APPENDIX A | EXISTING CONDITIONS REPORT (NOVEMBER 2020)

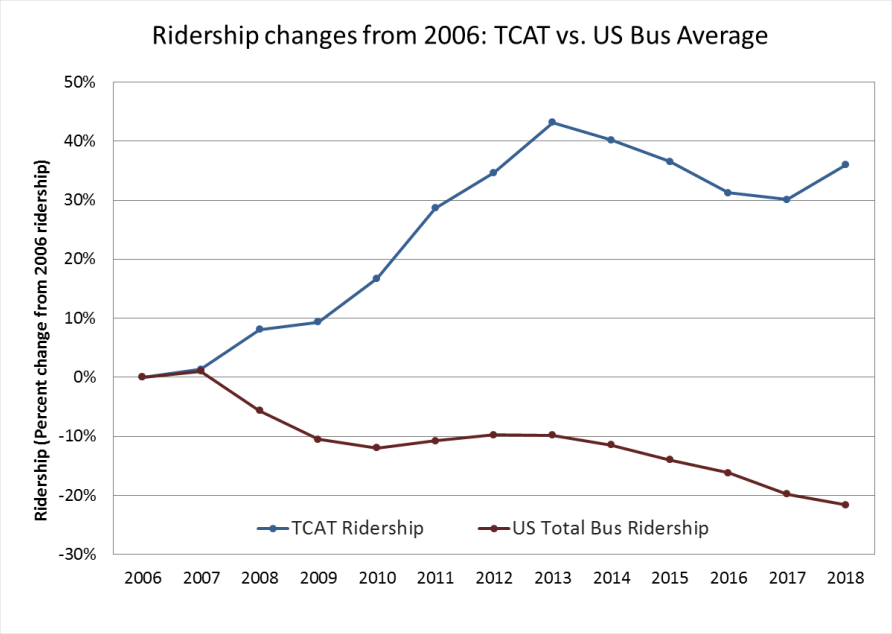
Contents

1. Introduction

Tompkins Consolidated Area Transit (TCAT) provides public transportation services to urban, suburban, and rural communities throughout Tompkins County, New York. TCAT serves various destinations including Cornell University and local colleges, medical institutions, commercial centers, and regional transportation hubs. To address such a large range of transportation demands, TCAT has established multiple types of bus routes, varied by service frequency and span, days of the week, seasonality, and vehicle type.

TCAT has bucked national trends by increasing ridership since 2017 and exceeding 4 million annual passenger trips in 2018. This is part of a longer period of increasing and stable ridership since 2009, when the most recent Transit Development Plan was implemented. It stands in contrast to declining bus ridership trends across the United States, as shown in **Figure 1.1**.

Figure 1.1



As identified in its 2018 Strategic Plan, TCAT operates efficiently across a large service area, has a strong customer base from Cornell University, is investing in customer outreach and technology, and can draw on a mix of funding from local, state, and federal sources. However, the need for significant capital investment and the shifting landscape of private shared mobility services present challenges for the future.

Due to COVID-19, Tompkins County has experienced significant shifts in work schedules, travel demands, and travel patterns. With the shift to work-from-home for a large portion on the workforce, and the concerns over crowding implications on transit vehicle, ridership in 2020 was significantly lower than previous years. These trends, which are expected to continue in the coming years, in addition to

growing uncertainties in government funding, will continue to pose new challenges, as well as new opportunities, for TCAT.

Ithaca and Tompkins County are changing. With multiple new constructions and revitalizations of buildings, roads and parks, the development of our region is constant. As the region changes, so do our needs to move from one place to another rapidly and conveniently. Transportation systems such as roads, bike facilities, and transit need to adapt as well.

The landscape around mobility is changing too, as fixed-route transit, Microtransit, bikes, and shared car rides increasingly evolve into a coherent network of transportation choices, offering more affordable, social and environmental-friendly alternative to single-occupancy vehicles.

The TCAT bus network provides a vital service to both residents and visitors who take the bus to get to jobs, education, health services, shopping, and recreation. Considering the substantial development in Tompkins County and the rapidly changing mobility sphere, the evolution of the bus network is a critical step in continuing TCAT's growth and commitment to deliver safe, reliable, and affordable transit services.

TCAT is taking a visionary look into the future. The Transit Development Plan (TDP) is a holistic process in which TCAT undertakes a comprehensive review of the demand for transit in its service area and its existing bus network, aiming to better tailor service to demand, increasing overall ridership and utilization, and providing equitable and reliable bus service.

The overarching goal of the TDP is to develop a flexible and adaptable set of recommendations that will allow TCAT to simultaneously rebuild from the impact of COVID-19 adjust its service to address future demands. Under this goal, the TDP objectives are:

- Plan for a clear, efficient, and attractive transit system
- Encourage multi-modal connectivity
- Offer solutions for first/last-mile services
- Develop enhanced bus frequent-service corridors
- Enhance amenities at bus stops and park and rides
- Increase overall ridership, reliability, and resource utilization
- Ensure equitable, accessible, and inclusive transit service

Both TCAT operations and the TDP process have adapted since the onset of the COVID-19 pandemic in early 2020. In response to a substantial drop in ridership due to stay-at-home directives, TCAT started scaling back service in March 2020, gradually adding back service over the summer. For the fall service period that started August 30, most service is operating as normal or at about 90% compared to the same period last year. As of early September 2020, ridership is at about 30% of typical levels and on-time performance is at 90% - significantly higher than previous years.

TCAT implemented bus and facility cleaning protocols in early March, including disinfecting buses and the Green Street Station daily with a professional-grade germicidal electrostatic sprayer. The crisis also prompted TCAT to cease accepting fares March 20 through September 5, so that riders would not have

to use the farebox, which is located next to the driver area. TCAT resumed fare collection after installing driver barriers in all buses. Riders must wear face coverings, per New York State Executive Order, and TCAT is limiting each bus to 25 riders.

On the TDP side, the long-term development of TCAT bus network remains the study's objective; therefore, most data and analyses in this report reflect the conditions existed in 2019, prior to COVID-19. However, the study considers different scenarios, some of which related to the changes expected due to the pandemic. In addition, the study's public outreach efforts were modified to comply with Social Distancing guidelines and limitations.

The Existing Conditions Report is the first major step of the TDP. Relying on data collected from local, regional, and federal sources, the report includes in-depth analyses of the TCAT service area and the bus service performance; it considers indicators such as population density and travel patterns in the assessment of demand for transportation services; it takes an in-depth look at the existing bus network to understand the supply of such services; it accounts for social vulnerability to grasp the added value of the transit system as a social service; and overall, it lays the foundation for the planning processes of the bus system, which will take place in the TDP.

The Existing Conditions Report has seven chapters and an appendix:

1. **Plans and Documents Review** describes the planning context of Tompkins County and the region, including key findings about and recommendations for transit service.
2. **Land Use, Demographics and Socioeconomic Characteristics** documents indicators such as population density, car ownership, age, vulnerable populations, employment centers, land use, and key transit destinations.
3. **Traveling around Ithaca and Tompkins County** identifies major travel patterns, average commute times, mode share, and activity by bus stop.
4. **Transit Amenities and Infrastructure** describes bus stop types, park-and-ride facilities, and the potential for transit priority treatments.
5. **Transit Gap Analysis** identifies the extent to which transit service matches demand, as well as aligning with TCAT's aspirational goals.
6. **Coverage Analysis** shows the area and population served by transit in comparison to a Social Vulnerability Index.
7. **Network Performance Review** analyzes the TCAT network in terms of service type, ridership, route productivity (passengers per hour), and on-time performance.
8. **Route Profiles** include an at-a-glance summary of performance, service characteristics, and ridership of each bus route in the existing TCAT network.

2. Plans and Documents Review

Current transit planning efforts in the Tompkins County area exist within a broader context that has evolved over time. This chapter reviews that planning context, including plans that primarily focus on TCAT such as the organization's short- and long-range transit improvement plans, as well as regional and local plans within Tompkins County such as the Ithaca-Tompkins County Transportation Council's 2040 Long Range Transportation Plan and the 2013 Regional Transportation Study.

Findings from this chapter contextualize future transit planning work in Tompkins County by enumerating the region's planning goals, highlighting consistent visions, and identifying unfulfilled objectives of the planning process. Key findings and summary bullets below include items related specifically to transit network or service development, including both operations and infrastructure considerations. Content items that were not related to transit service are omitted from the summary.

