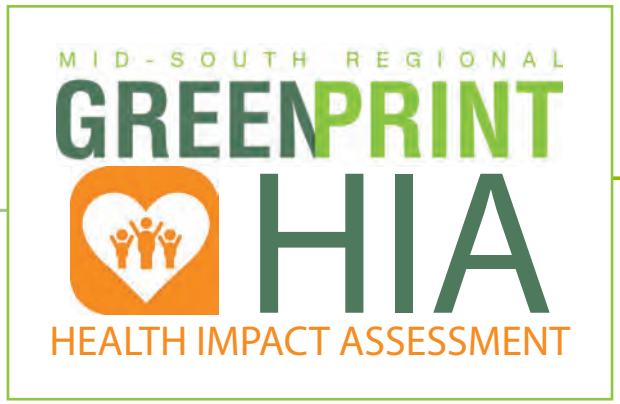

Mid-South Regional Greenprint Health Impact Assessment: Final Report

Prepared for the Memphis and Shelby County
Office of Sustainability on behalf of
the Mid-South Regional Greenprint Consortium
by the Georgia Health Policy Center

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CONNECTING COMMUNITIES FOR OUR FUTURE

Authors from the Georgia Health Policy Center in the Andrew Young School of Policy Studies at Georgia State University

James E. Dills, MUP MPH

Jamila M. Porter, MPH

Michelle J. M. Rushing, MPH

Elizabeth J. Fuller, DrPH

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Greenprint HIA Advisory Committee

Shunji Brown-Woods
Director, Coordinated School Health
Shelby County Schools

Fayre Crossley
Director of The Grant Center
Alliance for Nonprofit Excellence

Rita Harris
Regional Organizer
Sierra Club Environmental Justice Program

Jason Hodges
Community Health Planner
Shelby County Health Department

Shelly Johnstone
Director of Community Development (Retired)
City of Hernando, MS

Cynthia Magallon Puljic
Group Vice President
YMCA of Memphis & the Mid-South

Cathy Marcinko
Grant Development Coordinator
Le Bonheur Community Health & Well-Being

Gia Matheny
Director of Community Development
City of Hernando, MS

Larry Smith
Supervisor, Air Quality Improvement Branch
Shelby County Health Department

Jonathan Spencer
Design Intern
Memphis Regional Design Center

Ramona Taylor
City Councilor
City of West Memphis, AR
and
Director of Development
Crittenden Regional Hospital

Rick Thomas
Partner and Vice President
Medical Services Research Group/Health Management Associates

Andrew Trippel
Planner
Looney Ricks Kiss, Inc.

Jimmie Tucker
Managing Principal
Self+Tucker Architects

Tara Wohlgemuth
Mid South Parks and Greenways Coordinator

John Zeanah
Program Manager, Mid-South Regional Greenprint
Memphis and Shelby County Office of Sustainability

Alta Planning + Design and TRUST Marketing

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Executive Summary

Introduction and Purpose

The purpose of this document is to provide the Mid-South Regional Greenprint Consortium and the larger Mid-South community with recommendations for ensuring that the final Greenprint Plan has the greatest positive impact on public health throughout the region.

What is Health Impact Assessment?

HIA is a process for ensuring that plans and policies support healthy communities. HIA is typically used to enhance policies in non-health sectors, such as parks and recreation, transportation and land use planning, and economic and community development. HIA has evolved from the awareness that many projects, policies, and initiatives that have no explicit health goals still impact public health, and as such, decisions regarding these actions should be informed about these potential health impacts in a constructive and actionable way.

Within the context of the Mid-South Regional Greenprint Plan, this HIA is being conducted in order to achieve the Community Health and Wellness working group's strategic vision of ensuring that the Greenprint contributes to a region of healthy and safe communities. Specifically, this HIA furthers the implementation of Action 4.1.3, as defined in the Greenprint Vision Plan: "Advocate for the inclusion of Health Impact Assessments (HIA) and Health in All Policies (HiAP) reviews as part of jurisdictional planning, development and legislative processes."

Overarching Comments and Priority Recommendations

There are three categories that best sum up the ways in which the Greenprint is likely to impact health: building healthy communities, framing parks and trails as existing resources for health, and promoting healthy travel behaviors. These overarching comments bring together information from analysis of each Strategic Direction and present an integrated perspective that is meant to inform implementation. Priority recommendations are then included based on this perspective. The analyses that lead to these recommendations and more information on who may be involved in carrying them out are available in the full report.

Building Healthy Communities

Improving environmental conditions in the Mid-South is a critical function of the Greenprint, but much of the potential for improving public health is actually tied to actions that use green infrastructure as a catalyst for creating stronger communities throughout the region. The Greenprint is about more than parks, trails, and sustainable ecosystems: it is about creating contexts for healthy behaviors within the region's communities. These behaviors can range from simply being exposed to trees and greenery on a daily basis to having the ability to easily access employment and educational opportunities. The Greenprint Consortium should be viewed as an opportunity to foster collaboration that ensures future projects are designed

and implemented in ways that maximize the benefits of sustaining healthy populations and environments. This HIA is meant as an early step toward that broader goal.

Perhaps one of the best ways to ensure healthy outcomes in the context of Greenprint implementation is through robust community involvement, especially from communities that have high numbers of vulnerable subpopulations from a public health standpoint. These subpopulations include the young, the elderly, persons in poverty, the linguistically isolated, and other groups that may not traditionally be involved in shaping the decisions that impact their communities. The more that communities are involved in these decisions, the more likely that they will take advantage of improvements, and the more likely that they will achieve the potential for benefits to their health.

Parks and Trails as an Existing Resource for Health

While new facilities and enhanced connectivity are attractive options for the long-term future of the Mid-South and will likely lead to a variety of public health improvements over the span of decades, focus on improving existing resources in the short-term should positively impact community health more immediately. This impact will be particularly relevant in communities identified as having higher risk for negative health outcomes, which tend to have access to green space, but not high quality green space. In these areas, it will be important to frame park improvements as part of broader neighborhood improvement to address issues such as fear of crime or other deterrents of park use and more broadly, community revitalization. Promotional and educational programming in these areas focusing on benefits of green space and safe walking and biking habits would also be good short-term strategies that could be leveraged in future improvements.

Promoting Healthy Travel Behaviors

A significant portion of community health benefits is likely to come from potential increases in walking and biking for both recreation and transportation as a result of the strategies contained in the Greenprint. Developing an interconnected network of trails and other infrastructure for these active modes will not only facilitate recreational use, but it will also allow for greater use of these means as regular forms of travel. When people begin to choose walking or biking over car travel for daily trips, the greatest long-term benefits for health occur. These health benefits are only achievable if the facilities envisioned in the Greenprint are successful in changing travel behavior of individuals over time. For this to happen, there needs to be consideration given to contextual factors beyond physical design. Two especially important considerations within the context of Greenprint implementation are education about safety and access to functional destinations within the network (e.g. trails that connect residential areas to commercial centers).

Priority Recommendations

The following are key recommendations adapted from the analyses of each Strategic Direction presented in the full report. When existing Actions under the Healthy and Safe Communities Strategic Direction (SD4) are particularly relevant for achieving the broader recommendation, they are included for reference.

- **A public involvement plan for the Greenprint should be created to ensure that equity remains a focus throughout implementation.** Having a specific public involvement plan would ensure that communities' voices are heard and incorporated into the long-term actions that the Greenprint Plan sets out. Some Actions under Strategic Directions 2 and 8 address issues of sustained involvement of communities, but there is no suggestion of a specific plan for public involvement.

- **Examine population characteristics near redevelopment sites to determine the specific health concerns of the local community and how addressing underutilized property may impact them.** Where there are existing communities around sites designated for revitalization, engaging those populations to determine their desires and concerns will allow for more local support of the eventual reuse, which would likely increase any positive health impacts. For sites that are not near populated areas, there may be a wider range of potential reuse options; though the surrounding landscape and existing land uses should still be considered as important contexts for the reuse.

- **Use work in existing parks as an opportunity to broaden the discussion beyond the park boundaries to include neighborhood factors** such as vacant land and crime, allowing for a more concrete recognition of how closely the success of park renovation is tied to creating a healthy and safe neighborhood surrounding it. Engaging the community in these discussions will be critical.

- **Develop a coordinated maintenance and safety improvement plan for all existing parks**, rather than park-specific projects. The pilot park(s) under Action 1.2.4 (Create, fund and execute a pilot project to address maintenance and safety issues in one or more underused parks) should be chosen with the ultimate goal of defining this regional strategy.

- **Promote safety in existing parks as a means to potentially increase use of these existing resources for health improvement.** SD4 offers some specific recommendations as actions under Objective 4.3 to promote safe, healthy, and walkable communities. These should be considered priority recommendations in the short term:

    - **4.3.1** Create and organize citizen groups, agencies, and community police to enhance safety in parks, trails and green spaces

    - **4.3.2** Integrate active and passive security measures in parks, trails and green spaces
    - **4.3.3** Incorporate Crime Prevention through Environmental Design (CPTED) design principles in green space planning

- **Pursuit of actions that aim to increase greenery (through landscaping or other means) should be done in the context of other Greenprint strategies that more directly address underlying socioeconomic issues in the region** like employment, education, and housing affordability. Simply increasing the amount of vegetation in an area is unlikely to generate much health improvement in isolation; therefore it is critical to view Actions like 6.1.8 (Increase tree canopy throughout the region…) or 6.4.5 (Encourage changes in policy and covenants to allow for natural landscaping in existing and new development) as pieces of the broader livability goals of the Greenprint. For example, Action 4.3.6 and 4.1.4 under the SD4 will help to foster positive perceptions of greenery in the region, which may lead to more positive effects on mental health:

    - **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organizations
    - **4.1.4** Create and support nature- and place-based youth education and physical fitness programs as a means for improving child health, development, and education

- When defining plans for expanded connectivity for pedestrians and bicyclists, s**trategies to supplement direct routes with less-direct and lower traffic routes within the street network should be considered.** Especially in the case of bicycling, newer users may be more comfortable on streets with less traffic, so identifying parallel or alternative routes, rather than focusing on major auto corridors, may lead to greater health benefits. Commuters tend to prefer more direct routes, which would correspond to auto-centric corridors.

- **Implementing an educational program promoting bicycle and pedestrian safety**, especially among new and/or inexperienced riders and walkers, would likely mitigate any potential increases in injury risk. This recommendation supports the following Action under SD 4:

    - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

- **Incentivize mixed land use and higher densities through economic development tools** and corresponding changes to policy. This might include defined density bonuses for developers who chose to build near intersections of alternative transportation modes (i.e. allowance to build at a higher density because they chose a “healthy”

location). Other incentives may involve commitments to help expand or maintain trails near development, creation of location or design-based tax incentives, and targeted recruitment of businesses that support the use of alternative transportation.

- **Strategies to promote positive attitudes toward walking should be implemented in tandem with policies that could lead to supportive changes in the built environment, like mixed-use development.** Some of the SD4 Actions help to address this:
    - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups
    - **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organizations

- **Ensure pedestrian-oriented design** in mixed use and mixed income communities to enhance the benefit of having a mix of uses. To further enhance the potential for these communities to benefit from proximity to green infrastructure, also incorporate bicycle facilities into designs.

- **Ensure that areas in and around employment and education centers are developed to include a variety of land uses (such as residential and commercial) and densities high enough to facilitate alternatives to driving** as viable transportation modes in an integrated network. Connectivity can only be successful in the context of destinations, so encouraging a variety of other residential and commercial uses to be co-located with employment and education centers will increase the likelihood of people utilizing active forms of transportation (including transit), which would likely lead to improvements in health.

Strategic Directions and Potential Health Impacts

The table presented below provides a brief summary of each Greenprint Strategic Direction and its connection to creating healthy communities. The full report contains more information about baseline conditions in the Mid-South and analyses of one or two specific Actions under each Direction.

Summary of Greenprint Strategic Directors, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 1: A Regional Interconnected Network of Parks, Greenways and Open Spaces	• Improve access and use of existing parks and greenways • Expand and connect green assets including parks, greenways, and linkages • Protect and enhance natural corridors for people and animals	Actions taken to achieve these goals are likely to have long term positive effects on community health through increases in use of green infrastructure. The strongest positive influence will occur if people who currently do not visit these spaces often begin using them regularly.
Strategic Direction 2: Increased Equitable Participation and Community Ownership	• Engage and include a diverse group of individuals, groups, and communities from across the region • Connect regional communities to build relationships and bring down barriers • Buy-in from all communities in region • Develop capacity of social equity partners to stay involved through plan implementation	Engaging the broadest range of individuals in planning and implementation of the Greenprint will ensure maximum positive public health impact by increasing both community ownership and use of facilities, precipitating many of the health impacts discussed throughout this assessment. Having this broad engagement, especially from vulnerable populations, will also increase the likelihood of the Greenprint Actions reducing health disparities in the long term.

Summary of Greenprint Strategic Directors, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 3: Enhanced Access through Transportation Choices	• Increase transportation choices and modal connections • Connect people to jobs, schools, goods and services, and natural areas • Link communities and neighborhoods across the region • Improve the impact of the transportation system on the built environment, natural environment, and regional quality of life	Actions taken to achieve these goals are likely to have positive long term health effects for the Mid-South community; however, these impacts will likely vary based on the sub-populations considered. People most likely to see health benefits are those who chose to switch from driving to regular use of alternative transportation modes (i.e., walking, biking, and/or transit) within this enhanced system. There will also be potentially positive health effects for people who already utilize these modes regularly, as well as for some drivers in the region, though the impact may be smaller in magnitude. Any improvements in environmental health as a result of changes in the transportation system would likely be evenly spread across the region.
Strategic Direction 4: Healthy and Safe Communities	• Develop and promote a comprehensive concept of community health and wellness • Assess and promote health impacts of green infrastructure on residents and communities • Promote healthy, safe, and walkable communities • Enhance regional quality of life for all residents and communities	Achieving these goals will have both direct and indirect impacts on population health in the region. Direct impacts will come from emphasizing healthy behaviors through education and advocacy; while the indirect impacts will occur by integrating health perspectives into decision-making processes and collaborations where it may not typically be included, as recommended throughout this HIA.

Summary of Greenprint Strategic Directors, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 5: Improved Neighborhoods and Fair Housing Choices	• Build on existing assets at the neighborhood level • Increase affordable, location-efficient, and fair housing choices • Ensure access to green space from every neighborhood in the region • Implementation of the plan in an equitable way that ensures resources are distributed fairly across the region	Actions taken to achieve these goals are likely to have long term effects on the health of the region and more immediately on the areas that are targeted by these actions. There is great opportunity to use these objectives to improve the housing situation of some of the most vulnerable populations in the region; though this effort may need to be contextualized within broader efforts to promote mixed-use development in the region. The strongest positive influence on community health will likely occur when activities target existing communities where disparities in health are most evident.
Strategic Direction 6: Sustainable Resources and a Quality Environment	• Conserve and protect natural resources (air, water, and land) and biodiversity • Convert vacant lands and brownfields into productive green assets • Promote sustainable agricultural and watershed management policies and practices • Promote and protect biodiversity and wildlife habitat	Improvements to the environment brought about by Actions to achieve these goals will likely lead to improvements in community health status through impacts on environmental determinants such as air and water quality. The magnitude of these impacts is likely to be small in comparison to other Strategic Directions because of the nature of environmental quality determinants. These impacts will accrue relatively equally across the population, with vulnerable populations potentially experiencing the greatest benefit. Environmental improvement also includes addressing more visible aspects like litter and trash removal, which will have bearing on people's perceptions of green space as safe and/or useable. Actions that focus at this level (similar to those explored under Strategic Direction 1) may lead to more proximal improvements to health through promoting physical activity and exposure to nature.

Summary of Greenprint Strategic Directors, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 7: A Productive Workforce and Economy	• Empower individuals to improve economic outcomes • Increase and enhance regional employment opportunities, and • Support neighborhood-level economic development	Actions taken to achieve these goals are likely to have long term effects on the health of the community; though these effects could be unevenly distributed throughout the region. The strongest positive influence on community health will likely occur when activities target low income areas and/or areas with high unemployment.
Strategic Direction 8: Effective Long-term Regional Planning	• Build capacity for long-term participation in the public planning process • Form or utilize an organization that can sustain the goals of the Mid-South Regional Greenprint Consortium • Establish a system to maintain shared data resources long-term • Incorporate social equity in the public planning process across the region	Actions to accomplish these goals are not likely to have a direct impact on population health in the short-term, but they will have positive effects in the long-term, as long as public health perspectives are consistently included in future planning and data activities.

Conclusions and Lessons Learned

Conducting this HIA as part of the Mid-South Greenprint provided decision makers, stakeholders, and community members an opportunity to reflect on the public health implications of green infrastructure planning in the region. The Greenprint Consortium had already taken important steps in this direction by including a Working Group and Strategic Direction focused on community health and wellness early in the process. The inclusion of HIA as one of this Working Group's key actions leveraged their initial involvement into the current opportunity to more consistently apply a public health lens to the broad range of decisions and actions outlined by the Greenprint Vision and Plan.

One of the most apparent and overarching lessons learned from this HIA is that collaborative execution of Greenprint Actions and Objectives is critical for success. From an HIA perspective, this collaborative execution is necessary to maximize the potential for improvement of community health within the Greenprint context. As detailed in this report, the Community Health and Wellness Working Group should continue to promote its work to improve public health as an integral piece of the other Working Groups' efforts and to seek out opportunities for collaboration and information sharing in the future. The other Working Groups should also begin to more consistently consider the integration of public health perspectives into their ongoing work, especially in the arenas of Social Equity and Long Term Planning.

The regional scale and inclusive nature of the Greenprint process presented both opportunities and challenges for HIA. An overriding theme of this assessment is that the Greenprint Plan will impact a wide variety of health determinants throughout the region, and by influencing these determinants, it has great potential to positively impact public health outcomes over time. Fully characterizing and addressing these influences requires sustained collaboration, both within the public health sector and with professionals from other sectors involved with the Greenprint.

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Introduction

The purpose of this document is to provide the Mid-South Regional Greenprint Consortium and the larger Mid-South community with recommendations for ensuring that the final Greenprint Plan has the greatest positive impact on public health throughout the region.

This introductory section includes information on Health Impact Assessment (HIA) generally, a brief note on healthy communities and the Greenprint vision, and an outline of the Greenprint Strategic Directions that guide the organization of the remainder of this report.

This final report builds on content from the *Mid-South Regional Greenprint Health Impact Assessment: Preliminary Report of Baseline Conditions* originally compiled in October 2013.[1] The preliminary report is referenced throughout this document and can be found on the Greenprint Website here: http://www.midsouthgreenprint.org/hia/

What is Health Impact Assessment?

The As the connections between public decisions, health, and community wellbeing have become more apparent, Health Impact Assessment, or HIA, has emerged as an increasingly popular tool for informing decision-makers (and communities) about these connections. The National Research Council defines HIA as "a systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program, or project on the health of a population and the distribution of those effects within the population. HIA provides recommendations on monitoring and managing those effects."[2]

HIA is an effective process for ensuring that plans and policies support healthy communities. HIA is typically used to enhance policies in non-health sectors, such as parks and recreation, transportation and land use planning, and economic and community development. HIA has evolved from the awareness that many projects, policies, and initiatives which have no explicit health goals nonetheless impact the health of the population, and as such, decisions regarding these actions should be informed about these potential health impacts in a constructive and actionable way.

Within the context of the Mid-South Regional Greenprint Plan, this HIA is being conducted in order to achieve the Community Health and Wellness working group's strategic vision of ensuring that the Greenprint contributes to a region of healthy and safe communities. Specifically, this HIA furthers the implementation of Action 4.1.3, as defined in the Greenprint Vision Plan: "Advocate for the inclusion of Health Impact Assessments (HIA) and Health in All Policies (HiAP) reviews as part of jurisdictional planning, development and legislative processes, as appropriate."[3]

Healthy Communities and the Greenprint Vision

The foundation for this HIA is the concept of a healthy community. This concept moves beyond the idea of health as the absence of disease and considers the concept more broadly to include "a state of complete physical, social and mental well-being."[4] The Community Health and Wellness group has developed the following definition of "health" for the Greenprint:

> *Health is a dynamic process for achieving a state of physical, mental, emotional, intellectual, spiritual and social well-being throughout the lifespan. (Implicit in this definition are assumptions related to supporting conditions, e.g., adequate personal safety, housing security and food security, and adequate access to healthcare and social services.)*

Once these holistic definitions of health are established, defining "healthy community" becomes a broader concept that encompasses a wide range of values and perspectives that may or may not be unique to a particular population in a specific place. For this reason, communities and stakeholders are often consulted in order to provide a local perspective on healthy community. Defining "healthy community" is closely tied to the concepts of "quality of life" and "livability" in many situations.

As the Greenprint Plan is made possible with funding from the US Department of Housing and Urban Development (HUD), consideration of their six "livability principles" provides a good framework from which to begin. These principles are adapted to the context of the Greenprint as follows:

1. **Providing more transportation choices** through increased greenway, multi-modal, bike and pedestrian routes and greater connectivity within and between communities.
2. **Promoting equitable, affordable housing** by improving environmental conditions and amenities for urban neighborhoods adjoining greenways and open spaces, and planning land use and zoning changes to promote affordable housing.
3. **Enhancing economic competitiveness** by improving quality of life in the Mid-South region thereby attracting/retaining businesses and residents.
4. **Supporting existing communities** through providing new or improved greenway and open space amenities and access to economic or employment opportunities connected to greenways and open spaces.
5. **Coordinating policies and leveraging investment** related to greenways and open spaces across the region.
6. **Valuing communities and neighborhoods** by enhancing and providing access to greenway and open space amenities and employment opportunities and improving residential property values.

Participants in a public meeting held for this HIA on July 25, 2013 were asked to define "healthy community" after being presented with the above livability principles. All of their responses are included in the Preliminary Report[1], but common themes include feeling safe, having the ability to achieve one's full potential, and being able to easily access healthy foods, places to be active, and other services. These informal responses mirror a more formalized set of vision statements for the Greenprint Plan,[3] which essentially lays out the framework of "healthy community" for the purposes of this HIA. This vision is for the Greenprint Plan to result in:

- Increased participation and decision-making by traditionally marginalized populations
- Increased access to greenways, bikeways and other modes of alternative transportation or fuels throughout the region, including low-income and minority neighborhoods
- Reduced social and economic disparities for disadvantaged populations in the target region, including gradual reduction in poverty levels and a measurable increase in essential goods and services within low income neighborhoods
- Decreased overall combined housing and transportation costs per household
- Increased proportion of affordable housing units that have high access to quality fresh foods
- Increased proportion of affordable housing located close to walking trails, parks and schools
- Improved public health outcomes that result from creating safer, more walkable neighborhoods.

The Consortium Working Groups, Strategic Directions, and Social Determinants of Health

The Greenprint Consortium is tasked with developing and implementing the actions necessary to achieve the regional vision described above. The Greenprint Vision Plan lays out the Objectives and Actions each Working Group developed based on eight Strategic Directions.[3] While each Working Group has a Strategic Direction that conceptually fits with its primary area of expertise (presented in **Table 1**), it should be noted that many of the directions intersect with the activities of other working groups.

Table 1: The Eight Consortium Working Groups and Associated Strategic Directions	
Working Group	**Strategic Directions**
Parks & Greenways	#1. A Regional Interconnected Network of Parks, Greenways and Open Spaces
Social Equity	#2. Increased Equitable Participation & Community Ownership
Alternative Transportation & Fuels	#3. Enhanced Access & Transportation Choices
Community Health & Wellness	#4. Healthy and Safe Communities
Housing & Neighborhood Land Use	#5. Improved Neighborhoods & Fair Housing Choices
Resource Conservation & Environmental Protection	#6. Sustainable Resources & a Quality Environment
Workforce Development & Regional Employment	#7. A Productive Workforce & Economy
Data Mapping & Evaluation	#8. Effective Long-term Regional Planning

Social Determinants of Health

In its Healthy People 2020 guidance, the US Department of Health and Human Services identifies addressing "social determinants" of health as an important component of population-based strategies to improve the health of the nation. The Greenprint will impact a range of social determinants, and this HIA explains these impacts in more detail. Healthy People 2020 explains the term like this:

"Social determinants of health are conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks. Conditions (e.g., social, economic, and physical) in these various environments and settings (e.g., school, church, workplace, and neighborhood) have been referred to as 'place.' In addition to the more material attributes of 'place,' the patterns of social engagement and sense of security and well-being are also affected by where people live. Resources that enhance quality of life can have a significant influence on population health outcomes. Examples of these resources include safe and affordable housing, access to education, public safety, availability of healthy foods, local emergency/health services, and environments free of life-threatening toxins.

Understanding the relationship between how population groups experience "place" and the impact of 'place' on health is fundamental to the social determinants of health—including both social and physical determinants."[5]

Healthy People 2020 identifies five key areas, or groups, of social determinants of health, illustrated in **Figure 1**. This figure is adapted for this HIA using the iconography of the Greenprint Working Groups and Strategic Directions in **Figure 2**.

Following the next section, which focuses on overarching comments and recommendations, the remainder of this report is organized to sequentially address the health implications of each of the eight Strategic Directions. In each case, specific recommendations are made to help the corresponding Working Group consider the health impacts of their Greenprint Implementation Actions.

Figure 1: The Five Elements of Social Determinants of Health

Source: Healthy People 2020[5]

Figure 2: The Strategic Directions of the Greenprint as a Model for Social Determinants of Health

Overarching Comments & Priority Recommendations

This section presents a high-level perspective on three major ways in which the Greenprint is likely to impact health: building healthy communities, framing parks and trails as existing resources for health, and promoting healthy travel behaviors. These overarching comments bring together information from analysis of each Strategic Direction and present an integrated perspective that is meant to inform implementation. Priority recommendations are included based on this perspective.

Building Healthy Communities

Improving environmental conditions in the Mid-South is a critical function of the Greenprint, but much of the potential for improving public health is actually tied to actions that use green infrastructure as a catalyst for creating stronger communities throughout the region. For example, efforts to promote sustainable watershed management will improve ecosystem health and may reduce human exposure to waterborne pollutants. However, when these watershed management activities are nested within broader smart growth strategies that support affordable housing, higher densities, and mixed use developments clustered near existing activity centers and infrastructure, the opportunities for improved human health become much greater.

The Greenprint is about more than parks, trails, and sustainable ecosystems: it is about creating contexts for healthy behaviors within the region's communities. These behaviors can range from simply being exposed to trees and greenery on a daily basis to having the ability to easily access employment and educational opportunities. Measuring these types of behaviors and their relationships to specific health outcomes at a population level is a complex undertaking. The Greenprint Consortium should be viewed as an opportunity to facilitate collaborations to accomplish this undertaking so that future strategies can be designed in ways that maximize the benefits of sustaining healthy populations and environments. This report is meant as a first step toward that broader goal.

Perhaps one of the best ways to ensure healthy outcomes in the context of Greenprint implementation is through robust community involvement, especially from communities that have high numbers of vulnerable subpopulations from a public health standpoint. These subpopulations include the young, the elderly, persons in poverty, the linguistically isolated, and other groups that may not traditionally be involved in shaping the decisions that impact their communities. The more that communities are involved in these decisions, the more likely that they will take advantage of improvements, and the more likely that they will achieve the potential for benefits to their health. Other HIAs have recommended developing extensive public involvement strategies as part of long term implementation of plans like the Greenprint. The same should be done in the Mid-South.

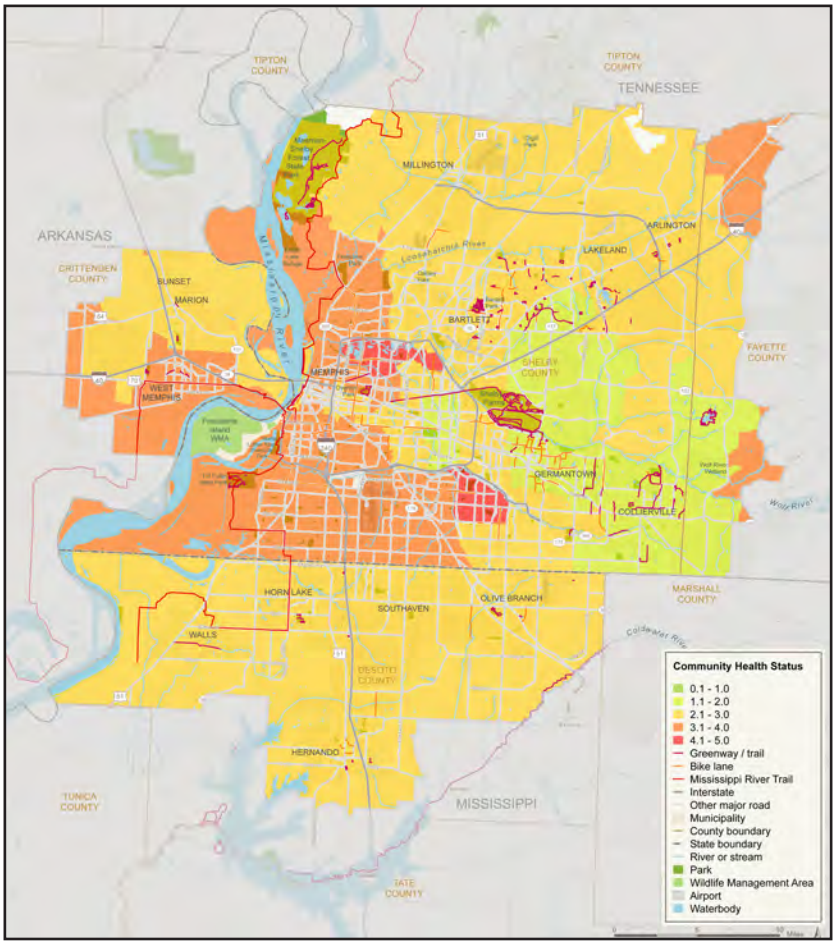
Please see the sections on Strategic Direction 5: Improved Neighborhoods and Fair Housing Choices and Strategic Direction 6: Sustainable Resources and a Quality Environment for more detailed discussions on how the Greenprint can lead to building healthy communities.

Parks and Trails as an Exisiting Resource for Health

While new facilities and enhanced connectivity are attractive options for the long-term future of the Mid-South and will likely lead to a variety of public health improvements over the span of decades, focus on improving existing resources in the short-term should positively impact community health more immediately. This impact will be particularly relevant in communities identified as having higher risk for negative health outcomes (areas in darker shades of orange in **Map 1**), which tend to have access to green space, but not high quality green space. In these areas, it will be important to frame park improvements as part of broader neighborhood improvement to address issues such as fear of crime or other deterrents of park use and more broadly, community revitalization. Promotional and educational programming in these areas focusing on benefits of green space and safe walking and biking habits would also be good short-term strategies that could be leveraged in future improvements.

More detailed evidence and assessment related to parks and trails as an existing resource for health can be found in the section on Strategic Direction 1: A Regional Interconnected Network of Parks, Greenways and Open Spaces.

Map 1: Community Health Status



For a larger version of this map, please see Appendix A.

Promoting Healthy Travel Behaviors

A significant portion of community health benefits is likely to come from potential increases in walking and biking for both recreation and transportation as a result of the strategies contained in the Greenprint. Developing an interconnected network of trails and other infrastructure for these active modes will not only facilitate recreational use, but it will also allow for greater use of these means as regular forms of travel. When people begin to choose walking or biking over car travel for daily trips, the greatest long-term benefits for health occur.

These health benefits are only achievable if the facilities envisioned in the Greenprint are successful in changing travel behavior of individuals over time. For this to happen, there needs to be consideration given to contextual factors beyond physical design. Two especially important considerations within the context of Greenprint implementation are education about safety and access to functional destinations within the network (e.g. trails that connect residential areas to commercial centers).

Use of alternative modes is often tempered by perceptions of safety and is sensitive to social and physical context, which can vary according to neighborhood as well as demographics such as age, gender, racial or ethnic identity, and socio-economic status.[6-8] Therefore, educational programs promoting bicycle and pedestrian safety, as well as education of drivers about their role in promoting safety, would likely mitigate any potential increases in injury risk.

Ensuring that there are desirable destinations to facilitate increased use of walking and biking for both recreation and functional purposes is also an important part of having a successfully interconnected system. Land use and other policies can increase the likelihood of people utilizing these alternative modes regularly. For example, ensuring that employment and education centers are not isolated uses simply connected to the transportation network, but rather become part of an integrated network that includes a variety of land uses (such as residential and commercial) and densities high enough to facilitate alternatives to driving as viable transportation modes. With an increase in use of these modes, there would likely be an increase in physical activity at a population level over time, which in turn, would lead to reductions in many chronic diseases that impact the Mid-South.

To read more about how the Greenprint can help in promoting healthy travel behaviors, please see the section on Strategic Direction 3: Enhanced Access through Transportation Choices.

Priority Recommendations

The following are key recommendations adapted from the analyses of each Strategic Direction presented in the remainder of the full report. When existing Actions under the Healthy and Safe Communities Strategic Direction (SD4) are particularly relevant for achieving the broader recommendation, they are included for reference. Also included are examples of who would likely be involved in implementing these recommendations.

- **A public involvement plan for the Greenprint should be created to ensure that equity remains a focus throughout implementation.** As recommended in other HIAs, having a specific public involvement plan would ensure that communities' voices are heard and incorporated into the long-term actions that the Greenprint Plan sets out. Some Actions under Strategic Directions 2 and 8 address issues of sustained involvement of communities, but there is no suggestion of a specific plan for public involvement.

Who would be involved in making this happen: Member organizations of the Greenprint Consortium (especially those involved with Strategic Direction 2), neighborhood and community-based groups, and Planning Departments.

- **Examine population characteristics near redevelopment sites to determine the specific health concerns of the local community and how addressing underutilized property may impact them.** Where there are existing communities around sites designated for revitalization, engaging those populations to determine their desires and concerns will allow for more local support of the eventual reuse, which would likely increase any positive health impacts. For sites that are not near populated areas, there may be a wider range of potential reuse options; though the surrounding landscape and existing land uses should still be considered as important contexts for the reuse.

Who would be involved in making this happen: Planning Departments, Public Health Agencies, community groups, social services organizations, university partners, and/or local environmental groups. Good examples of local groups engaging in this type of community-based work include the Building Neighborhood Capacity Programs in Frayser and Binghampton, and Christ Community Health Services.

- **Use work in existing parks as an opportunity to broaden the discussion beyond the park boundaries to include neighborhood factors** such as vacant land and crime, allowing for a more concrete recognition of how closely the success of park renovation is tied to creating a healthy and safe neighborhood surrounding it. Engaging the community in these discussions will be critical.

Who would be involved in making this happen: Parks and Recreation Departments, neighborhood councils and watch groups, Police and Public Safety groups, volunteer organizations, Public Health Departments, and school-based groups. The Frayser Neighborhood Council is a good example of an organization looking to broaden the conversation beyond parks to include a neighborhood perspective.

- **Develop a coordinated maintenance and safety improvement plan for all existing parks**, rather than park-specific projects. The pilot park(s) under Action 1.2.4 should be chosen with the ultimate goal of defining this regional strategy.

Who would be involved in making this happen: Parks and Recreation Departments and member organizations of the Greenprint Consortium and Mid-South Greenways Steering Committee in consultation with Police and Public Safety groups.

- **Promote safety in existing parks as a means to potentially increase use of these existing resources for health improvement.** SD4 offers some specific recommendations as actions under Objective 4.3 to promote safe, healthy, and walkable communities. These should be considered priority recommendations in the short term:
    - **4.3.1** Create and organize citizen groups, agencies, and community police to enhance safety in parks, trails and green spaces

Who would be involved in making this happen: Parks and Recreation Departments at county and municipal levels can work in partnership with police departments, volunteer crews for parks (Shelby Farms & Overton Park), and neighborhood watch groups. Good local examples of where this type of activity is taking place include Shelby Farms, Overton Park, and the V&E Greenline.

    - **4.3.2** Integrate active and passive security measures in parks, trails and green spaces
    - **4.3.3** Incorporate Crime Prevention through Environmental Design (CPTED) design principles in green space planning

Who would be involved in making this happen: Parks and Recreation Departments, neighborhood councils and watch groups, and police and public safety groups. The Frayser Neighborhood Council is a good example of the type of group that could collaborate with designers and public safety officials to implement these types of actions.

- **Pursuit of actions that aim to increase greenery (through landscaping or other means) should be done in the context of other Greenprint strategies that more directly address underlying socioeconomic issues in the region** like employment, education, and housing affordability. Simply increasing the amount of vegetation in

an area is unlikely to generate much health improvement in isolation; therefore it is critical to view Actions like 6.1.8 or 6.4.5 as pieces of the broader livability goals of the Greenprint. For example, Action 4.3.6 and 4.1.4 under the SD4 will help to foster positive perceptions of greenery in the region, which may lead to more positive effects on mental health:

- **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organizations

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, member organizations of the Greenprint Consortium, school-based groups, non-profit conservancies. A good local example is the Wolf River Conservation Corps hosted by the Wolf River Conservancy.

- **4.1.4** Create and support nature- and place-based youth education and physical fitness programs as a means for improving child health, development, and education

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, member organizations of the Greenprint Consortium, school-based groups, and/or non-profit conservancies.

- When defining plans for expanded connectivity for pedestrians and bicyclists, s**trategies to supplement direct routes with less-direct and lower traffic routes within the street network should be considered.** Especially in the case of bicycling, newer users may be more comfortable on streets with less traffic, so identifying parallel or alternative routes, rather than focusing on major auto corridors, may lead to greater health benefits. Commuters tend to prefer more direct routes, which would correspond to auto-centric corridors.

Who would be involved in making this happen: Planning Departments, MPOs, Public Works Departments, City Engineers, member organizations of the Greenprint Consortium, community groups, and advocacy groups like Livable Memphis.

- **Implementing an educational program promoting bicycle and pedestrian safety**, especially among new and/or inexperienced riders and walkers, would likely mitigate any potential increases in injury risk. This recommendation supports the following Action under SD 4:

  - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and/or Schools (in combination with Bike Rodeos, Safe Routes to School projects, or other similar activities). A good example of this type of activity is Le Bonheur's "Walk this Way" pedestrian safety class for kids and families.

- **Incentivize mixed land use and higher densities through economic development tools** and corresponding changes to policy. This might include defined density bonuses for developers who chose to build near intersections of alternative transportation modes (i.e. allowance to build at a higher density because they chose a "healthy" location). Other incentives may involve commitments to help expand or maintain trails near development, creation of location or design-based tax incentives, and targeted recruitment of businesses that support the use of alternative transportation.

Who would be involved in making this happen: Economic Development officials, Chambers of Commerce, Planning Departments, and/or Housing Authorities.

- **Strategies to promote positive attitudes toward walking should be implemented in tandem with policies that could lead to supportive changes in the built environment, like mixed-use development.** Some of the Healthy and Safe Community Actions help to address this:
    - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and/or Schools (in combination with Bike Rodeos, Safe Routes to School projects, or other similar activities). A good example of this type of activity is Le Bonheur's "Walk this Way" pedestrian safety class for kids and families.

    - **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organizations

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, member organizations of the Greenprint Consortium, school-based groups, non-profit conservancies. A good local example is the Wolf River Conservation Corps hosted by the Wolf River Conservancy.

- **Ensure pedestrian-oriented design** in mixed use and mixed income communities to enhance the benefit of having a mix of uses. To further enhance the potential for these communities to benefit from proximity to green infrastructure, also incorporate bicycle facilities into designs.

Who would be involved in making this happen: Planning Departments, pedestrian and bicycle coordinators, MPOs, City Engineers, Housing Authorities, neighborhood groups, private sector developers, and affordable housing groups like Habitat for Humanity and United Housing.

- **Ensure that areas in and around employment and education centers are developed to include a variety of land uses (such as residential and commercial) and densities high enough to facilitate alternatives to driving** as viable transportation modes in an integrated network. Connectivity can only be successful in the context of destinations, so encouraging a variety of other residential and commercial uses to be co-located with employment and education centers will increase the likelihood of people utilizing active forms of transportation (including transit), which would likely lead to improvements in health.

Who would be involved in making this happen: Planning Departments, MPOs, land developers. Crosstown is a local example of development that moves in this direction.

