NASHVILLE AREA
Metropolitan Planning Organization

# 2014 Regional Bicycle & Pedestrian:
## Non-Motorized Demand
## Physical Activity Assessment

# NON-MOTORIZED LATENT DEMAND ANALYSIS

The objective of the development of the Non-Motorized Latent Demand Model in 2008 was to produce a decision tool that would allow planners and engineers to determine the real need for walking and bicycle facilities within the Nashville region. At the macro level, this is a regional pedestrian and bicycle model that incorporates the entirety of the transportation planning area of the Nashville region. The whole Nashville Area MPO (Davidson, Rutherford, Williamson, Wilson, Sumner, Robertson, and Maury Counties) is included in this model. However, it is very much a microscopic model, producing a fine-grained, parcel-level analysis of walking and biking trip making demand.

## TRIP MODEL

The latent demand trip model uses land use, household data, employment data, and proximity data for every parcel in the study area to predict the trip making characteristics of each individual parcel. The model is based on data from national and local sources such as the 2009 National Household Transportation Survey and Nashville MTA's On-Board Survey conducted in 2006. The trip model uses eight specific trip types for walking and five trip types for cycling which include travel to school, travel to recreation, travel to shop, travel to work, travel to errand, walk to transit, walk from transit, and walk from parking. While most of the trip types originate from households, there are some trip types that are assumed to originate from places of employment and transit stops. Each predicted trip is attributed to the originating parcel.

To estimate the walking or cycling trips for a parcel, a few key pieces of information must be known; specifically, the number of households within that parcel, employment, and the minimum distance to the nearest school, retail area, transit stop, and recreational facility must be known for each parcel. In addition to parcel-specific data, the model requires information relative to employment proximity and significant parking structures.

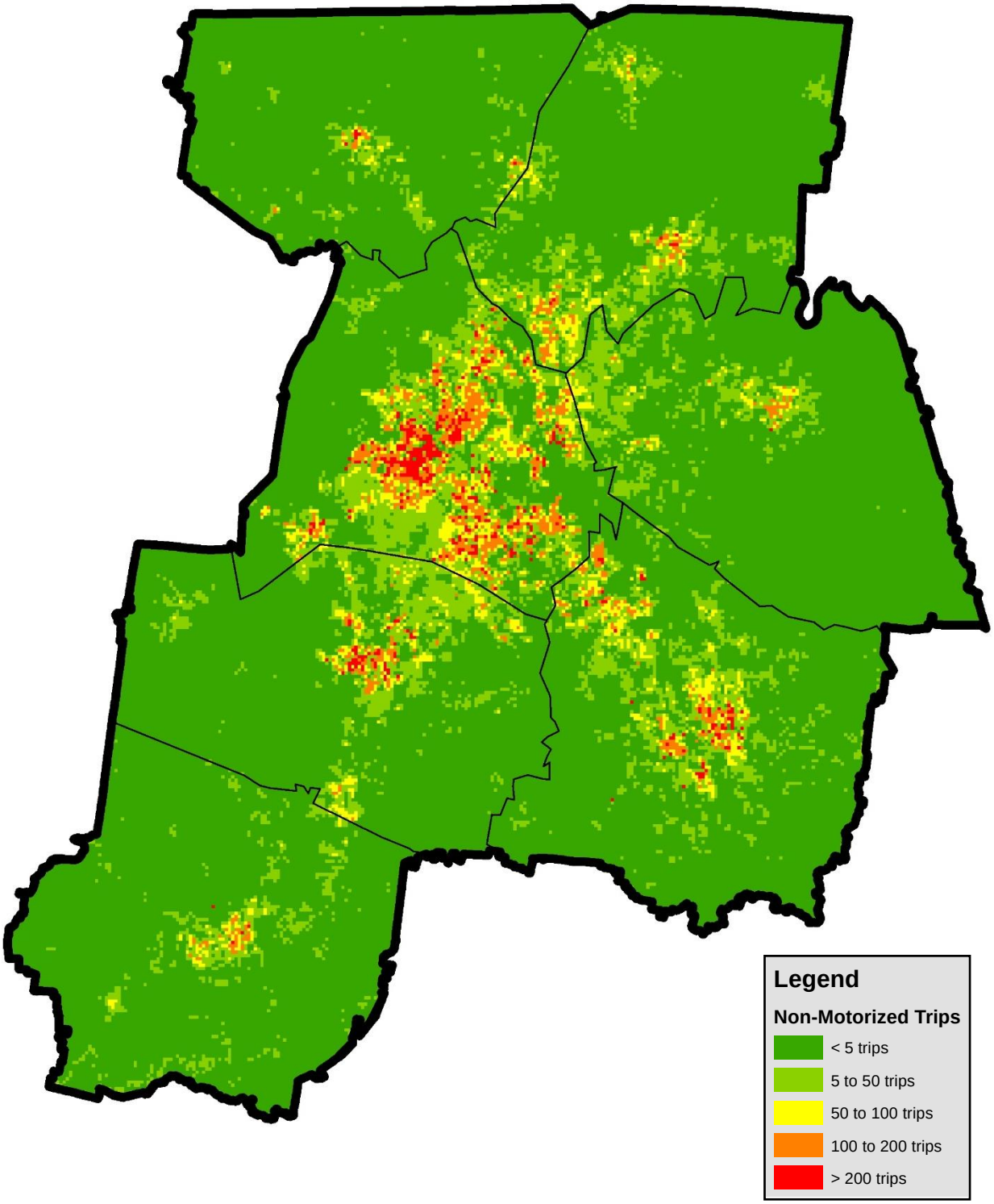
In order to quantify the walking and cycling potential of a parcel, the aforementioned minimum distances are used to predict the probability that a person would make a walking or cycling trip for the identified trip purpose. These probabilities are developed using data from the 2009 National Household Travel Survey and reflect the decreased likelihood of making a non-motorized trip with increasing trip distance.