- TCAT Plans
    - TCAT Strategic Plan 2018 – 2030 (2018)
    - Transit-Oriented Development: A Guide for Tompkins County (2018)
    - Conceptual TCAT Facility Masterplan Options (2016)
    - Phase 2: Site Selection for Tompkins Consolidated Area Transit (2019)
    - TCAT Transit Development Plan (2009)
- Tompkins County and Regional Plans
    - The Ithaca-Tompkins County Transportation Council (ITCTC) 2040 Long Range Transportation Plan (2019)
    - Tompkins County Comprehensive Plan (2015)
    - Regional Transportation Study (2013)
    - NY State Route 96/Trumansburg Road Pedestrian Corridor Study Project (2020)
    - NY State Route 96 Corridor Management Study (2009)
    - NY State Route 13/366 Corridor Management Plan (2008)
- Local Plans in TCAT Service Area
    - City of Ithaca Comprehensive Plan (2015)
    - Ithaca College Five-Year Strategic Plan (2015)
    - Tompkins-Cortland Community College 2015-2020 Strategic Plan (2015)
    - Town of Ithaca Comprehensive Plan (2014)
    - Cornell University Parking Optimization Study (2019)
    - Cornell University Campus Master Plan (2008)
    - Town of Dryden Comprehensive Plan (2005)

Overall Key Findings

The following are key findings from the document review:

- **Transit Service Improvement**
  - TCAT is committed to providing and improving transit services. This includes streamlining the existing system, reducing bus travel times, expanding the service area, improving operational productivity and cost efficiency, and increasing ridership.
  - TCAT recognizes the diversity of its ridership base and strives to expand and improve mobility for all transit riders, including vulnerable populations such as low-income households and minority, disabled, and senior populations.
  - Simplifying and establishing transit service development priorities, in conjunction with investments in technology innovation such as real-time bus arrival signs, were highlighted in the most recent 2018 TCAT Strategic Plan.
- **Transit Capital Improvements**
  - Local and regional stakeholders, including the ITCTC, are committed to fostering transit services and have included a range of transit service development recommendations as part of their long-range planning efforts. These include transit infrastructure upgrades and capital funding needs, improvements to passenger facilities, identifying suitable locations for inter-city bus stations, marketing strategies to promote transit ridership, and expanding transit access for rural communities.
  - TCAT's current facility is operating beyond its capacity and alternative options to accommodate growth in both fleet size and support staff will need to continue being explored.
- **Multimodal and Regional Mobility**
  - Regional mobility remains a challenge but can potentially be improved by facilitating connectivity between different service operators, providing evening/weekend services, and coordinating schedules for popular major travel destinations. Identifying additional park-and-ride locations was recommended to provide greater access to existing transit routes in suburban and rural areas.
  - Corridor management plans in the region highlighted past planning efforts to densify and promote nodal developments. Sustained population growth in the region may result in new transit destinations and demand.

TCAT Plans and Programs

TCAT Strategic Plan 2018 – 2030 (2018)

The TCAT Strategic Plan is intended to guide the growth of TCAT as an organization over the next decade. Building off of the 2013 Regional Transportation Study, the strategic plan communicates all aspects of TCAT's operations, defines a concise and energizing vision and mission, lays out specific goals for achieving that vision along with associated actions and performance measures, and addresses both current and anticipated issues within an evolving transportation landscape. Recommendations related to transit service development are summarized below:

Setting Priorities + Goals

- Evaluate existing and any planned routes for adherence to TCAT's Service Development Priorities and service standards, and flag routes that might require changes.
- Identify candidates for high frequency service on routes with highest ridership and/or in areas with latent demand.
- Consider routes for piloting high-frequency service, including elements such as unique bus stop signage, bus branding, and electronic messaging on buses.
- Initiate and execute an updated Transit Development Plan (TDP), which considers the Service Development Priorities and route redesigns.

TCAT Service Development Priorities

- Streamline routes and avoid deviations onto side streets, which increase travel time and reduce transit's competitiveness and desirability for through riders.
- Ensure new routes are simple and operate along relatively direct paths to serve both well-defined and growing markets.
- Tailor bus service to demand and increase frequency along high-demand and growing corridors while maintaining service in lower-demand areas.
- Provide all-day, high frequency service along the three to five highest-demand corridors in the system; focus on peak hour service in other areas where ridership is lower, noting that some locations don't exhibit traditional "peak" hours during morning and evening weekday rush hours.
- Continue to evaluate bus stop spacing systemwide. The baseline spacing is ¼ mile in the urban environment and longer distances in rural areas, depending on land uses, topography, and the road network.
- Continue to focus on serving transit dependent populations as effectively as possible, recognizing that feeder service, demand-responsive, or other non-fixed route options may be preferable in certain cases.

Procurement of a Sustainable Fleet

- Continue to develop a scheduled and balanced bus transition plan to address future needs, including consideration for growing the aggregate size of the fleet based on increased demand for service, and potential changes in useful life of future vehicles.

Investments in Technology Innovation

- Continue to expand the installation of real-time bus arrival signs at relevant stations and troubleshoot any existing issues.
- Explore opportunities for a farebox system replacement that will allow easy fare payment options through Smart Card or smartphone technology, with alternative non-tech payment options for riders who require them.
- Develop a comprehensive 2020 Technology Roadmap for future technology investment and deployment.

Facilitating Multimodal Connections

- Work with the City of Ithaca and Tompkins County to explore potential sustainable + multimodal hub locations in conjunction with bus replacement planning and charging needs.
- Formalize and enhance amenities (e.g. bus shelters, bike racks, real-time signage, etc.) at certain existing rural park and ride facilities to make them a formal part of the TCAT network.
- Work with the City of Ithaca and local institutions to explore park and ride locations outside the Downtown core to alleviate parking and congestion issues within Downtown and improve transit access for new suburban developments.

Adapting to a Changing Landscape

- Develop a New Mobility Adaptation Plan to detail strategic actions TCAT will take in response to the evolving marketplace, and revisit annually.
- Explore first /last mile partnership opportunities to attract riders to core TCAT service and increase the utility of public transit in lower-density areas.
- Explore further partnerships with public and private partners (including volunteer drivers) to provide alternatives to low-ridership routes or provide additional demand-responsive, semifixed route service at off peak times.
- Implement, evaluate, and adjust actions taken in a New Mobility Adaptation Plan.
- Consider the partial conversion of TCAT's lowest ridership fixed routes to demand responsive or flexible routes that utilize new technology, potentially in coordination with Gadabout.
- Work with Gadabout to pilot and evaluate additional business models for paratransit service Long-Term Strategic Initiatives.

Transit-Oriented Development: A Guide for Tompkins County (date TBD)

Compiled by TCAT and intended for public outreach and stakeholder engagement, this guide provides an overview of Transit Oriented Development (TOD) including its potential benefits, typical typologies, and strategies for implementation. The TOD guide has not been published yet; it is likely to be influenced by other ongoing planning efforts in Ithaca, which encourage the reduction of parking and consider other transportation demand management (TDM) measures.

Final Conceptual TCAT Facility Masterplan Options (2016)

TCAT's existing 52,500 square feet facility was originally constructed in 1992 and met the agency's programmatic needs at that time. Since then, TCAT has grown in both fleet size and support staff; TCAT's operations now exceed the physical boundaries of both the site and building. The existing facility also has significant deferred maintenance issues that need to be addressed.

This report concluded that ridership will increase by 20% over the next 20 years for both the TCAT fleet and Gadabout, potentially further exacerbating the existing operational challenges at the facility. The proposed new facilities are situated on a theoretical 10-acre parcel of land, about double the existing site acreage. Two new building options were proposed, with the primary difference being how bus circulation is handled within the facility.

This report is part of the federal funding process and recommended additional thought be given to interim expansion opportunities that can alleviate the spatial constraint at TCAT's current facility.

Site Selection for TCAT Operation Facility (2019)

In 2019, TCAT engaged with Wendel to further study the relocation of their operations to a new site location based on the recommendations of the 2016 facility masterplan study (Phase 1). The study employed both qualitative and quantitative metrics to identify two potential sites: Vanguard and Airport (Warren Road).

The Vanguard Site is an existing building structure that used to be a printing company. The existing structure is composed of approximately 200,000 sf of usable space, meets the test fit requirement, and could accommodate the full building program.

The Airport Site is adjacent to the Ithaca Tompkins Regional airport, located northeast of the City of Ithaca. The site meets the test fit requirement, and like the Vanguard Site, there would be minimal impact on operations at the existing Willow Avenue site during the construction of a new facility.

Based on the results of this study, in December 2019 TCAT's Board passed Resolution 2019-17, identifying the Airport Site as the most optimal for the new facility.

TCAT Transit Development Plan (2009)

The focus of the 2009 TDP was the review of the fixed-route bus network and proposed changes to achieve the following goals:

- Streamline the system
- Reduce bus travel times
- Serve previously unserved regions within the service area
- Improve operation performance
- Increase ridership

TCAT and the consultant team performed a comprehensive on-site exploration of every fixed route in the TCAT system, documenting surrounding land use, service frequencies, and availability of facilities. Where possible, accurate passenger activity, traffic conditions, and operating speeds by bus routes were recorded. Proposed route-specific recommendations, informed by the reconnaissance field work, underwent two rounds of public input before they were finalized.

The Capital Plan chapter summarized supporting elements of the TDP including vehicles types, the need to build/obtain a larger maintenance facility, park-and-rides, vehicle replacement cycles, bus stop amenities, and fare system replacements.