Health Impact Assessment by Strategic Direction

This HIA presents each Strategic Direction individually, but it is important to note that the actual impacts on health will arise from all the directions being implemented in concert. A major part of the HIA scoping process was to narrow the analysis to a manageable set of Actions that fall under the broader headings of Strategic Directions. Each section below begins with a broad introduction to the possible health impacts of each Direction based on the goals stated in the Greenprint Vision and a brief background on the relationships between the topic and health. Then a more detailed analysis of potential impacts of a specific Action or Actions is examined.

For most Strategic Directions, the HIA Advisory Committee identified Implementation Actions as specific topics for more in-depth assessment of potential health impacts. This does not imply a lack of health impact for the Actions not selected, but was rather a means to focus the analysis. Similarly, the Committee also selected a "priority health concern" for each Action to further focus the discussions presented below. Being designated as a "priority health concern" within this assessment does not necessarily indicate stronger relationships between the Action and any specific health outcome or that a selected outcome is a greater threat to community health than other outcomes presented in the discussion. Many of the selected Actions will have overlapping impacts on a range of health outcomes and determinants. Therefore, designation as a "priority health concern" within this HIA reflects the collective interest of the HIA Advisory Committee in exploring a specific health issue within the context of a specific Action.

Strategic Direction 1: A Regional Interconnected Network of Parks, Greenways and Open Spaces

Through development of a regional interconnected network of parks, greenways and open spaces, the Greenprint seeks to:

- Improve access and use of existing parks and greenways
- Expand and connect green assets including parks, greenways, and linkages
- Protect and enhance natural corridors for people and animals

Actions taken to achieve these goals are likely to have long term positive effects on community health through increases in use of green infrastructure. The strongest positive influence will occur if people who currently do not visit these spaces often begin using them regularly.

Background

Parks, trails, and other green open spaces are critical pieces of sustainable and livable communities, and many of their benefits can be viewed through a health lens. In a series of briefing papers, the American Planning Association identifies a wide range of benefits associated with parks;[9] a few of their "Key Points" are listed here:

- Physical activity opportunities in parks help to increase fitness and reduce obesity.
- Parks provide people with contact with nature, known to confer certain health benefits and enhance well-being.
- Parks resources can mitigate climate, air, and water pollution impacts on public health.
- Cities need to provide all types of parks, to provide their various citizen groups with a range of health benefits.
- Parks are one of the quickest and most effective ways to build a sense of community and improve quality of life.
- Green residential spaces are gathering places where neighbors form social ties that produce stronger, safer neighborhoods.
- Barren spaces are more frightening to people and are more crime prone than parks landscaped with greenery and open vistas.
- City parks offer children a sense of place, self-identity, and belonging as an antidote to social alienation, vandalism, and violence.

The most common way parks can contribute to health is through the provision of venues for physical activity, which is associated with many positive health outcomes, including reduced obesity, less risk for chronic diseases, and better mental health outcomes.[10] A review of fifty

quantitative research studies on greenspace and physical activity from the US and other countries in 2011 found that two-thirds reported positive associations; though some of these had ambiguous results, pointing to the complexity of the relationship being studied.[11] In a 2010 review of qualitative studies, researchers found similar results and were able to add that perceptions of the social environment (how people interact with one another) are intertwined with perceptions of the physical environment, meaning that physical activity patterns are influenced by more than just the design of green spaces.[12]

Parks are excellent venues for recreational activity, but when they are designed as part of a connected multimodal transportation system with access to destinations in mind, they can also serve utilitarian roles, creating more opportunity for increased physical activity and easier access to certain goods and services, which can improve various health outcomes.[13, 14]

In addition to physical activity benefits, parks and trails offer opportunities for exposure to nature, which can benefit mental health.[15] They also serve as community gathering places, which can lead to a stronger sense of community and improve health through mechanisms related to social capital.[16]

All of these benefits are only achievable if parks and trails are used regularly, and use is often tempered by perceptions of safety.[6, 7, 17] Additionally, use of parks and trails is sensitive to the social and physical context, which can vary according to neighborhood as well as the user's age, gender, racial or ethnic identity, socio-economic status, health status, or other factors.[8]

HIA Target Action for Strategic Direction 1: A Regional Interconnected Network of Parks, Greenways and Open Spaces

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 1 for a more detailed assessment of potential health impacts.

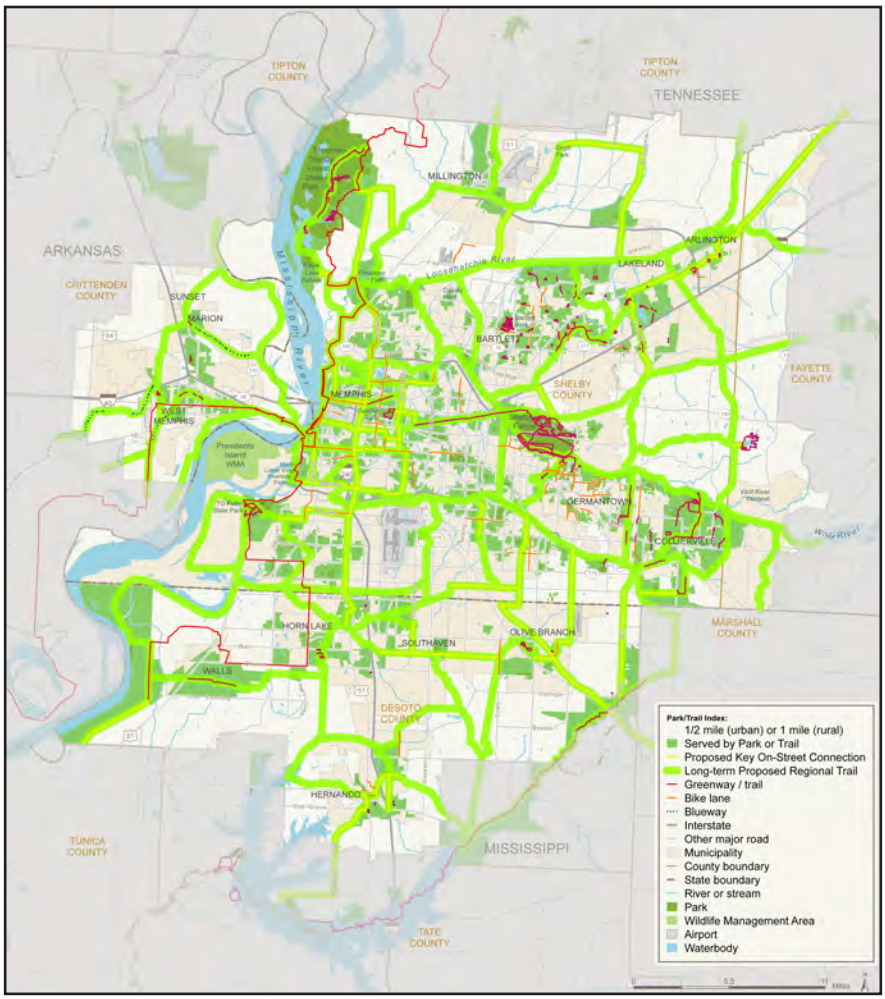
Objective 1.2: Improve the access and use of existing parks and green space for the benefit of people and wildlife

Action 1.2.4: Create, fund and execute a pilot project to address maintenance and safety issues in one or more underused parks

As part of the vision for an interconnected system, this objective focuses on existing assets, which are illustrated in **Map 2: Park and Trail Accessibility Index** in various shades of green (the bright green lines are long-term proposed trails). Addressing maintenance and safety issues can potentially improve people's perception of the underused parks selected for a pilot project. With positive changes in perceptions, there would likely be an increase in use. As more people use the parks for various purposes, the community could see improvements in physical activity levels, the social environment, and other health determinants. Achieving these benefits is most likely if people use the parks regularly. The geographic reach of any health improvements depends on whether or not the pilot parks are visited by residents of the surrounding neighborhood(s) or by visitors from across the region.

Map 1: Community Health Status (reproduced below) shows that areas of particular need from a health promotion perspective are in West Memphis, in areas immediately north and south of Downtown Memphis, in an area around the Hickory Hill neighborhood south east of the central city, and in pockets of Fayette County in the eastern edge of the region. Comparing the Community Health Status map to the Parks and Trails Accessibility map shows variable levels of access in the areas of health need, with none standing out as particularly better or worse than other parts of the region, in which 38% of the population currently live within ½ mile of a park.[1] Based on research showing that both quality and quantity of greenspace are important in the positive associations between parks and health,[18] comparison of the two maps suggests that availability of park spaces, or quantity, may not be the primary determinant of park use (or lack thereof) in these areas, and strategies that focus on improving perceptions, or quality, of existing parks in these communities may have greater impact on health than the provision of new facilities.

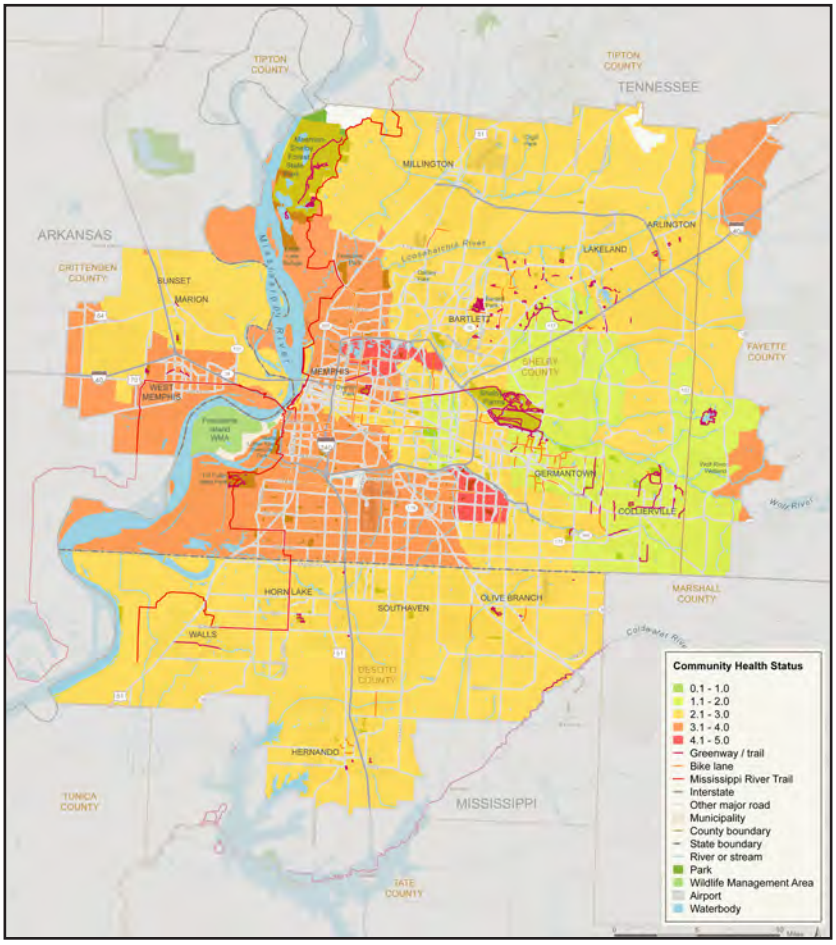
Map 2: Parks and Trail Accessibility Index



For a larger version of this map, please see Appendix A.

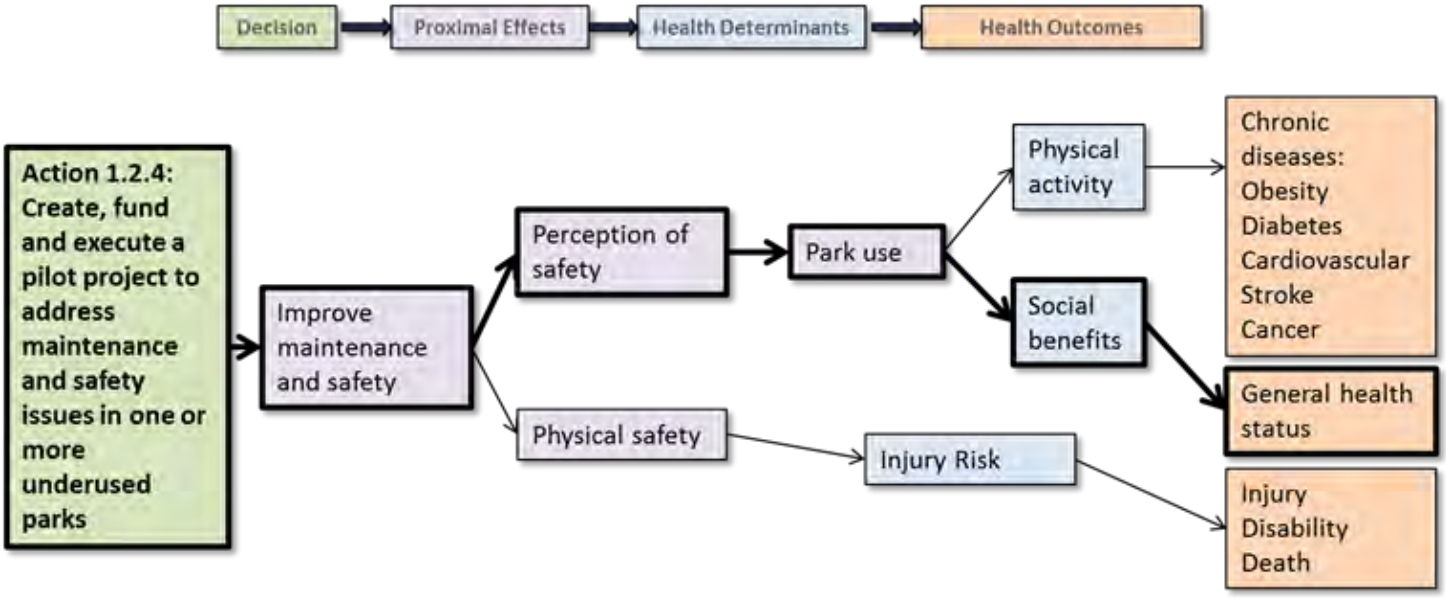
The HIA Advisory Committee identified impacts on general health status through potential changes in the social environment as the priority health concern for assessment of this action. This relationship is identified in bold in **Figure 3**. The impacts of this action on the social environment include changes in perceptions of safety, which can lead to increased use of parks and trails. If the actions are successful in increasing use, there could then be additional benefits in terms of positive social interactions taking place within the parks or on the trails.

Map 1: Community Health Status



For a larger version of this map, please see Appendix A.

Figure 3: Conceptual Pathway for Action 1.2.4 with Priority Pathway in Bold



General Health Status

On self-reported measures of general health status, the Greenprint Region is comparable to the nation as a whole, with roughly 16% of people reporting that they have poor or fair health.[1] However, when objective measures of premature mortality are considered, the region does not fare as well. For example, the rate of Years of Potential Life Lost (YPLL) due to premature death per 100,000 population is 6,851 nationally, and in the Greenprint Region this rate is 9,616, topping out at 13,801 in Crittenden County.[1]

Safety

Numerous HIAs dealing with green space topics from around the US have consistently found safety to be a key factor in characterizing relationships between parks, trails, and health impacts.[19-24] One of these HIAs, from Greenville, SC, summed the relationship up nicely by stating that "a park will not benefit community residents unless they can safely access [and use] it."[23]

The importance of safety, and perceptions thereof, is no less of a concern in the Mid-South. Responses to the public surveys conducted during the Greenprint visioning process provide useful information on perceptions of safety and parks in the region, though the responses may not be entirely representative of the general population or targeted subgroups:[3]

- Roughly half of respondents identified "personal safety concerns" as one of the top three factors that discourages use of parks, trails, and green space
- Nearly one in six respondents identified safety as what they would most like to see improved by the innovative use of greenspace in their neighborhood

- Slightly less than half of respondents identified "improved safety from crime" as one of the top three changes that would most improve their experience of walking, bicycling, and trail use. Nearly one in four identified it as their top change to improve their experience.
- Roughly four of every five people responding indicated that promoting healthy, safe, and walkable communities was "very important" to them. This is one of the objectives under Strategic Direction 4 and was the most highly ranked objective across all Strategic Directions in Public Survey 2.

Interestingly, a survey administered by University of Memphis anthropology students in the neighborhoods around a proposed North Memphis greenline in 2011 found that safety was not a primary concern.[25] A total of 125 surveys were completed, and results revealed that a majority of respondents was not worried about safety. Only six people mentioned it when prompted for additional comments or concerns. While these data are not from a published source, they do shed some light on perspectives within one of the areas noted to have poorer community health status (**Map 1**).

Objective measures of crime in the Mid-South demonstrate that at least some cause for concern; however, it is unclear how these figures might specifically relate to use of parks throughout the region or in targeted locations. Independent of its impact on park use, fear of crime has been linked to poor health and low quality of life, typically through stress-related mechanisms.[26] It should also be noted that objective measures of crime and perceptions of crime do not always correspond to one another, and evidence suggests that perception has the stronger relationship with behavior.[27]

The age-adjusted death rate for homicides from 2006 to 2010 in Shelby County was more than twice the rate for Tennessee and almost three times the US rate.[1] **Table 2: Violent Crime Rates 2011** and **Table 3: Property Crime Rates 2011** display crime rates in select jurisdictions within the Greenprint Region and the United States for violent and property crimes, respectively. Data are from the FBI, Uniform Crime Reports, prepared by the National Archive of Criminal Justice Data for 2011. Violent crime includes murder, non-negligent manslaughter, forcible rape, robbery, and aggravated assault. Property crime includes burglary, larceny-theft, and motor vehicle theft. In both cases West Memphis had by far the highest rate in the region at roughly six times the national rate for violent crime and three and a half times for property crime.

Table 2: Violent Crime Rates (2011)	
Geographic Area	**Violent Crime Rate per 100,000 population**
West Memphis, AR	2325.7
Memphis, TN	1583.5
Millington, TN	866.8
United States	386.3
Southaven, MS	284.7
Collierville, TN	103.7
Germantown, TN	71.4

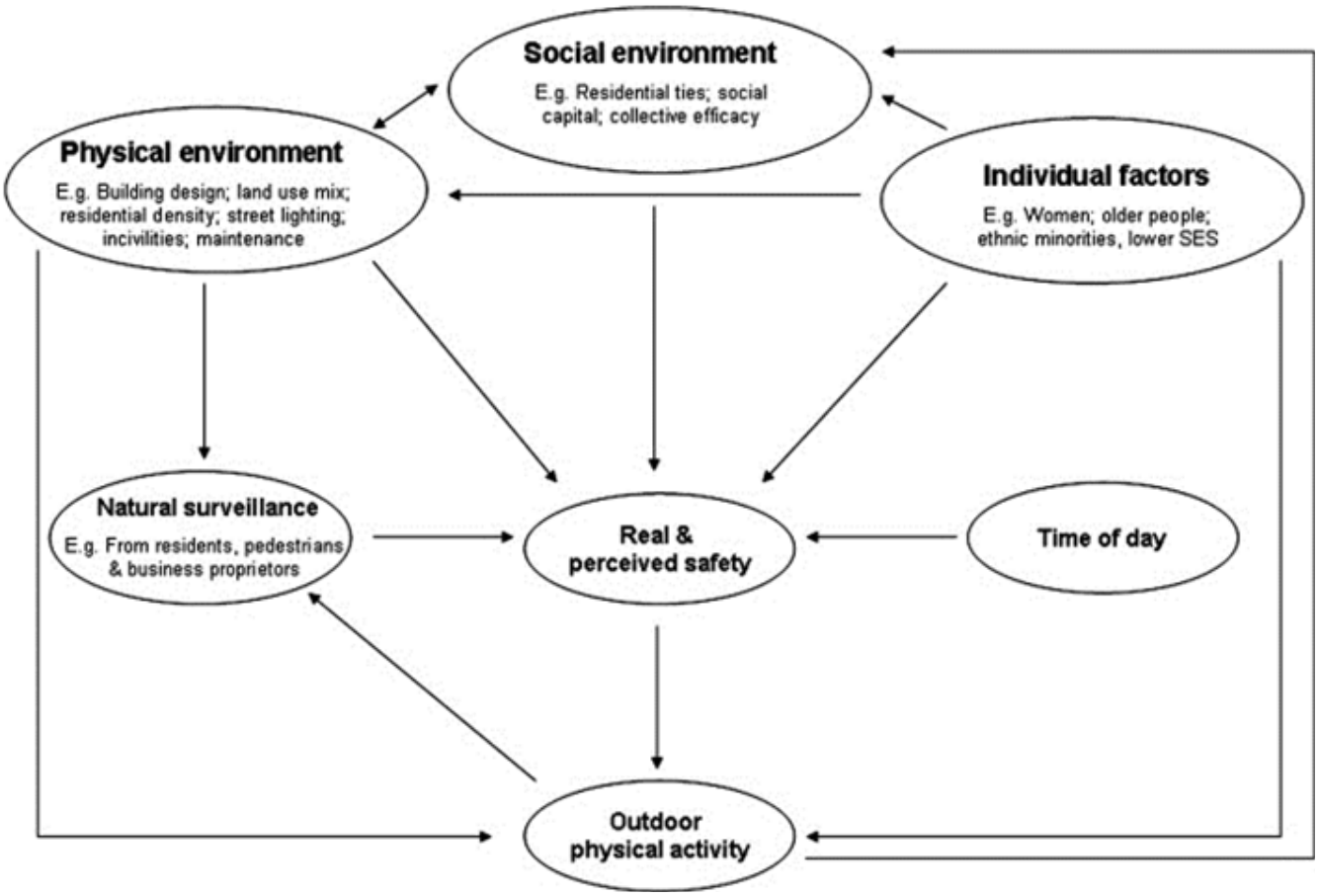
Data Source: FBI

Table 3 : Property Crime Rates (2011)	
Geographic Area	**Property Crime Rate per 100,000 population**
West Memphis, AR	9968.2
Memphis, TN	6489.0
Millington, TN	5395.4
Southaven, MS	3136.2
United States	2908.7
Collierville, TN	1555.4
Germantown, TN	1206.8

Data Source: FBI

Figure 4 below from a 2008 review by Foster and Giles-Corti provides a theoretical framework based on the socio-ecologic model of health for the factors influencing perceptions of safety and physical activity.[27] While the figure is focused specifically on outdoor physical activity, it also provides an appropriate model of the multiple levels of influence to consider in the context of this discussion of Greenprint Action 1.2.4.

Figure 4: Theoretical Framework for Safety and Physical Activity



From Foster and Giles-Corti, 2008[27]

In terms of the physical environment, a review of literature on the relationship between personal safety and urban green spaces conducted in 2012 found that, in addition to individual and social factors, vegetation character, maintenance, and design had strong influence on perceived safety.[26] Vegetation-related aspects identified as being of particular importance included landscape design, possibilities for overview and control (natural surveillance), vegetation density, and vegetation character and maintenance. The review concludes that landscape design with an open character and low density undergrowth might have positive effects on perceived personal safety. Other research has shown that both enclosed spaces and "anonymous and deserted" open spaces are associated with fear of crime.[28]

Crime Prevention through Environmental Design (CPTED) is cited in multiple HIAs as a strategy to address issues of perceived safety in parks and on trails.[22, 23] This concept is also recommended in the Greenprint Vision as Action 4.3.3 under the Healthy and Safe Communities Strategic Direction, as are other safety related actions, which are included for reference below. In preparing the current HIA, no literature was found that directly examined CPTED implementation and park use, but CPTED strategies have proven effective in reducing crime and the fear of crime in multiple settings.[29]

Once designed, maintenance of the physical environment in parks is essential in fostering positive perceptions and use. An HIA of a specific park plan in Omaha, NE found that perceptions of the park as being unsafe were "made worse by inadequate park maintenance," adding that "very little crime is reported within the park compared to the surrounding neighborhood."[19] Implementation of Action 1.2.4 should focus on the maintenance element as an integral part of addressing safety in the pilot park, including strategies to address littering and trash dumping.

Because the purpose of improving an existing park under this action is to increase use by the surrounding community, characteristics of the population in that community are also important to consider. This corresponds to the "Individual Factors" piece of the framework in **Figure 4 (Theoretical Framework for Safety and Physical Activity)**. Continuing with safety as a driving determinant, research identifies high crime rates and negative perceptions of safety as barriers particularly relevant for women and minorities,[27] who, in the Greenprint Region are both more likely to be inactive than men or Whites, respectively.[1] Unsafe conditions have also been shown to be of particular concern among new users of green space facilities.[30] Research on African American populations is somewhat inconsistent in determining specific factors that positively associate with physical activity, both broadly and specifically within parks.[31, 32]

It will be important to actively engage community members in determining strategies for improving parks in ways that address their concerns rather than relying too heavily on existing research from other cities. This is because the local use of parks is driven mostly by local perceptions, which may vary not only from region to region, but also from neighborhood to neighborhood. Evaluating local projects, both existing and planned, will be critical in building evidence within the Mid-South that can be used to continually inform park maintenance and safety strategies.

Social Benefits

If strategies to improve maintenance and safety are successful in increasing use of pilot sites, then there would be more opportunities for social interactions that can lead to stronger communities and improved health. Roughly 1 in 5 people report having inadequate social support in the four Mid-South Counties, which is comparable to the national statistic.[1] In a 2004 study of seven US cities, well-maintained parks were shown to improve communities by increasing neighborhood cohesion, as indicated by greater likelihood of chance interactions with neighbors, greater pride in communities, and more local improvement groups like

neighborhood watch.[33] The social dimension of the relationship between parks and health is difficult to measure and characterize, but it is an important component to consider as both a determinant of use and an outcome (See "Social Environment" in **Figure 4: Theoretical Framework for Safety and Physical Activity**).

Trees and greenery promote social interaction in public spaces,[34] and community gardens have been shown to be particularly effective in this respect.[35] In sum, research indicates that residents of greener neighborhoods, which includes parks, experience less stress and more social cohesion.[18] Increased levels of social cohesion are in turn related to improved health outcomes;[16] though this relationship is complex and difficult to characterize at a population or community level.[36]

Recommendations for Target Action 1.2.4 - Create, fund and execute a pilot project to address maintenance and safety issues in one or more underused parks

- The Healthy and Safe Communities Strategic Direction offers some specific recommendations as actions under Objective 4.3 to promote safe, healthy, and walkable communities. T**hese should be considered priority recommendations in the short term** based on analysis of this Target Action:

    - **4.3.1** - Create and organize citizen groups, agencies, and community police to enhance safety in parks, trails and green spaces

Who would be involved in making this happen: Parks and Recreation Departments at county and municipal levels can work in partnership with police departments, volunteer crews for parks (Shelby Farms & Overton Park), and neighborhood watch groups. Good local examples of where this type of activity is taking place include Shelby Farms, Overton Park, and the V&E Greenline.

    - **4.3.2** - Integrate active and passive security measures in parks, trails and green spaces

    - **4.3.3** - Incorporate Crime Prevention through Environmental Design (CPTED) design principles in green space planning

Who would be involved in making this happen (4.3.2 & 4.3.3): Parks and Recreation Departments, neighborhood councils and watch groups, and police and public safety groups. The Frayser Neighborhood Council is a good example of the type of group that could collaborate with designers and public safety officials to implement these types of actions.

- **Systematically collect data on use and perceptions to define "underused parks"** and to gain evidence to support (or refute) assumption that maintenance and safety issues are leading to the current lack of use in specific areas.

Who would be involved in making this happen: Parks and Recreation Departments, Metropolitan Planning Organizations (MPOs), member organizations from the Greenprint Consortium, non-profit conservancies, and/or local volunteer groups. Examples include the work AmeriCorps is doing with the V&E Greenline and The Wolf River Conservancy's efforts to track use of their facilities. University partners could also be engaged in the collection and analysis of data.

- **Evaluate CPTED design features and their effect on perception and use** of the pilot park(s) to inform future improvements in the region and as a contribution to the literature.

Who would be involved in making this happen: Parks and Recreation Departments and university partners could evaluate CPTED implementation in consultation with Police and Public Safety groups. There could also be a role for the member organizations of the Greenprint Consortium in ensuring any lessons learned are disseminated throughout the region.

- **Develop a coordinated maintenance and safety improvement plan for all existing parks**, rather than park-specific projects. The pilot park(s) under this Action should be chosen with the ultimate goal of defining this regional strategy.

Who would be involved in making this happen: Parks and Recreation Departments and member organizations of the Greenprint Consortium in consultation with Police and Public Safety groups.

- Implementation of Action 1.2.4 should **focus on the maintenance element as an integral part of addressing safety** in the pilot park. This would include ongoing and regular litter pick up by city and/or public-private partnership organizations using volunteers. Police and code enforcement authorities should aggressively enforce existing litter and dumping laws. Special focus should be given to establishing or enhancing programs that involve school-age kids and parents in park clean up.

Who would be involved in making this happen: Parks and Recreation Departments, Police Departments, school-based organizations (e.g. PTAs), Code Enforcement Departments, non-profit conservancies, volunteer groups, and/or faith-based groups. Good local examples include Faith in Action's Memphis Cleanup project, Clean Memphis, and Memphis City Beautiful.

- **Use work in the pilot park(s) as an opportunity to broaden the discussion beyond the park boundaries to include neighborhood factors** such as vacant land and crime, allowing for a more concrete recognition of how closely the success of the park renovation is tied to creating a healthy and safe neighborhood surrounding it. (Adapted from Adams Park HIA in Omaha, NE.19) The process of engaging communities in the pilot(s) to help identify the deterrents of park use also relates to Strategic Direction 2, which focuses on engagement and empowerment.

Who would be involved in making this happen: Parks and Recreation Departments, neighborhood councils and watch groups, Police and Public Safety groups, volunteer organizations, Public Health Departments, and school-based groups. The Frayser Neighborhood Council is a good example of an organization looking to broaden the conversation beyond parks to include a neighborhood perspective.

Other Objectives under this Strategic Direction

The three objectives (and corresponding actions) under the Regional Interconnected Network of Parks, Greenways and Open Spaces Strategic Direction have great potential to impact critical health determinants across the region, such as physical activity and environmental quality. Each will exert this influence differently. **Table 4** includes brief notes for each and their possible relationship to improving health throughout the region.

Table 4: Health Perspectives on A Regional Interconnected Network of Parks, Greenways and Open Spaces Objectives (SD1)

Objective	Comment	Comparative Influence on Population Health
1.1 Expand and improve a network of green space hubs linked by greenways and trails	Expanding and connecting green spaces will allow for increased use for both recreation and potentially transport and could impact health determinants for large portions of the regional population over the long term	High
1.2 Improve the access and use of existing parks and green space for the benefit of people and wildlife	Improvements to the existing infrastructure will have impact on many health determinants in the short term, especially for those living in areas already near parks	High
1.3 Develop a management entity to coordinate development of the green space network	The health impacts of this objective are fairly abstract and would depend heavily on future activities of this entity in respect to the other objectives	Low

Strategic Direction 2: Increased Equitable Participation and Community Ownership

Through increased equitable participation and community ownership, the Greenprint seeks to achieve the following:

- Engage and include a diverse group of individuals, groups, and communities from across the region
- Connect regional communities to build relationships and bring down barriers
- Buy-in from all communities in region
- Develop capacity of social equity partners to stay involved through plan implementation

Engaging the broadest range of individuals in planning and implementation of the Greenprint will ensure maximum positive public health impact by increasing both community ownership and use of facilities, precipitating many of the health impacts discussed throughout this assessment. Having this broad engagement, especially from vulnerable populations, will also increase the likelihood of the Greenprint Actions reducing health disparities in the long term.

Analysis under this Strategic Direction took place as a part of the other analyses contained within this HIA. This was done because the concepts of equity and participation should be considered throughout the Greenprint planning process and not necessarily isolated as a singular element from a health perspective. Similar to the discussion of Strategic Direction 8: Effective Long-term Regional Planning, the Advisory Committee felt that the concepts involved here were pervasive and addressed in the content from other sections. As such, much of the information below is adapted from other sections of the HIA, but it is collated here to provide consistent form to this report.

Background

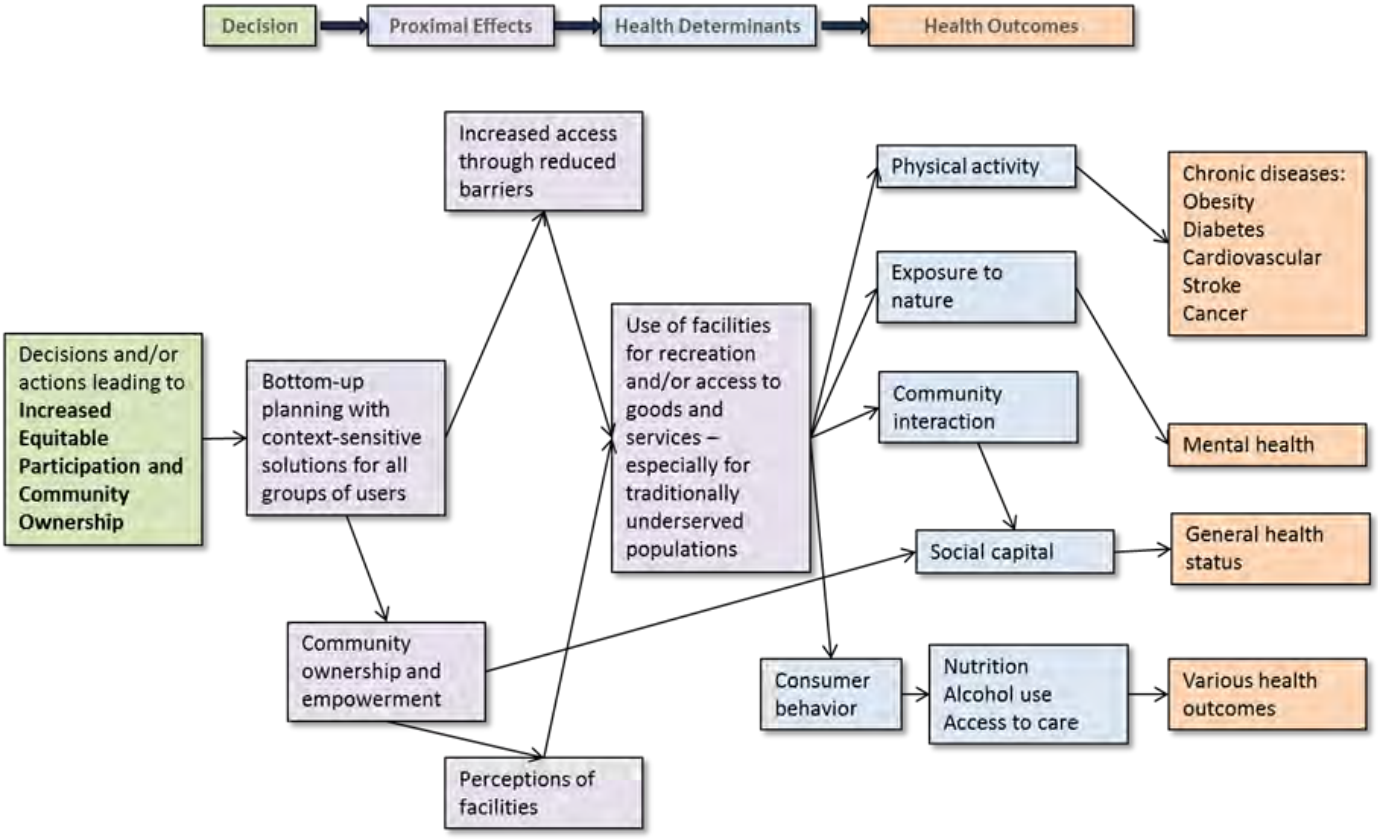
Two statements stand out in the Greenprint Vision as particularly relevant for a discussion of how this Strategic Direction relates to the framework of "healthy community" addressed earlier:[3]

- Increased participation and decision-making by traditionally marginalized populations
- Reduced social and economic disparities for disadvantaged populations in the target region, including gradual reduction in poverty levels and a measurable increase in essential goods and services within low income neighborhoods

The ability of communities to participate in the decisions that affect them is an integral aspect of a healthy community.[37, 38] While much of the health benefit derived from green infrastructure is related to its use, there is also value in the community ownership that can arise from having an equitable planning process that fully addresses the community's needs and concerns. The

social capital that can result from this type of process can lead to health benefits independent of the projects being considered, but those projects will also be more likely to be used by the local community when their voices are heard during the planning process and they perceive the projects as their own.[8] Thus having equitable participation in the planning stages can lead to improved access and use by traditionally marginalized population groups. Figure 3 presents a conceptual pathway connecting this Strategic Direction to potential health outcomes. Equitable participation also requires intentional efforts to break down barriers to participation, including barriers of language, education, age, and physical ability.

Figure 5: Pathway for Strategic Direction 2: Equitable Participation and Community Ownership



Health disparities often follow from social and economic disparities. Acknowledging and addressing this situation is critical in fostering an ability to use the Greenprint Actions to reduce some of the inequities that lead, in part, to notable health disparities. More information is available on disaprities in the Preliminary Report,[1] but **Table 5** illustrates that in comparison to the White population, Blacks in the Greenprint Region are roughly twice as likely to not graduate from high school and over 3.5 times as likely to be in poverty, disparities that are more severe than national comparisons. However, for health outcomes like heart disease and stroke mortality, the disparity in the region is more in line with national statistics; though Blacks are still more likely to die from either outcome than Whites. It is important to note that the same disparities do not exist for all outcomes; for example, Blacks are much less likely to die from suicide than Whites within the region and within the US.

Perspectives from Target Action Analyses

Table 6 displays a summary of potential strategies for incorporating equitable participation and community ownership into each of the Target Actions explored in this HIA. Many of these strategies could easily be adapted for use with other Greenprint Actions across all the Strategic Directions. The text below represents some key pieces of the assessment of Target Actions that are relevant here.

Table 5: Racial Disparities for Select Indicators, Blacks Compared to Whites (1.0 = Equal distribution of indicator, >1.0 Blacks more likely, <1.0 Blacks less likely)

Indicator	Greenprint Region	United States
No High School Diploma	2.11	1.49
Poverty	3.62	2.23
Heart Disease Mortality	1.27	1.28
Stroke Mortality	1.79	1.45
Suicide	0.38	0.40

From Strategic Direction 1: A Regional Interconnected Network of Parks, Greenways, and Open Spaces

Behaviors that the Greenprint hopes to foster that may lead to improved community health may manifest differently in different subpopulations. For example, in addition to physical contexts, use of parks and trails is also sensitive to the social environment individuals experience, which can vary according to neighborhood as well as the user's age, gender, racial or ethnic identity, socio-economic status, health status, or other factors.[8] Considering safety as a driving determinant of use, research identifies high crime rates and negative perceptions of safety as barriers particularly relevant for women and minorities,[27] who, in the Greenprint Region are both more likely to be inactive than men or Whites, respectively.[1] Unsafe conditions have also

been shown to be of particular concern among new users of green space facilities.[30] Research on African American populations is somewhat inconsistent in determining specific factors that positively associate with physical activity, both broadly and specifically within parks.[31, 32]

From Strategic Direction 3: Enhanced Access through Transportation Choices

While people appear to desire quality connections, there may also be a bias that improving transit is more important for lower income populations. While it is true that lower income groups are more likely to be dependent on transit, part of implementing the Greenprint should be promoting the message that improved transit can have positive effects for all income groups in the region. It is also important to note that the purpose of this Strategic Direction is to improve transportation choice, so transit is not the only option to consider. Especially in rural low income areas where transit is not feasible, enhancing access can be difficult. Bike/greenways can play a big role in addressing this issue, as can the Transportation Demand Management (TDM) strategies recommended by the Greenprint Bus Transit to Workplace study.[39]

From Strategic Direction 5: Improved Neighborhoods and Fair Housing Choice

Residential proximity to parks and trails is particularly important in promoting healthy behaviors among youth, who in the Greenprint region are much more likely to spend time watching television than engaging in recommended levels of physical activity.[1, 17]

Action 5.1.4 (Create design standards, incentives, and encourage density in support of mixed-use and mixed-income communities near green infrastructure) supports the conclusions of a regional Fair Housing and Equity Assessment conducted as part of the Mid-South Regional Greenprint and Sustainability Plan.[3] The analysis indicates that a majority of the region lacks inventory of decent, affordable housing options. Numerous other impediments related to lack of capacity, organizational issues, and unfair lending practices demonstrate that equity challenges exist in affordable housing. As recommendations are acted upon, agencies could take advantage of opportunities to link fair housing development to green infrastructure development proposed in the Greenprint Vision Plan. Linking housing development with green infrastructure would likely improve health through a variety of mechanisms, and fair housing and health equity are fundamentally linked.