The result of the equation for each trip type is the expected number of walking and bicycling trips by trip purpose. These trips are reported individually by trip type and are also summed to obtain the total number of one-way walking and bicycling trips on a typical work/school day. It is important to note that the trips produced by the model assume ideal facilities and connections; as such, the trips calculated by the model are a combination of both unrealized and realized trips. Where facilities currently exist, the trips shown by the model likely represent actual trips; conversely, where facilities presently do not exist, the trips shown for each parcel represent potential trips that could be made if facilities were constructed.

The results of the non-motorized model can be reported on a parcel level as well as by blocks or neighborhoods. In addition, the trips can be aggregated to a street network to allow a roadway segment analysis of non-motorized trips. The demand for walking and biking trips per quarter mile grid for all eight of the trip types is shown in Figure 1.

Figure 1 shows the most concentrated areas of walking and biking trips where they would be expected. Areas in Davidson County such as the Vanderbilt campus, Downtown, East Nashville, and the Nolensville Road corridor all show increased levels of non-motorized activity. Core areas of the surrounding counties such as Murfreesboro, Franklin, Lebanon, Hendersonville, Springfield, and Columbia also show concentrations of walking and biking activity. It is within these areas that mixtures of commercial, office, and retail land uses can often be found within close proximity to residential neighborhoods and higher density housing such as apartments, increasing the potential for non-motorized trips.

Figure 1: Non-Motorized Latent Demand Model Results for MPO Area



## FUTURE LAND USE IMPACTS ON NON-MOTORIZED DEMAND

One of the applicable features of the non-motorized demand is its usefulness in examining the impacts on walking and bicycling demands, spurred by growth within a community. As such, an analysis of future non-motorized demand was conducted using data for a 2040 horizon year.