The Title VI chapter analyzed the extent to which any of the recommended changes from the TDP would impact minority bus routes, defined as a route that has at least one third of its total route mileage in a census tract(s) or traffic analysis zone(s) with a percentage of minority population greater than the percentage of minority population in the transit service area.

Tompkins County Plans

ITCTC 2040 Long Range Transportation Plan (2019)

The 2040 LRTP is the fifth update since the original 1995 plan. Overarching goals that pervade all other goals as part of the LRTP include:

- Improve the safety of the transportation system
- Enhance coordination among transportation providers to the benefit and convenience of users
- Minimize negative environmental impacts of transportation
- Reduce vehicle miles of travel and the number of drive-alone trips
- Ensure the equitable availability of mobility options in the community

Recommendations in the LRTP that relate to transit service development are listed below:

Transit Promotion

- TCAT follows a marketing strategy with comprehensive public outreach. ITCTC will provide support and assistance in continuing and expanding the promotion of public transportation

Transit Infrastructure and Capital Needs

- TCAT has a detailed capital needs plan that addresses the acquisition/replacement of vehicles, communications equipment, transit facility equipment, safety and security equipment, and bus stops and shelters. The ITCTC will work in coordination with TCAT and Tompkins County to ensure that its facilities and equipment needs are met in order to provide the highest quality public transportation system for the residents of Tompkins County.

Passenger Facilities Improvements

- TCAT has assessed needs at passenger stops and shelters for signage, ADA and pedestrian access, lighting, safety, communications, bike storage and physical and design integration with surroundings, including the need for bus pull-offs and road shoulder improvements. These efforts will be coordinated with planned pedestrian facility improvements. In addition, TCAT would like to explore passenger facility amenities, such as wireless internet access at key stops and on vehicles, energy-efficient lighting and heating, etc. TCAT will work to meet identified needs with the ITCTC and other relevant agencies, such as NYSDOT, the County Highway Department, and other municipalities.

Inter-City Bus Station Location Evaluation

- The long-time location of the inter-city bus terminal in Ithaca closed in 2018. The City of Ithaca is accommodating inter-city buses on an interim basis offering curbside service on the 100 block of E. Green Street. Further evaluation is needed to identify potential locations for a permanent facility for inter-city buses.

Rural Transportation Services

- TCAT sees provision of rural commuter transportation service as a key need and growth opportunity over the next ten years. The components of TCAT's rural transportation strategy include: First, TCAT will coordinate fixed-route services with service in neighboring counties.

Second, TCAT will explore the feasibility of implementing alternative service delivery models in rural areas such as the expanded park-and-ride system and the demand-response feeder service. TCAT and Gadabout are engaged in designing a First Mile/Last Mile Pilot project that integrates paratransit and fixed route services to allow passengers to make connections to/from a main bus stop to their home or other destination address.

Tompkins County Comprehensive Plan (2015)

The following policies related to transit service development were adopted by the County as part of the comprehensive plan:

- Maintain and improve critical elements of the existing transportation network to support the safe movement of people and goods.
- Reduce the use of fossil fuels in transportation.
- Shift travel away from driving-alone to biking, walking, carpooling/ridesharing, and using transit.
- Consider the needs of populations that are particularly challenged by transportation when developing systems and alternatives.

In 2013, 59.9% of the Tompkins County's population drove alone to work. Approximately 25% of the people who worked within Tompkins County lived outside of the County, and 82% of them drove alone to work. To effectively shift people away from driving alone, the plan recommended supporting and facilitating transportation alternatives, specifically transit. Among the improvements that would encourage commuters to try different modes were applying effective communication technologies, creating convenient payment methods, implementing real-time bus tracking, and providing additional park-and-ride locations and access points to transit routes in suburban and rural areas.

NY State Route 96/Trumansburg Road Pedestrian Corridor Study Project (2020)

Route 96/Trumansburg Road Pedestrian Corridor Study Project is a feasibility analysis of pedestrian infrastructure needs. It includes a comprehensive public participation process, review of the existing transportation network, traffic, crash data, right-of-way ownership, existing land use, potential future development, and pedestrian usage, and a preliminary environmental analysis.

The Needs and Opportunities section identified the following themes related to transit service development:

- Many bus stops along the corridor are difficult to access by pedestrians as they are located on segments without sidewalks and/or behind the drainage ditch.
- There is a need to improve bus pads in many locations.

Regional Transportation Study (2013)

The Regional Transportation Study (RTS) was a planning project developed by the Regional Transportation Planning Coalition to study transportation in the seven-counties of Cayuga, Cortland, Tioga, Chemung, Schuyler, Seneca, and Tompkins. The study resulted in a strategic plan to address transportation infrastructure, systems and/or operational improvements, and enhancements needed to accommodate projected transportation needs.

The RTS examined existing services and needs, projected future demands, incorporated stakeholder input, and developed a series of recommendations in a phased implementation plan that addressed alternatives to reduce single occupancy trips, reduce commuter traffic on the highway network, potentially expand bus transportation, incorporate coordinated mobility programs, and enhance customer information and agency interaction.

Demographic trends at the time of this study suggested continued growth in regional transportation options due to inter-county travel. However, unstable funding and reliance on the NY State budget was expected to influence how specific projects or processes could be implemented.

The framework for a regional system was developed to form the basis for a program of projects that could be pursued by the affected agencies and the Regional Transportation Planning Coalition.

In 2016, Tompkins County contracted with Cornell Cooperative Extension of Tompkins County to develop a mobility management program to implement the RTS. Since May 2016, a regional coalition of mobility managers and local partners has been organized. A website and an online, interactive map, showing public transit routes, population, employment and healthcare sites, was published in www.MoveTogetherNY.org.

NYS Route 96 Corridor Management Study (2009)

The purpose of the Route 96 Corridor Management Study was to define an appropriate approach to manage anticipated growth along the corridor, from the southern boundary of Trumansburg to the intersection of Route 96 and Route 13 in the City of Ithaca. The study looked at the impacts of nodal development patterns versus a sprawling development pattern with a focus on access management issues, transportation systems improvements, transit services developments, and the overall enhancement of the corridor's aesthetic character.

State Route 96 begins at the Seneca-Tompkins Counties line, just north of Trumansburg, and travels southeast through Trumansburg, Jacksonville, Ulysses, and Ithaca. It culminates in downtown Ithaca, at the confluence of State Route 13 and the Cayuga Inlet. The Route 96 Corridor Management Study examined the 10-mile stretch of road and all land uses within a mile-buffer around the Corridor.

The study concluded that increased transit use would help mitigate many of the negative aspects identified with living along this corridor. Many residents expressed interest in using transit if it became more accessible to them. Short-term projections would likely not result in significant ridership changes as current routes were found to often be underutilized and had the ability to capture large number of riders. As future development occurs, the study recommended that the local communities continue to coordinate with TCAT and define changes warranted to existing transit routes.

Transit Infrastructure and Service Recommendations

- Cayuga Medical Center Node
    - Bus stop enhancement or relocation
    - New bus stops
    - New bus pull-off area along the corridor
- Hamlet of Jacksonville

- Bus stop amenities
- New bus stops

Recommendations to Increase Transit Use

- Consider bus routing changes as developments occur along the corridor.
- Consider the provision of Express routes, e.g. to/from the Town of Trumansburg, to make an efficient link between the employees and their jobs.
- Pilot projects to test the potential for flexible services to complement fixed route services.
- At least one park-and-ride location recommended at the Cayuga Medical Center, and potentially a second in Jacksonville.

NYS Route 13/366 Corridor Management Plan (2008)

The Route 13/366 Corridor Management Plan (CMP) was a collaborative effort between Tompkins County, the Town of Dryden, and the Village of Dryden. This CMP defined nodal development points that can accommodate potential increases in development while safely and efficiently moving commuters into and out of Cornell University, Ithaca, Dryden, Varna, and Cortland. The nodal development scenario was compared against the existing development scenario in the CMP.

The NYS Route 13/366 Corridor is a heavy commuter route with steadily increasing traffic volume. It is the primary of five corridors into and out of Tompkins County and the Ithaca, connecting directly into the heart of Cornell University. The Corridor also provides access to I-81. TCAT routes 41, 43, and 45 served the corridor at the time of the study, connecting Ithaca, Varna, Etna, Dryden, and Freeville to Cornell, T3C, and the Shops at Ithaca Mall.

The CMP determined that the continuation of the low-density development patterns would not promote the use of transit along the corridor as there would be sufficient demand and clear destinations for new transit services. If the corridor did fully build out and demand was warranted under the nodal development scenario, the plan recommended that TCAT consider adding a route with stops every quarter or half mile along the corridor, while improving transit amenities.