Supporting mixed-use development may be a strategic way to address issues of affordability and access for lower-income populations and improve health in communities of need. However, doing so may be complicated without strong public support, the lack of which is suggested by the survey responses.[3] Promoting broader health benefits of mixed use strategies may be a way to combat possible negative or ambivalent perceptions in the public regarding housing affordability.

By targeting Action 5.3.2 (Investigate the potential of converting underutilized land to green space in areas that are currently not well served) to communities currently not well served, the Greenprint could potentially help to address health disparities, particularly where assuming areas with poorer access to greenspace are also areas with poorer health status. In a 2013 study of vacant properties in Philadelphia, researchers found that the nearby residents had strong perceptions of how the vacant land negatively impacted their health and were able to offer several solutions to the problem, including conversion to park space or community gardens.[40] That research concluded that local residents should be engaged in the design and implementation of vacant land strategies.

From Strategic Direction 6: Sustainable Resources and a Quality Environment

Focusing on landscape design elements in lower income neighborhoods within the Greenprint region could have subtle effects on the populations' ability to cope with poverty and/or other socioeconomic stressors; however pursuit of Action 6.4.5 (Encourage changes in policy and covenants to allow for natural landscaping in existing and new development) should be done in the context of other Greenprint strategies that more directly address underlying socioeconomic issues in the region like employment, education, and housing affordability. Though associations between vegetation and mental health have been well documented, establishing causality is difficult, and the relationship is likely to be bi-directional.[41] One review points out that because of this ambiguity, "simplistic urban interventions" to increase green landscape design may fail to address underlying determinants.[42] Therefore, this Greenprint Action will have the best chance of improving health if other Actions that address these underlying determinants are also successful.

From Strategic Direction 7: A Productive Workforce and Economy

Positive impacts on general health and well-being at the community level are going to be most likely if increases in employment and education access are experienced by populations that are otherwise disconnected from these opportunities. Research demonstrates that the relationship between health and income is much more prominent at lower ends of the economic spectrum.[43] Therefore, improvements in access to employment and educational opportunities may only have a marginal effect on the health of individuals that are already relatively well off, but the effect in more disadvantaged communities could be substantial.

Table 6: Potential Methods for Incorporating Equitable Participation & Community Ownership by HIA Target Action		
Strategic Direction	**HIA Target Action(s)**	**Potential Methods of Equitable Participation & Community Ownership**
SD1: A Regional Interconnected Network of Parks, Greenways and Open Spaces	Action 1.2.4 Create, fund, and execute a pilot project to address maintenance and safety issues in one or more underused parks	• At least 1-2 parks selected for the pilot project should be located in low-income and/or underserved communities within the Greenprint region • A sample of community members are interviewed to better understand their specific maintenance and safety concerns and if addressing these concerns would increase their use of parks; upon addressing these concerns, updates should be provided to the community to confirm that their voices were heard and their needs were addressed.
SD:3 Enhanced Access through Transportation Choices	Action 3.1.5 Retrofit auto-centric corridors to be more bicycle and pedestrian friendly	• Before beginning retrofits, community members should be engaged to support the identification of corridors most in need of modifications (based on factors such as frequency of use and route location); this process of engagement will help ensure that community members understand, use, and have ownership of specific pedestrian and bicycle modifications.
	Action 3.2.2 Develop policies which encourage higher-density commercial and residential development at intersections of alternative transportation modes	• Proposed policies, before they are formally adopted, should be put forward for public comment for a sufficient period of time to allow community members to review the policies and provide feedback. This process will help ensure that any polices that are adopted are robust, include community input, and do not inadvertently disenfranchise specific community groups.

Table 6: Potential Methods for Incorporating Equitable Participation & Community Ownership by HIA Target Action		
Strategic Direction	**HIA Target Action(s)**	**Potential Methods of Equitable Participation & Community Ownership**
SD 5: Improved Neighborhoods and Fair Housing Choices	Action 5.1.4 Create design standards, incentives, and encourage density in support of mixed-use and mixed-income communities near green infrastructure	• Proposed policies, before they are formally adopted, should be put forward for public comment for a sufficient period of time to allow community members to review the policies and provide feedback. This process will help ensure that any polices that are adopted are robust, include community input, and do not inadvertently disenfranchise specific community groups. • Any proposed policies, incentive programs, or design standards should have special oversight (ideally involving members from impacted communities) to ensure that future mixed-use construction projects: (1) involve minority-owned businesses; (2) include local workers from impacted communities; and (3) minimize potential impacts related to displacement or gentrification.
	Action 5.3.2 Investigate the potential of converting underutilized land (including publicly owned vacant property) to green space in areas that are currently not well served	• Communities in which underutilized land exists should be consulted (e.g., through a series of community meetings or in multiple public forums) to ensure that residents are able to: (1) provide insight into what properties are selected for conversion; and (2) provide input in the type of greenspace that results from a conversion. This engagement will help ensure that the resulting greenspaces are eventually used by community members and residents upon completion.

Table 6: Potential Methods for Incorporating Equitable Participation & Community Ownership by HIA Target Action		
Strategic Direction	**HIA Target Action(s)**	**Potential Methods of Equitable Participation & Community Ownership**
SD:6 Sustainable Resources and a Quality Environment	Action 6.3.1 Determine the potential for reusing brownfields and underutilized properties for low impact development, sustainable agriculture, buffer zones, or alternative energy sources	• Community members should be consulted and engaged in decisions related specific properties will be selected and for what purpose. This is necessary to ensure that communities will take ownership for properties that have new uses, particularly if they will require ongoing maintenance by community members and residents (e.g., community gardens).
	Action 6.4.5 Encourage changes in policy and covenants to allow for natural landscaping in existing and new development	• Any policy changes should be vetted by community members to ensure that any unintended adverse consequences (if any) are minimized.
SD:7 A Productive Workforce and Economy	Action 7.1.1 Develop a multi-modal transportation network that emphasizes connectivity to employment and education centers	• Given the long-term and overarching nature of this Action, significant outreach and engagement will be necessary by a variety of government agencies (e.g., MPOs, public works departments, planning agencies, etc.), major employers, education centers, retailers, and other stakeholders to ensure that residents and employees within impacted communities are aware of ongoing plans to develop multi-modal transportation networks. There should be multiple methods for residents and local employees to be both educated and engaged. Lessons learned should be taken from other cities that have achieved or are engaged in these efforts.

Perspectives from other HIAs

There are lessons learned from other HIAs conducted around the country that can inform Shelby County's effort to increase participation and ownership, especially with some of the traditionally harder to reach populations.

In the Atlanta Beltline HIA, the recommendation was made to develop a 25-year public involvement process that applies strategies to involve representatives of all stakeholder groups.[22] A similar public involvement plan for the Greenprint would help to ensure that equity remains a focus throughout implementation.

In respect to encouraging trail use by senior citizens, a Greenway HIA in Maine made several recommendations. While these strategies were targeted at seniors, they are also likely to make the greenway more useable for everyone. They included: designing facilities that are compliant with the Americans with Disabilities Act (especially near senior housing and other residential areas), paving surfaces, providing ramps where necessary, placing benches at regular intervals, and ensuring safety through adequate lighting and the presence of law enforcement or community watch groups.[44] These concerns may not have been addressed had this perspective not been included in the HIA and planning processes, pointing to the importance of equitable participation strategies for improving health.

Recommendations for equitable use and reduction of social isolation from an HIA of a redevelopment plan in Dane County, Wisconsin included "enhancing street access to pedestrians and people with disabilities," noting that this "improves transportation equity within a community, particularly for people who cannot afford modes of private transport, and rely on walking, cycling and public transport for their transportation needs."[45]

Recommendations for Strategic Direction 2: Equitable Participation and Community Ownership

Several key Actions under this Strategic Direction are especially relevant in promoting a health equity perspective as the Greenprint moves forward:

- **2.1.5 Include traditionally underrepresented people (urban and rural) in future planning and community engagement activities**
  The ability of communities to participate in the decisions that affect them is an integral aspect of a healthy community. Materials should be provided in English and Spanish and community engagement activities should be conducted in both languages when possible. Culturally appropriate outreach should be conducted in order to engage traditionally underrepresented populations in activities.

- **2.2.4 Form a regional equity council to assess ongoing outreach and inform and involve the public of implementation**
  Ongoing effective and appropriate communication with the community is important throughout the process of implementation so that the community feels empowered and involved in the decisions that impact their environment

- **2.3.4 Identify and reduce language, education, transportation, time and technological barriers**
  Materials should be provided at a 3rd grade reading level in English and Spanish. Community engagement activities should be conducted in both languages when possible. Policies that encourage walking and public transit enable low income, disabled, elderly, and youth populations to participate where they may not be able to if private transportation were the only option.

- **2.3.3 Ensure implementation does not displace people, community assets, or community problems**
  Establish policies and programs to prevent displacement. Property tax freezes, assistance for housing improvements and other programs are strategies which have been used to reduce displacement of residents from neighborhoods where property values are rapidly increasing.

Other Relevant Recommendations

- **A public involvement plan for the Greenprint should be created to ensure that equity remains a focus throughout implementation**. As recommended in other HIAs, having a specific public involvement plan would ensure that communities' voices are heard and incorporated into the long-term actions that the Greenprint Plan sets out. Some Actions under Strategic Directions 2 and 8 address issues of sustained involvement of communities, but there is no suggestion of a specific plan for public involvement.

Who would be involved in making this happen: Member organizations of the Greenprint Consortium (especially those involved with Strategic Direction 2), neighborhood and community-based groups, and Planning Departments.

From Target Action 1.2.4 - Create, fund and execute a pilot project to address maintenance and safety issues in one or more underused parks

- **Use work in the pilot park(s) as an opportunity to broaden the discussion beyond the park boundaries to include neighborhood factors** such as vacant land and crime, allowing for a more concrete recognition of how closely the success of the park renovation is tied to creating a healthy and safe neighborhood surrounding it. (Adapted from Adams Park HIA in Omaha, NE.19) The process of engaging communities in the pilot(s) to help identify the deterrents of park use also relates to Strategic Direction 2, which focuses on engagement and empowerment.

Who would be involved in making this happen: Parks and Recreation Departments, neighborhood councils and watch groups, Police and Public Safety groups, volunteer organizations, Public Health Departments, and school-based groups. The Frayser Neighborhood Council is a good example of an organization looking to broaden the conversation beyond parks to include a neighborhood perspective.

From Target Action 5.3.2: Investigate the potential of converting underutilized land (including publicly owned vacant property) to green space in areas that are currently not well served

- **Develop an inventory of underutilized land around the region** and prioritize revitalization based on location, costs, and potential to impact vulnerable populations.

Who would be involved in making this happen: Planning Departments, County Tax Offices, member organizations of the Greenprint Consortium, and/or the Shelby County Land Bank run by the Public Works Division.

- **Consider a variety of uses in collaboration with local communities**. Given the wide range of possible uses for greenspace on converted properties, successfully engaging the nearby communities in the design and development process would likely lead to greater use (and potential health benefit) of the new asset. For example, community

gardens are a particularly attractive option in many cases, but it is important to gauge whether or not this idea is supported by the local community, which may be more inclined to gravitate toward another use.

Who would be involved in making this happen: Planning Departments, member organizations of the Greenprint Consortium, neighborhood and community groups, and individual property owners. Grow Memphis and the Green Leaf Learning Farm run by the non-profit Knowledge Quest are good examples of local organizations participating in this type of work.

- **As properties are revitalized, continue to follow-up with surrounding residents** to determine the impact on their perceptions and activities over time. Tracking this type of information will allow for better targeted uses of resources in the future. It will also give an indication of changes in greenspace needs based on potential changes in demographics (e.g. as the community ages or new residents move into the area, etc.).

Who would be involved in making this happen: University partners, community groups, Planning Departments, Public Health agencies, social service organizations, and/or the Housing Authorities.

From Action 6.3.1: Determine the potential for reusing brownfields and underutilized properties for low impact development, sustainable agriculture, buffer zones, or alternative energy sources

- **Examine population characteristics near sites to determine the specific health concerns of the local community and how addressing underutilized property may impact them.** Where there are existing communities around these sites, engaging those populations to determine their desires and concerns will allow for more local support of the eventual reuse, which would likely increase any positive health impacts. For sites that are not near populated areas, there may be a wider range of potential reuse options; though the surrounding landscape and existing land uses should still be considered as important contexts for the reuse.

Who would be involved in making this happen: Planning Departments, Public Health Agencies, community groups, social services organizations, university partners, and/or local environmental groups. Good examples of local groups engaging in this type of work include the Building Neighborhood Capacity Programs in Frayser and Binghampton, and Christ Community Health Services.

From Target Action 6.4.5: Encourage changes in policy and covenants to allow for natural landscaping in existing and new development

- **Pay special attention to opportunities for improving landscapes in lower income areas.** Landscape design improvements in lower income neighborhoods within the Greenprint region could have subtle effects on the populations' ability to cope with poverty and/or other socioeconomic stressors that lead to poorer health. These subtle effects could accumulate over time and lead to improvements in health outcomes. Success in this area will likely require landscaping components to be part of larger, economically viable investments in these communities. Therefore, the changes to policies and covenants supported by this Action should ensure that natural landscaping is strongly encouraged (if not required) when (re)development occurs in low-income areas.

Who would be involved in making this happen: Planning Departments, developers, and/or the Housing Authorities. Master Gardeners could also be engaged based on their community service requirements for certification.

From Target Action 7.1.1: Develop a multi-modal transportation network that emphasizes connectivity to employment and education centers

- **Focus on extending connectivity to vulnerable populations that could most benefit from better access to existing employment and education centers.** These lower income populations, who are more likely to have limited transportation options, have the greatest potential to capitalize on the health benefits of increased income and education. A network that improves their access to these opportunities throughout the region would be likely lead to the greatest public health improvements.

Who would be involved in making this happen: Planning Departments, MPOs, economic development staff, and/or social service providers.

Objectives under this Strategic Direction

The three objectives (and corresponding actions) under the Increased Equitable Participation and Community Ownership strategic direction have potential to impact health across the region. **Table 7** includes brief notes for each and their possible relationship to improving health throughout the region.

Table 7: Health Perspectives on Increased Equitable Participation and Community Ownership Objectives (SD2

Objective	Comment	Comparative Influence on Population Health
2.1 Engage and include a diverse group of individuals, groups, and communities from across the region through implementation	Including a wide range of people in the implementation process will increase local ownership of green infrastructure and likely increase its use over the long term, which would lead to many of the health benefits noted throughout this document	Medium
2.2 Build a strong culture of effective citizen planning by increasing the capacity of groups and leaders, especially in traditionally underserved communities	Community leaders with improved capacity to advocate for the needs of their communities are more likely to achieve results that lead to local improvements. This is especially relevant for populations considered vulnerable from a health perspective, who are most likely to be underrepresented in public decision making.	Medium
2.3 Ensure equity in implementation priority, site selection and resource allocation	Equitable distribution of green resources throughout the region, with a focus on areas that are currently underserved, will likely increase use across the region, but most importantly from a health perspective will provide new opportunities for populations that have the greatest need.	High

Strategic Direction 3: Enhanced Access through Transportation Choices

To enhance access through transportation choices, the Greenprint seeks to:

- Increase transportation choices and modal connections
- Connect people to jobs, schools, goods and services, and natural areas
- Link communities and neighborhoods across the region
- Improve the impact of the transportation system on the built environment, natural environment, and regional quality of life

Actions taken to achieve these goals are likely to have positive long term health effects for the Mid-South community; however, these impacts will likely vary based on the sub-populations considered. People most likely to see health benefits are those who chose to switch from driving to regular use of alternative transportation modes (i.e., walking, biking, and/or transit) within this enhanced system. There will also be potentially positive health effects for people who already utilize these modes regularly, as well as for some drivers in the region, though the impact may be smaller in magnitude. Any improvements in environmental health as a result of changes in the transportation system would likely be evenly spread across the region.

Background

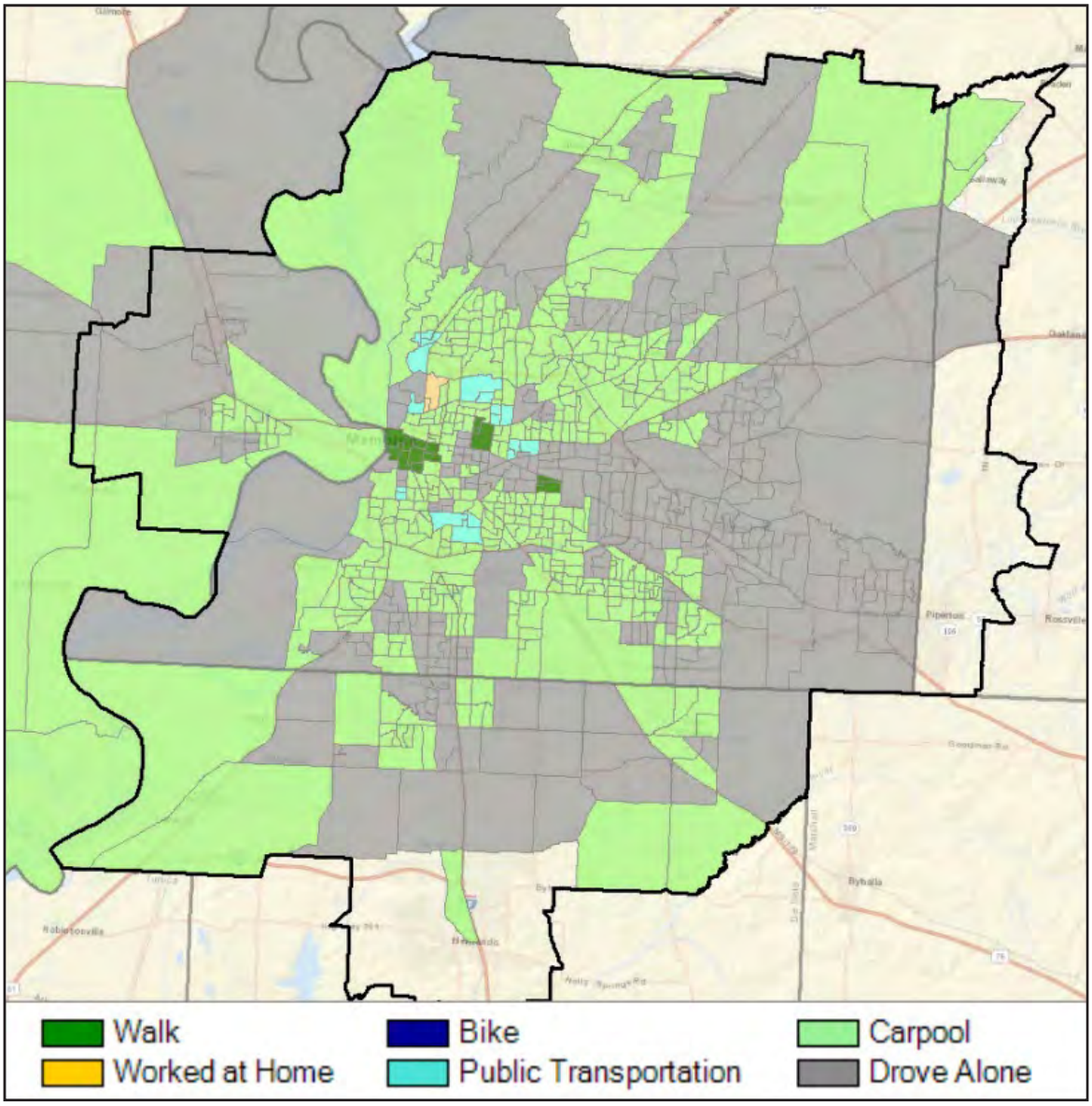
Transportation systems and behaviors have well established links to many health determinants including air quality, injury risk, and physical activity/inactivity.[46, 47] By utilizing green infrastructure to enhance access and transportation choices in the region, the Greenprint has the potential to improve numerous health outcomes such as deaths and disability from transportation-related injuries, asthma and other respiratory diseases, and obesity-related chronic diseases, all of which have been identified as health concerns in the Mid-South (**Table 8: Transportation-Related Health Outcomes**).[1]

Table 8: Transportation-Related Health Outcomes in the Greenprint Region and United States		
Health Outcome	**Greenprint Region**	**United States**
Heart Disease Mortality 2006-2010, Age-Adjusted Death Rate (Per 100,000 Pop.)	181.55	134.65
Stroke Mortality 2006-2010, Age-Adjusted Death Rate (Per 100,000 Pop.)	56.22	41.78
Obesity 2009, Percent of Adults with BMI > 30.0	33.82%	27.35%
Diabetes Prevalence 2009, Percent of Adult Population	11.55%	8.72%
Motor Vehicle Crash Deaths 2006-2010, Age-Adjusted Rate (Per 100,000 Pop.)	16.67	13.04
Asthma Prevalence 2006-2010, Percent of Adult Population	10.66%	13.20%

Greenways, trails, and on street facilities for pedestrians and cyclists provide venues for recreational physical activity and opportunities for exposure to nature, both of which are positively associated with health outcomes.[10, 15] Designing these types of infrastructure as part of an interconnected transportation system can improve access to goods, services, and employment, leading to more use of active transportation for utilitarian purposes, possibly replacing automobile trips, and reducing vehicle miles traveled.[48-50]

Map 3 (Alternative Transportation to Work) shows that there is much room for growth within the region in terms of increasing the use of alternative modes of transportation. An analysis conducted by Alta Planning + Design as part of this HIA and using the same data used to create this map concluded that current levels of bicycling and walking may account for 0.5% and 6.2% of the regional recommended levels of physical activity, respectively. Greenprint actions that address infrastructure for these modes could potentially increase regular use of them within the region, and if that increase reaches the average level seen across the nation, biking and walking could account for up to 4.6% and 12.9% of recommended physical activity in the region. Please see the full report "Physical Activity in the Mid-South from Bicycling and Walking," available as **Appendix B**, for a complete explanation of these figures

Map 3: Alternative Transportation to Work



This map shows primary alternative commuting mode by census block with the stipulation that the alternative share is at least 10% of the total number of commuters.

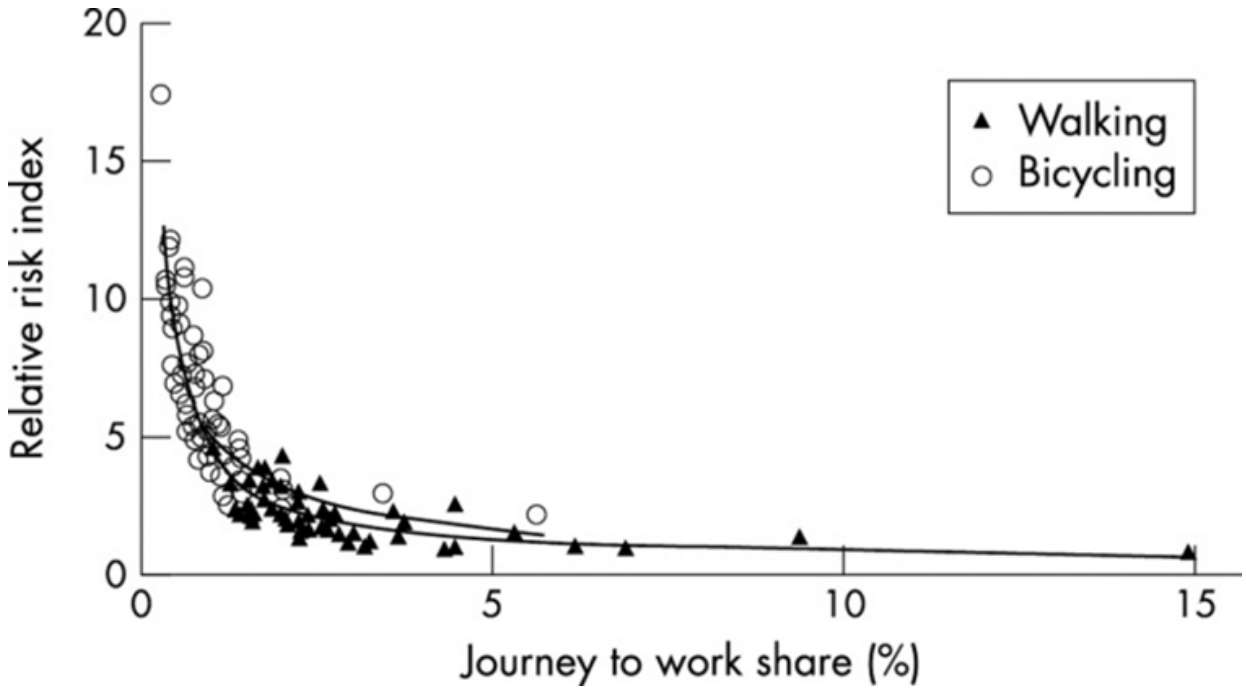
Source: Greenprint Vision Appendix[3]

In addition to potential physical activity benefits, a reduction in automobile traffic could translate into improved air quality, which can lead to lower rates of respiratory disease, as well as cardiovascular symptoms over time.[51] The estimated health costs of traffic-related air pollution in the US are somewhere between $40 and $80 billion.[52] The major pollutants emitted by motor vehicles include carbon monoxide, sulfur dioxide, particulate matter, nitrogen oxides, and volatile organic compounds, the latter two of which undergo chemical reactions in the air that produce ground-level ozone. Each of these pollutants can harm the body, cause serious health issues, and are essentially unavoidable when present in high concentrations in the air people breathe.

Some of the strongest evidence for the relationship between reducing traffic and reducing air pollution-related illness was made possible by a natural experiment during the 1996 Summer Olympics in Atlanta, GA.[53] Efforts to prevent severe traffic in the city during the two weeks of the Games were successful and allowed researchers to show that the 23% reduction in traffic over this period was associated with a 28% drop in ground-level ozone. This decrease in ozone correlated with a 42% reduction in asthma acute care events, as determined from analysis of Georgia Medicaid records. These findings illustrate that large scale changes in travel behavior can lead to positive environmental and public health consequences. The impact of transportation actions implemented as part of the Greenprint will certainly not be as dramatic as the effects seen in the Atlanta study, but if they are successful in reducing congestion and VMT over time, they have the potential to improve pollution-related health effects at a population level.

Reduced automobile trips combined with improvements in bicycle and pedestrian facilities could also reduce the rate of traffic crashes and injuries.[54, 55] A 2003 study using several large datasets from the US and Europe found an inverse relationship between the number of people walking or biking and the rate of traffic-related injuries, an effect termed "safety in numbers."[56] **Figure 6** is from this study and illustrates this relationship using data from cities in California. The theory behind "safety in numbers" holds that as motorist become more accustom to seeing pedestrians and cyclists, they modify their driving behaviors and are less likely to be involved in collisions. While this theory offers a feasible explanation for this observed relationship, other research has urged caution in assuming causality due to a lack of evidence for a specific mechanism and other possible explanations.[57]

Figure 6 : Walking and bicycling in 68 California cities in 2000



From Jacobsen, 2003[56]

In addition to the effects on physical activity, air quality, and injury discussed above, reductions in traffic congestion related to Greenprint actions could also lead to reductions in traffic-related stress and the amount of money families have to budget for transportation, potentially leading to the use of those funds for more healthy purchases.[46]

All of these benefits are only achievable if the facilities envisioned in the Greenprint are successful in changing travel behavior of fairly large numbers of individuals over time. For this to happen, there needs to be consideration given to contextual factors beyond physical design. Use is often tempered by perceptions of safety and is sensitive to social and physical context, which can vary according to neighborhood as well as demographics such as age, gender, racial or ethnic identity, and socio-economic status.[6-8]

HIA Target Action 1 for Strategic Direction 3: Enhanced Access and Transportation Choices

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 3 for a more detailed assessment of potential health impacts.

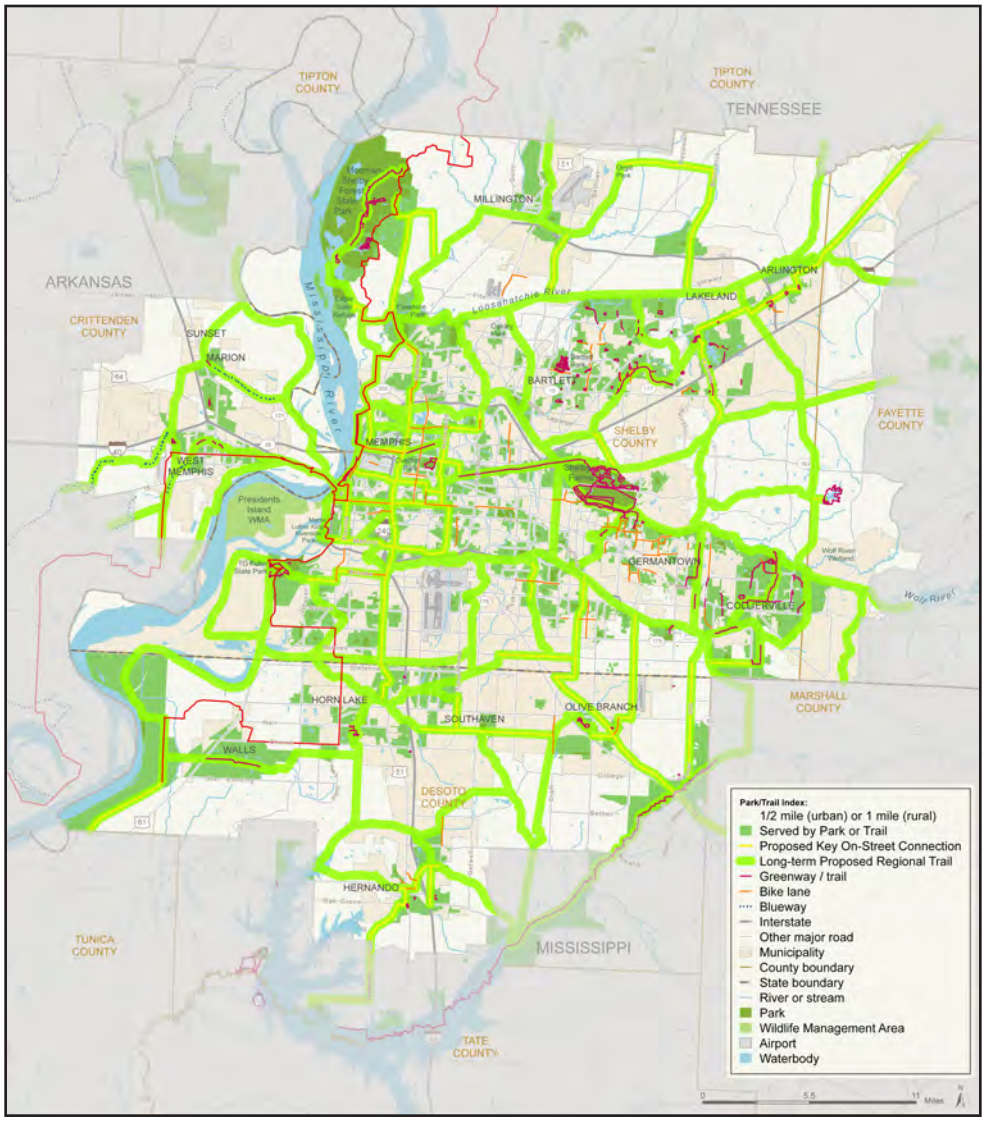
Objective 3.1: Connect communities and neighborhoods across the region through the multimodal transportation network and green infrastructure

Action 3.1.5: Retrofit auto-centric corridors to be more bicycle and pedestrian friendly

The Greenprint sets out a vision for connecting communities and neighborhoods as part of a regional multimodal system that includes green infrastructure, as displayed in **Map 4**. An important piece of this connectivity is ensuring safe on-street connections between trails and other off-street infrastructure. This connectivity is critical to creating a truly regional system and achieving potential public health benefits.

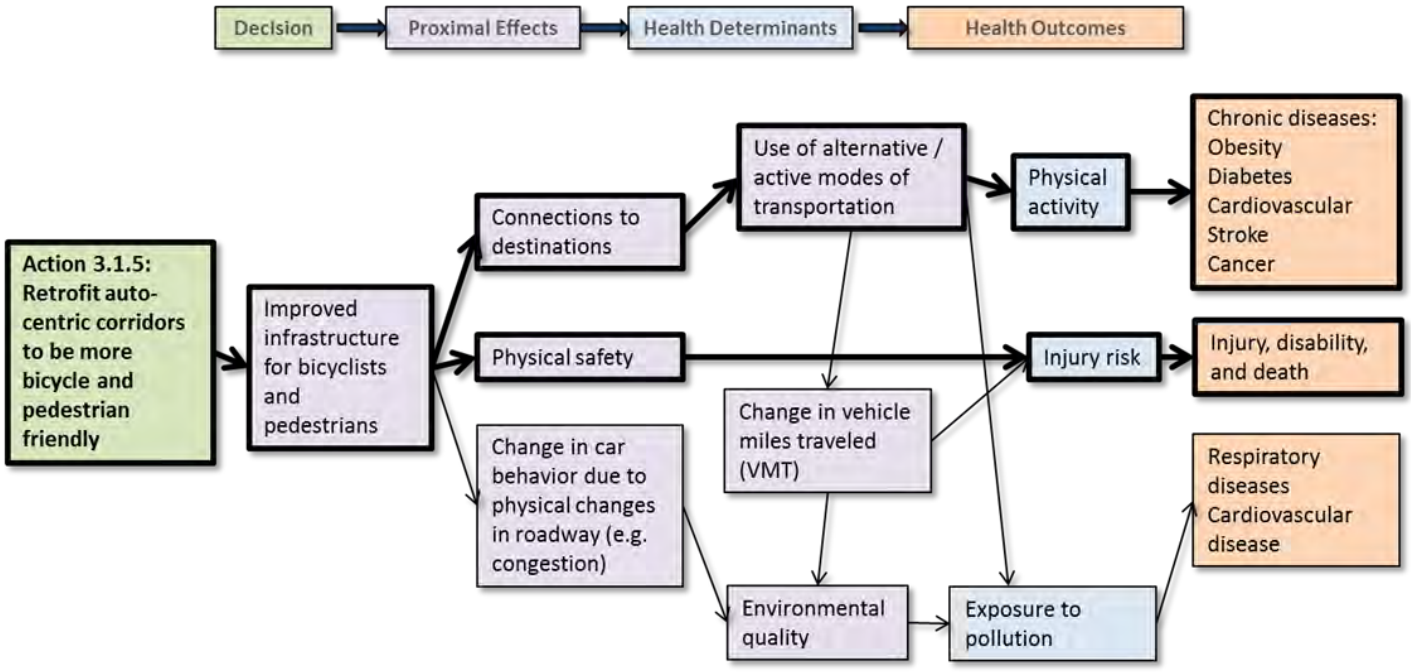
The HIA Advisory Committee identified impacts on physical activity and injury risk as priority health concerns for assessment of this action. These relationships are identified in bold in **Figure 7**. Retrofitting auto-centric corridors with infrastructure for bicycling and walking would create a safer environment for people using those modes, lowering the risk for transportation-related injuries. The key to increasing physical activity through this means is increasing use of these modes, which requires “new” people to choose to bicycle and/or walk for recreation or regular transportation. In the case of bicycling, newer users may be more comfortable on streets with less traffic, so identifying parallel or alternative routes, rather than focusing on major auto corridors, may lead to greater health benefits.

Map 4: Connectivity Recommendations



For a larger version of this map, please see Appendix A.

Figure 7: Pathway for Action 3.1.5 with Priority Pathways in Bold



Improving the safety and design of pedestrian and bicycle facilities appears to be a public concern in the Mid-South. Responses to the public surveys conducted during the Greenprint visioning process provide useful information on perceptions of these facilities (or lack thereof) in the region, though the responses may not be entirely representative of the general population or targeted subgroups:[3]

- Nearly half of respondents identified "streets and trails that are safe for walking and biking" as the item they most felt would most improve their health or the health of the community.
- Roughly three quarters of respondents identified improving "streets for bicycling and walking with bike lanes, sidewalks, crosswalks, etc." as one of their top three critical transportation improvements.
- Similarly, roughly three quarters of respondents identified improving "streets for all modes of travel ('Complete Streets') as one of their top three critical transportation improvements.
- Just over half of respondents identified "more sidewalks, crosswalks, and on-street bicycle lanes" as one of their top three changes that would most improve their experience of walking, bicycling, and trail use. This is slightly less than those who identified "more trails separated from motor vehicle traffic."
- Just over half of respondents identified "more trails separated from motor vehicle

traffic" as one of their top three changes that would most improve their experience of walking, bicycling, and trail use. This is slightly more than those who identified "more sidewalks, crosswalks, and on-street bicycle lanes."

- Approximately half of respondents identified "better maintenance of sidewalks, crosswalks, bicycle lanes, and trails" as one of their top three changes that would most improve their experience of walking, bicycling, and trail use.

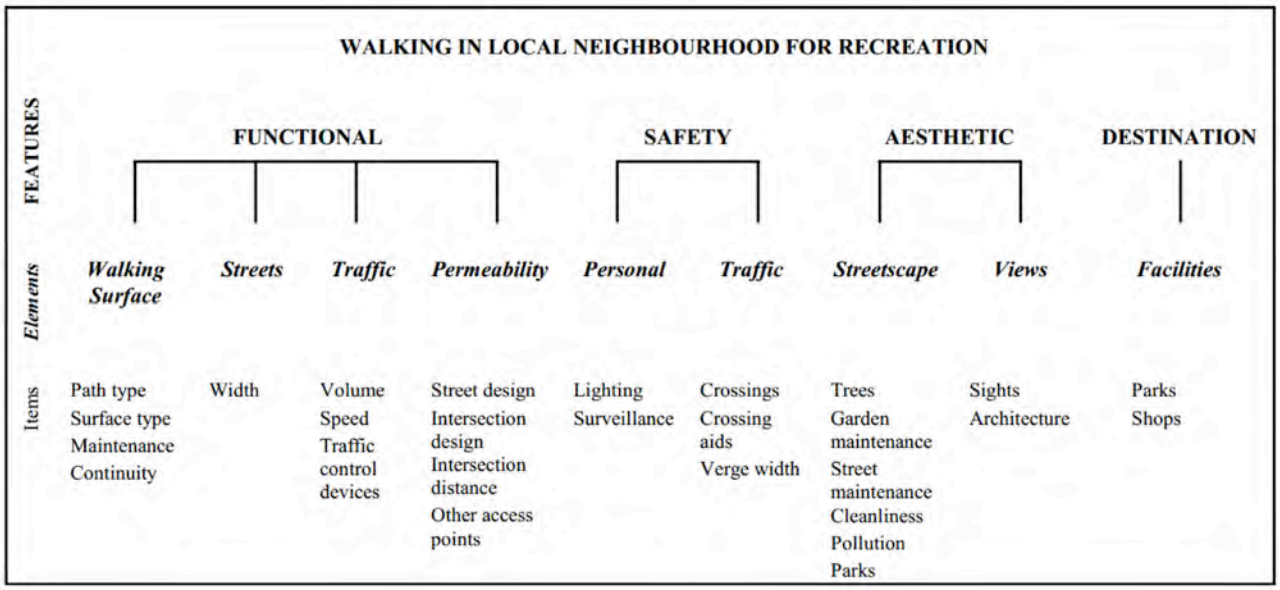
Physical Activity

Several statistics point to the need to increase physical activity throughout the region.[1] Almost 30 % of adults in the Greenprint region get no leisure time physical activity, and women are 25% more likely than men to be inactive. Available data for youth show that almost one in four high school students in Memphis do not participate in the recommended 60 minutes per day of activity, compared to less than one in six nationally. Over half watched television three or more hours per day. These data are only for leisure time physical activity and do not include more functional trips such as commuting via active modes like walking or biking, which, as noted above, are particularly low within the region. They also do not include any information on occupational activity.