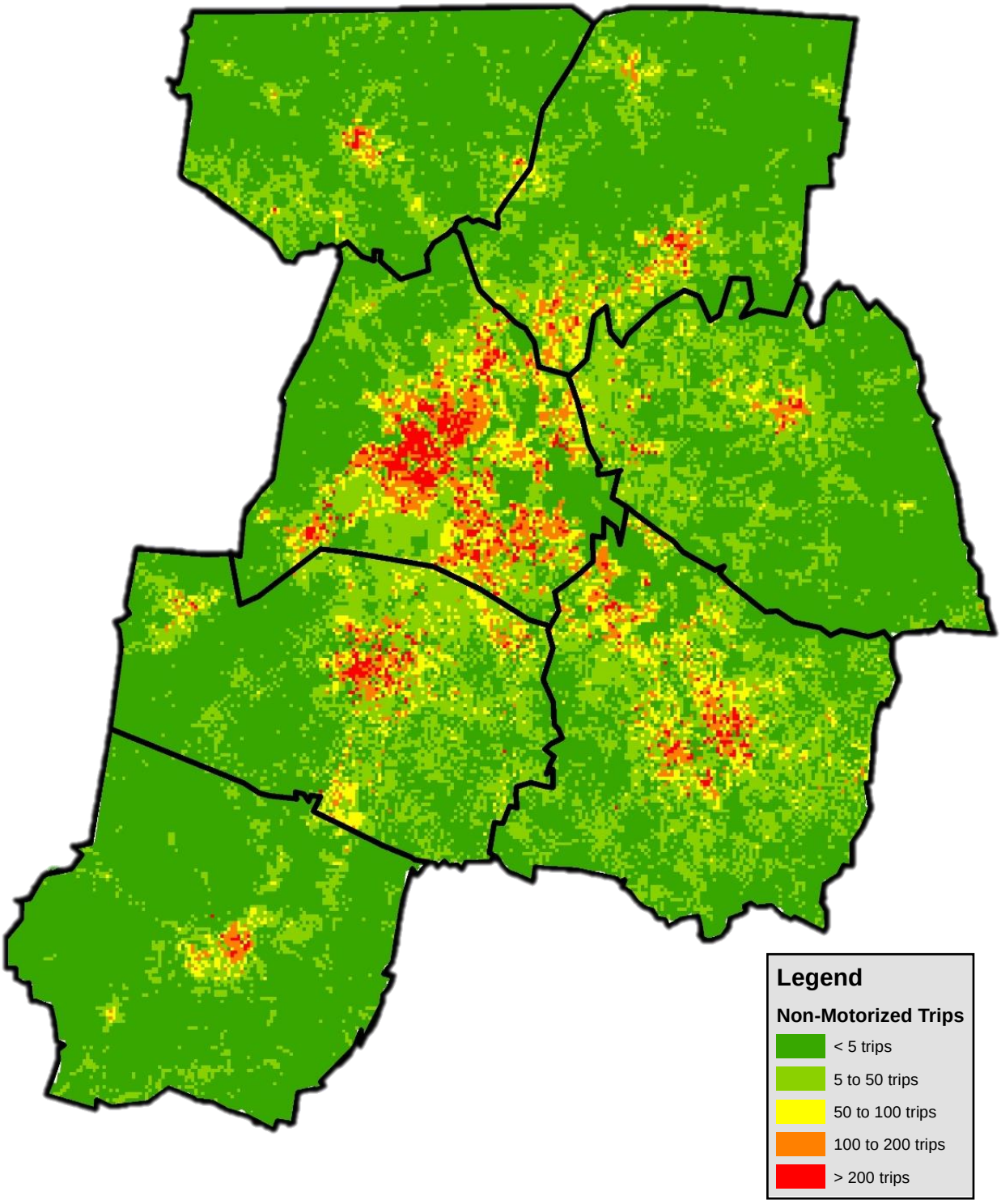
Because the model is dependent on households and employment at the parcel level, CommunityViz outputs were used to allocate future growth in people and jobs. Similar to the base year model, there were eight specific trip types for walking and five trip types for cycling which include travel to school, travel to recreation, travel to shop, travel to work, travel to errand, walk to transit, walk from transit, and walk from parking. However, the minimum distances to some of those destinations could not be determined for the future scenario; such destinations included schools, parks, transit stops, and parking facilities. As such, the future trip generation for those purposes was only impacted by growth in population and employment and not by decreased walking or biking distances to those attractions.

The resulting non-motorized demand for 2040 is shown in Figure 2 with summary results presented in Table 1 below. It can be seen from Figure 2 that Davidson County shows a growing intensity of non-motorized trips compared to surrounding counties, which seem to have more dispersed trip-making. Additionally, suburban cities within the MPO area (e.g., Franklin, Murfreesboro, Mount Juliet, and Hendersonville) show a growing intensity of trips, similar to Davidson County.

Table 1: Model Comparison

| | 2010 | 2040 | Percent Change |
|---|---|---|---|
| Households | 569,254 | 972,647 | +71% |
| Population | 1,449,737 | 2,528,351 | +74% |
| Employment | 688,012 | 1,452,789 | +111% |
| Walking Trips | 692,709 | 1,065,365 | +54% |
| Biking Trips | 34,350 | 64,066 | +87% |

Figure 2: Non-Motorized Latent Demand Model Results for MPO Area in 2040



## PHYSICAL ACTIVITY ASSESSMENT

In addition to predicting the quantity of walking and biking trips within the MPO area, a separate analysis was conducted to estimate the minutes of physical activity that could be realized from these trips given the presence of ideal facilities and connections. National data was used from the 2009 NHTS to determine the average duration of walking and biking trips by trip purpose. Based on these calculations, the minutes of physical activity for each non-motorized trip were summed and allocated to the quarter-mile grid system. This was ultimately done to aid the MPO in evaluating potential investments in non-motorized modes and the associated benefits of increased physical activity.