Local Plans within TCAT's Service Area

City of Ithaca Comprehensive Plan (2015)

The Mobility and Transportation Chapter of the 2015 City of Ithaca Comprehensive Plan focus on achieving a sustainable transportation system with viable alternatives to private automobile trips. Goals and recommendations related to transit service development include:

Goals

- Ithaca's transportation infrastructure shall be designed to increase multi-modal connectivity, creating an interwoven network that extends into adjacent municipalities.
- To reduce auto dependency, transportation modes shall be prioritized in the following order: pedestrian, bicycle, transit, private cars, and freight.
- Frequent transit service, along with improved stops and shelters, throughout a broad service area will offer increased comfort, safety, and accessibility, particularly in areas serving low-income and elderly people.

- Pedestrian, bike, and transit improvements will be spread equitably throughout the city so people of all income levels and abilities will benefit from them.

Recommendations

- Promote participation in public and private TDM programs. The City should work in partnership with the private sector to find mutually beneficial solutions to accommodate employee commuting and other transportation needs, including bicycles.
- Advocate for the expansion of bus service and air travel to regional destinations and coordinate local bus service with intercity schedules.

The Mobility and Transportation chapter also described the City's commitment for innovation, including advancing transportation technology, design, construction, and materials while being mindful of long-term environmental, safety, and fiscal impacts. It included a recommendation to improve transit efficiency through the introduction of Intelligent Transportation Systems (ITS) technologies.

Ithaca College Five-Year Strategic Plan (2015)

This strategic plan is a blueprint and framework for how Ithaca College will continue to provide exceptional educational experience that is accessible, affordable, and responsive to the needs of all Ithaca College students. While the strategic plan does not cover transit-related topics, Ithaca College's plan to become a year-round campus with a multigenerational student body will help inform the TDP.

Tompkins-Cortland Community College (TC3) 2015-2020 Strategic Plan (2015)

This strategic plan highlights TC3's focus on student success. While the strategic plan does not include transit-specific topics, TC3's focus on strengthening community connections will help inform the TDP.

Town of Ithaca Comprehensive Plan (2014)[1]

The Town of Ithaca's 2014 Comprehensive Plan and 2007 Transportation Plan describe the Town's commitment towards fostering a transportation system that enhances quality of life. Goals and recommendations pertain to transit service development include:

Goal: Develop and maintain a multimodal transportation system that fosters effective movement of people and goods.

Recommendations:

- Develop a transportation system that serves the mobility interests of the Town's residents and businesses, while recognizing the interests of through traffic.
- Work with TCAT, ITCTC, and major employers, to develop a park-and-ride system.

[1] In November 2020, the Town of Ithaca adopted its New Neighborhood Code, which essentially reflect the community vision developed in the 2014 Comprehensive Plan. Defined as a form-based zoning and design code, the new code creates the framework for planning and building with a wide variety of housing choices, networks of pedestrian-friendly streets, shops, offices, parks and public places all near each other. The code supports compact, walkable mixed-use developments in growth areas, near the major employment and activity hubs.

- Consider increasing funding to TCAT to ensure adequate levels of transit service in the Town.
- Improve transit service frequency to underserved areas of the Town and rural areas of the County.
- Continue to support Gadabout to ensure continued service for senior citizens and people with disabilities.

Goal: Develop and maintain a transportation system that promotes livable, healthy, and attractive neighborhoods.

Recommendation:

- Minimize disruptions caused by buses in residential neighborhoods, while nevertheless providing adequate transit service to the neighborhood.

Goal: Coordinate with other local and regional organizations to promote a regionally coordinated transportation system.

Recommendation:

- Continue to explore opportunities for increased intermunicipal sharing of facilities, equipment, labor, knowledge, and expertise.

Goal: Promote future development patterns that reduce the use of private automobiles and encourage the alternative modes of transportation.

Recommendation:

- Continue to work with TCAT and developers to ensure that new development in the Town is served by transit where possible; key issues are adequacy of access for buses in site plans, provision of bus stops and shelters, and route extensions or service enhancements where feasible.

Cornell University Parking Optimization Study (2019)

The Cornell University Parking Optimization Study provides an assessment of the current parking conditions and identifies potential strategies to improve on-campus parking and transportation services for all users. The transit connectivity and mobility section summarized the major findings:

- Only one out of four on-campus TCAT routes - Route 82 - has enough span and frequency to move people on campus at an acceptable rate; however, it is highly crowded. Providing additional frequent routes with 5-10-minute headways will have a significant financial impact.
- Multiple bus routes use the same stops to facilitate transfers. This creates some confusion for passengers trying to decide which bus to take to stay within campus.
- Numerous TCAT routes cut through the campus and contribute to overall congestion. However, reducing on-campus cut-through routes may result in increased transfer needs and major capital investment in transfer hubs.

Cornell University Campus Master Plan (2008)

This master plan provides Cornell University with an integrated framework to guide its long-term physical development. The transportation and circulation chapter outlines key strategies and initiatives to improve transit service:

- Work with TCAT to optimize and simplify the transit system
- Introduce and formalize a campus circulator
- Install transit information kiosks at strategic locations around campus
- Establish transit hubs at entrances to both East and West campuses

Town of Dryden Comprehensive Plan (2005)[2]

One of the goals of Dryden 2005 Comprehensive Plan was planning a safe, efficient, and diversified transportation system to serve the needs of all town residents. Specific transit-related objectives to support that goal were:

- Encourage the increased use of existing or new public transit services as an alternative to private automobiles.
- Expand public transit routes within the town and develop a network of bus stops, Park-and-Ride locations, and other facilities that will help increase the use of public transit.

Recommendations related to transit service development included:

- Promote the use of public transit through more compact development patterns along transit routes, development of park and ride locations, and a network of bicycle and pedestrian paths.
- Strongly advocate for improved public transit service within the Town of Dryden.
- Ensure that bus stops are conveniently located and maintained.
- Develop bus service between Dryden, TC3, and Cortland.
- Ensure that the bicycle and pedestrian path network allow connections to existing bus routes.
- Ensure that the street system within new developments are transit- and pedestrian-friendly.

[2] The Town of Dryden is currently developing its new comprehensive plan.

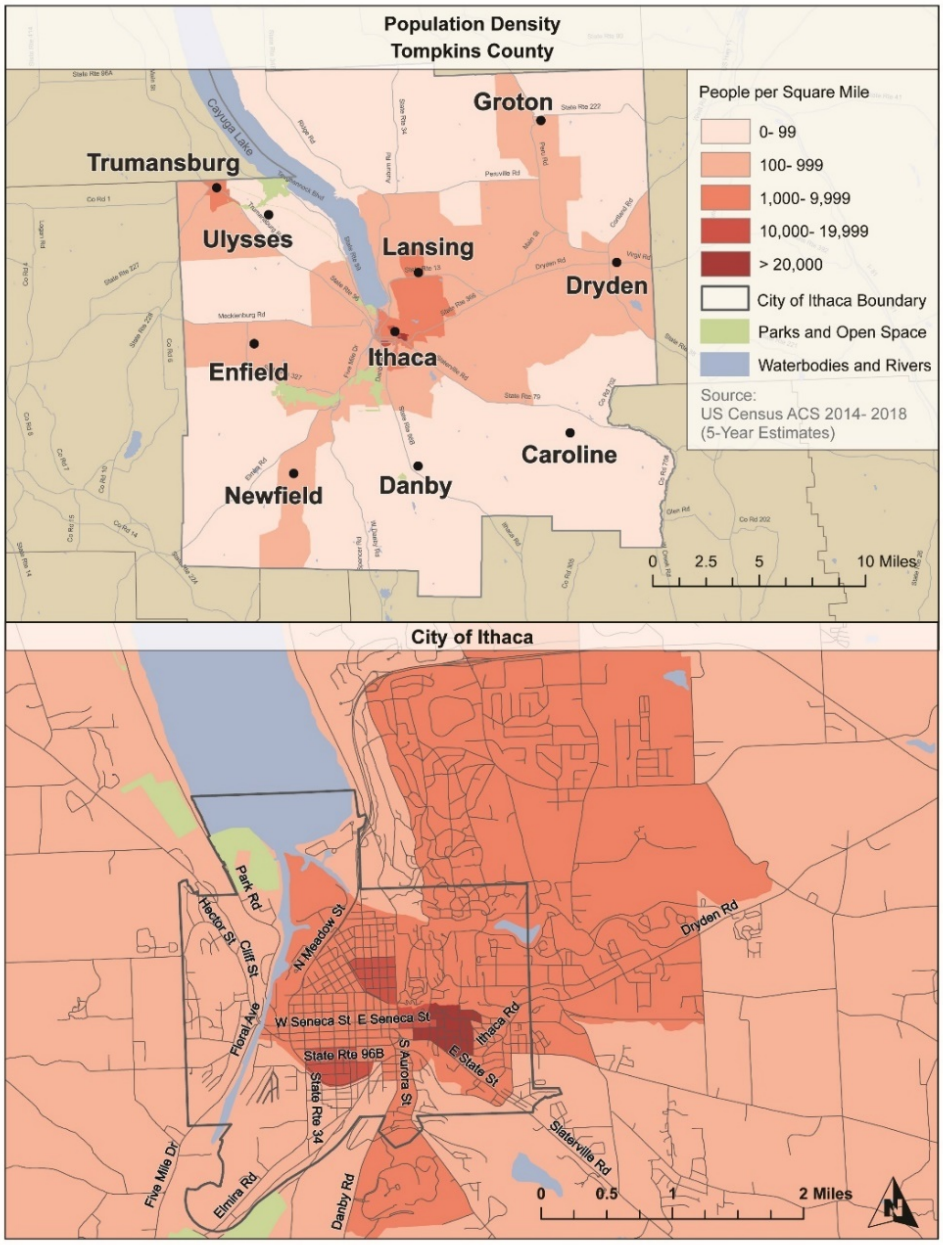
3. Land Use, Demographics and Socioeconomic Characteristics

3.1 Population

3.1.1 Population Density

Population density within Tompkins County is concentrated in and around the city of Ithaca with lower population densities moving farther away from the downtown core and Cornell University. **Figure 3.1** shows Tompkins County and Ithaca's population density.