Walking and bicycling can be divided into two broad and overlapping categories of physical activity: recreational and utilitarian. Recreational activity is done simply for the benefit of the trip itself, be it for fun or to achieve health goals. Utilitarian activity is more purpose driven, which means the trip is to commute to work or to get to a store, for example. The built environment influences people's likelihood to participate in these different types of activities in different ways. For example, utilitarian activity has been shown to be related more to the directness of available routes, the number of available destinations, perceived access to bike lanes, and the presence of other active people.[7, 58, 59] Recreational trips show stronger associations with route aesthetics, access to recreational facilities, and alternative routes.[7, 58]

Walking is the most common form of physical activity, so efforts to increase both recreational and utilitarian varieties are key components of any strategy to improve health through environmental design.[60] An HIA in Dane County, Wisconsin noted that barriers to walking for physical activity include lack of pedestrian oriented infrastructure, poorly maintained footpaths, dangerous street crossings, and the volume of traffic passing through a neighborhood.[45] **Figure 8** presents a framework of environmental factors that influence recreational walking in a neighborhood.[61] As retrofits are proposed and implemented to improve corridors in the Mid-South, many, if not all of these factors should be considered, and though the focus in **Figure 8** is on recreational walking, many of them are also important for utilitarian walking and bicycle trips as well.

Figure 8: A framework of the potential environmental influences on recreational walking



From Pikora et al, 2003[61]

The analysis of physical activity from bicycling and walking conducted by Alta Planning + Design (available as **Appendix B**) notes that bicycling rates are typically more responsive to changes in transportation infrastructure than walking. While national bicycling rates have trended upward for the last decade – growing nearly 50% over that time –walking rates are still declining slowly at the national level. Because walking is heavily dependent on the availability of short trips – generally under one mile – it is more dependent on factors like land use that are slow to change. It is quicker to build a bike boulevard or install a cycle track than it is to incent walkable, mixed-use development, which is dependent on private developers and the health of the real estate market. Bicycling rates in the Mid-South are therefore more likely to increase at a faster relative rate than walking, and may hold greater short-term potential for creating health benefits to the region.

A 2011 study of bicycling in New Jersey found that most cycling was done for recreation, a characteristic likely to be shared with the Mid-South, given low levels of bicycle commuting in the region.[62] In New Jersey these recreational cyclists tended to be men and people with high incomes and levels of education, a finding they report to be consistent with most prior research on the topic. Further, for these recreational users, proximity to parks showed an association with bicycling. Data for the Mid-South show that men tend to be more active than women, and people with higher incomes and educational attainment typically have better health outcomes.1 This points to a potential need for targeted promotion of recreational bicycle use among lower income individuals and women along with broader promotion of utilitarian use in the region. Having many alternative routes in an area has been shown to increase the odds of cycling for recreation.[58]

A 2009 study of commuting patterns in the Minneapolis-St. Paul area showed that improvements in bicycle facilities significantly impacted levels of bicycle commuting throughout the region, but most significantly in areas nearer the improvements.[63] This study also reported that trips crossing the Mississippi River showed larger increases than other trips, a finding that is particularly relevant for West Memphis, where an increase in physical activity through regular biking could impact an area with some of the highest levels of chronic disease in the region.[1]

Attractive, green, and safe routes in leafy and attractive neighborhoods, with traffic slowing devices (e.g. speed tables, traffic circles, etc.), four-way street intersections, and access to dedicated paths have all been shown to have positive impacts on bicycle commuting.[58, 59] Exhaust fumes, traffic congestion and lack of direct routes are some factors with negative impacts.[59] One study of bicycle commuting in Vancouver, Canada found that increased odds of bicycling were associated with less hilliness, higher intersection density, less highways and arterials, presence of bicycle signage, traffic calming, cyclist activated traffic lights, greater land use mix, and higher population density.[64] A conclusion from that research particularly applicable to this Greenprint Action was that for bicycle commuting, characteristics of the route were more important that characteristics of the origin or the destination.

Safety

Efforts to increase walking and bicycling in the Mid-South through retrofitting auto-centric corridors should also consider implications for the safety of all road users. Speed and visibility are two of the most important factors in the occurrence and severity of roadway injuries, and both can be addressed through the design of roadway retrofits. Research suggests that improving streets and street networks to better accommodate bicycles and pedestrians may lead to enhanced safety for all road users.[54-56, 65]

For pedestrian safety, a pilot study in Toronto, Canada reported between a 5-20% reduction in mid-block accidents with improved definition of the spatial edge separating the pedestrian environment from the roadway.[66] Strategies to define this edge included raised concrete planters, shrubs, decorative lights and medians, flowers, sculpture, trees, and entry markers and bollards. Other HIAs have found sidewalks, frequent pedestrian crossing signals and crosswalks, adequate lighting, and small block sizes to be important in promoting pedestrian safety.[45] Improving visibility at crossings appears to be particularly effective in improving pedestrian safety.[67]

Injury risks vary by road and facility type for bicyclists. **Table 9** presents data from a 1997 study of US and Canadian bicycle commuters showing that sidewalks are the most dangerous place for cyclists and roads with dedicated infrastructure are safest.[68] Other research supports a similar ranking based on fall and injury risk, suggesting it is safest to cycle on-road, followed by off-road paths and trails, and then on sidewalks.[69, 70] Evidence also suggests that the severity of injuries is greater on sidewalks.[70] Based on this information, this Action should decrease the injury risk for cyclists in the region by providing dedicated infrastructure along roadways. It should be noted that though the risk and rate of injuries appears likely to decrease, there may be an increase in

number of crashes and injuries due to increases in the number of cyclists; though it is unclear how the severity of injuries may be affected.[70] In addition to urban form and traffic levels, attitude and experience were also important factors that affected injury risk in the studies referenced above. Therefore, an educational program promoting bicycle safety, especially among new and/or inexperienced riders, would likely mitigate any potential increases in injury risk for these riders. Further, educational programs targeting driver behavior regarding cyclists should also be considered as a strategy for mitigating injury risk. This recommendation supports Actions under Strategic Direction 4 Healthy and Safe Communities, as discussed below.

Table 9: Relative Danger Index (RDI) for Various Bicycle Facilities

Facility Type	RDI (higher number indicates greater danger)
Streets with bike lanes or bike routes	0.50
Bike paths	0.67
Minor streets without bicycle facilities	1.04
Major streets without bicycle facilities	1.26
Sidewalks	5.30

Data from Moritz, W. E. 1997[68]

An HIA examining greenway infrastructure in the San Francisco Bay Area found that use of the greenway could prevent a significant portion of injuries if it became the chosen route by cyclists and pedestrians, replacing the busy roadways, where that analysis showed more injury "hot spots."[20] That HIA added that where the greenway intersected with the street network, special consideration should be given to safety in the design. This supports a recommendation for examining alternative routes in addition to the on-street improvements considered under this Action. An example of work currently being done in the Mid-South focusing on street-crossing improvements is the V&E Greenline in Memphis.

Recommendations for Target Action 3.1.5: Retrofit auto-centric corridors to be more bicycle and pedestrian friendly

- **Ensure safe designs for both on-street and off-street facilities**, paying particular attention to locations where the two intersect.

Who would be involved in making this happen: Planning Departments, MPOs, Public Works Departments, City Engineers, Parks and Recreation Departments, community groups, and advocacy groups like Livable Memphis.

- **Strategies to supplement direct routes with less-direct and lower traffic routes within the street network should be considered**. In the case of bicycling, newer users may be more comfortable on streets with less traffic, so identifying parallel or alternative routes, rather than focusing on major auto corridors, may lead to greater health benefits. Commuters tend to prefer more direct routes, which would correspond to auto-centric corridors.

Who would be involved in making this happen: Planning Departments, MPOs, Public Works Departments, City Engineers, member organizations of the Greenprint Consortium, community groups, and advocacy groups like Livable Memphis.

- **Implementing an educational program promoting bicycle and pedestrian safety**, especially among new and/or inexperienced riders and walkers, would likely mitigate any potential increases in injury risk for these riders. This recommendation supports the following Action under Strategic Direction 4 Healthy and Safe Communities:

    - 4.3.5 Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

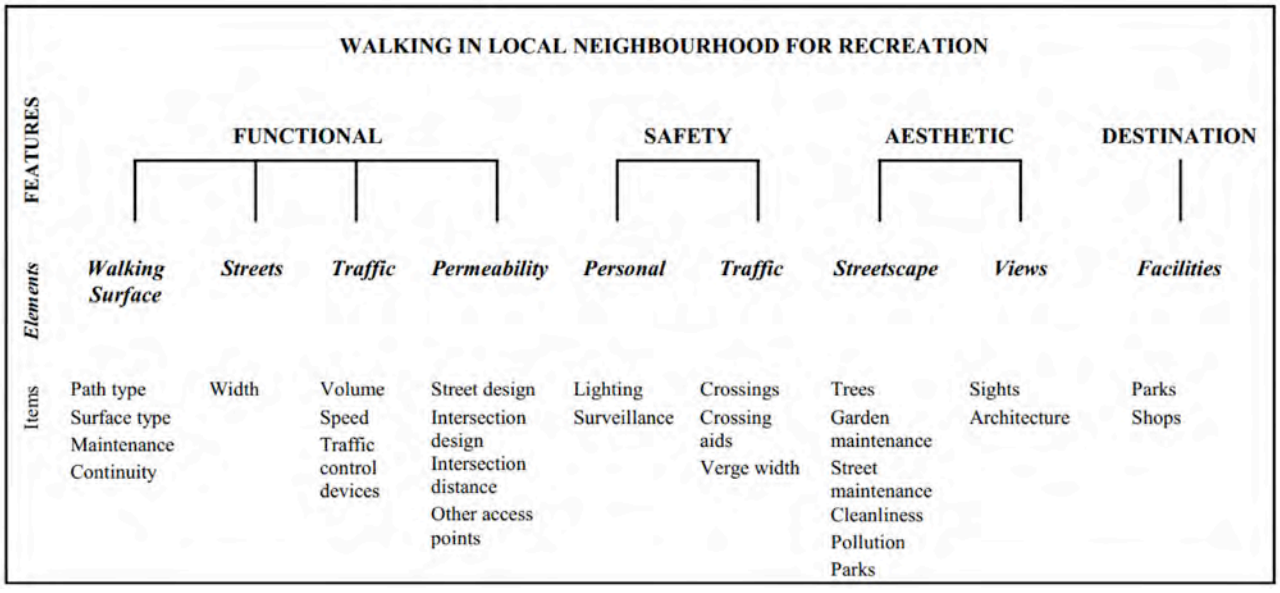
Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and/or Schools (in combination with Bike Rodeos, Safe Routes to School projects, or other similar activities). A good example of this type of activity is Le Bonheur's "Walk this Way" pedestrian safety class for kids and families.

- **Create targeted promotional campaigns for both recreational and utilitarian bicycle use throughout the region**. Because of differences in motivation and environmental perceptions between these two groups of potential bicyclists, the greatest increase in bicycle-related physical activity will be seen if improved facilities are promoted in a way that recognizes these differences. For example, potential bicycle commuters (utilitarian users) may be more interested in how quickly and safely they can reach employment or commercial centers; while recreational users may be more interested in how attractive the surroundings are and be less concerned about connectivity to destinations.

Who would be involved in making this happen: Health Agencies, Convention and Visitors Bureaus, Parks and Recreation Departments, Planning Departments, Departments of Transportation (e.g. TDOT), non-profit trail operators like Shelby Farms Park Conservancy, member organizations of the Greenprint Consortium, and/or public and private employers. A good example of a promotional campaign from a health perspective is the American Heart Association's "Get Moving" program, which can be found on their website: www.heart.org.

- **Develop a locally-based conceptual framework of bicycle and pedestrian influences to guide retrofitting strategies**. Selected stakeholders and local experts could be engaged to develop a framework of the potential environmental influences on walking and biking similar to **Figure 8** (reproduced below), which could then be applied across the region when and where infrastructure improvements are being considered. This could be done in conjunction with Action 3.4.1, which calls for changes to public policy to include Complete Streets frameworks, and the sub-planning project led by the Community Development Council of Greater Memphis to create a Complete Streets Design Manual. The conceptual framework recommended here could serve as a bridge between the mostly environmental design components of Complete Streets work and the sociocultural influences of behavior, resulting in a more complete characterization of influence that can be used by various actors to more successfully promote biking and walking in the region.

Figure 8: A framework of the potential environmental influences on recreational walking



From Pikora et al, 2003[61]

Who would be involved in making this happen: This would be a good join project between Health Departments, Planning Departments, MPOs, university partners, and other member organizations from the Greenprint Consortium to define an initial paradigm for promoting biking and walking throughout the region.

HIA Target Action 2 for Strategic Direction 3: Enhanced Access through Transportation Choices

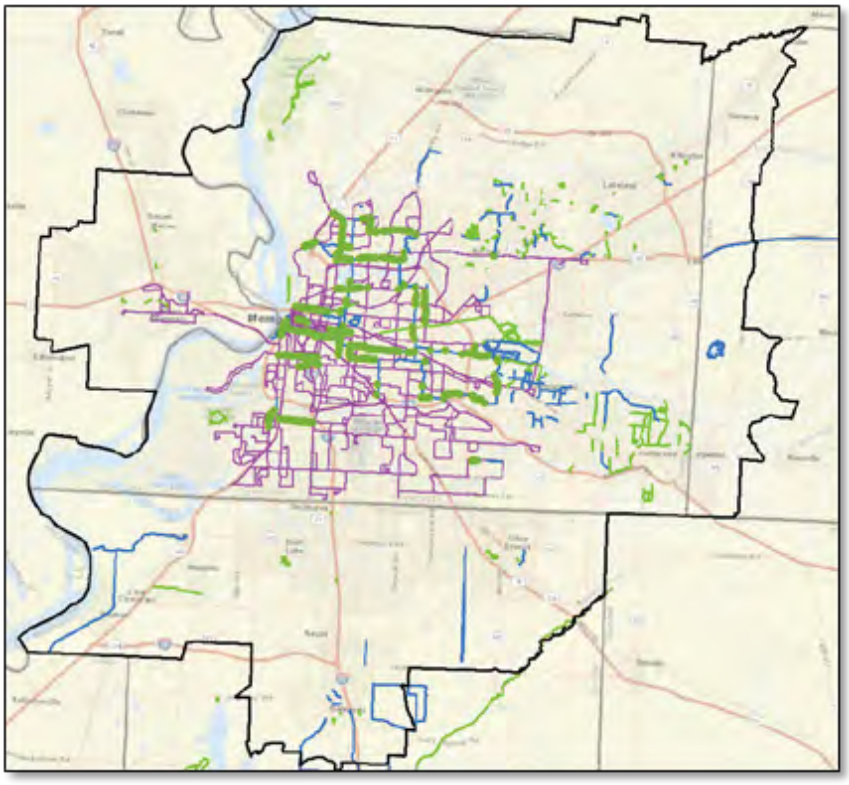
The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 3 for a more detailed assessment of potential health impacts.

Objective 3.2: Increase transportation choices and modal connections for all users

Action 3.2.2: Develop policies which encourage higher-density commercial and residential development at intersections of alternative transportation modes

Greenprint Objective 3.2 focuses transportation choice, and Action 3.2.2 aims to facilitate the higher densities needed to make options other than automobile travel truly viable in the region. **Map 5** shows the relative strength of the transit network in Memphis and inner suburbs. Areas in darkest green have the fewest formal bikeway or greenway connections to transit corridors. These areas should have the highest priority consideration for improved walking and bicycling access to transit corridors.[3] What Action 3.2.2 will do is ensure that there are desirable destinations to facilitate increased use of the connected system laid out under other objectives.

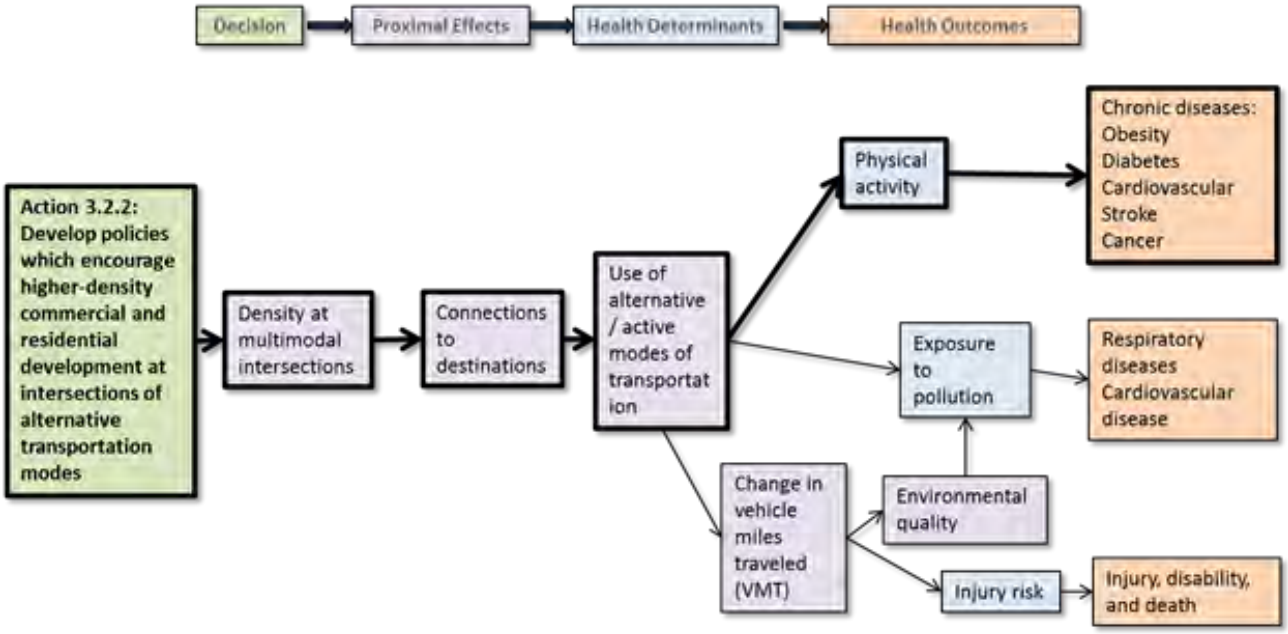
Map 5: Multimodal Connections



Source: Greenprint Vision Appendix[3]

The HIA Advisory Committee selected physical activity (and the related chronic diseases) as the priority outcome for assessment of this Action. As noted above, both adults and children throughout the region tend to be less active than their counterparts elsewhere in the nation, and this contributes, in part, to the higher rates of chronic diseases observed in the Mid-South. Developing policies to promote higher density of commercial and residential development around key multimodal nodes can increase the likelihood of people utilizing alternative modes such as walking, biking, and transit as part of their functional or recreational trips. With an increase in use of these alternative modes, there would likely be an increase in physical activity at a population level over time. **Figure 9** shows the conceptual pathway for this action with the physical activity pathway emphasized in bold.

Figure 9: Pathway for Action 3.2.2 with Priority Pathways in Bold



Much of transportation behavior and mode choice depends on distance between origins, destinations, and dedicated facilities (e.g. distance to a street with a bike lane), as well as on the quality and appeal of these destinations and facilities. Studies suggest that distances to retail and bicycle facilities are statistically significant predictors of choosing active modes of transport, especially at close distances, but the relationships do not appear to be linear.[71] With higher densities of origins (residential) and destinations (commercial or other uses), distances are likely to be shorter.

Density is a major factor in determining use of alternative transportation modes, especially transit, where use has been shown to associate with higher levels of physical activity in the form of walking to and from stops.[72] Research suggest that residential density needs to be at least four units per acre to achieve minimum service provision, while densities closer to fifteen units

per acre are needed to have a more robust transit system and see shifts from single occupancy vehicles.[73, 74] Other research on the distances people are willing to walk in order to access transit consistently report that a quarter mile is a good rule of thumb, though people are willing to walk a little further to access better quality or more reliable transit (i.e. light rail vs. bus).[75, 76] Currently few areas in the Mid-South have the densities necessary to support robust use of alternative modes, and it is unclear how the quarter mile rule of thumb may vary within the region. This Action aims to address that issue.

The Greenprint Public Surveys are useful in helping to gauge perceptions of transit and development-related topics in the region. While people appear to desire quality connections, there may also be a bias that improving transit is more important for lower income populations. While it is true that lower income groups are more likely to be dependent on transit, part of implementing the Greenprint should be promoting the message that improved transit can have positive effects for all income groups in the region. Results from the two public surveys are presented below:[3]

- Roughly one in six respondents identified increasing "the proportion of low- and very low-income households within a 30-minute transit commute of major employment centers in urban, suburban, and rural settings" as their most important housing and development-related goal. This was the lowest response for the four options presented.
- Roughly two fifths of respondents identified improving "bus stops and bus service, and provide more bus routes" as one of their top three most critical transportation improvements.
- Nearly nine in ten respondents indicated that increasing "transportation choices and connections between modes" was somewhat or very important to them.
- Nearly nine in ten respondents indicated that connecting "people to jobs, schools, goods and services, and natural areas" was somewhat or very important to them.

It is also important to note that the purpose of this Strategic Direction is to improve transportation choice, so transit is not the only option to consider. Especially in rural low income areas where transit is not feasible, enhancing access can be difficult. Bike/greenways can play a big role in addressing this issue, as can the Transportation Demand Management (TDM) strategies recommended by the Greenprint Bus Transit to Workplace study.[39]

Recommendations for Target Action 3.2.2: Develop policies which encourage higher-density commercial and residential development at intersections of alternative transportation modes

- **Define a minimum residential and commercial density in policies for targeted areas**. An effective way of encouraging higher density is to strengthen minimum requirements within the zoning or development code, where possible, and to then only allow variance from those requirements on a case-by-case basis. Specific density overlays could be proposed for areas near alternative mode intersections.

Who would be involved in making this happen: Planning Departments, informed by local developers and builders, the Housing Authorities, and MPOs.

- **Incentivize mixed land use and higher densities through economic development tools** and corresponding changes to policy. This might include defined density bonuses for developers who chose to build near alternative mode intersections (i.e. they're allowed to build at a higher density because they chose a "healthy" location). Other incentives may involve commitments to help expand or maintain trails near development, creation of location or design-based tax incentives, and targeted recruitment of businesses that support the use of alternative transportation.

Who would be involved in making this happen: Economic Development officials, Chambers of Commerce, Planning Departments, and/or the Housing Authorities.

- **Work to improve perceptions of transit in the region through improved service and marketing**. Connections between the active transportation network (trails, sidewalks, bike infrastructure, etc.) and the transit system will enhance the ability of higher density developments to succeed, increasing the likelihood of positive health impacts. The main focus should be on improving service and perceptions in the urban core where transit is most available and used most frequently. Building on improvements in service to better market transit to new users in the suburban parts of the region could then lead to reductions in car use and associated health benefits as some of these people begin to use transit regularly. Finally, exurban and rural areas with no transit access should still be considered in a regional marketing strategy. These populations may not have a high potential for using transit, but improving their perceptions of the transit system as a resource for the whole region could help ensure better success of that system.

Who would be involved in making this happen: Memphis Area Transit Authority, V-Ride (Van pools), MPOs, transit and rider advocacy organizations (e.g. Bus Riders Union), member organizations of the Greenprint Consortium, and/or Convention and Visitors Bureaus.

Other Objectives under this Strategic Direction

The four objectives (and corresponding actions) under the Enhanced Access and Transportation Choices Strategic Direction have potential to impact a critical health determinant across the region: how people choose to move about the region. Each will exert this influence differently, and the greatest impact will come from the Actions working in concert with each other and with other Objectives. **Table 10** includes brief notes for each Transportation Objective and its possible relationship to improving health throughout the region.

Table 10: Health Perspectives on Enhanced Access through Transportation Choices (SD3)

Objective	Comment	Comparative Influence on Population Health
3.1 Connect communities through a multimodal transportation network and green infrastructure	For people to be able to engage in active transportation (including transit use), there must be a well-maintained and connected network. Enhancing connectivity could have short term benefits as well as long term benefits for health	High
3.2 Increase transportation choices and modal connections for all users	Similar to Objective 3.1, providing a true choice in transportation can lead to more use of active modes and more physical activity over the long term	High
3.3 Enhance regional transit service and transportation demand management	Connecting to destinations further increases the likelihood of people using active modes	Highest
3.4 Improve transportation system impacts on the built environment, natural environment, and regional quality of life	Better designed components of a transportation system can lead to increased use as well, but not as much as the connectivity and density factors addressed in the other objectives. More sustainable transportation systems could lead to environmental improvements with health benefits accruing to the whole population	Medium

Strategic Direction 4: Healthy and Safe Communities

In respect to ensuring healthy and safe communities, the Greenprint seeks to:

- Develop and promote a comprehensive concept of community health and wellness
- Assess and promote health impacts of green infrastructure on residents and communities
- Promote healthy, safe, and walkable communities
- Enhance regional quality of life for all residents and communities

Achieving these goals will have both direct and indirect impacts on population health in the region. Direct impacts will come from emphasizing healthy behaviors through education and advocacy; while the indirect impacts will occur by integrating health perspectives into decision-making processes and collaborations where it may not typically be included, as recommended throughout this HIA.

Within the context of the Mid-South Regional Greenprint Plan, this HIA is being conducted in order to achieve the Community Health and Wellness working group's strategic vision of ensuring that the Greenprint contributes to a region of healthy and safe communities. Specifically, this HIA furthers the implementation of Action 4.1.3, as defined in the Greenprint Vision Plan: "Advocate for the inclusion of Health Impact Assessments (HIA) and Health in All Policies (HiAP) reviews as part of jurisdictional planning, development and legislative processes, as appropriate."[3]

Many of the existing Actions under Strategic Direction 4 are noted throughout this document as particularly relevant for ensuring success in the implementation of the Target Actions considered in this HIA. These recommendations are reproduced below, along with other related recommendations for which the public health community could have a role and should be considered a priority by members of the Community Health and Wellness Working Group and other groups involved in the implementation of the Greenprint. There are also several additional recommendations made specifically within the context of this Strategic Direction that were developed through the HIA process. Following the recommendations is a comprehensive table (**Table 11**) that summarizes how a public health perspective can be applied to each of the Strategic Directions.

There are major roles for public health professionals throughout the region when it comes to implementation of the Greenprint, and their inclusion in the Consortium is a successful early step toward greater involvement in the decision-making processes that influence health determinants throughout the Mid-South (e.g. greenspace, land use, transportation, housing, etc.). Key areas where the public health community can contribute include messaging about public health benefits, advocating for policies that support healthy behaviors, and data collection and surveillance of health behaviors and outcomes over time.

Recommendations for Strategic Direction 4: Healthy and Safe Communities

From Target Action 1.2.4 - Create, fund and execute a pilot project to address maintenance and safety issues in one or more underused parks

- The Healthy and Safe Communities Strategic Direction offers some specific recommendations as actions under Objective 4.3 to promote safe, healthy, and walkable communities. T**hese should be considered priority recommendations in the short term** based on analysis of this Target Action:

    - **4.3.1** - Create and organize citizen groups, agencies, and community police to enhance safety in parks, trails and green spaces

Who would be involved in making this happen: Parks and Recreation Departments at county and municipal levels can work in partnership with police departments, volunteer crews for parks (Shelby Farms & Overton Park), and neighborhood watch groups. Good local examples of where this type of activity is taking place include Shelby Farms, Overton Park, and the V&E Greenline.

    - **4.3.2** - Integrate active and passive security measures in parks, trails and green spaces

    - **4.3.3** - Incorporate Crime Prevention through Environmental Design (CPTED) design principles in green space planning

Who would be involved in making this happen (4.3.2 & 4.3.3): Parks and Recreation Departments, neighborhood councils and watch groups, and police and public safety groups. The Frayser Neighborhood Council is a good example of the type of group that could collaborate with designers and public safety officials to implement these types of actions.

- **Evaluate CPTED design features and their effect on perception and use** of the pilot park(s) to inform future improvements in the region and as a contribution to the literature.

Who would be involved in making this happen: Parks and Recreation Departments and university partners could evaluate CPTED implementation in consultation with Police and Public Safety groups. There could also be a role for the member organizations of the Greenprint Consortium in ensuring any lessons learned are disseminated throughout the region.

From Target Action 3.1.5: Retrofit auto-centric corridors to be more bicycle and pedestrian friendly

- **Implementing an educational program promoting bicycle and pedestrian safety,** especially among new and/or inexperienced riders and walkers, would likely mitigate any potential increases in injury risk for these riders. This recommendation supports the following Actions under Strategic Direction 4: Healthy and Safe Communities:

    - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and/or Schools (in combination with Bike Rodeos, Safe Routes to School projects, or other similar activities). A good example of this type of activity is Le Bonheur's "Walk this Way" pedestrian safety class for kids and families.

From Target Action 5.1.4: Create design standards, incentives, and encourage density in support of mixed-use and mixed-income communities near green infrastructure

- **Promote the potential health benefits of mixed-use developments as part of marketing materials**. Strategically promote possible benefits for affordable housing and lower-income populations, but focus primarily on benefits for the broader community to secure support from the public.

Who would be involved in making this happen: Health Departments, Housing Authorities, private sector developers, and affordable housing groups like Habitat for Humanity and United Housing.

- **Strategies to promote positive attitudes toward walking should be implemented in tandem with policies that could lead to supportive changes in the built environment, like mixed-use development**. Some of the Healthy and Safe Community Actions help to address this:

    - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and/or Schools (in combination with Bike

Rodeos, Safe Routes to School projects, or other similar activities). A good example of this type of activity is Le Bonheur's "Walk this Way" pedestrian safety class for kids and families.

- **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organizations

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, member organizations of the Greenprint Consortium, school-based groups, non-profit conservancies. A good local example is the Wolf River Conservation Corps hosted by the Wolf River Conservancy.

From Target Action 6.4.5: Encourage changes in policy and covenants to allow for natural landscaping in existing and new development

- **Pursuit of this Action should be done in the context of other Greenprint strategies that more directly address underlying socioeconomic issues in the region** like employment, education, and housing affordability. Simply increasing the amount of vegetation in an area is unlikely to generate much health improvement in isolation; therefore it is critical to view this Action as one piece of the broader livability goals of the Greenprint. For example, Actions 4.3.7 and 4.4.4 under the Healthy and Safe Communities Strategic Direction will help to foster positive perceptions of greenery in the region, which may lead to more positive effects on mental health:

  - **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organizations

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, member organizations of the Greenprint Consortium, school-based groups, non-profit conservancies. A good local example is the Wolf River Conservation Corps hosted by the Wolf River Conservancy.

  - **4.1.4** Create and support nature- and place-based youth education and physical fitness programs as a means for improving child health, development, and education

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, member organizations of the Greenprint Consortium, school-based groups, and/or non-profit conservancies.

Additional Recommendations

- **Develop a coordinated surveillance plan along with the Long-term Regional Planning group** in order to ensure that relevant public health data are tracked over time and available for future planning activities. This will be critical in institutionalizing a Health in All Policies perspective of decision-making in the region.

Who would be involved in making this happen: Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and University partners.

- Water and soil quality are emphasized in the current Actions for SD 4. A**ctions should also be taken to promote awareness of air quality issues** and tools like the Air Quality Index (AQI) throughout the region.

Who would be involved in making this happen: Public Health Departments, Planning Departments, MPOs, environmental advocacy groups, member organizations of the Greenprint Consortium, and University partners.

- **Engage with primary care providers to be champions of the Greenprint and its potential to improve health and prevent illness**. Developing materials that can be used by primary care physicians and others on the "front lines" of health promotion and health care. An example would be developing a Greenprint branded prescription pad for physical activity or other behaviors facilitated by the actions of the Greenprint Plan.

Who would be involved in making this happen: Public Health Departments, local physicians and hospitals, and member organizations of the Greenprint Consortium.

Table 11: Summary of Greenprint Strategic Directions, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 1: A Regional Interconnected Network of Parks, Greenways and Open Spaces	• Improve access and use of existing parks and greenways • Expand and connect green assets including parks, greenways, and linkages • Protect and enhance natural corridors for people and animals	Actions taken to achieve these goals are likely to have long term positive effects on community health through increases in use of green infrastructure. The strongest positive influence will occur if people who currently do not visit these spaces often begin using them regularly.
Strategic Direction 2: Increased Equitable Participation and Community Ownership	• Engage and include a diverse group of individuals, groups, and communities from across the region • Connect regional communities to build relationships and bring down barriers • Buy-in from all communities in region • Develop capacity of social equity partners to stay involved through plan implementation	Engaging the broadest range of individuals in planning and implementation of the Greenprint will ensure maximum positive public health impact by increasing both community ownership and use of facilities, precipitating many of the health impacts discussed throughout this assessment. Having this broad engagement, especially from vulnerable populations, will also increase the likelihood of the Greenprint Actions reducing health disparities in the long term.

Table 11: Summary of Greenprint Strategic Directions, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 3: Enhanced Access through Transportation Choices	• Increase transportation choices and modal connections • Connect people to jobs, schools, goods and services, and natural areas • Link communities and neighborhoods across the region • Improve the impact of the transportation system on the built environment, natural environment, and regional quality of life	Actions taken to achieve these goals are likely to have positive long term health effects for the Mid-South community; however, these impacts will likely vary based on the sub-populations considered. People most likely to see health benefits are those who chose to switch from driving to regular use of alternative transportation modes (i.e., walking, biking, and/or transit) within this enhanced system. There will also be potentially positive health effects for people who already utilize these modes regularly, as well as for some drivers in the region, though the impact may be smaller in magnitude. Any improvements in environmental health as a result of changes in the transportation system would likely be evenly spread across the region.
Strategic Direction 4: Healthy and Safe Communities	• Develop and promote a comprehensive concept of community health and wellness • Assess and promote health impacts of green infrastructure on residents and communities • Promote healthy, safe, and walkable communities • Enhance regional quality of life for all residents and communities	Achieving these goals will have both direct and indirect impacts on population health in the region. Direct impacts will come from emphasizing healthy behaviors through education and advocacy; while the indirect impacts will occur by integrating health perspectives into decision-making processes and collaborations where it may not typically be included, as recommended throughout this HIA.

Table 11: Summary of Greenprint Strategic Directions, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 5: Improved Neighborhoods and Fair Housing Choices	• Build on existing assets at the neighborhood level • Increase affordable, location-efficient, and fair housing choices • Ensure access to green space from every neighborhood in the region • Implementation of the plan in an equitable way that ensures resources are distributed fairly across the region	Actions taken to achieve these goals are likely to have long term effects on the health of the region and more immediately on the areas that are targeted by these actions. There is great opportunity to use these objectives to improve the housing situation of some of the most vulnerable populations in the region; though this effort may need to be contextualized within broader efforts to promote mixed-use development in the region. The strongest positive influence on community health will likely occur when activities target existing communities where disparities in health are most evident.

Table 11: Summary of Greenprint Strategic Directions, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 6: Sustainable Resources and a Quality Environment	• Conserve and protect natural resources (air, water, and land) and biodiversity • Convert vacant lands and brownfields into productive green assets • Promote sustainable agricultural and watershed management policies and practices • Promote and protect biodiversity and wildlife habitat	Improvements to the environment brought about by Actions to achieve these goals will likely lead to improvements in community health status through impacts on environmental determinants such as air and water quality. The magnitude of these impacts is likely to be small in comparison to other Strategic Directions because of the nature of environmental quality determinants. These impacts will accrue relatively equally across the population, with vulnerable populations potentially experiencing the greatest benefit. Environmental improvement also includes addressing more visible aspects like litter and trash removal, which will have bearing on people's perceptions of green space as safe and/or useable. Actions that focus at this level (similar to those explored under Strategic Direction 1) may lead to more proximal improvements to health through promoting physical activity and exposure to nature.
Strategic Direction 7: A Productive Workforce and Economy	• Empower individuals to improve economic outcomes • Increase and enhance regional employment opportunities, and • Support neighborhood-level economic development	Actions taken to achieve these goals are likely to have long term effects on the health of the community; though these effects could be unevenly distributed throughout the region. The strongest positive influence on community health will likely occur when activities target low income areas and/or areas with high unemployment.

Table 11: Summary of Greenprint Strategic Directions, Corresponding Goals, and Broad Health Impact		
Strategic Direction	**Goals from Greenprint Vision**	**Comment on Health Impact**
Strategic Direction 8: Effective Long-term Regional Planning	• Build capacity for long-term participating in the public planning process • Form or utilize an organization that can sustain the goals the Mid-South Regional Greenprint Consortium • Establish a system to maintain shared data resources long-term • Incorporate social equity in the public planning process across the region	Actions to accomplsih these goals are not likely to have a direct impact on population health in the short-term, but they will have positive effects in the long-term, as long as public health perspectives are consistently included in future planning and data activities.

Strategic Direction 5: Improved Neighborhoods and Fair Housing Choices

In respect to improved neighborhoods and fair housing choice, the Greenprint seeks to:

- Build on existing assets at the neighborhood level
- Increase affordable, location-efficient, and fair housing choices
- Ensure access to green space from every neighborhood in the region
- Implemented in an equitable way that ensures resources are distributed fairly across the region

Actions taken to achieve these goals are likely to have long term effects on the health of the region and more immediately on the areas that are targeted by these actions. There is great opportunity to use these objectives to improve the housing situation of some of the most vulnerable populations in the region; though this effort may need to be contextualized within broader efforts to promote mixed-use development in the region. The strongest positive influence on community health will likely occur when activities target existing communities where disparities in health are most evident.

Background

A Greenprint that uses green infrastructure to further goals for Improved Neighborhoods and Fair Housing Choices can contribute to community health by connecting homes with destinations and ensuring that those homes are affordable for all income levels. Addressing affordability can contribute to health status by potentially influencing household budgets, which gets to one of the strongest determinants of health: income.[77, 78] For a more detailed discussion of income, see below in the section on Strategic Direction 7: A Productive Workforce and Economy.

Ensuring that neighborhoods have access to parks and green spaces is important in promoting physical activity, exposure to nature, and other social determinants of health. Parks are excellent venues for recreational activity, and when they are designed as an integral part of a neighborhood, they also serve as community gathering places, which can lead to a stronger sense of community and improve health through mechanisms related to social capital.[14, 16] Living near greenspace offers increased opportunities for exposure to nature, which can benefit mental health.[15]

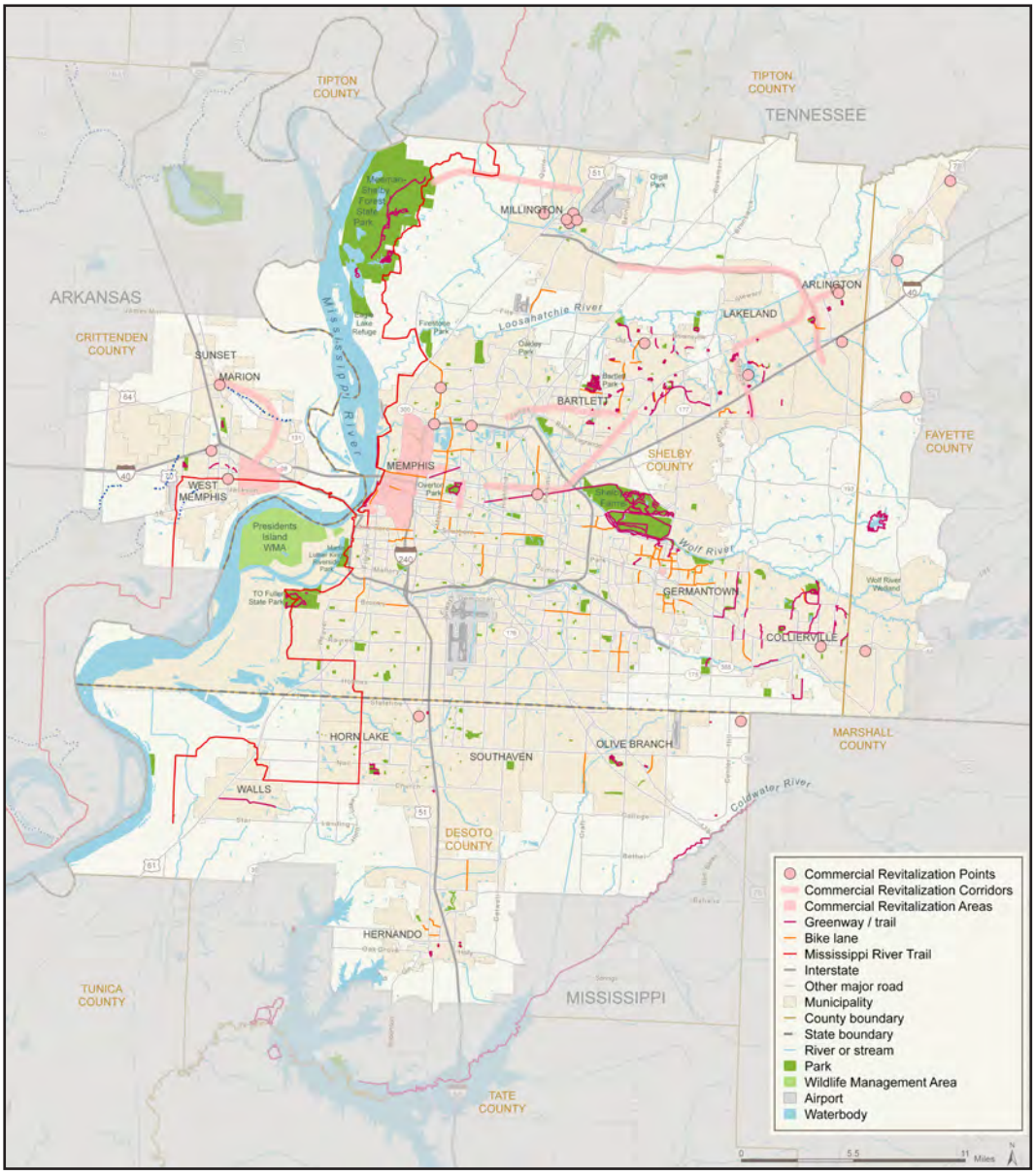
Residential locations that offer a range of transportation options - including alternatives to driving - can reduce household transportation costs while increasing access to employment, which is explored under Strategic Direction 7.[48] Housing that is integrated into a greenspace network that connects to neighborhood destinations and the larger region will allow for increased access for both recreational and utilitarian trips.[13, 17, 79] With greater access comes greater use, which can lead to health benefits associated with physical activity, exposure to nature, and increased community interaction.[80]

Ensuring that housing near these amenities remains affordable may prevent the stress that follows from involuntary displacement associated with rising housing costs, though little existing research exists to support this. If housing remains affordable there is also the possibility that families will spend less of their budgets on housing and more on healthy goods and services.[81]

Map 6: Housing Focus Areas

For a larger version of this map, please see Appendix A.