Since walking and biking trips for the purpose of recreation tend to be longer on average, they have a significant effect on the minutes of physical activity in an area. In order to analyze the results of this analysis, the trips made and minutes of physical activity incurred for recreational trip purposes were identified separately. This allows for analysis of both utility and recreational trips independently when examining their contributions to minutes of physical activity generated within the MPO area. Table 2 below shows the hours of physical activity by county for the MPO area. Figure 3 and Figure 4 below also show the intensity of physical activity anticipated within the 7-county area excluding recreational trips and including recreational trips, respectively.

As expected, the areas with the most walking and biking potential, as predicted by the non-motorized latent demand model, also show the highest concentrations of physical activity generated by those trips. The difference in intensity of non-motorized travel when recreational trips are included can be seen between the two figures below.

Table 2 Physical Activity Assessment

| County | Hours of Physical Activity Excluding Recreational Trips | Hours of Physical Activity Including Recreational Trips |
|---|---|---|
| MPO Area | 82,473 | 179,853 |
| Davidson | 42,347 | 92,340 |
| Maury | 3,660 | 7,271 |
| Robertson | 2,257 | 4,507 |
| Rutherford | 14,199 | 28,426 |
| Sumner | 6,150 | 16,079 |
| Williamson | 9,969 | 22,066 |
| Wilson | 3,891 | 9,165 |