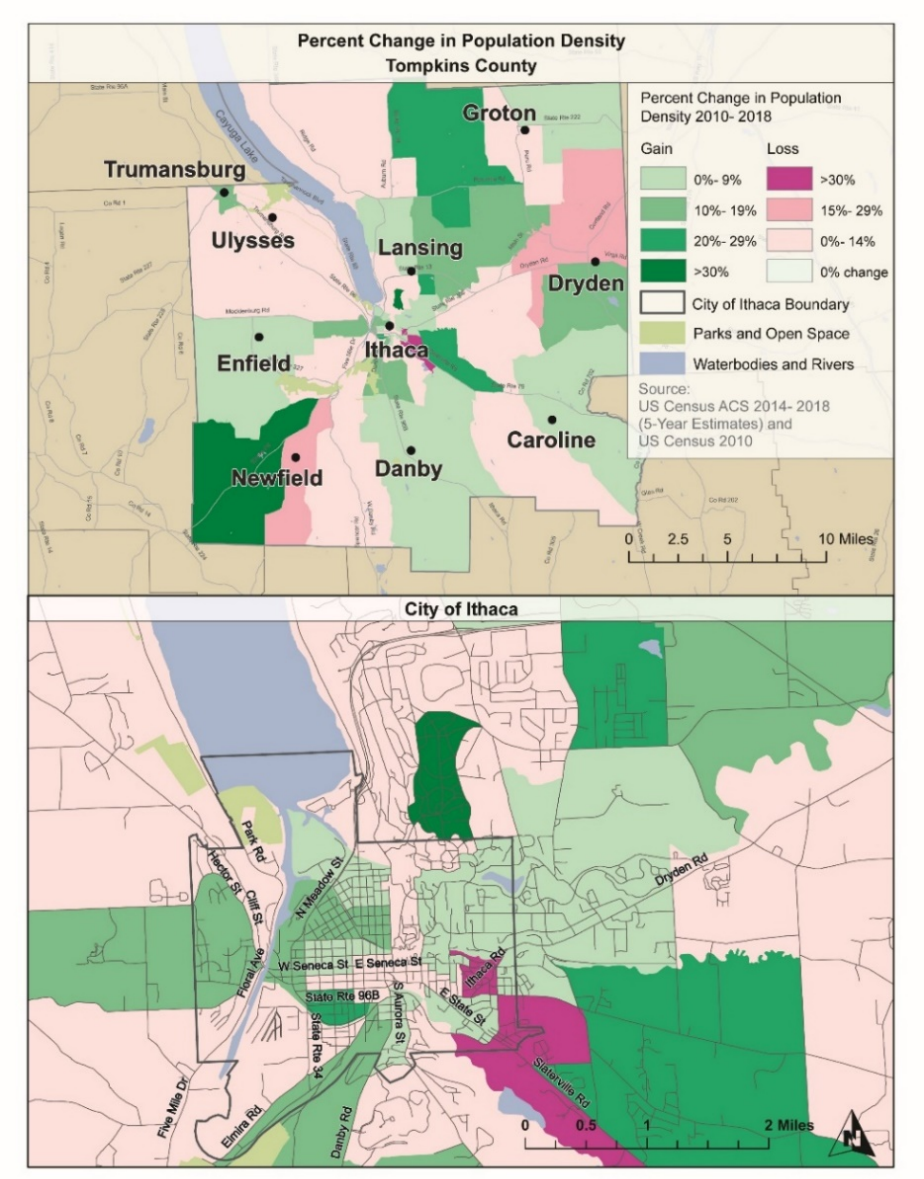
Figure 3.1



3.1.2 Population Density Change (2010-2018)

Between 2010 and 2018, the Tompkins County population grew by 1.4 percent, from 101,560 to 102,960 residents. During the same period, Ithaca's population grew by 2.7 percent, from 29,770 to 30,570. Areas of population growth and loss vary across the county. Growth within the county was focused near Newfield, Trumansburg, and in parts of Ithaca. Areas with losses are found in East Ithaca and in the Collegetown neighborhood in Ithaca. The population loss on East Hill is likely attributed to the removal of housing units between 2016 and 2018 in preparation for new development in the area. These patterns can indicate future trends as areas that have experienced growth or loss of population may demonstrate similar trends in the next 5-10 years. However, the impact of COVID-19 on future urban development remains to be seen. **Figure 3.2** shows population density changes between 2010 and 2018 in Tompkins County and in Ithaca.

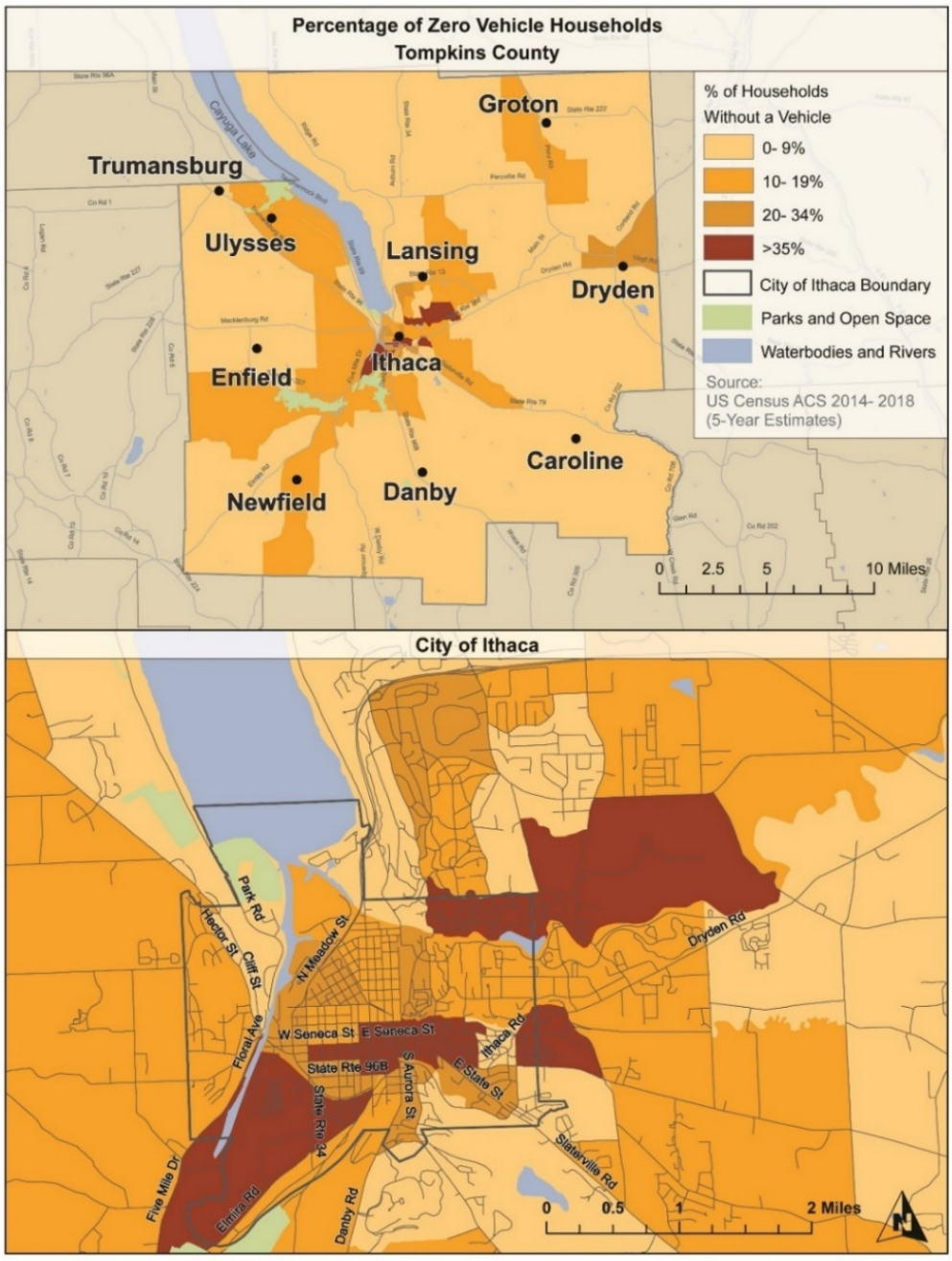
Figure 3.2



3.1.3 Zero-Car Households

93 percent of the households in Tompkins County have access to a vehicle. That percentage is slightly lower in Ithaca, where 78 percent of households have access to a vehicle. As in many college campuses around the country, vehicle ownership is even lower in areas of student residences. Concentrations of zero-car households are found in Collegetown, Cornell Heights Historic District, and Dryden, where student populations are concentrated. **Figure 3.3** shows the percent of zero-car households within Tompkins County and the City of Ithaca.