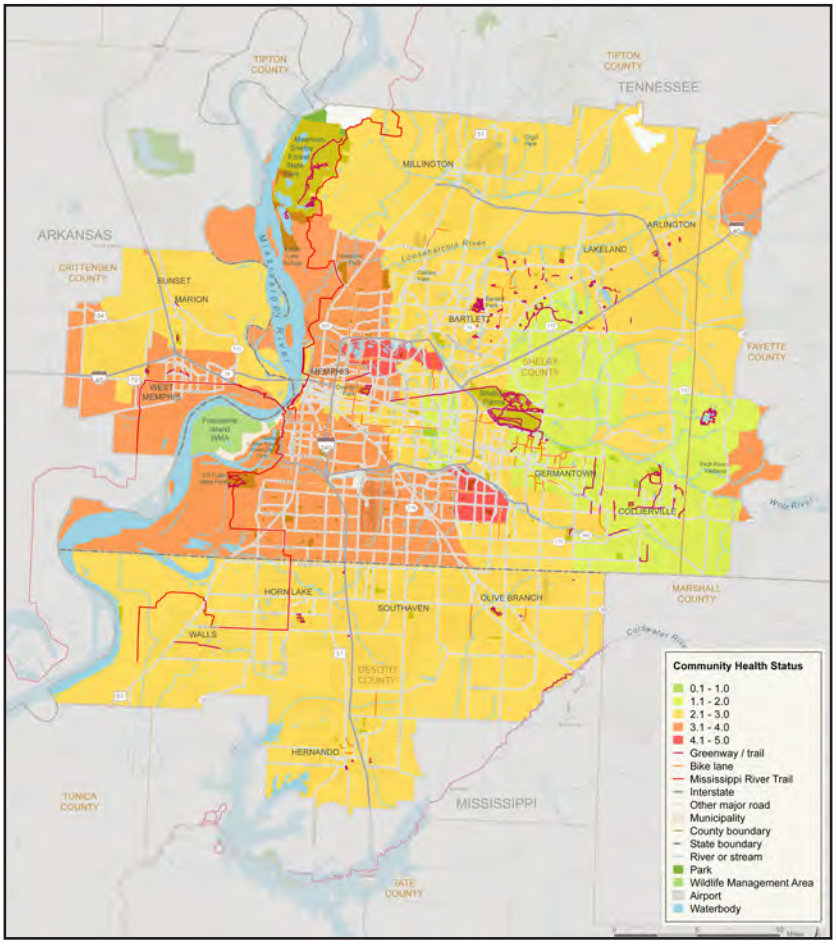
Map 7: Commercial Revitalization Focus Areas



For a larger version of this map, please see Appendix A.

The housing focus areas identified in **Map 6** and the commercial revitalization areas in **Map 7** are in some of the areas identified in **Map 1** (reproduced below) as having the most social deprivation and poorest health status. Targeting these areas will likely have a strong positive impact on the health of these communities, but only if steps are taken to ensure that the benefits accrue to those who already live there rather than simply replacing the existing population with healthier individuals from elsewhere. Steps should be taken to avoid involuntary displacement, or gentrification.

Map 1: Community Health Status



For a larger version of this map, please see Appendix A.

HIA Target Action 1 for Strategic Direction 5: Improved Neighborhoods and Fair Housing Choices

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 5 for a more detailed assessment of potential health impacts.

Objective 5.1: Increase affordable, location-efficient, and fair housing choices

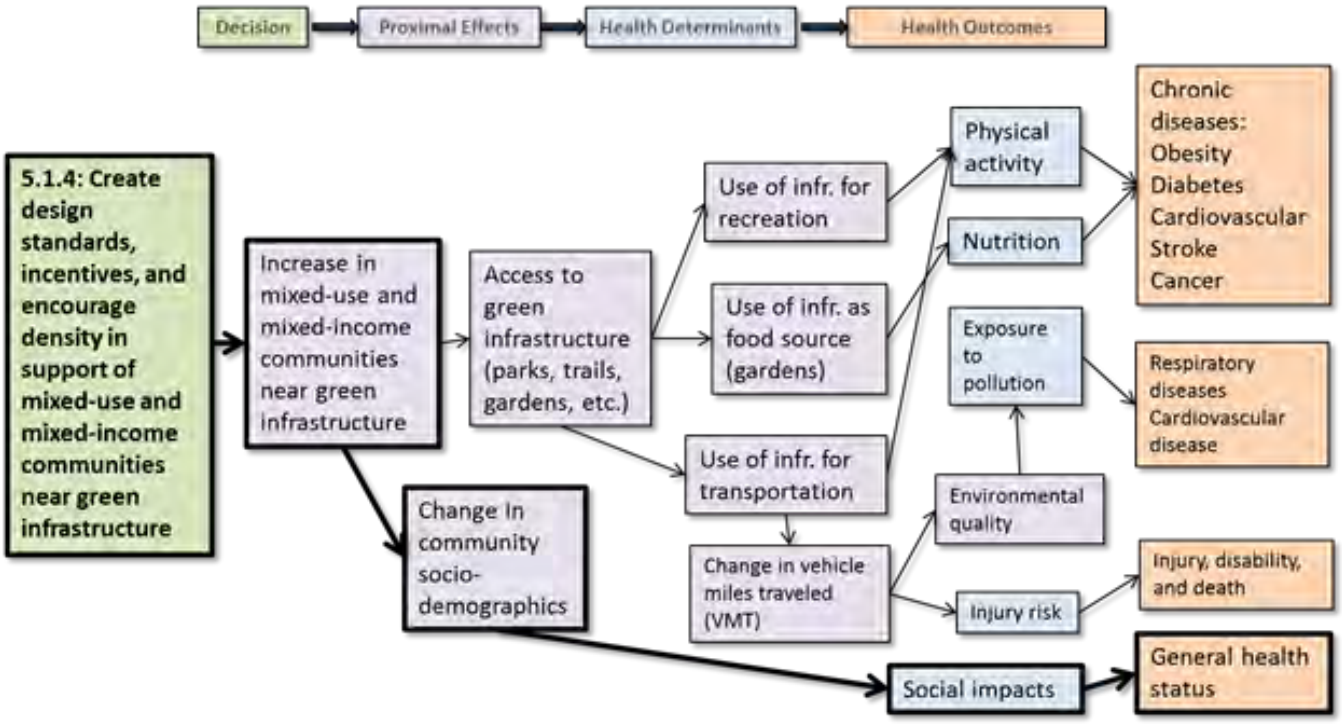
Action 5.1.4: Create design standards, incentives, and encourage density in support of mixed-use and mixed-income communities near green infrastructure

This objective addresses housing issues by focusing on increasing choice and amount of affordable housing. Affordability needs to be defined in a way that includes options for those at the lowest end of the economic spectrum, who are known to have worse health indicators generally.[43] Instituting policy changes that support mixed-use, and possibly more importantly,

mixed-income development near health promoting green infrastructure would be likely to improve health status in communities where this takes place. Over time, if these policies shape the way development occurs throughout the region, there could be far-reaching improvements to health.

The HIA Advisory Committee identified impacts on general health status through potential changes in socioeconomics as the priority health concern for assessment. This relationship is identified in bold in **Figure 10**. Impacts on general health status could possibly occur through the strengthening of both existing and new neighborhoods through standards for mixed use and income. In either case, most evidence suggests that improvements in health status would come from the potential for increased social interaction and physical activity. There is less evidence in the literature about the possible health effects of mixed income communities; thus the majority of information below pertains to mixed use development.

Figure 10: Pathway for Action 5.1.4 with Priority Pathways in Bold



On self-reported measures of general health status, the Greenprint Region is comparable to the nation as a whole, with roughly 16% of people reporting that they have poor or fair health.[1] However, when objective measures of premature mortality are considered, the region does not fare as well. Nationally, the rate of Years of Potential Life Lost (YPLL) due to premature death per 100,000 population is 6,851. In the Greenprint Region this rate is 9,616, topping out at 13,801 in Crittenden County.[1]

Data for social support and physical activity are also important to consider under this Action, as they would ultimately contribute some influence to the broader statistics on general health. In the four Mid-South Counties, roughly 1 in 5 people report having inadequate social support, which is comparable to the national statistic.[1] Almost 30 % of adults in the Greenprint region report no leisure time physical activity, and women are 25% more likely than men to be inactive. Available data for youth show that almost one in four high school students in Memphis do not participate in the recommended 60 minutes per day of activity, compared to less than one in six nationally. **Table 12** shows the possible consequences of this lack in physical activity in the form of chronic diseases in the region.

Table 12: Physical Activity-Related Chronic Disease Outcomes in the Greenprint Region and United States

Health Outcome	Greenprint Region	United States
Heart Disease Mortality 2006-2010, Age-Adjusted Death Rate (Per 100,000 Pop.)	181.55	134.65
Stroke Mortality 2006-2010, Age-Adjusted Death Rate (Per 100,000 Pop.)	56.22	41.78
Obesity 2009, Percent of Adults with BMI > 30.0	33.82%	27.35%
Diabetes Prevalence 2009, Percent of Adult Population	11.55%	8.72%

Physical activity is strongly associated with mixed land use; however, evidence on the relationship between mixed land use and social capital is less conclusive.[82, 83] Researchers agree that the less time spent in cars, a possible result of well-planned mixed-use development, is likely to have a beneficial effect on the development of social capital.[82]

People who live in neighborhoods with a greater mix of uses have been shown to be less likely to be obese, drive less, and walk more, and in data from a study of the Atlanta region, increasing land use mix by 25% was associated with an almost 7% lower likelihood of obesity.[83] For reference, if 7% fewer adults were obese in the Mid-South, that would be almost 20,000 people.[1] The data presented are from cross-sectional analyses, and there is little longitudinal evidence to present on potential changes in obesity after mixed-use development occurs, but another study in Atlanta suggests that people may become more physically active after moving to a mixed-use development.[84]

Environmental changes brought about by increases in mixed-use development should increase physical activity through walking to accomplish routine activities such as shopping and going to work.[85] Some research suggests that these lifestyle activities are as effective as structured

exercise routines in losing weight.[86] Characteristics of mixed-use development, such as the presence of destinations like retail facilities and services alongside residential uses have been shown to serve as incentives for people to engage in walking activities.[61]

When assessing the potential for mixed-use communities to promote walking, there is a social dimension to consider along with environmental design. People's attitudes toward walking have been shown to be important in determining how environmental changes actually affect behavior: the more positive people's attitudes about walking, the more likely they are to walk.[87] Therefore, strategies to promote positive attitudes toward walking should be implemented in tandem with policies that could lead to supportive changes in the built environment, like mixed-use development.

There is also evidence that living in mixed-use communities is associated with more likelihood of using trails for recreation, so ensuring that the green infrastructure envisioned by the Greenprint is connected to the developments supported by this Action would likely enhance population health benefits of both.[88] Residential proximity to parks and trails is particularly important in promoting healthy behaviors among youth, who in the Greenprint region are much more likely to spend time watching television than engaging in recommended levels of physical activity.[1, 17] Some research suggests that availability of recreational spaces is more effective in promoting physical activity among normal weight and overweight persons than in obese persons.[89] This would indicate that connecting mixed-use development and recreational infrastructure may be more successful in preventing obesity than reducing it; however there is support for the utilitarian components of mixed-use development being effective in promoting activity among those who are already obese.[86]

Supporting mixed-use development will also support general health and well-being through potential changes in transportation behavior. Buildings with mixed uses have been shown to generate more commute trips using transit than single use buildings.[90] Encouraging residential uses as part of mixed-use projects is important in achieving transportation-related health benefits, as residential densities have been shown to exert stronger influence on commuting mode choices than levels of land use mixture, but further examination of walking and bicycling commuters shows that the presence or absence of desirable neighborhood shops may be a better predictor of mode choice than residential densities alone.[91] Further, evidence suggests that the mix of uses and density are much stronger determinants of travel behavior than micro-scale urban design features; however, these design features are likely to be more important for non-commuting activity.[92]

When mixed use can be collocated with transit, in what is termed Transit Oriented Development (TOD), evidence suggests synergies may occur that lead to greater success in terms of both transit use and the pedestrian environment.[93] Home prices in suburban TOD with a light rail component have been shown to be significantly higher within 1/8 of a mile of the station.[94] Prices outside 1/8 of a mile tend to remain more similar to comparison areas. This suggests that affordable housing could still be included with in the ¼ mile walk-to-transit radius suggested in

other research.[75] There is little research however that focuses on effects in TOD scenarios where buses are the transit component, perhaps because the impermanent nature of bus routes when compared to the more permanent nature of rail transit options makes it challenging to develop TOD concepts around bus transit. Affordability should remain a priority when promoting mixed use developments and/or TOD as the Greenprint is implemented.

This Action supports the conclusions of a Fair Housing and Equity Assessment conducted as part of the Mid-South Regional Greenprint and Sustainability Plan.[3] The analysis indicates that a majority of the region lacks inventory of decent, affordable housing options. Numerous other impediments related to lack of capacity, organizational issues, and unfair lending practices demonstrate that equity challenges exist in affordable housing. As recommendations are acted upon, agencies could take advantage of opportunities to link fair housing development to green infrastructure development proposed in the Greenprint Vision Plan. As the discussion above indicates, linking housing development with green infrastructure would likely improve health through a variety of mechanisms, and fair housing and health equity are fundamentally linked.

When housing and development-related goals were examined through the Greenprint Public Surveys, 38.6% of respondents indicated that increasing essential goods and services in low-income neighborhoods is most important when compared to creating more affordable housing solutions close to walking trails, parks and schools (21.8%), or to increasing the proportion of low and very low income households within a 30-minute transit commute of major employment centers (16.6%). However, 23% of respondents indicated that none of these housing and development-related goals is important, which suggests that there is a perception that affordable housing issues are either not prevalent or not perceived as important in the Mid-South.[3] Supporting mixed-use development may be a strategic way to address these issues of affordability and access for lower-income populations and improve health in communities of need. However, doing so may be complicated without strong public support, the lack of which is suggested by the survey responses. Promoting broader health benefits of mixed use strategies may be a way to combat possible negative or ambivalent perceptions in the public regarding housing affordability.

Recommendations for Target Action 5.1.4: Create design standards, incentives, and encourage density in support of mixed-use and mixed-income communities near green infrastructure

- **Use policy to set minimum requirements for affordable and/or subsidized units** and build incentive structures around this provision. From a health promotion perspective, affordability should remain a priority when promoting mixed use developments and/or TOD as the Greenprint is implemented.

Who would be involved in making this happen: Planning Departments, Economic Development staff, the Housing Authorities, private sector developers, neighborhood groups, and affordable housing groups like Habitat for Humanity and United Housing.

- **Ensure pedestrian-oriented design** in these types of communities to enhance the benefit of having a mix of uses. To further enhance the potential for these communities to benefit from proximity to green infrastructure also incorporate bicycle facilities into designs.

Who would be involved in making this happen: Planning Departments, pedestrian and bicycle coordinators, MPOs, City Engineers, the Housing Authorities, neighborhood groups, private sector developers, and affordable housing groups like Habitat for Humanity and United Housing.

- **Promote the potential health benefits of mixed-use developments as part of marketing materials**. Strategically promote possible benefits for affordable housing and lower-income populations, but focus primarily on benefits for the broader community to secure support from the public.

Who would be involved in making this happen: Health Departments, Housing Authorities, private sector developers, and affordable housing groups like Habitat for Humanity and United Housing.

- **Ensure that the green infrastructure network envisioned by the Greenprint Plan directly connects to the developments supported by this Action**. Emphasizing this connection over proximity would likely enhance population health benefits of both the green infrastructure and the mixed use/income developments. Action 5.2.2 under Objective 5.2 (Ensure neighborhood access to green spaces) also addresses this important connection:

    - **5.2.2** Develop incentives and regulations encouraging housing developers to incorporate green space (or open space conservation) or links/access to green space in their projects

Who would be involved in making this happen: Member organizations of the Greenprint Consortium, Planning Departments, Economic Development staff, private sector developers, transportation planners. The V&E Greenline connections to the Crosstown project is a good example of this type of development.

- **Strategies to promote positive attitudes toward walking should be implemented in tandem with policies that could lead to supportive changes in the built environment, like mixed-use development**. Some of the Healthy and Safe Community Actions help to address this:

    - **4.3.5** Organize and promote activities for the safe use of parks, trail, green spaces, and bicycle and pedestrian facilities, such as organized walks and rides and walking school bus groups

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, MPOs, member organizations of the Greenprint Consortium, and/or Schools (in combination with Bike Rodeos, Safe Routes to School projects, or other similar activities). A good example of this type of activity is Le Bonheur's "Walk this Way" pedestrian safety class for kids and families.

- **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organization

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, member organizations of the Greenprint Consortium, school-based groups, non-profit conservancies. A good local example is the Wolf River Conservation Corps hosted by the Wolf River Conservancy.

- Following from Action 5.1.7 which calls for developing metrics to monitor progress of fair housing impacts for use **in evaluating future green infrastructure development, some key topics to consider include**:

  - Where are there currently mixed-use and mixed-income communities in the Region?
  - What existing policies impede mixed-use and/or mixed-income development?
  - How is "near" defined in terms of proximity to green infrastructure?
  - How can data be collected to characterize the social impacts of mixed-use/ income communities in the region?

Who would be involved in making this happen: Planning Departments, university partners, the Housing Authorities, and other social services organizations.

HIA Target Action 2 for Strategic Direction 5: Improved Neighborhoods and Fair Housing Choices

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 5 for a more detailed assessment of potential health impacts.

Objective 5.3: Improve existing neighborhood green assets and increase their use and benefit to the community

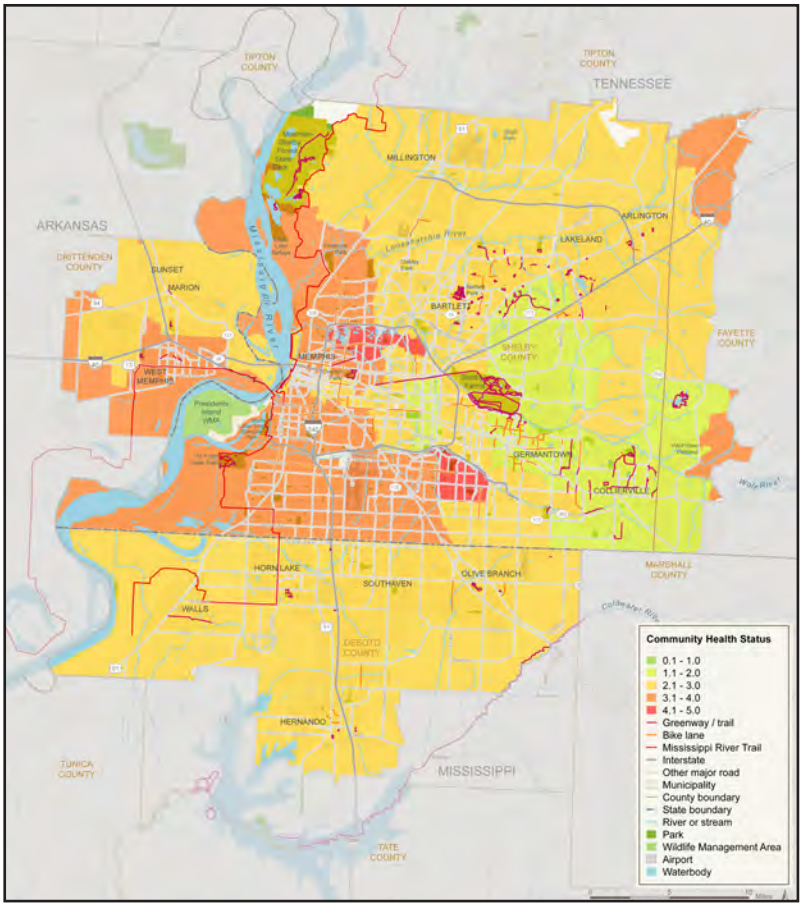
Action 5.3.2: Investigate the potential of converting underutilized land (including publicly owned vacant property) to green space in areas that are currently not well served

Focusing on existing neighborhood assets is a strategic way to use green infrastructure as a health improvement strategy and could have positive impacts for existing residents in the short term, compared to long-range strategies that look to create "new" healthy places. Many

communities in the region have underutilized properties that could benefit the surrounding areas by being converted to green space. By targeting this action to communities currently not well served, the Greenprint could potentially help to address health disparities, assuming areas with poorer access to greenspace are also areas with poorer health status.

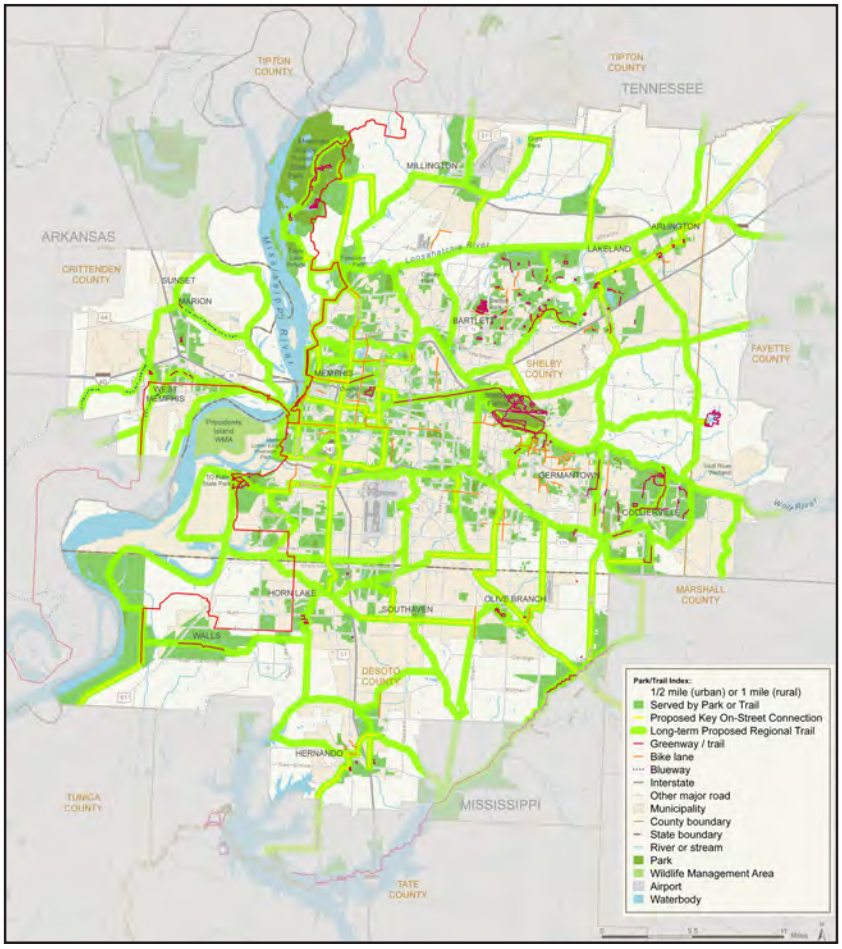
Map 1 (reproduced below) shows that areas of particular need from a health promotion perspective are in West Memphis, in areas immediately north and south of Downtown Memphis, in an area around the Hickory Hill neighborhood south east of the central city, and in pockets of Fayette County in the eastern edge of the region. Comparing the Community Health Status map to the Parks and Trails Accessibility map (**Map 2** reproduced below) shows variable levels of access in the areas of concern, with none standing out as particularly better or worse than other parts of the region, in which 38% of the population live within ½ mile of a park.[1] Regardless of current service level in these communities, converting vacant land to more functional green space would have the strongest potential impact in these areas.

Map 1: Community Health Status



For a larger version of this map, please see Appendix A.

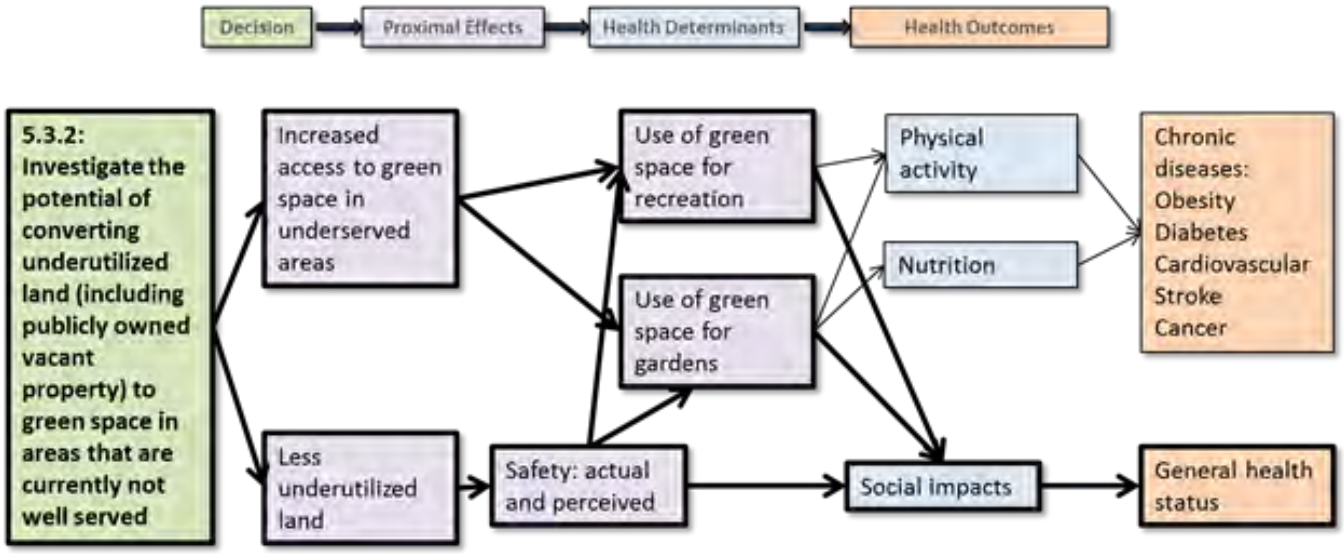
Map 2: Park and Trail Accessibility Index



For a larger version of this map, please see Appendix A.

The HIA Advisory Committee identified impacts on general health status through potential changes in the social environment as the priority health concern for assessment of this action. This relationship is identified in bold in **Figure 11**. The impacts of this action on the social environment include changes in perceptions of neighborhood safety, which can lead to increased use of green infrastructure. If the actions are successful in increasing use, there could then be additional benefits in terms of positive social interactions taking place within the underserved communities. This Action would also reduce the amount of vacant land, which would potentially have positive impacts independent of greenspace use.

Figure 11: Pathway for Action 5.3.2 with Priority Pathways in Bold



Data on the general health of the region are presented above, and the discussion of Strategic Direction 1 lays out the relationships between perceptions of safety, park use, and community health. An important finding to keep in mind under this Action that focuses on revitalizing underutilized properties is that it is often the quality of greenspace, rather than the quantity, that drives the use of that space and ultimately the likelihood of achieving potential health benefits.[18, 95, 96]

Converting underutilized properties to greenspace will likely have the strongest impact on neighborhood health by improving perceptions of safety. Evidence suggests that crimes and gun assaults may decrease in areas around recently greened lots and that perceptions of safety are even more likely to improve.[97, 98] Given the high levels of crime and violence in areas of the Mid-South displayed in **Table 2** and **Table 3** (reproduced below), along with evidence on perceptions of safety from the Greenprint Public Surveys, there appears to be significant potential for this Action to impact health through this pathway.

In a 2013 study of vacant properties in Philadelphia, researchers found that the nearby residents had strong perceptions of how the vacant land negatively impacted their health and were able to offer several solutions to the problem, including conversion to park space or community gardens.[40] That research concluded that local residents should be engaged in the design and implementation of vacant land strategies.

Table 2: Violent Crime Rates (2011)	
Geographic Area	**Violent Crime Rate per 100,000 population**
West Memphis, AR	2325.7
Memphis, TN	1583.5
Millington, TN	866.8
United States	386.3
Southaven, MS	284.7
Collierville, TN	103.7
Germantown, TN	71.4

Data Source: FBI

Table 3 : Property Crime Rates (2011)	
Geographic Area	**Property Crime Rate per 100,000 population**
West Memphis, AR	9968.2
Memphis, TN	6489.0
Millington, TN	5395.4
Southaven, MS	3136.2
United States	2908.7
Collierville, TN	1555.4
Germantown, TN	1206.8

Data Source: FBI

Recommendations for Target Action 5.3.2: Investigate the potential of converting underutilized land (including publicly owned vacant property) to green space in areas that are currently not well served

- **Develop an inventory of underutilized land around the region** and prioritize revitalization based on location, costs, and potential to impact vulnerable populations.

Who would be involved in making this happen: Planning Departments, County Tax Offices, member organizations of the Greenprint Consortium, and/or the Shelby County Land Bank run by the Public Works Division.

- **Consider a variety of uses in collaboration with local communities**. Given the wide range of possible uses for greenspace on converted properties, successfully engaging the nearby communities in the design and development process would likely lead to greater use (and potential health benefit) of the new asset. For example, community gardens are a particularly attractive option in many cases, but it is important to gauge whether or not this idea is supported by the local community, which may be more inclined to gravitate toward another use.

Who would be involved in making this happen: Planning Departments, member organizations of the Greenprint Consortium, neighborhood and community groups, and individual property owners. Grow Memphis and the Green Leaf Learning Farm run by the non-profit Knowledge Quest are good examples of local organizations participating in this type of work.

- **As properties are revitalized, continue to follow-up with surrounding residents** to determine the impact on their perceptions and activities over time. Tracking this type of information will allow for better targeted uses of resources in the future. It will also give an indication of changes in greenspace needs based on potential changes in demographics (e.g. as the community ages or new residents move into the area, etc.).

Who would be involved in making this happen: University partners, community groups, Planning Departments, Public Health agencies, social service organizations, and/or the Housing Authorities.

Other Objectives under this Strategic Direction

The four objectives (and corresponding actions) under the Improved Neighborhoods and Fair Housing Choices Strategic Direction have great potential to impact critical health determinants across the region. Each will exert this influence differently. **Table 13** includes brief notes for each and their possible relationship to improving health throughout the region.

Table 13: Health Perspectives on Improved Neighborhoods and Fair Housing Choices Objectives (SD5)

Objective	Comment	Comparative Influence on Population Health
5.1 Increase affordable, location-efficient, and fair housing choices	Better access to affordable fair housing options would greatly improve the health of populations at the lower end of the socioeconomic spectrum	Highest
5.2 Ensure neighborhood access to green spaces and walkability	Ensuring access to Greenspace for all neighborhoods would positively impact health behaviors and potentially environmental health throughout the region	High
5.3 Improve existing neighborhood green assets and increase their use and benefit to the community	Improving on existing assets in communities would potentially increase their use in the short term and could have far-reaching impacts on health if this use is sustained	High
5.4 Spur the (re)development of neighborhoods that are clean, attractive, and convenient to a wide range of community facilities	Improving existing and new neighborhoods should have a positive impact on the health of residents through improved perceptions and possibly higher levels of activity.	Medium

Strategic Direction 6: Sustainable Resources and a Quality Environment

In respect to sustainable resources and a quality environment, the Greenprint seeks to

- Conserve and protect natural resources (air, water, and land) and biodiversity
- Convert vacant lands and brownfields into productive green assets
- Promote sustainable agricultural and watershed management policies and practices
- Promote and protect biodiversity and wildlife habitat

Improvements to the environment brought about by Actions to achieve these goals will likely lead to improvements in community health status through impacts on environmental determinants such as air and water quality. The magnitude of these impacts is likely to be small in comparison to other Strategic Directions because of the nature of environmental quality determinants. These impacts will accrue relatively equally across the population, with vulnerable populations potentially experiencing the greatest benefit. Environmental improvement also includes addressing more visible aspects like litter and trash removal, which will have bearing on people's perceptions of green space as safe and/or useable. Actions that focus at this level (similar to those explored under Strategic Direction 1) may lead to more proximal improvements to health through promoting physical activity and exposure to nature.

Background

Environmental sustainability leads to improvements in environmental health and can also improve human health through a variety of mechanisms depending on what strategies are employed. Improving air quality reduces the risk of exposure to harmful air pollutants and can improve respiratory health.[51, 99-101] Utilizing the environment as a sustainable resource to enhance the local food system might increase access to fresh fruits and vegetables, which can improve nutrition-related health outcomes.[47, 102] Low impact development can improve water quality by reducing storm-water runoff and result in more stable ecosystems as well as in lower risk of gastrointestinal and other diseases.[103]

Incorporating environmentally sustainable practices into land development strategies can lead to reduced greenfield development and increased focus on reuse of brownfields and vacant land, which can reduce crime and other incivilities in the neighborhoods around these properties and allows for redevelopment using smart growth principles demonstrated to contribute to healthy communities.[104, 105]

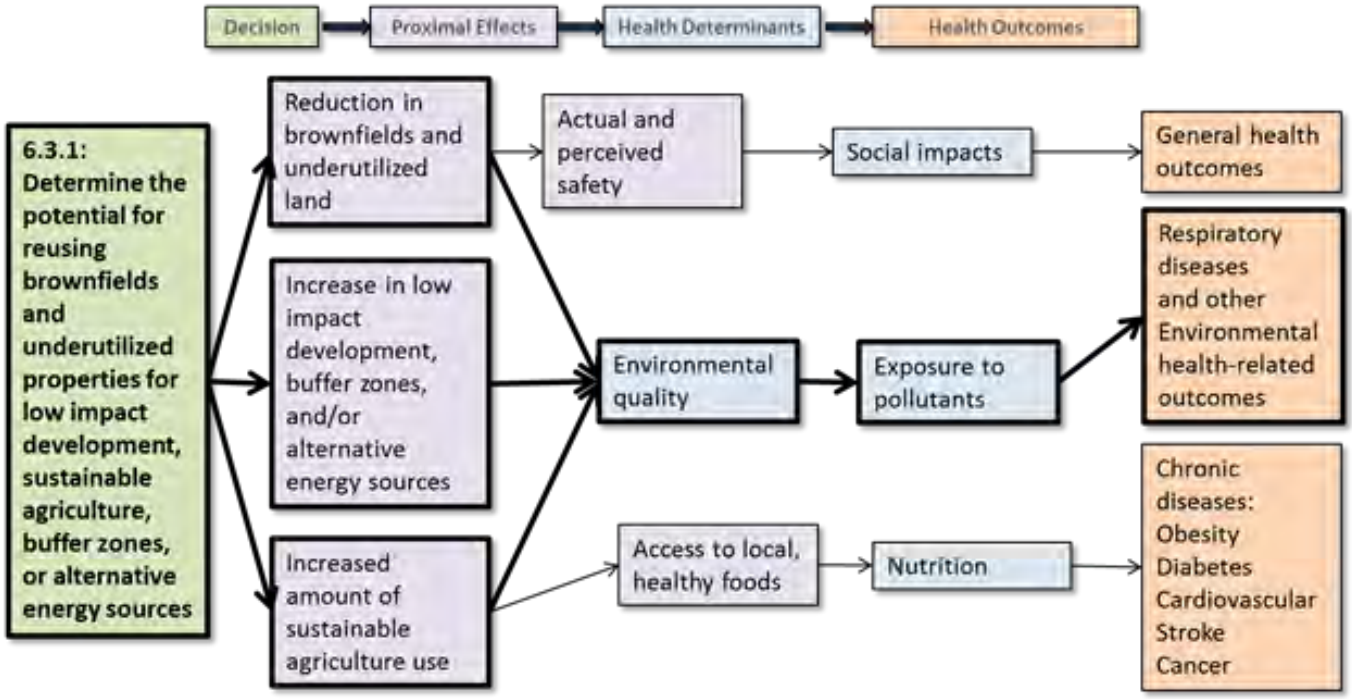
HIA Target Action 1 for Strategic Direction 6: Sustainable Resources and a Quality Environment

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 6 for a more detailed assessment of potential health impacts.

Objective 6.3: Promote sustainable watershed management policies and practices for water conservation and protection

Action 6.3.1: Determine the potential for reusing brownfields and underutilized properties for low impact development, sustainable agriculture, buffer zones, or alternative energy sources Implementation of the Greenprint that focuses on sustainable watershed management will improve ecosystem health. Nesting these watershed improvements within the context of sustainable development and redevelopment will result in other benefits as well. These benefits, such as reduced greenfield development and implementation of smart growth practices, are more likely to have sustained positive impacts on health of communities in the Mid-South than any efforts that focus solely on water conservation.

Figure 12: Pathway for Action 6.3.1 with Priority Pathways in Bold

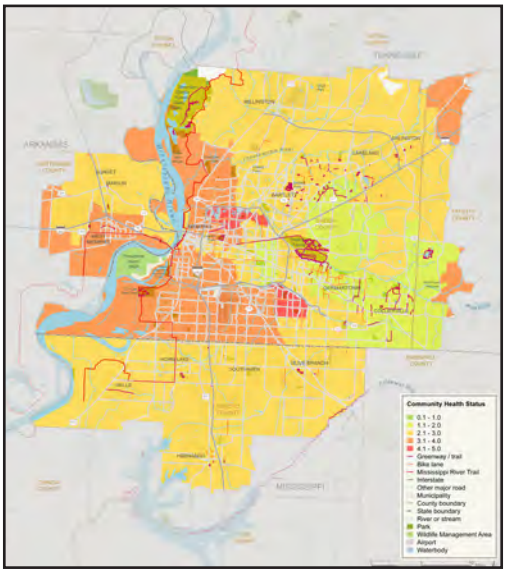


The HIA Advisory Committee identified environmental health related outcomes as the priority for assessment of this action, reflecting a particular concern air quality in the Mid-South. A specific pathway diagram with this pathway emphasized is included as **Figure 12**. Air pollution is related to numerous health outcomes, including respiratory and cardiovascular diseases. Rates for some environmental-related health outcomes in the Greenprint region are presented in **Table 14**. There are also large disparities in environmental health outcomes, but it is difficult to discern the relative influence of individual behaviors versus environmental exposures. For example, African Americans in the Greenprint Region are over 50% more likely to die from lung disease than whites, but without further epidemiological study, it is difficult to assess how much of this may be due to environmental determinants such as poor air quality or due to behaviors such as smoking.[1] This Action could potentially reduce concentrations of pollutants in areas with poor health status and high social inequity because many underutilized properties appear to be located within the areas of concern (**Maps 1 and 8** - Community Health Status (reproduced below) and Underutilized Properties).

