues
- Geographic information systems (GIS) for presenting information about existing conditions and proposed plans, and to engage community residents in neighborhood visioning and planning, including simulation and modeling of various scenarios created with community input
- Broadly disseminated land use and planning information, including through public workshops, newsletters, postal mailings, notices distributed in utility bills or at public schools, a speaker’s bureau, radio and television broadcasts, electronic mailings, Internet websites, and similar computer-based information networks
- Community meetings in neighborhoods to both share information and listen to concerns
- Communitywide planning input drop-by sessions at a central location (e.g., a sports arena, shopping mall, high school, major park, library, local fair, etc.), where residents can conveniently stop to register input on proposed plans or alternatives presented on displays through visual preference surveys (and perhaps also pick up a free hot dog or donut—food has a way of facilitating participation)
- A general community suggestion or community input system (e.g., mail box, e-mail address, Internet site, etc.) that allows public input on problems, issues, and ideas not currently on a decision-making body’s agenda.