Figure 3.3



3.1.4 Student Population Density (18 – 24 years of age)

The highest concentrations of residents aged 18-24 mirror that of the concentrations of zero-car households. Collegetown, Fall Creek, East Hill, Cornell Heights Historic District, Dryden, and the area near Ithaca College have the highest percent of residents aged 18-24. Noticeable differences between these two populations appear further from Ithaca, where the areas are more rural but have a significant population of residents aged 18-24. Cornell University students tend to live in Ithaca or close to campus as compared to all residents aged 18-24 who are more spread out throughout the county. **Figure 3.4** shows the distribution of residents aged 18 to 24 based on the US Census data. **Figure 3.5** shows the Cornell University student population density, based on the University records.

Figure 3.4

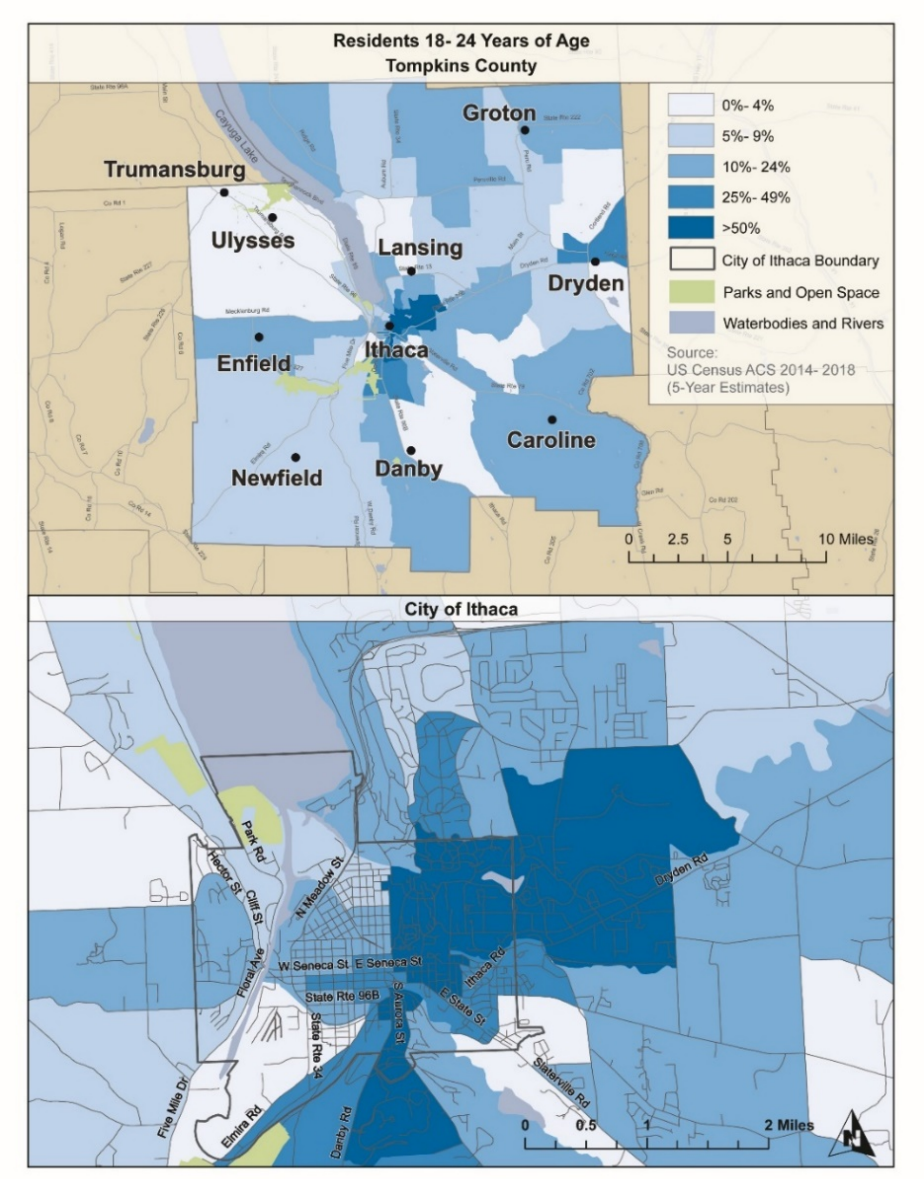
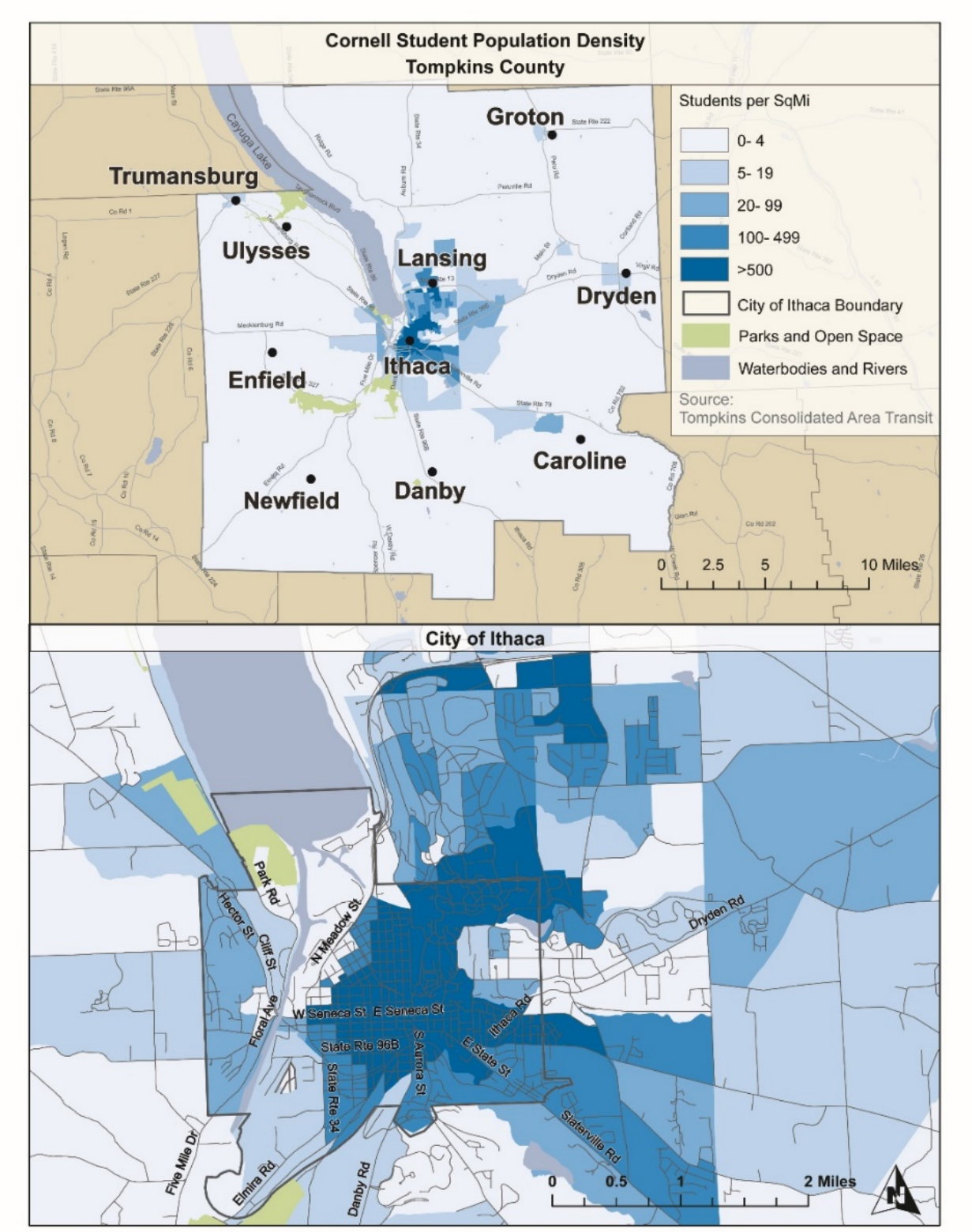