Table 14: Environment-Related Health Outcomes in the Greenprint Region and US

Outcome	Greenprint Region	United States
Age-Adjusted Death Rate, Lung Disease (Per 100,000 Pop.)	42.88	42.4
Percent Adults with Asthma	10.66%	13.20%
Lung Cancer, Annual Incidence Rate (Per 100,000 Pop.)	66.8	64.9
Age-Adjusted Death Rate, Cancer Mortality (Per 100,000 Pop.)	209.62	176.66

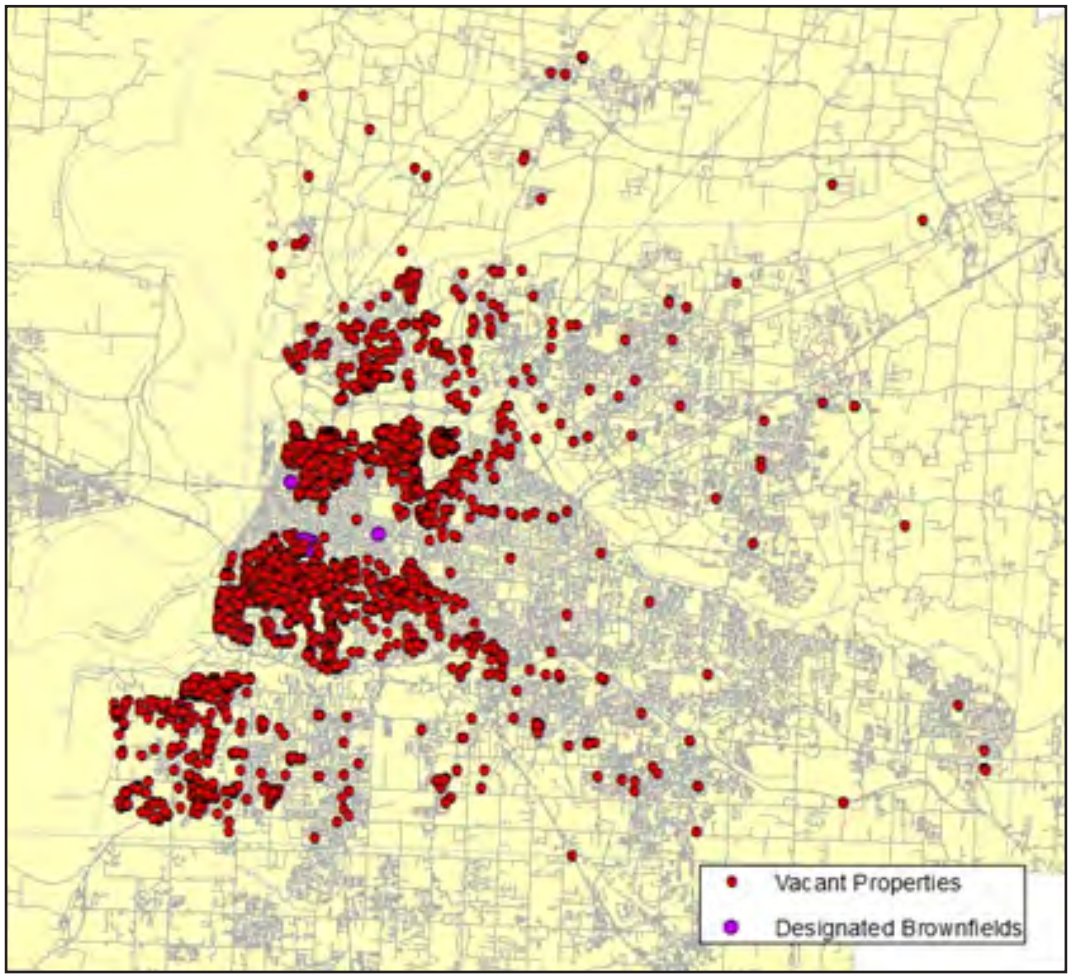
Map 1: Community Health Status



For a larger version of this map, please see Appendix A.

The US Environmental Protection Agency (EPA) defines brownfields as "abandoned, idle, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination." The health impacts of brownfields can be complex and include safety hazards, social and economic impacts, and risks of biological, physical, or chemical contamination.[106] Proximity to brownfields sites is correlated with increased rates of disease.[107-109] Brownfield sites may have multiple contaminants in the soil, water, and air, which have known and unknown health risks. The impact of brownfield sites on a community is not limited to exposure to environmental contaminants. Rather, they can also act as centers of drug use and other illicit activities, dumping, and blight.[110] Communities with extensive brownfield sites tend to have higher rates of infant mortality, HIV/AIDS, tuberculosis, and homicide.[110]

Map 8: Location of "Underutilized" Properties in Shelby County



Source: TN Dept. of Envrironmental Conservation, Shelby County Land Bank, and Memphis and Shelby County Office of Sustainability

An analysis of brownfields in Baltimore found that disparities existed between communities with high numbers of brownfields and those with fewer of these properties.[108] Specifically, that analysis showed that communities living in the highest brownfields zone experienced statistically higher mortality rates due to cancer (27% excess), lung cancer (33% excess), respiratory diseases (39% excess), and the major causes of death (index of liver, diabetes, stroke, COPD, heart disease, cancer, injury, and influenza and pneumonia; 20% excess), when compared with communities living in low brownfields zones. These differences were observed after adjusting for risk factors such as age and socioeconomic status. The study goes on to conclude that brownfields redevelopment is a key component of efforts to address environmental justice and health disparities seen across urban communities.

Addressing brownfield properties will likely have positive impacts on health in the surrounding communities by simply removing these health risks. Brownfield redevelopment, which entails assessing, cleaning, and reusing the site to acceptable health standards, can cause positive health impacts on the community by reducing the health risks associated with the contamination and mitigating the overall negative impact of brownfield sites on the community.[109] Addressing these properties using smart growth principles will likely add to those positive effects on community health.

An EPA review of five redevelopment projects in urban areas around the U.S. found significant health and environmental advantages, relative to allowing comparable development to occur in conventional patterns in a greenfield location.[111] Post-redevelopment, the brownfield locations resulted in comparatively fewer vehicle miles traveled (VMT) by their occupants, leading to lower emissions of carbon dioxide, nitrogen oxides, carbon monoxide, hydrocarbons, and other pollutants. They also resulted in less storm water runoff and fewer acres consumed, leading to lower levels of nitrogen, phosphorous, metals, and solids released into the water resources. These findings suggest a connection with physical activity as well, as residents experience new destinations in walking distance, perception of crime lessens, and neighborhood aesthetics improve. An HIA of a regional plan in Knoxville found that the potential benefits of recycling brownfields accrue to the whole community and often justify use of zoning or tax tools to facilitate such redevelopment.[112]

Based on feedback at the Consortium meeting on Jan 23, 2014, there is specific concern about how this issue plays out in areas not currently populated. There is little research that examines vacant and/or underutilized land of this type; though many environmental conclusions are likely to be similar to those discussed above. The social impacts would be less likely to translate from urban to non-urban sites where there are little or no residents nearby.

Not all brownfields or underutilized properties are appropriate candidates for redevelopment, as many are not likely to be located within existing communities and may be fairly isolated geographically. For these types of properties other types of uses, such as conservation buffers, could be explored as ways to improve environmental and human health in the region. Conservation properties, especially in more rural agricultural settings, have been shown to be successful in protecting biodiversity and improving ecosystem health.[113]

In terms of improving human health, sustainable urban agriculture is a use to consider when seeking to redevelop underutilized properties. According to the EPA, "urban agriculture projects can help bind contaminants while providing further benefits to the property and surrounding community. An urban farm or community garden can improve the environment, reduce greenhouse emissions, and improve access to healthy, locally grown food. Other possible benefits include promoting health and physical activity, increasing community connections, and attracting economic activity."[114] This strategy can be particularly effective in improving access to healthy foods in communities that are likely to lack affordable and healthy options. However, there are challenges to urban agriculture that should be considered. A 2013 review of these challenges includes the figure below, reproduced here as **Figure 13**.[115]

Figure 13: Threats to Urban Agriculture

A vacant lot urban farm highlighting abiotic challenges of urban agriculture, including: elevated atmospheric concentrations of industrial pollutants (A), elevated atmospheric concentrations of greenhouse gases from traffic emissions (B), contaminated storm water runoff (C), Lead-contaminated soils adjacent to aging housing stock (e.g., paint chips) (D), soils contaminated by heavy metals and/or polycyclic aromatic hydrocarbons (E), unpredictable access to municipal water sources (F), potentially contaminated recycled water sources (e.g., rainwater harvesting) (G), reduced light and wind speed due to the built environment (H), increased mechanical heat (e.g., air conditioners) (I), and increased surface temperatures from pavement and rooftops (J).

From Wortman and Lovell, 2013.[115]

That same review also offers solutions for addressing some of these challenges, reproduced below as **Figure 14**.

Figure 14: Urban Agriculture Solutions

Multifunctional buffers on urban farms may increase infiltration of stormwater, protect crops from drying winds, filter contaminated aerosols, improve aesthetics of the site, and provide additional marketable products from perennial plants.

From Wortman and Lovell, 2013.[115]

Recommendations for Action 6.3.1: Determine the potential for reusing brownfields and underutilized properties for low impact development, sustainable agriculture, buffer zones, or alternative energy sources

- **Examine population characteristics near sites to determine the specific health concerns of the local community and how addressing underutilized property may impact them**. Where there are existing communities around these sites, engaging those populations to determine their desires and concerns will allow for more local support of the eventual reuse, which would likely increase any positive health impacts. For sites that are not near populated areas, there may be a wider range of potential reuse options; though the surrounding landscape and existing land uses should still be considered as important contexts for the reuse.

Who would be involved in making this happen: Planning Departments, Public Health Agencies, community groups, social services organizations, university partners, and/or local environmental groups. Good examples of local groups engaging in this type of work include the Building Neighborhood Capacity Programs in Frayser and Binghampton, and Christ Community Health Services.

- **Ensure that smart growth strategies are employed when redevelopment occurs**. If the potential site is in an existing community or in an area where future residential or commercial growth may occur, then it will be important, from a health promotion perspective, to consider the reuse strategy as part of an overall plan for the area that focuses on improving quality of life and livability.

Who would be involved in making this happen: Planning Departments, Public Health Agencies, local environmental groups, and private sector developers.

- **When considering urban agriculture as a use for underutilized property, develop solutions based on best practices**. These include strategies similar to those presented in Figure 12 above. Consulting best practices from the urban agriculture field can help to improve community health by maximizing the potential success of these uses in terms of both food production and the development of a community asset.

Who would be involved in making this happen: Planning Departments, Grow Memphis, Public Health Agencies, local environmental groups, school-based organizations, and/or private sector developers.

HIA Target Action 2 for Strategic Direction 6: Sustainable Resources and a Quality Environment

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 6 for a more detailed assessment of potential health impacts.

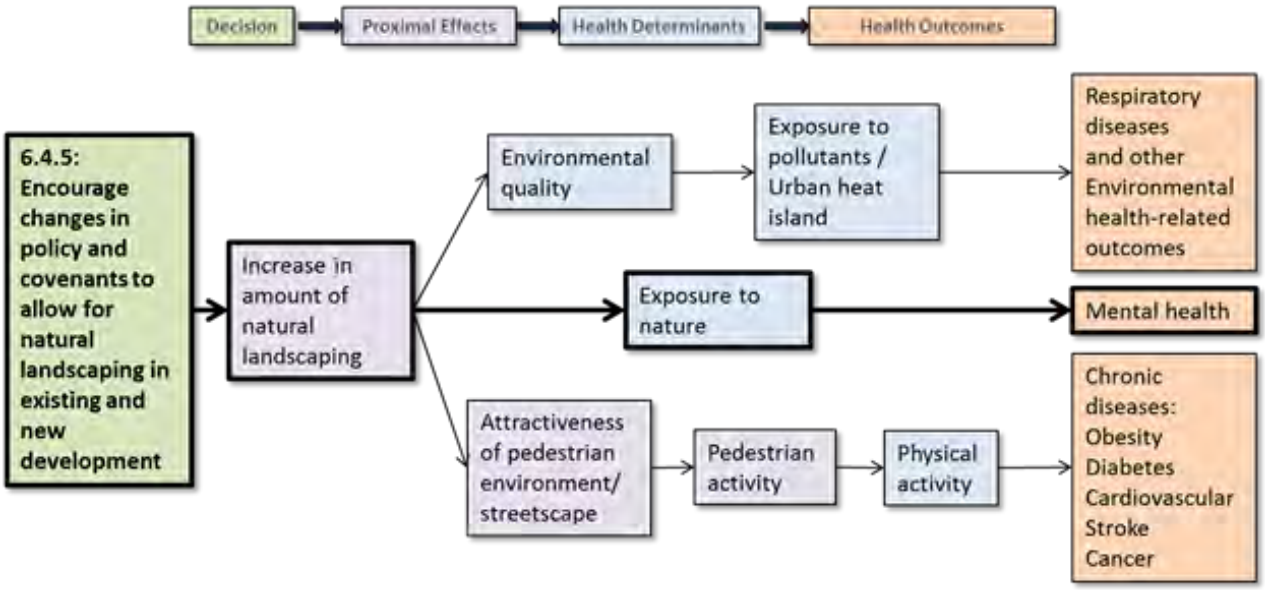
Objective 6.4: Promote and prioritize investments that protect biodiversity and wildlife habitat

Action 6.4.5: Encourage changes in policy and covenants to allow for natural landscaping in existing and new development

Biodiversity is an indicator of ecosystem health, and promoting actions that protect ecosystem health are likely to have positive effects on human health.[116] Actions under this objective recognize the role of people as both stewards of the environment as well as organisms that are part of the ecosystems of the Mid-South. Encouraging natural landscaping is an effective way of increasing vegetation in areas where people live and work. This type of landscaping provides benefits that can work synergistically with other forms of green infrastructure such as parks and trails to improve population health by encouraging social interactions, physical activity, and environmental quality.[117] A 2013 review of the literature in this topic area concludes that "the balance of evidence indicates conclusively that knowing and experiencing nature makes us generally happier, healthier people."[118] The positive health effects conferred by increasing natural landscaping are most likely to be seen in urban areas of the region where little vegetation currently exist.

The HIA Advisory Committee selected mental health as the priority health concern for assessment of this Action. **Figure 15** shows this relationship in bold. The relationship between vegetation (or greenness) and mental health appears fairly straight-forward in that numerous studies have shown that people that have greater exposure tend to also have better outcomes, regardless of any preexisting mental health issues. The mechanisms behind this relationship are more complex, and determining causality can be difficult. Mental health, also referenced as behavioral health, represents a complex set of conditions that are difficult to define and measure, but are none the less important components of overall health and well-being. Suicide is a major indicator of poor mental health and is a leading cause of death nationally and in Tennessee. In the Mid-South, the rate of suicides is lower than in the sates of Tennessee and Mississippi and roughly equal to the national rate.[1]

Figure 15: Pathway for Action 6.4.5 with Priority Pathways in Bold



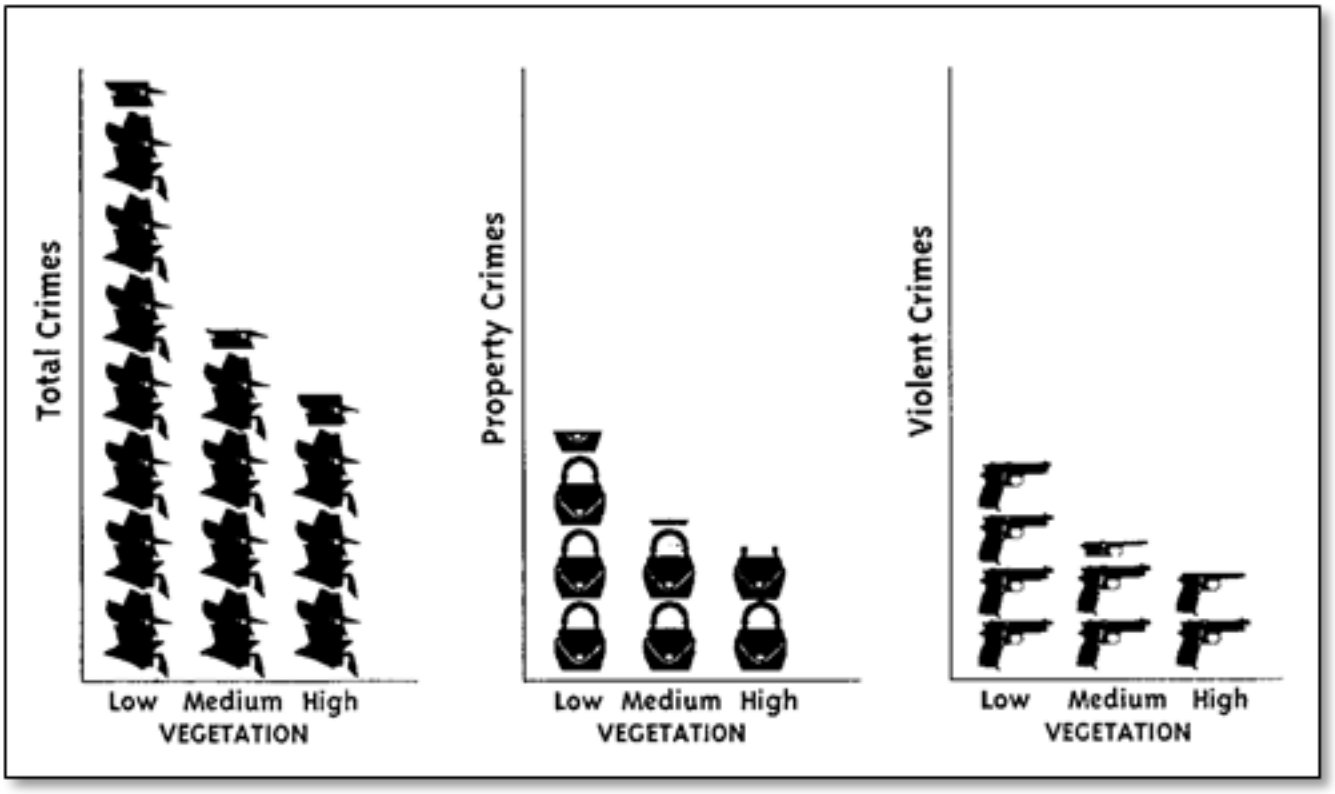
Streetscapes with greater quantity and better quality greenery have been shown to associate with better outcomes for a variety of health measures, including mental health.[119] Most studies focus on parks and other recreational spaces, but evidence suggests that the relationship between mental health and exposure to nature extends beyond active participation in useable greenspace to observable greenspace in the neighborhood environment.[120] The maximum health benefit in the Greenprint Region will occur if both useable and more passive decorative greenspaces are pursued.

Like many of the relationships between the built environment and health, the relationship between greenery and mental health is modulated by individual perceptions. In London, people who were dissatisfied with the greenspace in their neighborhoods had over double the risk for mental health issues compared to those who held positive perceptions.[121] Another study found that people who perceived their neighborhoods as highly green were 60% more likely to have better mental health compared to who perceived low levels of greenness; this was a stronger association than physical health, for which more greenery was associated with a 37% increase in likelihood.[122] Actions 4.3.7 and 4.4.4 under the Healthy and Safe Communities Strategic Direction will help to foster positive perceptions of greenery in the region.

As a component of neighborhood perception, fear of crime can impact mental health by increasing stress. Evidence suggests that increasing the amount of vegetation can have positive impacts on health by reducing this fear. In one study from Chicago, buildings with high levels of vegetation had 52% fewer total crimes, 48% fewer property crimes, and 56% fewer violent crimes than buildings with low levels of vegetation.[123] **Figure 16** is reproduced from that study and illustrates the relationship graphically. Given the high crime rates in parts of the Mid-South,[1]

efforts to increase the amount of vegetation in some areas could be part of a comprehensive strategy to prevent crime and possibly improve mental health. These efforts should go hand-in-hand with plans to incorporate Crime Prevention through Environmental Design (CPTED) principles into future development and redevelopment, as noted in Action 4.3.3.

Figure 16: Crime and Vegetation in Chicago Apartment Buildings



Mean number of crimes reported per building for apartment buildings with different amounts of vegetation (each icon represents one reported crime).

From Kuo & Sullivan, 2001[123]

Some gauges of mental health are subtle and related to psychological coping more so than specific outcomes. Another study from Chicago showed that public housing residents living in units without trees and grassy areas nearby were more likely to report more procrastination in facing their major issues and assessed their issues as more severe, less solvable, and more longstanding than other residents living in greener surroundings.[124] Focusing on landscape design elements in lower income neighborhoods within the Greenprint region could have subtle effects on the populations' ability to cope with poverty and/or other socioeconomic stressors.

Similar to the difficulties in measuring mental health at the population level, there is no standard way of measuring "greenness" of a neighborhood or property, so determining the amount of vegetation needed to obtain health benefits is difficult. Given the complexity of

the relationship, there is unlikely to be a threshold for effect, from a mental health standpoint as well as for other associate health outcomes and behaviors. Research on the connections between green space and health often characterizes the amount of vegetation observationally and categorizes areas broadly based on these study-specific observations and indices.[119, 123] As part of changes in policy to support natural landscaping in the Mid-South, a locally-relevant scale of greenness could be developed to help set benchmarks for measuring how green specific properties are. This regional index might then be used to facilitate future study of this relationship in the region.

Pursuit of this Action should be done in the context of other Greenprint strategies that more directly address underlying socioeconomic issues in the region like employment, education, and housing affordability. Though associations between vegetation and mental health have been well documented, establishing causality is difficult, and the relationship is likely to be bi-directional.[41] One review points out that because of this ambiguity, "simplistic urban interventions" to increase green landscape design may fail to address underlying determinants.[42] Therefore, this Greenprint Action will have the best chance of improving health if other Actions that address these underlying determinants are also successful.

Recommendations for Target Action 6.4.5: Encourage changes in policy and covenants to allow for natural landscaping in existing and new development

- **Pursuit of this Action should be done in the context of other Greenprint strategies that more directly address underlying socioeconomic issues in the region** like employment, education, and housing affordability. Simply increasing the amount of vegetation in an area is unlikely to generate much health improvement in isolation; therefore it is critical to view this Action as one piece of the broader livability goals of the Greenprint. For example, Actions 4.3.7 and 4.4.4 under the Healthy and Safe Communities Strategic Direction will help to foster positive perceptions of greenery in the region, which may lead to more positive effects on mental health:

    - **4.3.6** Encourage the use and care of parks, trails, and green spaces and bicycle facilities by youth and youth organization

Who would be involved in making this happen: Community groups, Parks and Recreation Departments, Public Health Departments, Planning Departments, member organizations of the Greenprint Consortium, school-based groups, non-profit conservancies. A good local example is the Wolf River Conservation Corps hosted by the Wolf River Conservancy.

    - **4.1.4** Create and support nature- and place-based youth education and physical fitness programs as a means for improving child health, development, and education

Who would be involved in making this happen: Community groups, Parks and Recreation

Departments, Public Health Departments, member organizations of the Greenprint Consortium, school-based groups, and/or non-profit conservancies.

- **Pay special attention to opportunities for improving landscapes in lower income areas.** Landscape design improvements in lower income neighborhoods within the Greenprint region could have subtle effects on the populations' ability to cope with poverty and/or other socioeconomic stressors that lead to poorer health. These subtle effects could accumulate over time and lead to improvements in health outcomes. Success in this area will likely require landscaping components to be part of larger, economically viable investments in these communities. Therefore, the changes to policies and covenants supported by this Action should ensure that natural landscaping is strongly encouraged (if not required) when (re)development occurs in low-income areas.

Who would be involved in making this happen: Planning Departments, developers, and/or the Housing Authorities. Master Gardeners could also be engaged based on their community service requirements for certification.

- **Collaborate with public safety professionals in developing landscaping strategies that effectively leverage the potential health benefits**. Given the high crime rates in parts of the Mid-South, efforts to increase the amount of vegetation in some areas may be perceived as unnecessary or even unsafe. Bringing a public safety perspective into the design process, through CPTED and direct engagement with public safety professionals, could help address these concerns and lead to more locally-tailored and effective solutions for both the communities concerned and for environmental health.

Who would be involved in making this happen: Police and Public Safety groups, Planning Departments, developers, landscape designers, Public Health Departments, local environmental groups.

- **Develop a locally-relevant metric for measuring "greenness."** As part of changes in policy to support natural landscaping in the Mid-South, a locally-relevant scale or index could be developed to help set benchmarks for determining how "green" specific properties are. This regional index might then be used to facilitate future evaluation of policy changes that allow for more natural landscaping.

Who would be involved in making this happen: Planning Departments, university partners, local environmental groups, and /or non-profit conservancies.

- **Coordinate plans within the region to support both useable and decorative greenspace**. Because there are potential health benefits from both the exposure to "greenness" and the active use of greenspace, changes in policy to encourage more natural landscaping should include attention to a full range of landscape types, from

small decorative spaces to larger spaces where people may engage in a variety of activities.

Who would be involved in making this happen: Planning Departments, landscape designers, local environmental groups, private developers, and /or non-profit conservancies.

- **Ensure that natural landscaping is permitted—and encouraged-- at a scale that encourages biodiversity.** This is based on the finding that much of the human health benefit from green space may be tied to species diversity, which itself is a good indicator of ecological health.

Who would be involved in making this happen: Planning Departments, landscape designers, local environmental groups and ecologists, private developers, and /or non-profit conservancies.

Other Objectives under this Strategic Direction

The four objectives (and corresponding actions) under the Sustainable Resources and Environment Strategic Direction have potential to impact health determinants across the region. Each will exert this influence differently. **Table 15** includes brief notes for each and their possible relationship to improving health throughout the region

Table 15: Health Perspectives on Sustainable Resources and Environment Objectives (SD6)		
Objective	**Comment**	**Comparative Influence on Population Health**
6.1 Conserve and protect natural resources including air, water and land	Conservation efforts will help to improve environmental quality over time, which will reduce risk of exposure to pollution throughout the region. Effects on health outcomes may not be large in magnitude	Medium
6.2 Promote sustainable watershed management policies and practices for water conservation and protection	Improvements in water quality are likely to have small effects on health outcomes. The benefit to health will come from integrating strategies for sustainable watershed management with strategies for sustainable (re) development	Low
6.3 Create productive green assets from underutilized lands and brownfields	Replacing brownfields and other underutilized properties with productive community or environmentally sustainable uses would likely have a direct and positive impact on health determinants, especially in nearby populations	High
6.4 Promote and prioritize investments that protect biodiversity and wildlife habitat	Protecting biodiversity and habitat should have a positive impact on ecosystem health and provide people with more opportunities for exposure to nature. This objective will have the greatest impact on human health when coordinated with Objectives that address socio-economic determinants.	Medium

Strategic Direction 7: A Productive Workforce and Economy

In order to contribute to a productive economy and workforce, the Greenprint seeks to:

- Empower individuals to improve economic outcomes
- Increase and enhance regional employment opportunities, and
- Support neighborhood-level economic development

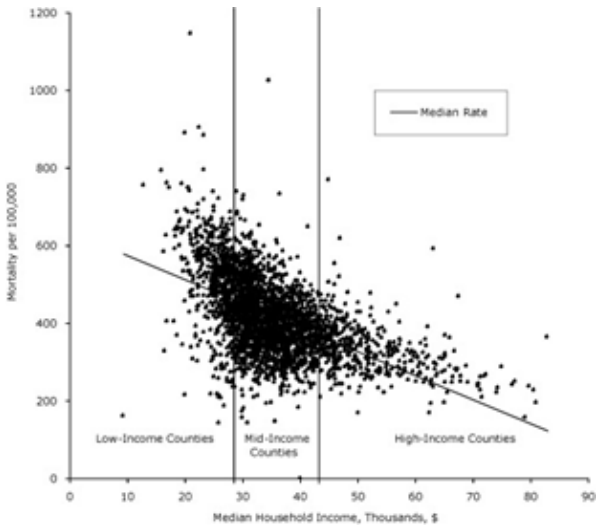
Actions taken to achieve these goals are likely to have long term effects on the health of the community; though these effects could be unevenly distributed throughout the region. The strongest positive influence on community health will likely occur when activities target low income areas and/or areas with high unemployment.

Background

Employment opportunities and access thereto contribute to health status by potentially influencing people's income, one of the strongest determinants of health.[77, 78] This relationship is bi-directional, with the existence of healthy communities also contributing to enhanced worker productivity and stronger economies.[125-127]

In a 2012 study of US counties, Cheng and Kindig found that an increase in median annual household income of roughly $9,000 was associated with a 13% reduction in county-level premature mortality (**Figure 17**).[43] For the four Greenprint counties, a 13% reduction in premature mortality would translate to between 500 and 1,000 fewer premature deaths each year (calculated using County Health Ranking Data).[128]

Figure 17: Median Income and Premature Mortality in US Counties



Median annual household income and age-adjusted mortality per 100,000 population aged birth to 75 years, 2002-2006. Bars represent 25th ($29,631) and 75th ($39,401) percentile delineations of median household income for 3,139 US counties. Counties are grouped by median household income levels into low-income (n=785); mid-income (n=1,570); and high-income (n=785) counties. *From Cheng and Kindig, 2012*.[43]

Mechanisms underlying the relationship between income and health are complex. Evidence from the literature suggests that poverty affects health through material deprivation (including lack of access to health care), decreased social participation, and decreased control over one's life. On the other hand, people with higher incomes may improve their health outcomes by being more likely to have higher levels of social participation and better access to safe neighborhoods, healthy foods, education, health care, and clean air.[77, 129] The four counties that comprise the Greenprint Region are ranked according to several indicators that reflect these determinants in **Table 16**. While these rankings do not represent a model for determining the impact of income on health, they do provide some evidence that these relationships are present in the region, with the highest income county (DeSoto) typically ranking "better" than the lowest income county (Crittenden).

Table 16: Greenprint Counties Ranked by Various Indicators Relevant to Employment and Health

Percent Families with Income Over $75,000 (highest on top)	**Percent Population in Poverty** (lowest on top)	**On-Time Graduation Rate** (highest on top)	**Unemployment Rate** (lowest on top)	**Percentage of Days Exceeding Air Quality Standard for PM2.5** (lowest on top)	**Percent Population with Low Food Access** (lowest on top)	**Age-Adjusted Death Rate for Homicide** (lowest on top)	**Percent Population Without Adequate Social / Emotional Support** (lowest on top)	**Percent Adults Without Any Regular Doctor** (lowest on top)
DeSoto	DeSoto	Fayette	DeSoto	Fayette	Fayette	DeSoto	Fayette	Fayette
Fayette	Fayette	DeSoto	Crittenden	Shelby	Crittenden	Fayette	Shelby	Shelby
Shelby	Shelby	Shelby	Shelby	DeSoto	Shelby	Crittenden	DeSoto	DeSoto
Crittenden	Crittenden	Crittenden	Fayette	Crittenden	DeSoto	Shelby	Crittenden	Crittenden

Aside from income, employment influences other health determinants as well. Having stable employment is related to self-esteem and can have bearing on several mental health indicators; though there is also evidence that too much work can cause stress and irritability, leading to negative health outcomes.[77] In an issue brief on employment and health, the Robert Wood Johnson Foundation cites a 2010 Gallup Poll that found unemployed Americans far more likely than employed Americans to be diagnosed with depression and report feelings of sadness and worry.[130]

Spatially, the design and location of green infrastructure can potentially increase access to employment centers.[48-50] Strategies to locate job opportunities near trails and greenways and to connect trails and greenways to employment centers throughout the region can increase the likelihood of people using these amenities as a commute option, thereby contributing to potential health benefits associated with physical activity, exposure to nature, and possibly social capital.

In sum, activities aimed at fostering a productive workforce and economy are likely to affect multiple health determinants, household income most directly. There are also inherent aspects of work that can improve mental health, and the location of employment opportunities can influence travel behaviors, which are associated with a variety of health determinants and outcomes.

HIA Target Action for Strategic Direction 7: A Productive Workforce and Economy

The HIA Advisory Committee selected the following action and corresponding objective under Strategic Direction 7 for a more detailed assessment of potential health impacts.

Objective 7.1: Enhance access and connectivity to employment, education, and training centers

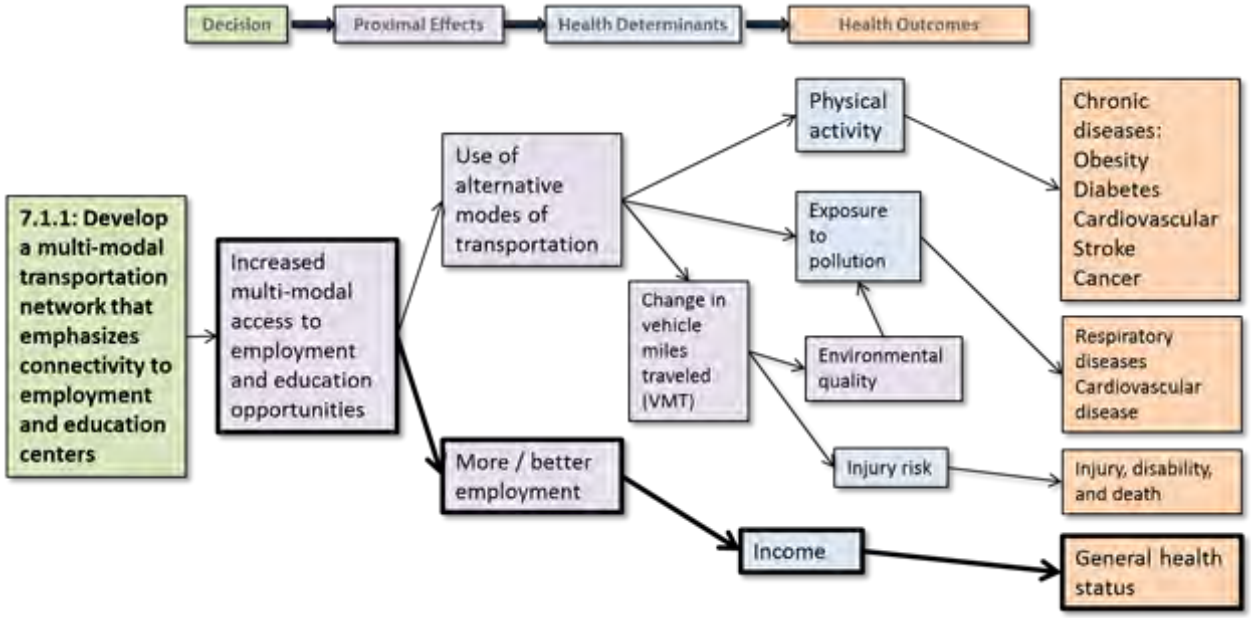
Action 7.1.1: Develop a multi-modal transportation network that emphasizes connectivity to employment and education centers

The Greenprint sets out a vision for connecting employment and education centers as part of a regional trails system, as displayed in **Map 8** (Employment and Education Centers). There are two ways this action may influence community health. First, expanding the transportation network through trails and on-street improvements (as defined under SD 3), may improve access to employment and educational opportunities such that under- or unemployed persons are able to engage in activities that lead to increases in income, which are associated with improved health status. Second, because there is a multi-modal aspect of these network improvements, more people may begin to walk, bike, or ride transit to existing or new employment and educational opportunities. With increases in these modes of travel, there are likely to be increases in physical activity that can lead to reductions in chronic diseases over time.

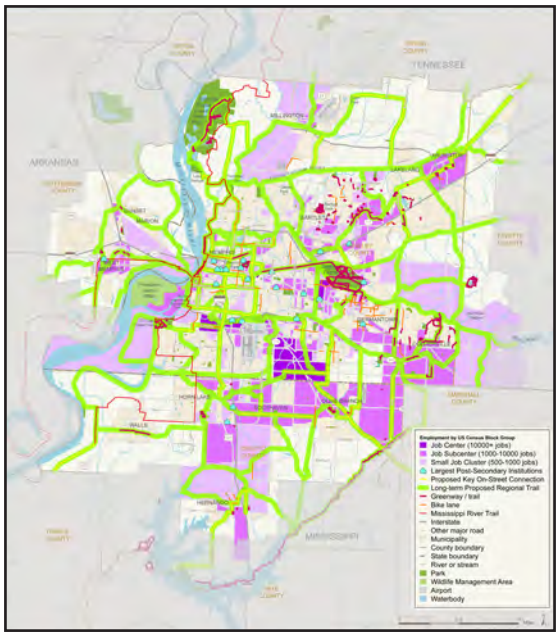
The HIA Advisory Committee identified impacts on general health status through potential changes in socioeconomics as the priority health concern for assessment. This relationship is identified in bold in **Figure 18**. As noted above, this action is likely to impact income if the improved connectivity leads to better access to employment and education opportunities. Positive impacts on general health and well-being at the community level are going to be most likely if this increase in access is experienced by populations that are otherwise disconnected from these opportunities. Research demonstrates that the relationship between health

and income is much more prominent at lower ends of the economic spectrum.[43] Therefore, improvements in access to employment and educational opportunities may only have a marginal effect on the health of individuals that are already relatively well off, but the effect in more disadvantaged communities could be substantial.

Figure 18: Pathway for Action 7.1.1 with Priority Pathways in Bold



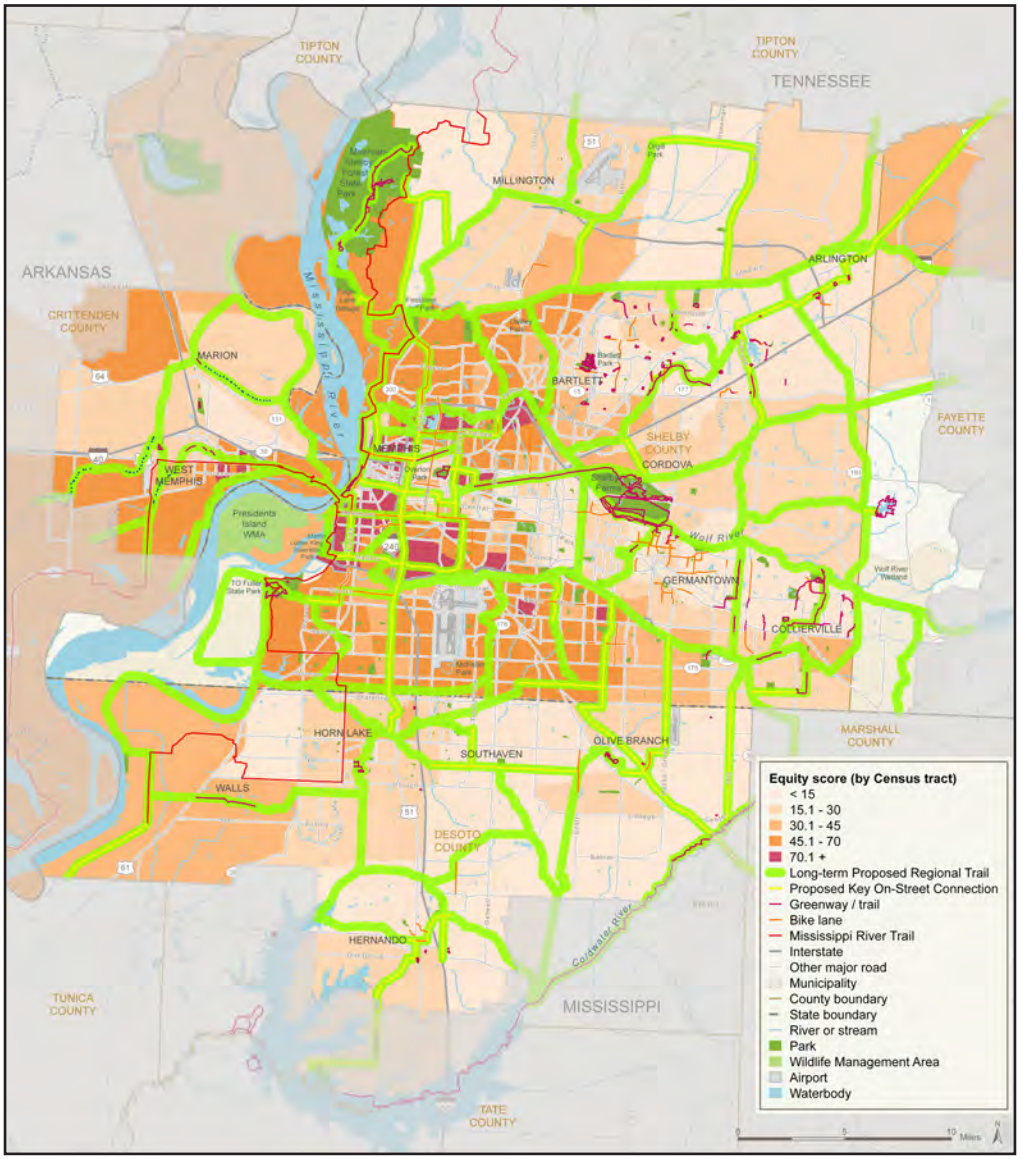
Map 8: Employment and Education Centers



For a larger version of this map, please see Appendix A.