Figure 3: Hours of Physical Activity Excluding Recreational Trips

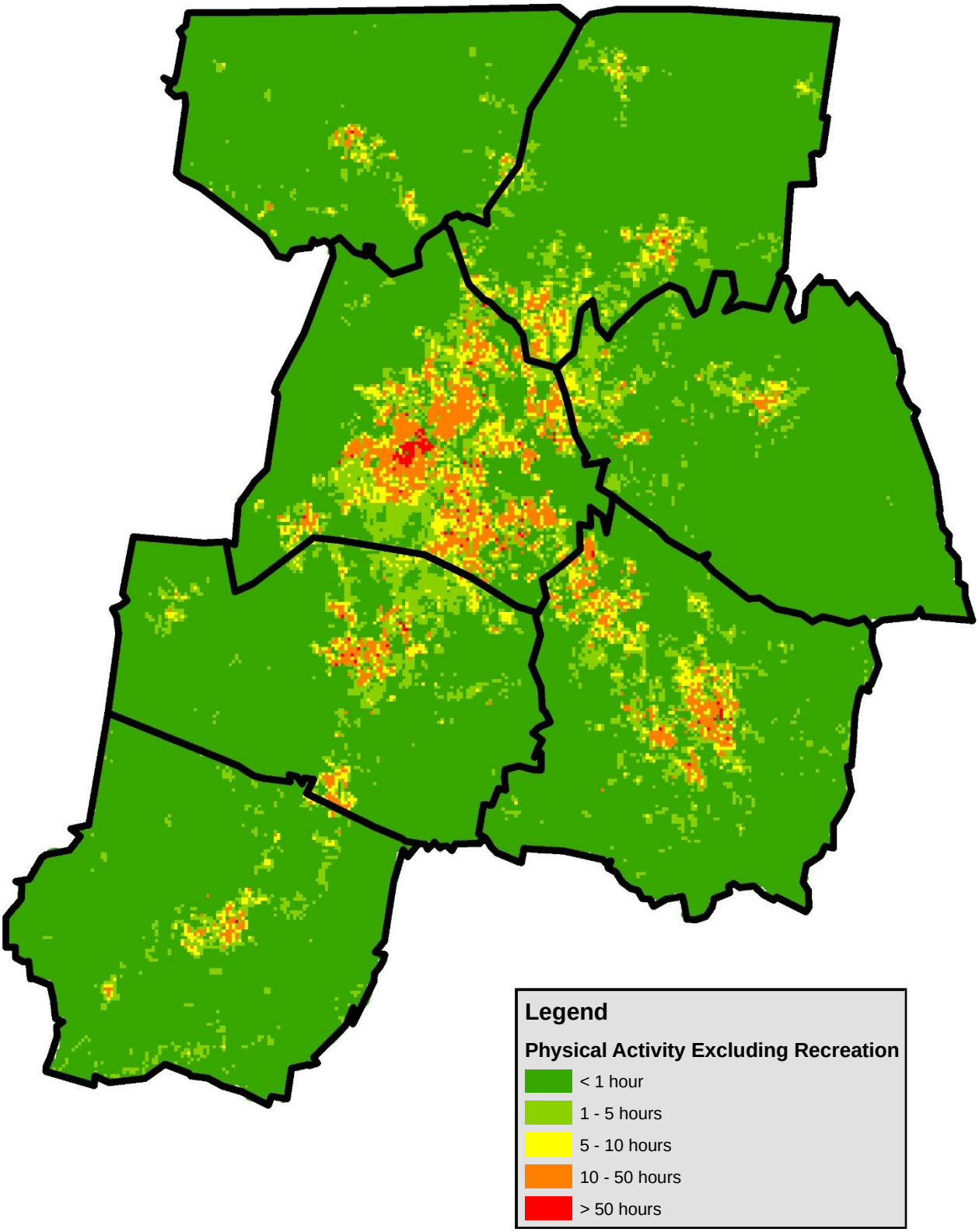
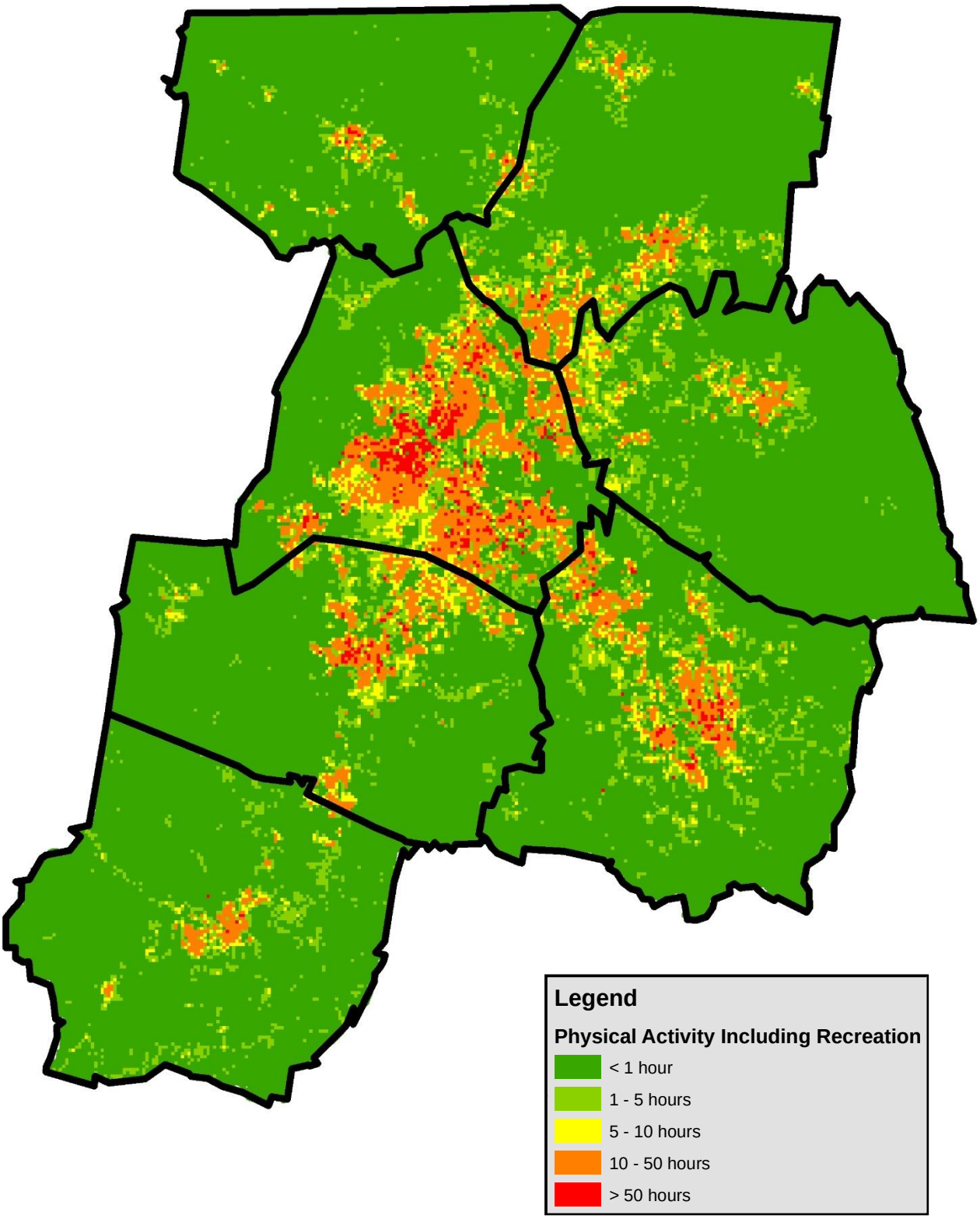



Figure 4: Hours of Physical Activity Including Recreational Trips