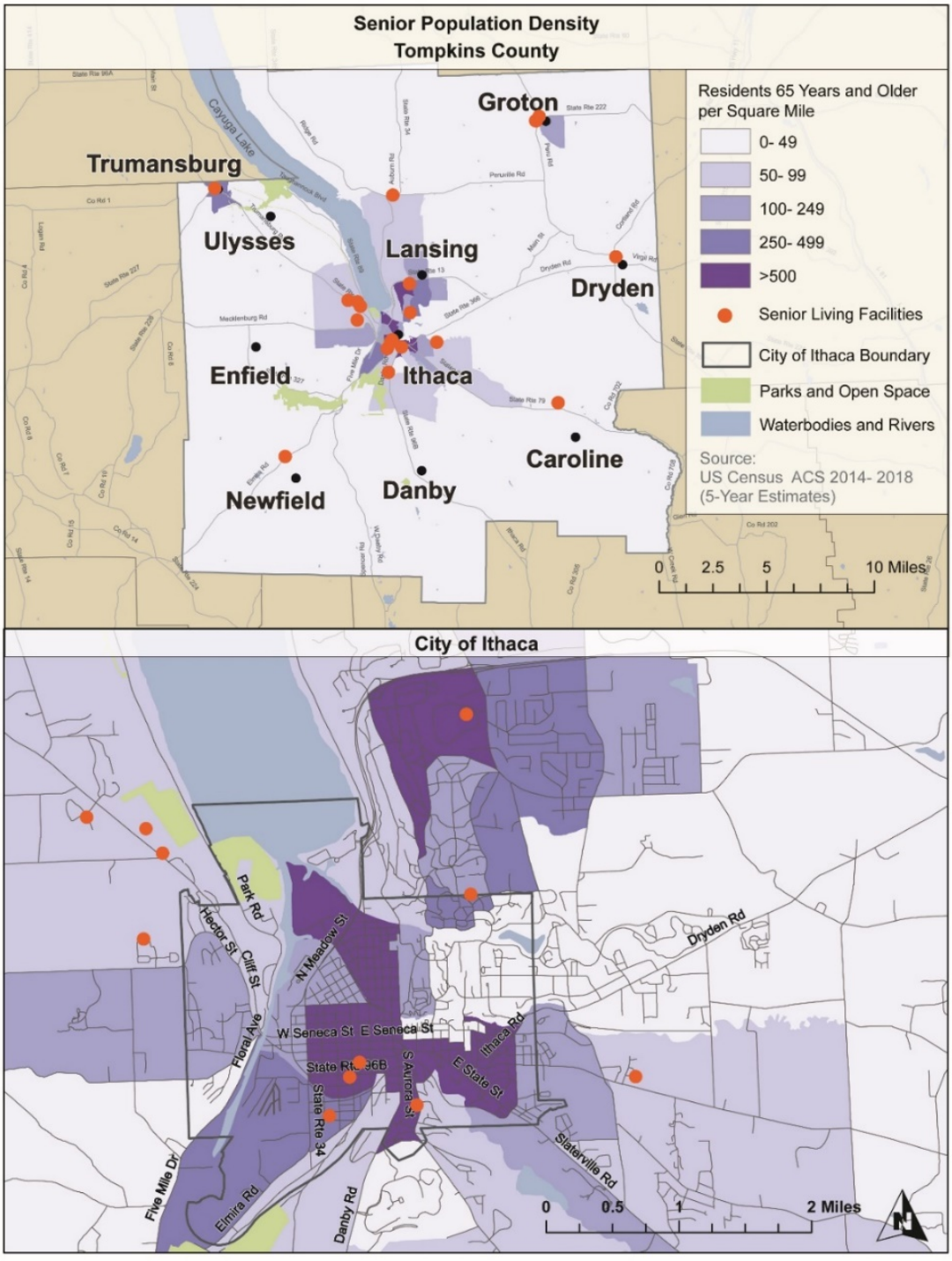
Figure 3.5


Cornell Student Population Density
Tompkins County
Students per SqMi
0- 4
5- 19
20- 99
100- 499
>500
City of Ithaca Boundary
Parks and Open Space
Waterbodies and Rivers
Source:
Tompkins Consolidated Area Transit
Groton
Trumansburg
Ulysses
Lansing
Dryden
Ithaca
Enfield
Caroline
Newfield
Danby
Cayuga Lake
0 2.5 5 10 Miles
City of Ithaca
Park Rd
Hector St
Cliff St
N Meadow St
Dryden Rd
Floral Ave
W Seneca St
E Seneca St
Ithaca Rd
State Rte 96B
S Aurora St
E State St
State Rte 34
Five Mile Dr
Elmira Rd
Danby Rd
Slaterville Rd
0 0.5 1 2 Miles
N

3.1.5 Senior Population Density (65 years and older)

Figure 3.6 shows higher concentration of senior citizens in Fall Creek and Downtown Ithaca along with Trumansburg and in Groton. On the other end of the spectrum, senior population is lower in areas dominated by college-age residents, particularly around Cornell University and Ithaca College.

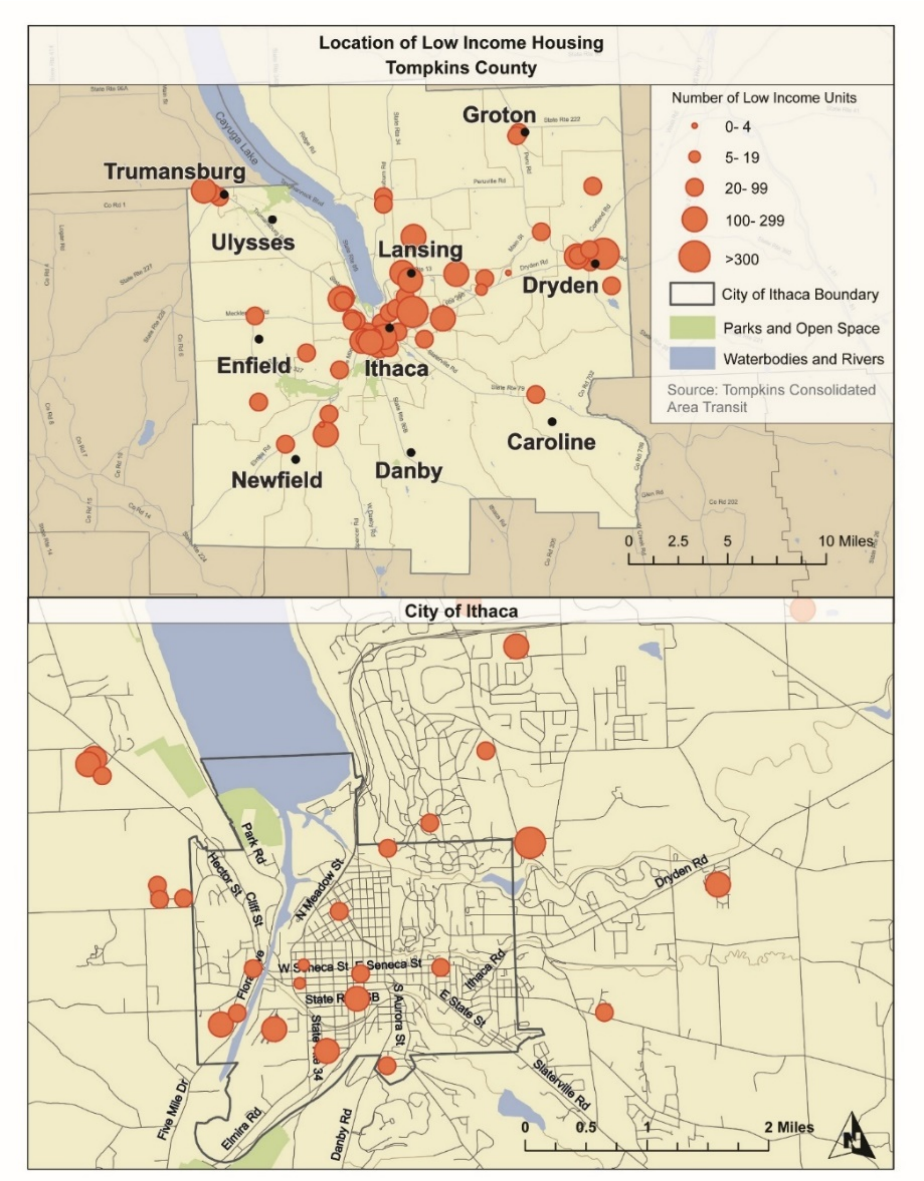
Figure 3.6



3.1.6 Low-Income Housing

Low-income housing is distributed throughout Tompkins County with more units located closer to Ithaca. Nearly half of all low-income housing units are located within Ithaca. A map of the location of low-income housing units is not readily available. Instead, the following methodology was used. Analyzing the Tompkins County GIS address and parcel layers, we located concentrations of multifamily housing and mobile home parks. We then determined the monthly asking rent of each location using publicly available rental listing resources; we selected apartment complexes that had at least 45 dwelling units and had asking rents at or below 26 percent of Tompkins County's monthly median household income. The average monthly housing cost was used as a proxy for identifying low income housing clusters. **Figure 3.7** shows the location of low-income housing within Tompkins County.