Maps 9 and 10 illustrate the current locations of low income or otherwise vulnerable populations and of corresponding low income jobs, respectively. Vulnerable populations, those that are most likely to accrue health benefits from better access, are clustered north and south of downtown Memphis (**Map 9**), while many of the lower-income jobs are dispersed throughout the region, with concentrations around the airport, along the Poplar Ave. corridor stretching east from downtown to Germantown, and in other areas east and southeast of the central city (**Map 10**). There are also clusters of low income jobs in the smaller city centers throughout the region in areas such as West Memphis, Millington, and Southaven.

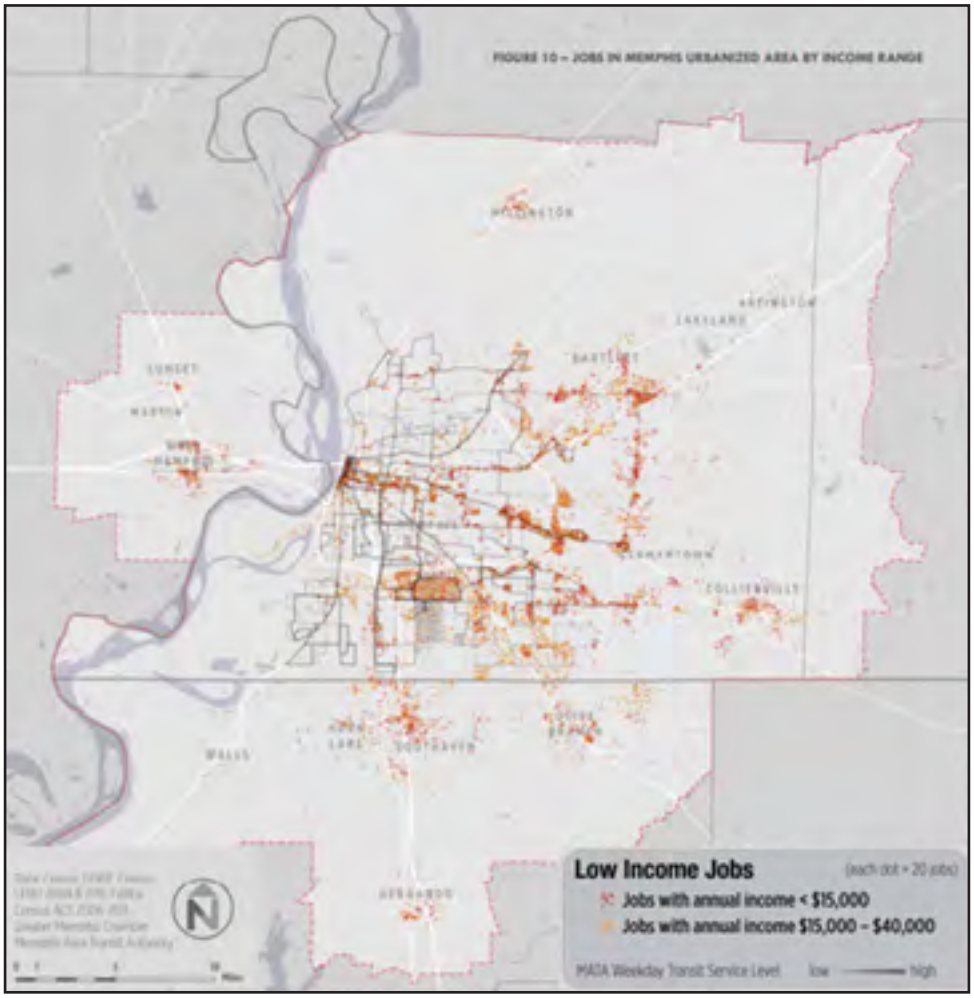
Map 9: Social Equity



For a larger version of this map, please see Appendix A.

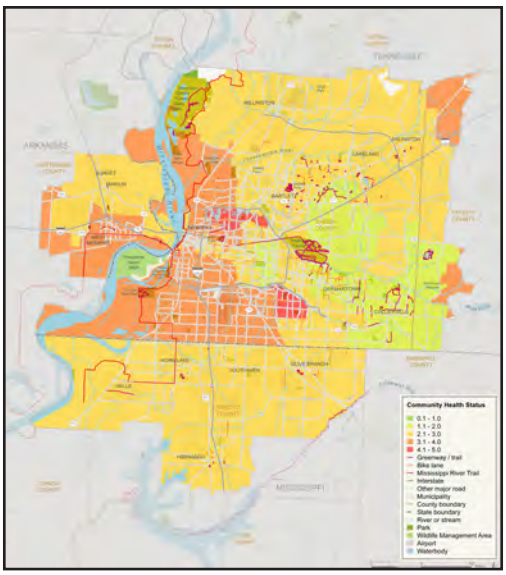
Map 1 (reproduced below) demonstrates that the areas with poorer health outcomes roughly correspond to areas with the highest levels of social inequality. On self-reported measures of general health status, the Greenprint Region is comparable to the nation as a whole, with roughly 16% of people reporting that they have poor or fair health.[1] However, when objective measures of premature mortality are considered, the region does not fare as well. Nationally, the rate of Years of Potential Life Lost (YPLL) due to premature death per 100,000 population is 6,851. In the Greenprint Region this rate is 9,616, topping out at 13,801 in Crittenden County.[1]

Map 10: Low Income Jobs



Source: Greenprint Transit and Employment Analysis[39]

Map 1: Community Health Status



For a larger version of this map, please see Appendix A.

In terms of the transportation environment affecting travel behavior, a 2010 meta-analysis of over fifty research articles on the subject found that vehicle miles traveled (VMT) is most closely related to destination accessibility, followed by street network design.[131] The same review found that more walking occurs with greater land use diversity, intersection density, and number of destinations within walking distance. The authors also found that population and job densities were only weakly associated with travel behavior, indicating that strategies aimed at decreasing VMT should be systemic in scope. Implementing this Greenprint action as envisioned would be a step toward making some employment and education destinations more accessible by multiple modes. However, the long term effects on transportation behavior are difficult to predict. A successful multimodal system would improve health in the community by potentially reducing the amount of time people spend in their cars and/or increasing physical activity through active transportation. This success could be achieved by ensuring that employment and education centers are not isolated uses connected to the transportation network, but rather become part of an integrated network that includes a variety of land uses (such as residential and commercial) and densities high enough to facilitate alternatives to driving as viable transportation modes.

By enhancing access to education and employment opportunities through a more connected multimodal transportation network, economic status may be improved, potentially leading to positive health outcomes at the population level. The transportation network is only one piece of this puzzle. Type and quality of opportunities, especially employment opportunities, will likely hold more influence on socioeconomic status, and thus on health, than location alone. This impact can be maximized by ensuring that connectivity to education and employment centers extends to the originating location(s) of populations that could most benefit, that the

types of employment and education opportunities match the needs of the local workforce, and that consideration is given to locating new opportunities nearer to the populations that could most benefit.

Recommendations for Target Action 7.1.1: Develop a multi-modal transportation network that emphasizes connectivity to employment and education centers

- **Ensure that areas in and around employment and education centers are developed to include a variety of land uses (such as residential and commercial) and densities high enough to facilitate alternatives to driving** as viable transportation modes in an integrated network. Connectivity can only be successful in the context of destinations, so encouraging a variety of other residential and commercial uses to be co-located with employment and education centers will increase the likelihood of people utilizing active forms of transportation (including transit), which would likely lead to improvements in health.

Who would be involved in making this happen: Planning Departments, MPOs, developers. Crosstown is a local example of development that moves in this direction.

- **Focus on extending connectivity to vulnerable populations that could most benefit from better access to existing employment and education centers**. These lower income populations, who are more likely to have limited transportation options, have the greatest potential to capitalize on the health benefits of increased income and education. A network that improves their access to these opportunities throughout the region would be likely lead to the greatest public health improvements.

Who would be involved in making this happen: Planning Departments, MPOs, economic development staff, and/or social service providers.

Other Objectives under this Strategic Direction

The five objectives (and corresponding actions) under the Productive Workforce and Economy Strategic Direction have great potential to impact critical health determinants across the region, namely socioeconomic status. Each will exert this influence differently. **Table 17** includes brief notes for each and their possible relationship to improving health throughout the region.

Table 17: Health Perspectives on Productive Workforce and Economy Objectives (SD7)

Objective	Comment	Comparative Influence on Population Health
7.1 Enhance access and connectivity to employment, education, and training centers	Access is a critical component in achieving potential benefits of education and employment throughout the region	High
7.2 Empower individuals to improve their economic outcomes by taking action at home	Individual actions can improve health, but greater population impact comes from leveraging systemic changes throughout the region that increase economic opportunity	Medium
7.3 Promote and support neighborhood-level economic development	Neighborhood-level strategies can be effective in targeting areas with the most need	High
7.4 Increase and enhance regional employment and economic development opportunities	Improving opportunities throughout the region could work in tandem with improving access to have broad influence on population health	High
7.5 Encourage green technology workforce development	Focus on a specific industry may not have large effects on community health until that industry is mature	Low

Strategic Direction 8: Effective Long-term Regional Planning

In establishing effective long-term regional planning, the Greenprint aims to:

- Build capacity for long-term participation in the public planning process
- Form or utilize an organization that can sustain the goals of the Mid-South Regional Greenprint Consortium
- Establish a system to maintain shared data resources long-term
- Incorporate social equity in the public planning process across the region

Actions to accomplish these goals are not likely to have a direct impact on population health in the short-term, but they will have positive effects in the long-term, as long as public health perspectives are consistently included in future planning and data activities.

Analysis under this Strategic Direction took place as an overarching concept and as part of the other analyses contained within this HIA. This was done because the actions pertaining to long-range planning are not necessarily isolated as a singular element from a health perspective. Similar to the discussion of Strategic Direction 2: Equitable Participation and Community Ownership, the Advisory Committee felt that the concepts involved here were pervasive and could be addressed in the content from other sections. As such, much of the information below is adapted from other sections of the HIA, but it is collated here to provide consistent form to this report.

Recommendations for Strategic Direction 8: Effective Long-term Regional Planning

From Target Action 1.2.4 - Create, fund and execute a pilot project to address maintenance and safety issues in one or more underused parks

It will be important to actively engage community members in determining strategies for improving parks in ways that address their concerns rather than relying too heavily on existing research from other cities. This is because the local use of parks is driven mostly by local perceptions, which may vary not only from region to region, but also from neighborhood to neighborhood. Evaluating local projects, both existing and planned, will be critical in building evidence within the Mid-South that can be used to continually inform park maintenance and safety strategies.

- **Systematically collect data on use and perceptions** to define “underused parks” and to gain evidence to support (or refute) assumption that maintenance and safety issues are leading to the current lack of use in specific areas.

Who would be involved in making this happen: Parks and Recreation Departments, Bicycle and Pedestrian Coordinators from regional Metropolitan Planning Organizations (MPOs),

member organizations from the Greenprint Consortium, non-profit conservancies, and/ or local volunteer groups. Examples include the work AmeriCorps is doing with the V&E Greenline and The Wolf River Conservancy's efforts to track use of their facilities. University partners could also be engaged in the collection and analysis of data.

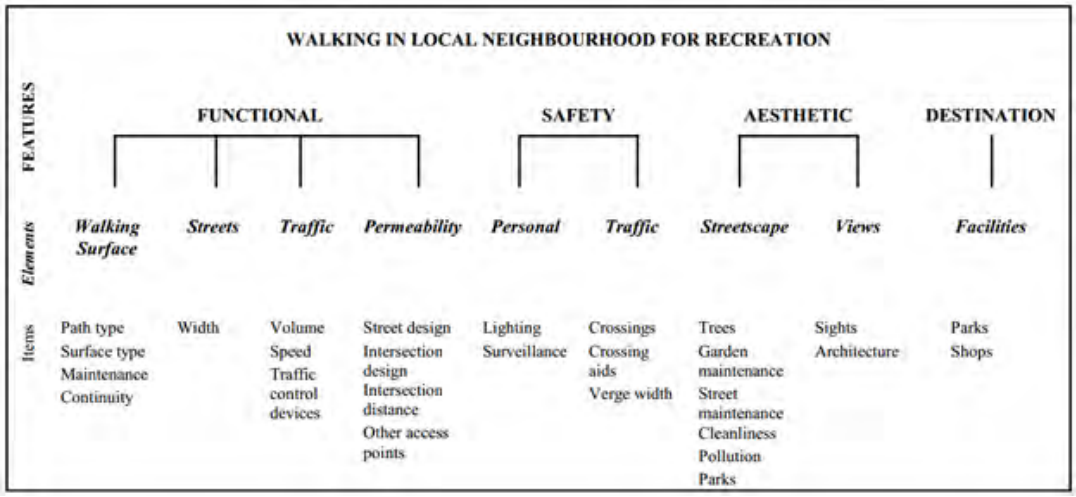
- **Evaluate CPTED design features and their effect on perception and use** of the pilot park(s) to inform future improvements in the region and as a contribution to the literature.

Who would be involved in making this happen: Parks and Recreation Departments and university partners could evaluate CPTED implementation in consultation with Police and Public Safety groups. There could also be a role for the member organizations of the Greenprint Consortium in ensuring any lessons learned are disseminated throughout the region.

From Target Action 3.1.5: Retrofit auto-centric corridors to be more bicycle and pedestrian friendly

- **Develop a locally-based conceptual framework of bicycle and pedestrian influences to guide retrofitting strategies.** Selected stakeholders and local experts could be engaged to develop a framework of the potential environmental influences on walking and biking similar to Figure 8 (reproduced below), which could then be applied across the region when and where infrastructure improvements are being considered. This could be done in conjunction with Action 3.4.1, which calls for changes to public policy to include Complete Streets frameworks.

Figure 8: A framework of the potential environmental influences on recreational walking



From Pikora et al, 2003[61]

Who would be involved in making this happen: This would be a good joint project between Health Departments, Planning Departments, MPOs, university partners, and other member organizations from the Greenprint Consortium to define an initial paradigm for promoting biking and walking throughout the region.

From Target Action 5.1.4: Create design standards, incentives, and encourage density in support of mixed-use and mixed-income communities near green infrastructure

- Following from Action 5.1.7 which calls for developing metrics to monitor progress of fair housing impacts for use **in evaluating future green infrastructure development, some key topics to consider include**:

    - Where are there currently mixed-use and mixed-income communities in the Region?
    - What existing policies impede mixed-use and/or mixed-income development?
    - How is "near" defined in terms of proximity to green infrastructure?
    - How can data be collected to characterize the social impacts of mixed-use/ income communities in the region?

Who would be involved in making this happen: Planning Departments, university partners, the Housing Authorities, and other social services organizations.

From Target Action 5.3.2: Investigate the potential of converting underutilized land (including publicly owned vacant property) to green space in areas that are currently not well served

- **Develop an inventory of underutilized land around the region** and prioritize revitalization based on location, costs, and potential to impact vulnerable populations.

Who would be involved in making this happen: Planning Departments, County Tax Offices, member organizations of the Greenprint Consortium, and/or the Shelby County Land Bank run by the Public Works Division.

- **As properties are revitalized, continue to follow-up with surrounding residents** to determine the impact on their perceptions and activities over time. Tracking this type of information will allow for better targeted uses of resources in the future. It will also give an indication of changes in greenspace needs based on potential changes in demographics (e.g. as the community ages or new residents move into the area, etc.).

Who would be involved in making this happen: University partners, community groups, Planning Departments, Public Health agencies, social service organizations, and/or the Housing Authorities.

From Target Action 6.4.5: Encourage changes in policy and covenants to allow for natural landscaping in existing and new development

- **Develop a locally-relevant metric for measuring "greenness."** As part of changes in policy to support natural landscaping in the Mid-South, a locally-relevant scale or index could be developed to help set benchmarks for determining how "green" specific properties are. This regional index might then be used to facilitate future evaluation of policy changes that allow for more natural landscaping.

Who would be involved in making this happen: Planning Departments, university partners, local environmental groups, and /or non-profit conservancies.

Objectives under this Strategic Direction

The two objectives (and corresponding actions) under the Long-range Regional Planning Strategic Direction have great potential to impact critical health determinants across the region, namely socioeconomic status. Each will exert this influence differently. **Table 18** includes brief notes for each and their possible relationship to improving health throughout the region.

Table 18: Health Perspectives on Long-range Regional Planning (SD 8)

Objective	Comment	Comparative Influence on Population Health
8.1 Continue regional collaboration of planning and policy-making and coordination of assets and resources	As detailed within this HIA, sustaining and implementing the goals of the Greenprint as they currently stand will no doubt influence health in the region, and this influence will most likely be positive. Over time, collaborations and resource-sharing between various partners in the region could have an influence on public health, but that influence is more likely to be positive if health agencies are included in this coordination.	High
8.2 Establish and maintain a shared data resources system to support decision making	Sharing data is one of the first and most important steps in collaborative decision-making; as long as data on health behaviors, determinants, and outcomes are included, there should be the opportunity for positive influence on health in the region	Medium

Conclusions and Lessons Learned

Conducting this HIA as part of the Mid-South Greenprint provided decision makers, stakeholders, and community members an opportunity to reflect on the public health implications of green infrastructure planning in the region. The Greenprint Consortium had already taken important steps in this direction by including a Working Group and Strategic Direction focused on community health and wellness early in the process. The inclusion of HIA as one of this Working Group's key actions leveraged their initial involvement into the current opportunity to more consistently apply a public health lens to the broad range of decisions and actions outlined by the Greenprint Vision and Plan. This HIA presents a number of recommendations intended to help decision makers capitalize on these opportunities.

One of the most apparent and overarching lessons learned from this HIA is that collaborative execution of Greenprint Actions and Objectives is critical for success. From an HIA perspective, this collaborative execution is necessary to maximize the potential for improvement of community health within the Greenprint context. As detailed in this report, the Community Health and Wellness Working Group should continue to promote its work to improve public health as an integral piece of the other Working Groups' efforts and to seek out opportunities for collaboration and information sharing in the future. The other Working Groups should also begin to more consistently consider the integration of public health perspectives into their ongoing work, especially in the arenas of Social Equity and Long Term Planning.

The regional scale and inclusive nature of the Greenprint process presented both opportunities and challenges for HIA. An overriding theme of this assessment is that the Greenprint Plan will impact a wide variety of health determinants throughout the region, and by influencing these determinants, it has great potential to positively impact public health outcomes over time. Fully characterizing and addressing these influences requires sustained collaboration, both within the public health sector and with professionals from other sectors involved with the Greenprint.

This HIA process was successful in facilitating collaborative thinking between health and non-health stakeholders, but it is unclear if the collaborative HIA work will lead to the sustained collaborations that are requisite for maximizing positive health impact throughout the region. Recruiting an HIA Advisory Committee with representatives from all eight Working Groups was a primary strategy for achieving this collaborative goal and was successful in two aspects. First, engagement with this group allowed for a more comprehensive HIA that considers all eight Strategic Directions. Without their review and input, the content of this assessment would be much less likely to address topics and decisions relevant to the members' respective Working Groups. Secondly, the opportunity for cross-sector collaboration on the HIA led to better understanding of the two-way information exchange that is critical for sustaining collaboration over time. Collaborative applications for future HIA funding and an evolution in perspectives of Community Health and Wellness Work Group members in regard to how to engage in future Health in All Policies work are two tangible examples of success in this arena.

However, challenges to sustaining this type of collaboration going forward are unavoidable when attempting to engage with large and diverse stakeholder groups like the Greenprint Consortium. While the participation from the Advisory Committee was well beyond adequate and was critical to the success of the HIA, there were still missed opportunities to have stronger or more constructive involvement from the full range of Working Groups. It is unlikely that this challenge is unique to HIA, but as a major goal of HIA is to bring the widest variety of applicable perspectives to the table, the challenge is particularly relevant for the field. Therefore, it will be important for members of the HIA Advisory Committee and for other stakeholders to view this HIA and the collaborative process behind it as more of a starting point than an end unto itself. Building on the initial connections made through this work will produce the greatest potential for sustained success in public health improvement through Health in All Policies strategies.

Incorporating HIA into a large-scale regional effort such as the Greenprint also presents a challenge for attempts to balance the breadth and/or depth to which various topics are explored. As evidenced by the Alta analysis of physical activity (**Appendix B**), any one of the Actions examined in the preceding chapter could warrant more comprehensive analysis, but this was not feasible with the resources dedicated to this HIA. It was therefore a conscious decision of the project team to attempt coverage of each Strategic Direction to a depth that would inform actionable recommendations for moving forward, but to stop short of providing comprehensive analysis of every possible action and outcome. Had a more narrow set of health topics and Greenprint Actions been selected for the assessment, there could have been more intensive data collection and analysis done for those topics. However, given the far-reaching potential for the Greenprint to impact community health through a host of avenues, the decision was made to go with breadth over depth. Similar to the relationships seeded through the collaborative process, the topics and questions raised within this HIA are meant to be seen as the starting point for future efforts aimed at more comprehensive analysis of specific issues.

Incorporating HIA into the Greenprint process after the vision had been defined but prior to finalizing the implementation strategies provided an ideal opportunity to advance health objectives within an ongoing regional planning process. The comprehensive scope of the assessment allows for relevant information to be made available for all eight Working Groups, as well as for community members, in a timely fashion. Had there been a more narrow scope for the HIA, more detailed analysis could have been conducted on certain issues in specific geographies, but the trade-off would have been less adaptable and relevant recommendations for the region. There have already been indications of various stakeholders recognizing the broader implications of their work for health in the Mid-South, so the HIA has been successful in this respect.

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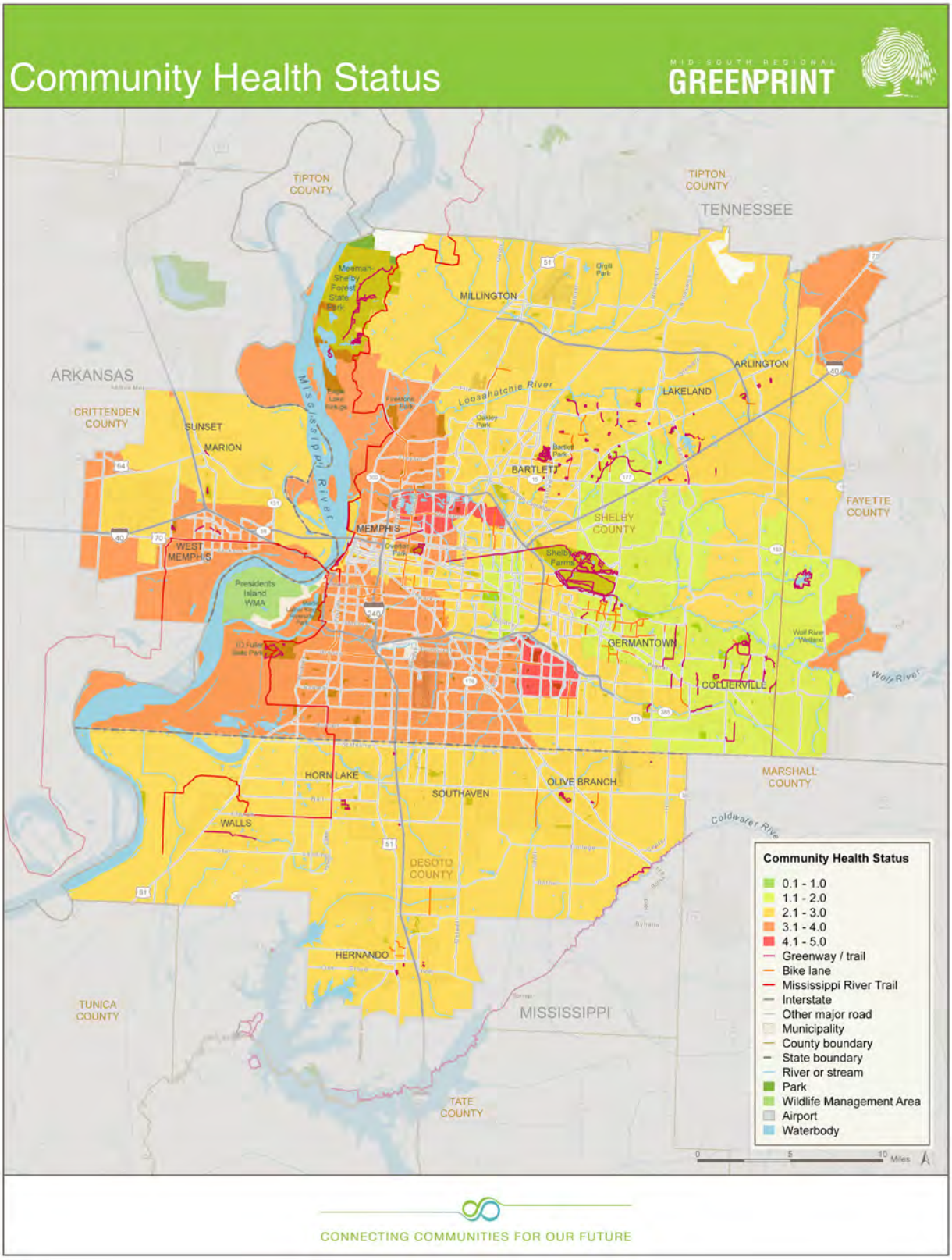
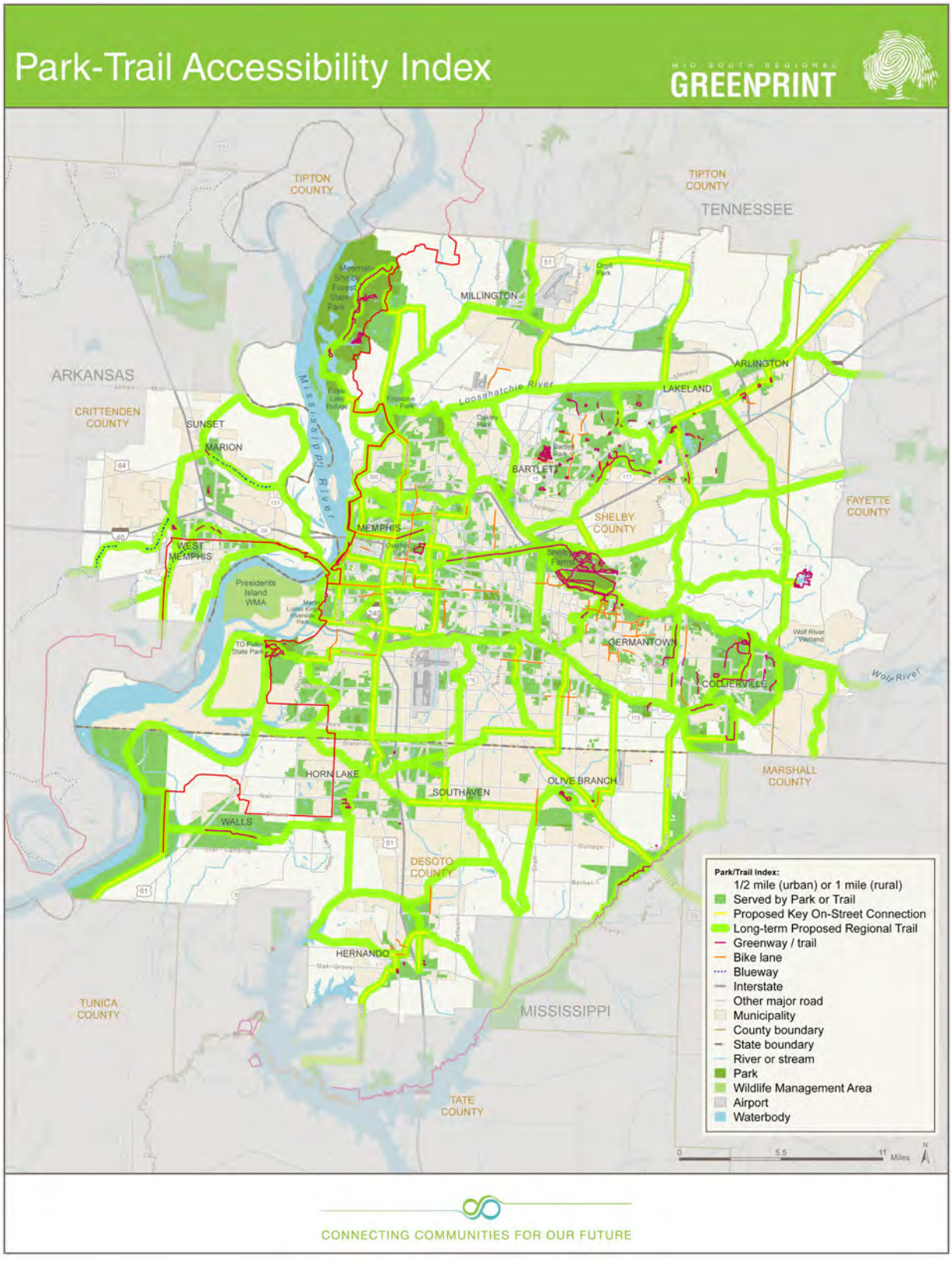
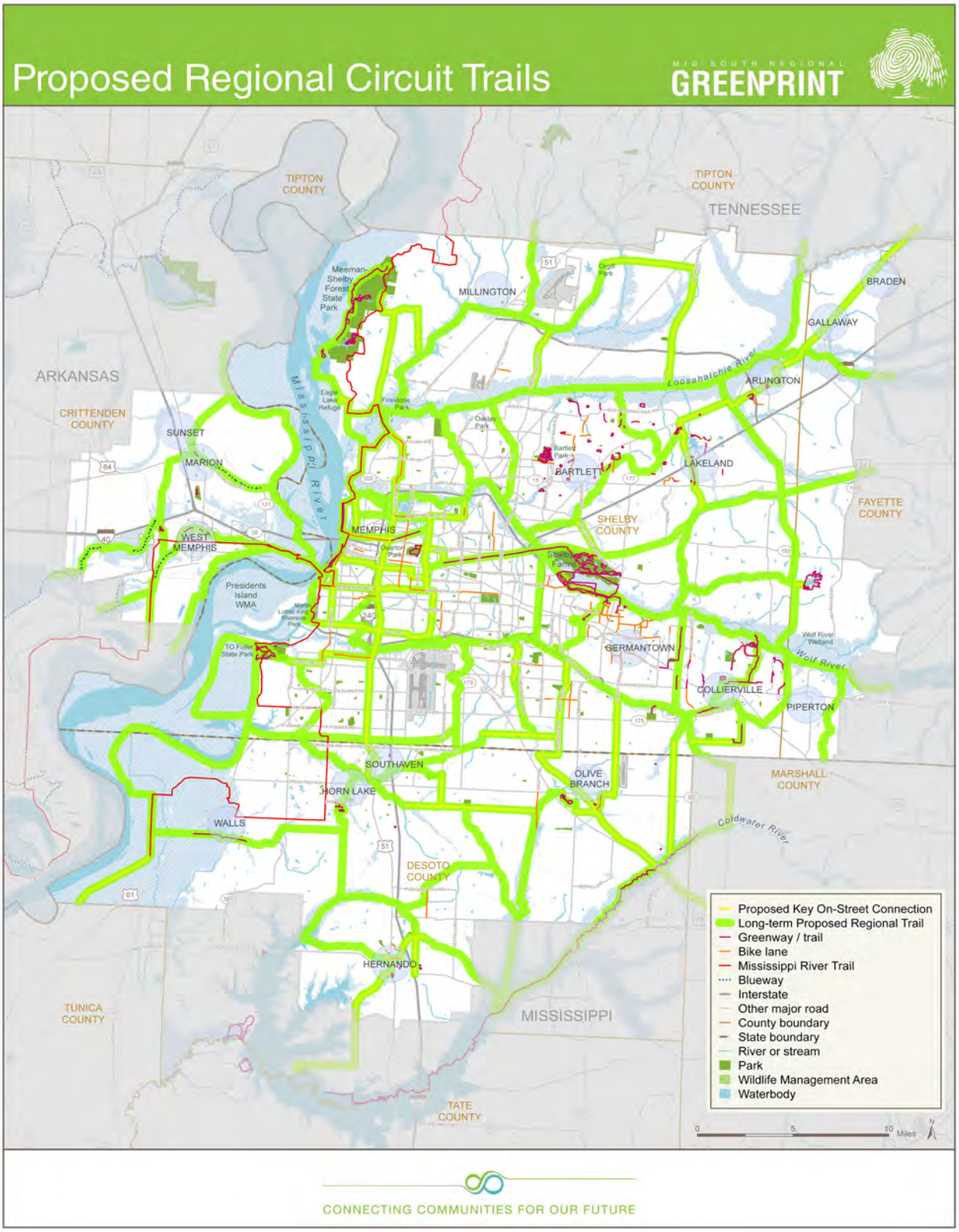
Appendix A: Detailed Maps




Park-Trail Accessibility Index
MID-SOUTH REGIONAL GREENPRINT
TIPTON COUNTY
TIPTON COUNTY
TENNESSEE
ARKANSAS
CRITTENDEN COUNTY
SUNSET
MARION
MILLINGTON
ARLINGTON
LAKELAND
Loosahatchie River
BARTLETT
FAYETTE COUNTY
SHELBY COUNTY
MEMPHIS
WEST MEMPHIS
Mississippi River
Presidents Island WMA
GERMANTOWN
COLLIERVILLE
Wolf River
MARSHALL COUNTY
HORN LAKE
SOUTHAVEN
OLIVE BRANCH
WALLS
DESOTO COUNTY
HERNANDO
TUNICA COUNTY
MISSISSIPPI
TATE COUNTY
Park/Trail Index:
1/2 mile (urban) or 1 mile (rural)
Served by Park or Trail
Proposed Key On-Street Connection
Long-term Proposed Regional Trail
Greenway / trail
Bike lane
Blueway
Interstate
Other major road
Municipality
County boundary
State boundary
River or stream
Park
Wildlife Management Area
Airport
Waterbody
0
5.5
11
Miles
N
CONNECTING COMMUNITIES FOR OUR FUTURE


Proposed Regional Circuit Trails
MID-SOUTH REGIONAL GREENPRINT
TIPTON COUNTY
TENNESSEE
ARKANSAS
CRITTENDEN COUNTY
SUNSET
MARION
WEST MEMPHIS
Presidents Island WMA
MEMPHIS
Meeman-Shelby Forest State Park
MILLINGTON
BRADEN
GALLAWAY
ARLINGTON
LAKELAND
BARTLETT
SHELBY COUNTY
FAYETTE COUNTY
GERMANTOWN
COLLIERVILLE
PIPERTON
MARSHALL COUNTY
SOUTHAVEN
HORN LAKE
OLIVE BRANCH
WALLS
DESOTO COUNTY
HERNANDO
TUNICA COUNTY
MISSISSIPPI
TATE COUNTY
Mississippi River
Loosahatchie River
Wolf River
Coldwater River
Proposed Key On-Street Connection
Long-term Proposed Regional Trail
Greenway / trail
Bike lane
Mississippi River Trail
Blueway
Interstate
Other major road
County boundary
State boundary
River or stream
Park
Wildlife Management Area
Waterbody
0 5 10 Miles
CONNECTING COMMUNITIES FOR OUR FUTURE


Housing Focus Areas
MID-SOUTH REGIONAL GREENPRINT
TIPTON COUNTY
TENNESSEE
ARKANSAS
CRITTENDEN COUNTY
SUNSET
MARION
WEST MEMPHIS
MEMPHIS
MILLINGTON
ARLINGTON
LAKELAND
BARTLETT
SHELBY COUNTY
FAYETTE COUNTY
GERMANTOWN
COLLIERVILLE
Presidents Island WMA
Mississippi River
Loosahatchie River
Wolf River
Coldwater River
HORN LAKE
SOUTHAVEN
OLIVE BRANCH
MARSHALL COUNTY
WALLS
DESOTO COUNTY
HERNANDO
TUNICA COUNTY
MISSISSIPPI
TATE COUNTY
Housing Recommendation Points
Housing Recommendation Corridors
Housing Recommendation Areas
Greenway / trail
Bike lane
Mississippi River Trail
Interstate
Other major road
Municipality
County boundary
State boundary
River or stream
Park
Wildlife Management Area
Airport
Waterbody
0 5 10 Miles
N
CONNECTING COMMUNITIES FOR OUR FUTURE


Commercial Revitalization Focus Areas
MID-SOUTH REGIONAL GREENPRINT
TIPTON COUNTY
TENNESSEE
ARKANSAS
CRITTENDEN COUNTY
SUNSET
MARION
WEST MEMPHIS
MEMPHIS
MILLINGTON
ARLINGTON
LAKELAND
BARTLETT
SHELBY COUNTY
FAYETTE COUNTY
GERMANTOWN
COLLIERVILLE
MARSHALL COUNTY
OLIVE BRANCH
SOUTHAVEN
HORN LAKE
WALLS
DESOTO COUNTY
HERNANDO
TUNICA COUNTY
MISSISSIPPI
TATE COUNTY
Mississippi River
Loosahatchie River
Wolf River
Coldwater River
Presidents Island WMA
Commercial Revitalization Points
Commercial Revitalization Corridors
Commercial Revitalization Areas
Greenway / trail
Bike lane
Mississippi River Trail
Interstate
Other major road
Municipality
County boundary
State boundary
River or stream
Park
Wildlife Management Area
Airport
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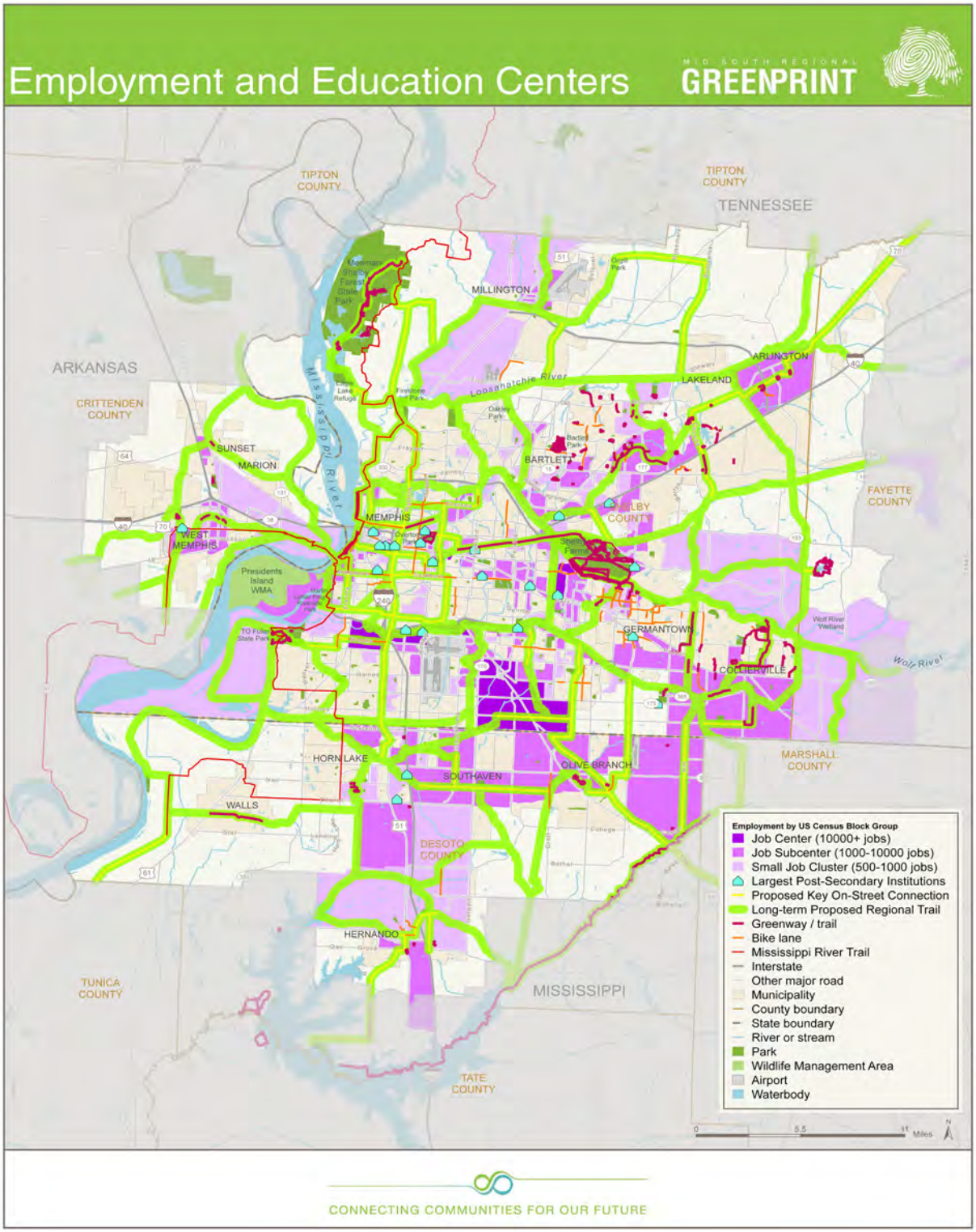
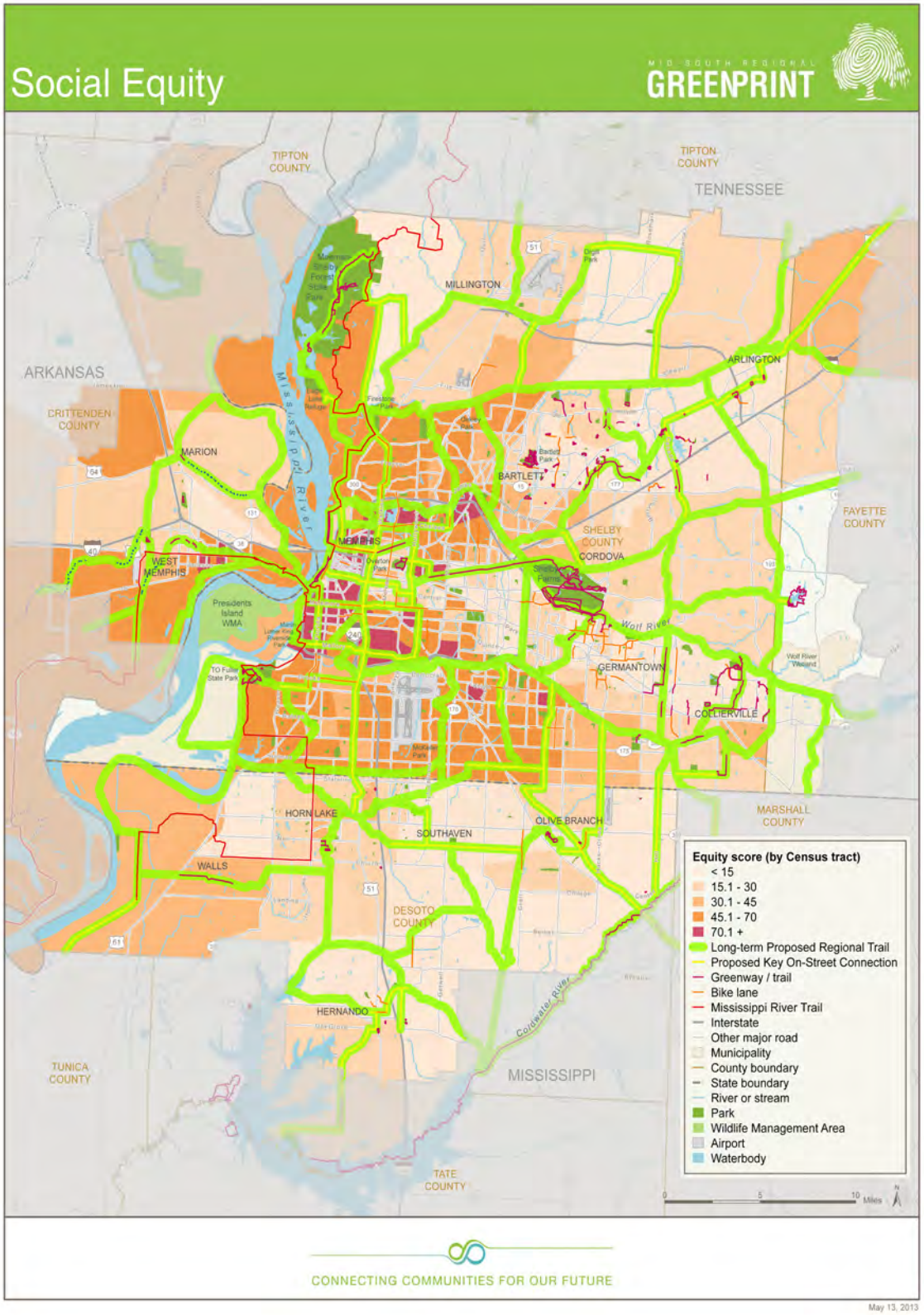
CONNECTING COMMUNITIES FOR OUR FUTURE


Employment and Education Centers
MID-SOUTH REGIONAL GREENPRINT
TIPTON COUNTY
TENNESSEE
ARKANSAS
CRITTENDEN COUNTY
MILLINGTON
ARLINGTON
LAKELAND
BARTLETT
SUNSET
MARION
MEMPHIS
WEST MEMPHIS
SHELBY COUNTY
FAYETTE COUNTY
GERMANTOWN
COLLIERVILLE
MARSHALL COUNTY
HORN LAKE
SOUTHAVEN
OLIVE BRANCH
WALLS
DESOTO COUNTY
HERNANDO
TUNICA COUNTY
MISSISSIPPI
TATE COUNTY
Mississippi River
Loosahatchie River
Wolf River
Employment by US Census Block Group
Job Center (10000+ jobs)
Job Subcenter (1000-10000 jobs)
Small Job Cluster (500-1000 jobs)
Largest Post-Secondary Institutions
Proposed Key On-Street Connection
Long-term Proposed Regional Trail
Greenway / trail
Bike lane
Mississippi River Trail
Interstate
Other major road
Municipality
County boundary
State boundary
River or stream
Park
Wildlife Management Area
Airport
Waterbody
0
5.5
11 Miles
CONNECTING COMMUNITIES FOR OUR FUTURE


Social Equity
MID SOUTH REGIONAL GREENPRINT
TIPTON COUNTY
TENNESSEE
ARKANSAS
CRITTENDEN COUNTY
MARION
MILLINGTON
ARLINGTON
BARTLETT
FAYETTE COUNTY
SHELBY COUNTY
CORDOVA
MEMPHIS
WEST MEMPHIS
Mississippi River
Presidents Island WMA
Wolf River
GERMANTOWN
COLLIERVILLE
MARSHALL COUNTY
HORN LAKE
SOUTHAVEN
OLIVE BRANCH
WALLS
DESOTO COUNTY
HERNANDO
Coldwater River
TUNICA COUNTY
MISSISSIPPI
TATE COUNTY
Equity score (by Census tract)
< 15
15.1 - 30
30.1 - 45
45.1 - 70
70.1 +
Long-term Proposed Regional Trail
Proposed Key On-Street Connection
Greenway / trail
Bike lane
Mississippi River Trail
Interstate
Other major road
Municipality
County boundary
State boundary
River or stream
Park
Wildlife Management Area
Airport
Waterbody
0 5 10 Miles
CONNECTING COMMUNITIES FOR OUR FUTURE
May 13, 2013

Appendix B: Physical Activity in the Mid-South from Bicycling and Walking

Supplemental Analysis produced by Alta Planning + Design begins on next page.

Physical Activity in the Mid-South from Bicycling and Walking

Introduction

Walking and bicycling are gaining new interest from communities across the United States after decades of neglect when most attention focused on motor vehicle transportation. However, due to low existing levels of use and funding, walking and bicycling face an uphill battle to prove their utility as viable, efficient modes of transportation. Many of walking and bicycling's greatest strengths – such as improving community health through physical activity – are not accounted for when evaluating transportation projects. Quantifying these factors demonstrates the importance of walking and bicycling transportation and help compare benefits with costs.

The benefits created by walking and bicycling are directly linked to levels of use or activity. For each additional mile traveled by walking or bicycling instead of driving, about one pound of greenhouse gas emissions are prevented, a few less cents are spent on gas, and a person gets a few minutes closer to reaching their recommended healthy levels of physical activity for the week. When walking and bicycling rates increase, these associated benefits add up to create healthier and more affordable communities. Increasing bicycling and walking transportation increases physical activity in a community. Because walking and bicycling are transportation activities, they play a role in a person's set of daily behaviors, keeping a person physically active on a regular basis such as through daily commuting, trips to school, social visits or trips to the grocery store.

To calculate the current benefits of walking and bicycling in the Mid-South, the first step is to estimate existing levels of use.

Estimating Walking and Bicycling Activity

User counts and user surveys are the two most commonly used tools for measuring walking and bicycling activity. The following section describes the strengths and weaknesses of each of these tools, and presents a methodology for estimating activity across an entire community.

User Counts

User counts, typically conducted at points across the street network during peak travel hours, capture levels of walking and bicycling activity on street or paths during a short period of time. While user counts can be instructive in comparing relative levels of use between one street and another, they do not fully capture the spectrum of walking and bicycling activity happening across the community over the length of the year. Counts are well suited to studying where people walk and bike, but do not provide answers to other important questions, such as:

- What destinations are people walking and bicycling to, and where are they coming from?
- How far are they traveling?
- What is the purpose of their trip?
- How often do they make similar walking or bicycling trips?
- How often do they make other kinds of walking or bicycling trips?
- Do other residents also make similar types of trips by walking and bicycling, or do they typically travel by another mode?

Therefore, while user counts are a good tool for measuring walking and bicycling at a certain location, user surveys are needed to estimate the overall role of bicycling and walking in the transportation patterns of residents across the region.

User Surveys

Transportation user surveys often ask respondents about their perceptions – e.g., their feeling of safety on a street – and about their usual travel behavior. The American Community Survey (ACS), an ongoing survey conducted by the US Census Bureau, collects social, economic and demographic information from respondents, and includes a question on respondents' commute to work. Sampling over 250,000 households per month, the ACS is the largest survey that asks Americans about their transportation habits, and the most widely available source of walking and bicycling data in communities. According to the 2007-2011 ACS[1], 0.15% of workers in the Mid-South bicycle to work, while 1.37% walk to work. These percentages are known as commute mode share; the percentage of a community's population making their journey to work by a certain mode of transportation compared to all modes.

Although commute mode share data is able to capture wider information about walking and bicycling than user counts alone, work commutes are just one type of trip. Mid-South residents make many other types of trips (to school, college, go shopping, etc.) by a variety of modes. Detailed household travel

[1] The Census Bureau recommends using 5-Year sample data sets for increased reliability of estimates over 1-Year or 3-Year samples. This report references 2007-2011 5-Year ACS data unless otherwise noted.

surveys can provide more information on travel patterns and help measure the full spectrum of walking and bicycling trips happening in the community.

Household Travel Surveys

Household travel surveys are usually conducted by phone, where an operator interviews each respondent using a detailed script to record a travel diary. To complete a travel diary, respondents are asked to recall all of their trips during a recent period of time, usually the last 24 hours or the previous full day. Detailed information is collected on the qualities of each trip, including the trip purpose, time of day, duration, length, mode, and other factors. By collecting this data from a large sample of people across the population, household travel surveys can provide information on where, why, and how far people are walking and bicycling for transportation. Though a recent household travel survey for the Mid-South is not available, national data from the 2009 National Household Travel Survey (NHTS 2009) can be used to estimate the number of other types of bicycling and walking trips being made in addition to work trips.

Estimating Overall Activity

Employed Workers and Adults

Overall adult bicycling and walking activity can be estimated by combining available local data such as ACS commute mode share with national trip purpose information from NHTS 2009. On average, 1.6 utilitarian bicycle trips are made for every bicycle-to-work trip in the United States, and 4.3 utilitarian walk trips are made for every walk-to-work trip. An additional 3.9 social/recreational walking trip and 4.8 bicycling trips are made for each walking or bicycling commute trip, respectively (see Figure 1 and Figure 2). Assuming travel behavior in Memphis is similar to these national averages shows how walking and bicycling trips can add up beyond just commute trips, and provide a significant portion of the physical activity necessary to meet the health needs of the community.

College Students

Student commute trips to school and college are estimated independently of ACS data, because the populations making those trips are substantially different from the employed workforce surveyed by ACS. National data on walking and bicycling college trip mode share from NHTS 2009 was used to represent trips to local colleges and universities like the University of Memphis.

School Children

National baseline K-8 school trip data from Safe Routes to School (SRTS) was used to estimate mode share for K-12 school trips such as local schools in the Shelby County School District. For each type of trip, average trip distance applied to estimate the total distance traveled by walking and bicycling. National average trip distance multipliers are sourced from NHTS and SRTS, ranging from 0.36 miles for the K-12 walk to school to 3.54 miles per adult bike commute trip.

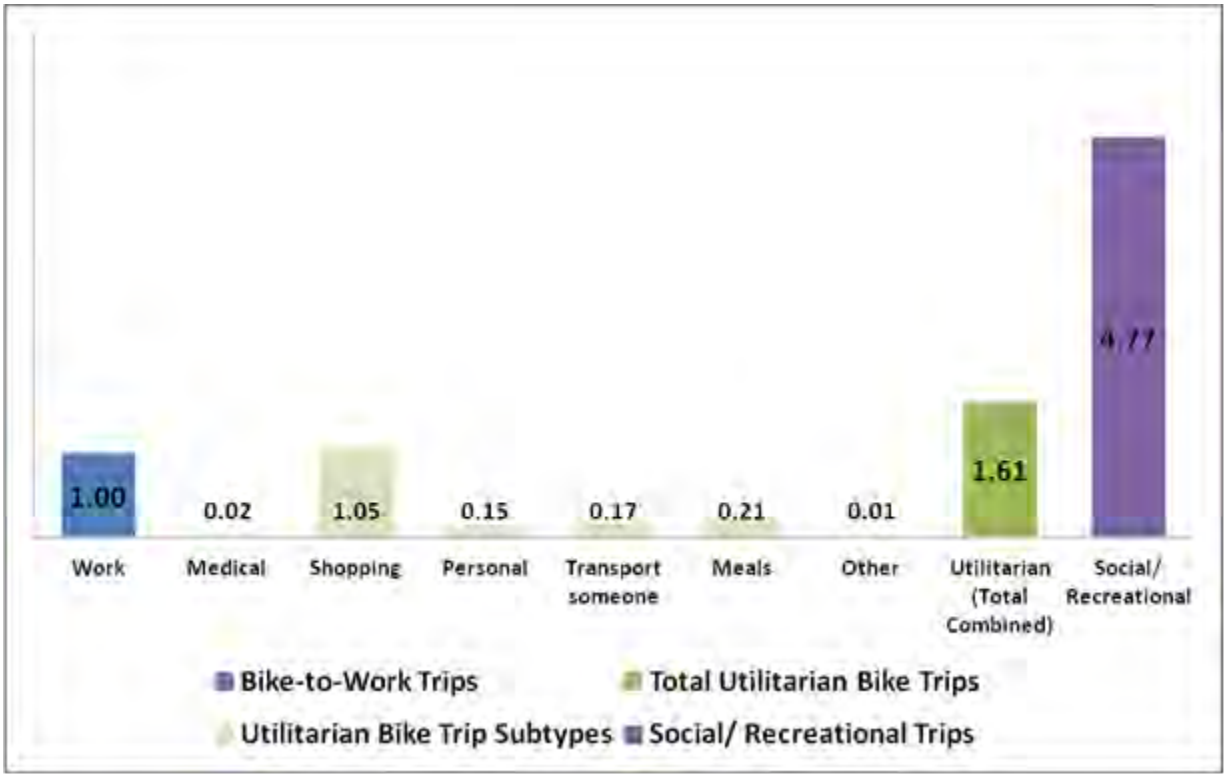


Figure 1. Ratio of Bicycle-To-Work Trips to Other Bicycle Trips (Source: NHTS 2009)

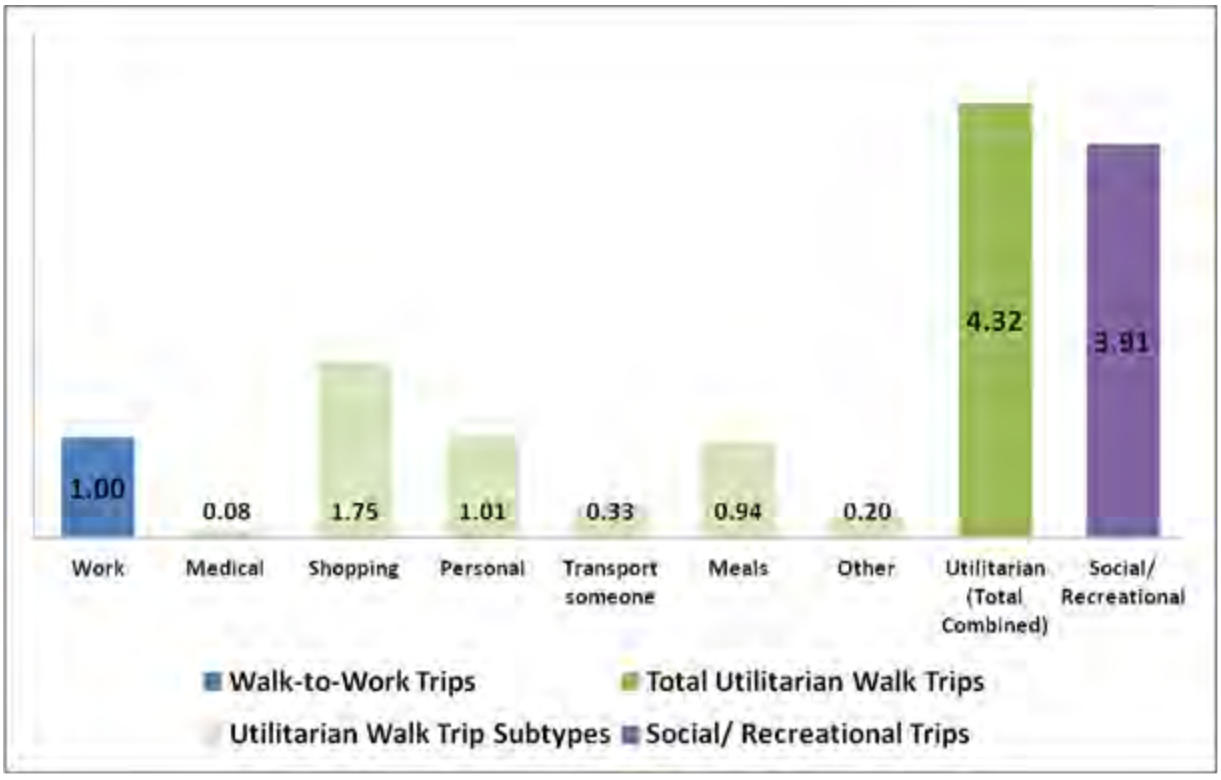


Figure 2. Ratio of Walk-To-Work Trips to Other Walk Trips (Source: NHTS 2009)

Bicycling and Walking Activity Estimate References and Methodology

Figure 3 provides a visual depiction of the steps used to translate local and national transportation data into an annual estimate of bicycling and walking activity currently happening in the Mid-South.

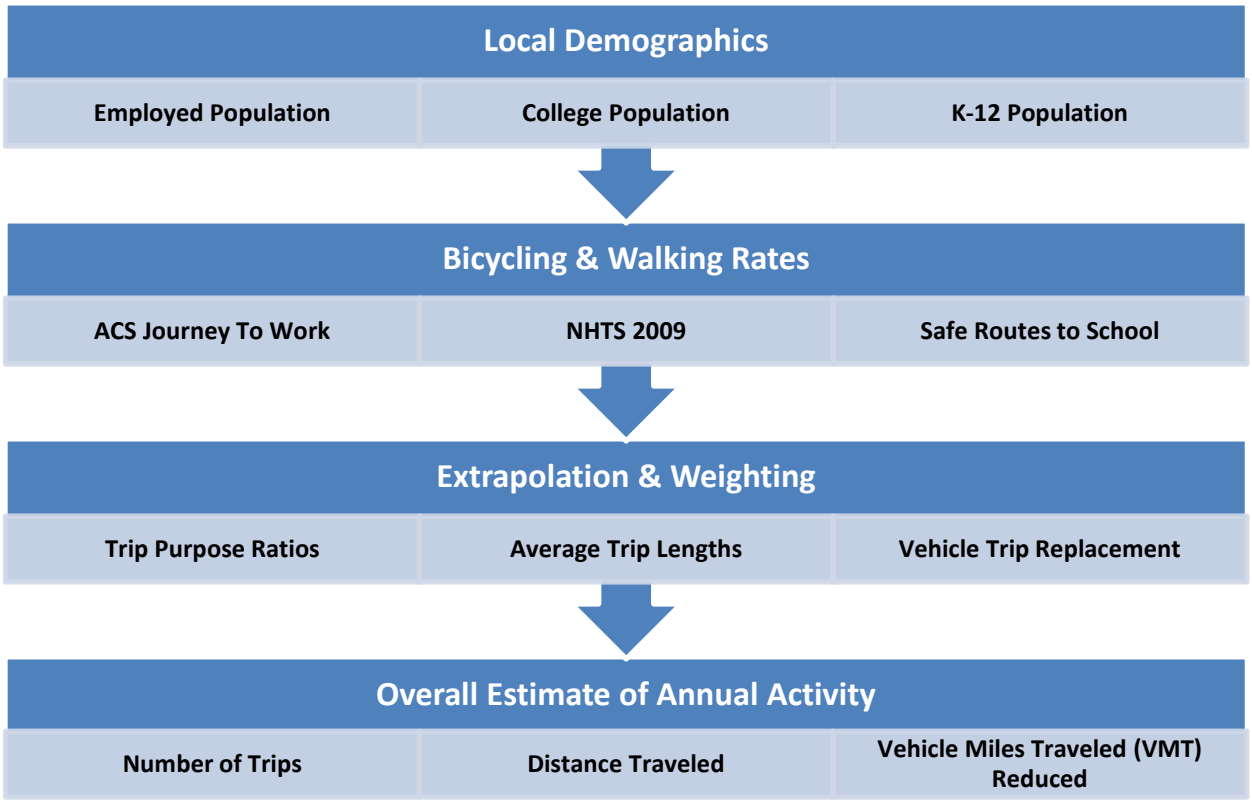


Figure 3. Mid-South Existing Walking and Bicycling Overall Activity Estimate Methodology

The scale of health benefits created by bicycling and walking are based on the number of people using walking and bicycling for transportation, the rate at which they walk and bike, and the distance they travel using active transportation. By multiplying estimates of overall bicycling and walking trips with average trip distances and normal travel speeds, these data can be used to estimate quantities of physical activity generated by current transportation behaviors in the community at large.

Table 1. Bicycling and Walking Activity Estimation References – Trip Purpose Multipliers

OVERALL BIKE/WALK ACTIVITY EXTRAPOLATION - TRIP PURPOSE MULTIPLIERS		
Factor	**Value**	**Source/Note**
Commute Trip Mode Share		
Bike:	0.15%	ACS 2007-11
Walk:	1.37%	ACS 2007-11
College Trip Mode Share		
Bike:	1.67%	NHTS 2009[2]
Walk:	6.82%	NHTS 2009
School Trip Mode Share (K-12)		
Bike:	1.00%	SRTS Baseline, 2010[3]
Walk:	13.35%	SRTS Baseline, 2010
Utilitarian Trip Multiplier		
Bike:	1.61	NHTS 2009 (average number of utilitarian trips per commute trip)
Walk:	4.32	NHTS 2009 (average number of utilitarian trips per commute trip)
Social/Recreational Trip Multiplier		
Bike:	4.77	NHTS 2009 (average number of soc./rec. trips per commute trip)
Walk:	3.91	NHTS 2009 (average number of soc./rec. trips per commute trip)

Table 2. Bicycling and Walking Activity Estimation References – Trip Distance Multipliers

OVERALL BIKE/WALK ACTIVITY EXTRAPOLATION - TRIP DISTANCE MULTIPLIERS		
Factor	**Value**	**Source/Note**
Commute Trip Distance (miles)		
Bike:	3.54	NHTS 2009
Walk:	0.67	NHTS 2009
College Trip Distance (miles)		
Bike:	2.09	NHTS 2009
Walk:	0.48	NHTS 2009
School Trip Distance (K-12)		
Bike:	0.77	SRTS Baseline, 2010
Walk:	0.36	SRTS Baseline, 2010
Utilitarian Trip Distance (miles)		
Bike:	1.89	NHTS 2009
Walk:	0.67	NHTS 2009
Social/Recreational Trip Distance (miles)		
Bike:	2.20	NHTS 2009

[2] 2009 National Household Travel Survey (http://nhts.ornl.gov/det/Extraction3.aspx).
[3] *Safe Routes to School Travel Data: A Look at Baseline Results*. National Center for Safe Routes to School, 2010 (http://www.sacog.org/complete-streets/toolkit/files/docs/NCSRTS_SRTS%20Travel%20Data.pdf).

Walk:	0.78	NHTS 2009

Table 3. Bicycling and Walking Activity Estimation References – Annual Multipliers

OVERALL BIKE/WALK ACTIVITY EXTRAPOLATION - ANNUAL MULTIPLIERS		
Factor	**Value**	**Source/Note**
Annual Work Days	251	261 Weekdays - 10 Federal holidays
Annual College Class Days	150	Assumes two 15-week semesters/three 10-week quarters
Annual K-12 School Days	180	Tennessee state minimum[4]

[4] *Number of Instructional Days/Hours in the School Year*, Education Commission of the States, 2008 (http://www.ecs.org/html/Document.asp?chouseid=7824).

Physical Activity Benefits of Active Transportation

Current levels of walking and bicycling in the Mid-South are somewhat lower than the national average, but still and return significant benefits to the region. The Centers for Disease Control and Prevention (CDC) recognizes bicycling and walking are common activities that people can participate in to be physically active and increase their health. By walking and bicycling for transportation, Mid-South residents can incorporate meaningful physical activity into their daily schedule. Exercise from bicycling and walking transportation typically falls under moderate intensity physical activity (see Figure 4).

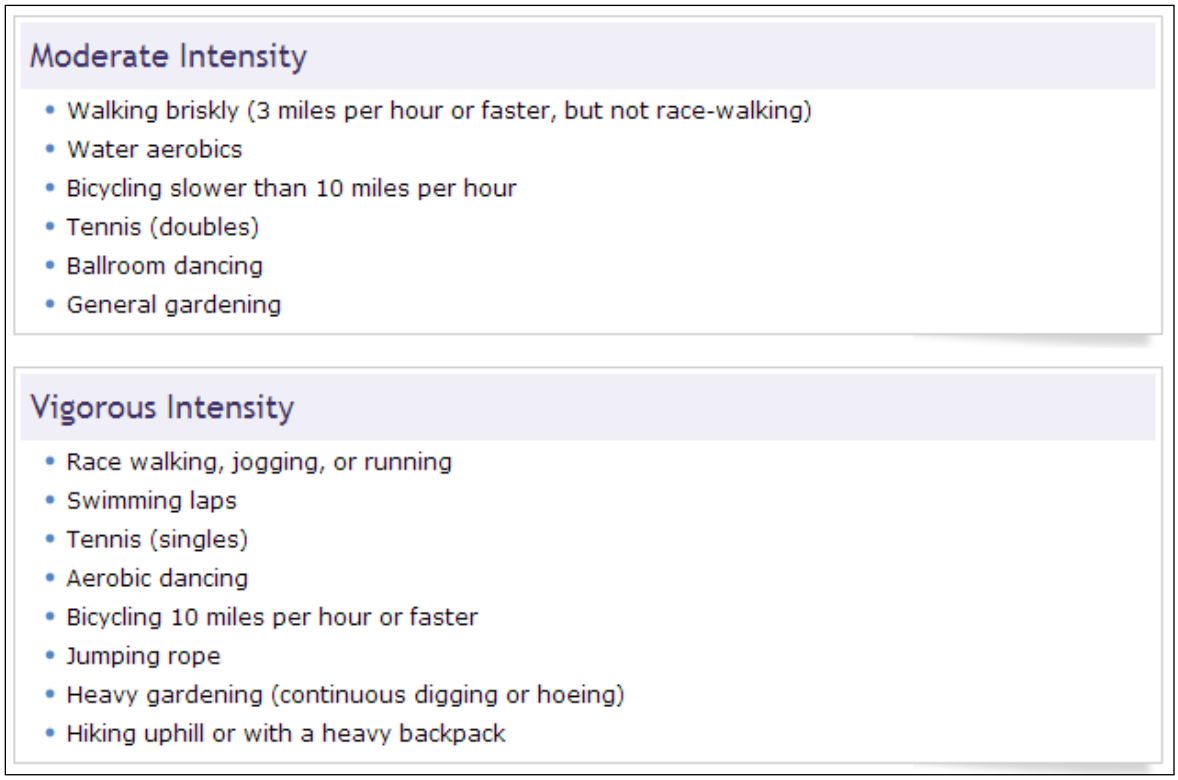


Figure 4. Examples of Moderate and Vigorous Physical Activity (Source: CDC[5]).

For many Mid-South residents, meeting the CDC's recommended minimum guideline of 150 minutes of moderate intensity physical activity per week could be as simple as commuting or making daily errands by walking and bicycling[6]. A walk commute of three quarters of a mile each way, or a bicycle commute of 2.5 miles each way, five times per week, is sufficient to meet the CDC's recommended guideline.

[5] *Measuring Physical Activity Intensity*, CDC (http://www.cdc.gov/physicalactivity/everyone/measuring/).
[6] *Physical Activity Guidelines for Americans*, CDC, 2008 (http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html).

Table 4. Example Physical Activity Benefits from Daily Active Transportation

EXAMPLE PHYSICAL ACTIVITY FROM ACTIVE TRANSPORTATION			
Active transportation mode	**Commute Distance (miles, round trip)**	**Assumed Speed**	**Weekly Minutes of Exercise (assumes 5 day work week)**
Walking	1.5	3 mph	150
Bicycling	5.0	10 mph	150
CDC recommended weekly physical activity (minutes)			**150**

Current levels of bicycling and walking transportation already make a significant contribution to the overall level of physical activity and health of residents in the community. Using the estimates of annual bicycling and walking activity using the methodology described above, Mid-South residents bike and walk a combined 47 million trips annually, traveling a total of 35 million miles. This translates into nearly 10 million hours of moderate intensity physical activity annual from walking and bicycling (see Table 5, Table 6 and Table 7).

Table 5. Mid-South Estimated Annual Active Transportation Trips

MID-SOUTH ESTIMATED PHYSICAL ACTIVITY BENEFITS OF ACTIVE TRANSPORTATION	
Estimated annual walking trips	**43,826,469**
Commute walking trips	3,415,106
Utilitarian walking trips	14,765,044
K-12 school walking trips	10,680,182
College commute walking trips	1,605,557
Social/recreational walking trips	13,360,580
Estimated annual bicycling transportation trips	**4,005,690**
Commute bicycling trips	381,018
Utilitarian bicycling trips	613,862
K-12 school bicycling trips	800,014
College commute bicycling trips	394,113
Social/recreational bicycling trips	1,816,684
Estimated annual active transportation trips	**47,832,159**

Table 6. Mid-South Active Transportation Physical Activity Benefits – Distance Traveled

MID-SOUTH ESTIMATED PHYSICAL ACTIVITY BENEFITS OF ACTIVE TRANSPORTATION		
Estimated annual miles walked	**Average Distance (miles)**	**Total Annual Distance (miles)**
Commute walking trips	0.67	2,288,121
Utilitarian walking trips	0.67	9,843,412
K-12 school walking trips	0.36	3,792,746
College commute walking trips	0.48	770,654
Social/recreational walking trips	0.78	10,382,802
Walking subtotal	**-**	**27,077,734**
Estimated annual miles biked	**Average Distance (miles)**	**Total Annual Distance (miles)**
Commute bicycling trips	3.54	1,348,804
Utilitarian bicycling trips	1.89	1,162,244
K-12 school bicycling trips	0.77	614,386
College commute bicycling trips	2.09	822,443
Social/recreational bicycling trips	2.20	3,995,319
Bicycling subtotal	**-**	**7,943,196**
Estimated annual miles traveled using active transportation		**35,020,931**

Table 7. Mid-South Active Transportation Physical Activity Benefits – Hours of Activity

MID-SOUTH ESTIMATED PHYSICAL ACTIVITY BENEFITS OF ACTIVE TRANSPORTATION			
Active transportation mode	**Distance Traveled (miles)**	**Assumed Speed**	**Total Hours of Physical Activity**
Walking trips	27,077,734	3 mph	9,025,911
Bicycling trips	7,943,196	10 mph	794,320
Total	**35,020,931**	**-**	**9,820,231**

Table 8. Mid-South Active Transportation Physical Activity Benefits – Relative Regional Health Impact

MID-SOUTH ESTIMATED PHYSICAL ACTIVITY BENEFITS OF ACTIVE TRANSPORTATION			
Active transportation mode	**Total Hours of Exercise**	**Annual recommended minimum physical activity (hours/person)**	**Annual average person-minimums of physical activity met by active transportation**
Walking trips	9,025,911	130	69,430
Bicycling trips	794,320		6,110
		Total	**75,540**
		Mid-South population	1,114,292
Regional minimum physical activity need met by active transportation			**6.8%**

Potential Increased Benefits

Memphis and the Mid-South are taking steps to improve the accessibility, safety and quality of the walking and bicycling environment. Memphis is participating in the Green Lane Project organized by the national bike advocacy group Bikes Belong, and was recently recognized with an Honorable Mention by the League of American Bicyclists' Bicycle Friendly Community (BFC) program. The region's new movement toward investing in bicycling and walking network improvements is starting to show results, and further improvements that increase walking and bicycling rates could return greater annual health benefits to the community.

Other cities awarded Bicycle Friendly Community designation can provide a valuable reference point for setting goals and creating a vision for what role bicycling could play in local transportation in future. Around the state, Nashville, Knoxville and Chattanooga have all achieved Bronze Bike Friendly Community Status. Many bicycle friendly communities have reputations for their livability and the quality of their walking environment in addition to bicycling, providing examples for how active transportation can help create healthier, livable communities. Table 9 shows existing walking and bicycling rates in Memphis and the Mid-South compared to other, similarly sized Bronze- and Silver-level BFC cities.

Table 9. Comparison Walking and Bicycling Rates

SELECTED CITY BICYCLING AND WALKING RATE COMPARISONS					
Geography	**BFC Level**	**Population**	**Employed Population**	**Bicycle Mode Share**	**Walk Mode Share**
United States	-	306,603,772	139,488,206	0.53%	2.83%
Austin, TX	Silver	782,149	419,751	1.28%	2.29%
Boston, MA	Silver	609,942	310,881	1.51%	14.85%
Baltimore, MD	Bronze	620,210	265,496	0.70%	6.48%
Charlotte, NC	Bronze	722,234	357,349	0.16%	2.03%
Louisville/Jefferson County, KY	Bronze	592,529	269,362	0.41%	2.24%
Memphis, TN	Hon. Mention	652,123	273,242	0.21%	2.01%
Memphis & the Mid-South, TN-AR-MS	-	1,114,292	497,349	0.15%	1.37%
Nashville-Davidson, TN	Bronze	595,132	295,356	0.34%	1.83%

The League of American Bicyclists reports that BFC-awarded cities have seen 80% growth in bicycling between 2000 and 2011. Although many Bronze-level BFC cities in the South have bicycle commuting rates similar to the national average, the average Silver-level bike friendly community has bicycling rates several times the national average. In these communities, commute mode choice data from ACS shows that many residents are able to get regular exercise by walking and bicycling for transportation.

If bicycling rates in the Mid-South could grow similarly to BFC cities, health benefits to the region would increase significantly. Table 10 explores the potential benefits of increased bicycling rates in the Mid-South at several example increased rates. "Regional physical activity need met" represents the total

estimated physical activity (in hours) attributed to bicycling at the associated mode share and overall trip making estimate, divided by the total need for the population of the entire region, assuming the CDC minimum recommended guideline for moderate physical activity of 150 minutes per week.

Table 10. Potential Physical Activity Benefits of Increased Bicycling in the Mid-South

MID-SOUTH POTENTIAL ANNUAL BICYCLING BENEFITS			
Bicycle commute mode share:	**Current**	**US average**	**Example Silver BFC (Austin, TX)**
	0.15%	**0.53%**	**1.28%**
Annual bicycling trips	4,010,000	13,930,000	33,600,000
Annual miles walked	7,940,000	27,580,000	66,520,000
Annual hours of physical activity	800,000	2,780,000	6,700,000
Recommended physical activity minimums met *(regional total/recommended minimum hours/person)*	6,100	21,200	51,100
Regional physical activity need met by bicycling	**0.5%**	**1.9%**	**4.6%**

Note: Estimates reflect conceptual benefits that would be generated at given increases in walking use as if they existed in the Mid-South today. Values are rounded for readability and do not reflect future demographic growth or other multiplier changes.

Bicycling rates are typically more responsive to changes in transportation infrastructure than walking. While national bicycling rates have trended upward for the last decade – growing nearly 50% over that time –walking rates are still declining slowly at the national level. Because walking is heavily dependent on the availability of short trips – generally under one mile – walking is more dependent on factors like land use that are slow to change. It is quicker to build a bike boulevard or install a cycle track than it is to incent walkable, mixed-use development, which is dependent on private developers and the health of the real estate market. Bicycling rates in the Mid-South are therefore more likely to increase at a faster relative rate than walking, and may hold greater short-term potential for creating health benefits to the region. Table 11 below shows physical activity benefits of walking at example increased rates; it may be challenging to increase walking rates to levels shown.

Table 11. Potential Physical Activity Benefits of Increased Walking in the Mid-South

MID-SOUTH POTENTIAL ANNUAL WALKING BENEFITS			
Walk commute mode share:	**Current**	**50% increase**	**US average**
	1.37%	**2.05%**	**2.83%**
Annual walking trips	43,830,000	65,750,000	90,680,000
Annual miles walked	27,080,000	40,620,000	56,030,000
Annual hours of physical activity	9,000,000	13,500,000	18,620,000
Recommended physical activity minimums met *(regional total/recommended minimum hours/person)*	69,400	104,100	143,600
Regional physical activity need met by walking	**6.2%**	**9.3%**	**12.9%**

Note: Estimates reflect conceptual benefits that would be generated at given increases in walking use as if they existed in the Mid-South today. Values are rounded for readability and do not reflect future demographic growth or other multiplier changes.

Disclaimer and Methodology Notes

While this estimate is instructive for understanding the current role played by walking and bicycling in the health of Memphis and the Mid-South region, its accuracy is limited to the quality of the available data. Trip purpose ratios and other multipliers used in the estimate are not necessarily the same in Memphis as they are nationally. For simplicity, physical activity needs and local physical inactivity rates used in the estimates represent the adult population; therefore demographic groups such as children and seniors are not broken out from the overall estimate and may not be represented accurately.

The estimate is also not exhaustive. For example, walking trips to access transit are common, but not specifically calculated in the estimate based on transit use in the region. This walking activity may represent additional physical activity and other associated benefits not captured in the above tables. A 2005 study estimated that 29% of regular transit users achieve minimum physical activity guidelines by walking associated with accessing transit.[7]

Despite these limitations, the estimates still demonstrate that walking and bicycling likely have a tangible and material impact on public health, and could play an increasingly significant role in the health of residents in the Mid-South in the future.

[7] *Walking to Public Transit: Steps to Help Meet Physical Activity Recommendations*. Besser, Lilah & Dannenberg, Andrew. American Journal of Preventive Medicine, 2005;29(4):273–280, (http://www.cdc.gov/healthyplaces/articles/besser_dannenberg.pdf).