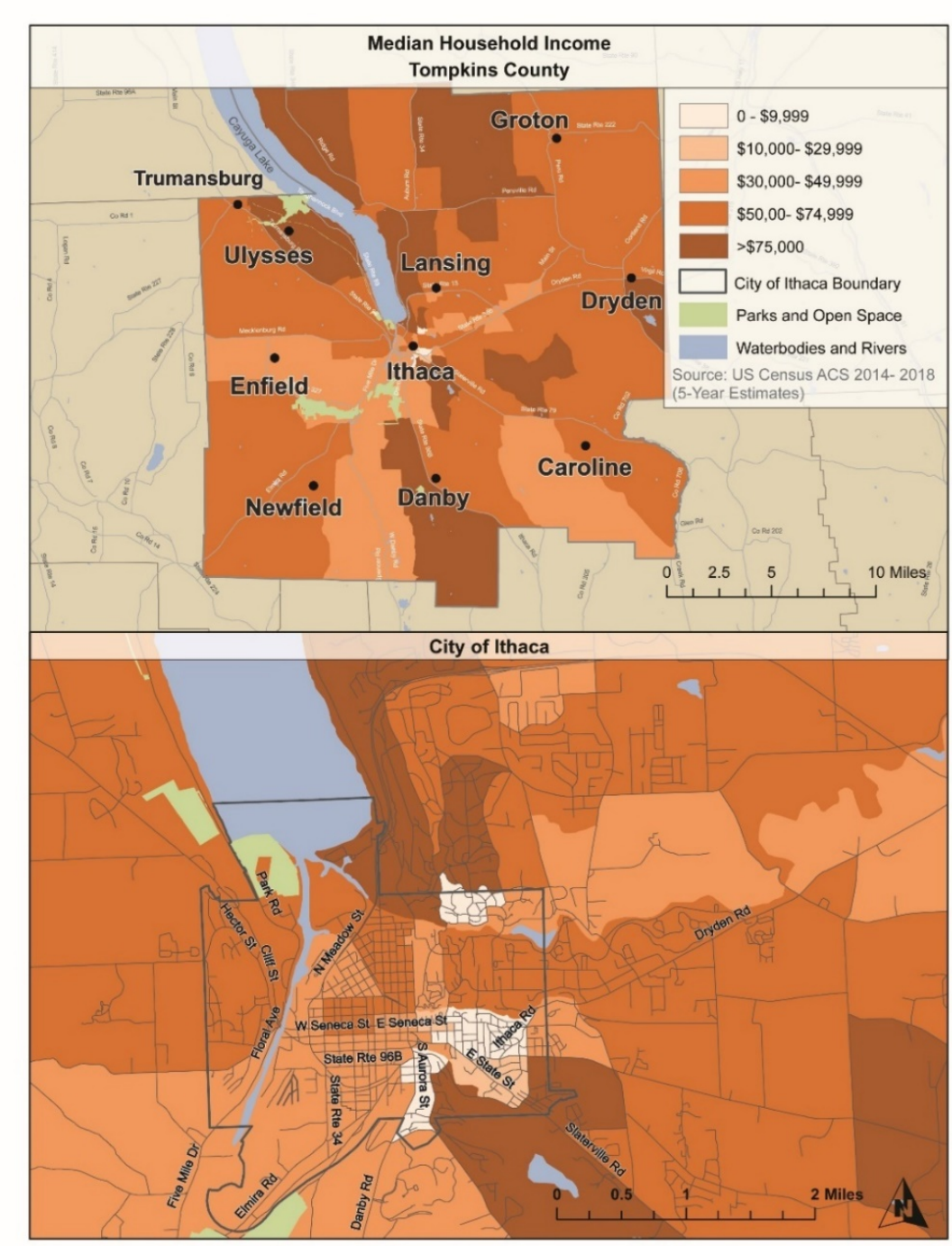
Figure 3.7



3.1.7 Median Income

The median household incomes of Tompkins County and Ithaca were $58,743 and $32,712, respectively, with both areas falling below the statewide median household income of $65,323. Areas around Cornell University that show median household incomes below $10,000 are dominated by students and may not reflect the non-student population that live in these neighborhoods. **Figure 3.8** shows the income distribution within the county.

Figure 3.8



3.1.8 Race and Ethnicity

Tompkins County residents come from a variety of racial and ethnic backgrounds with the majority (80.5 percent) of the population being white. This varies slightly from the racial and ethnic composition of Ithaca where a slightly lower portion of the population is white. **Table 3.1** shows the racial breakdowns for Ithaca and Tompkins County as compared to New York State. **Figure 3.9** and **Figure 3.10** show the spatial distribution of Ithaca and Tompkins County's population by race and ethnicity.

Table 3.1. Population Proportions by Race

Race	Ithaca	Tompkins County	New York State
White	68.8%	80.5%	63.8%
Black or African American	7.0%	4.1%	15.6%
Asian	17.1%	10.1%	8.3%
American Indian or Alaska Native	0.2%	0.2%	0.4%
Other	6.9%	5.0%	11.9%

Source: US Census, American Community Survey 2014-2018 (5-Year Estimates)

Figure 3.9

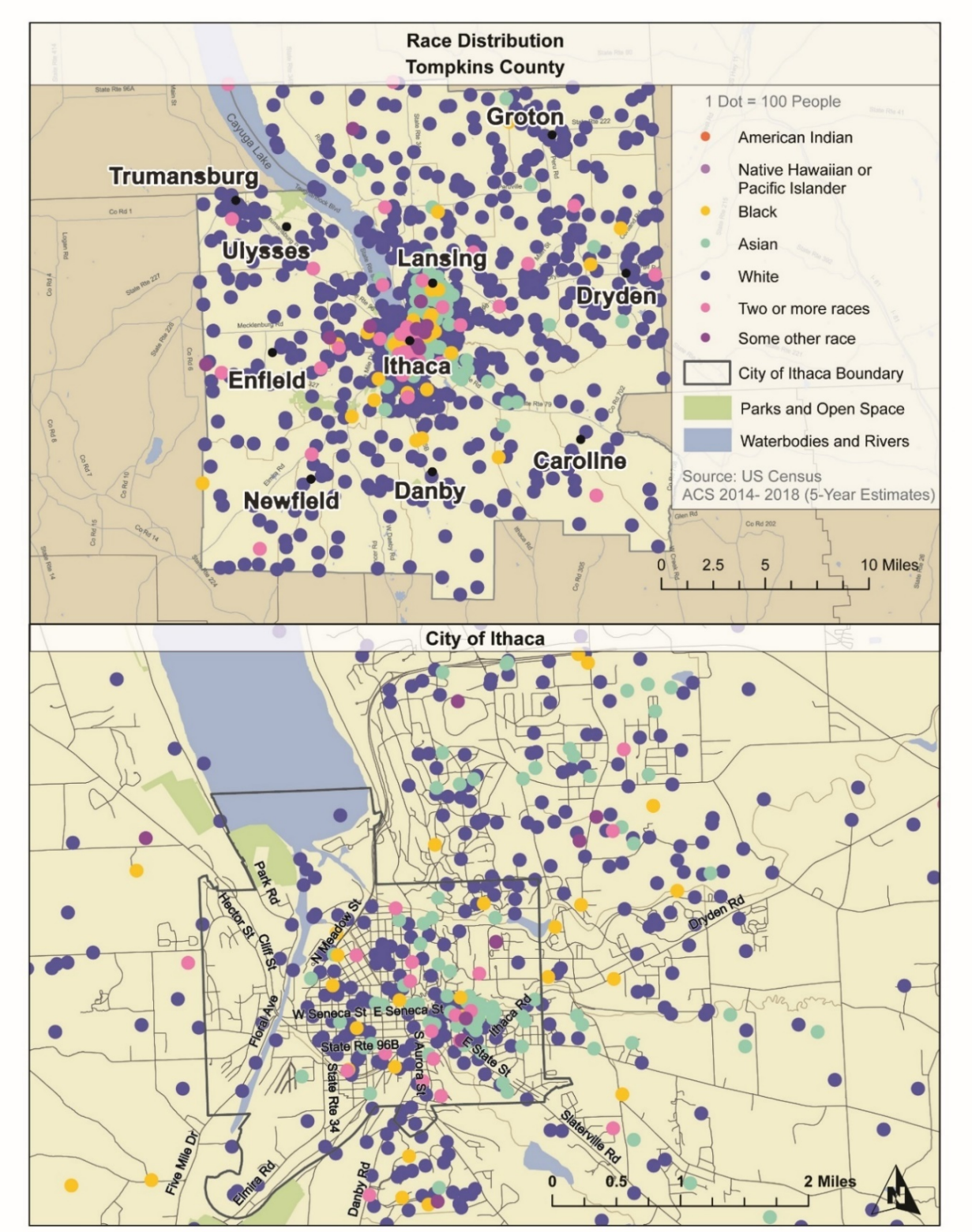
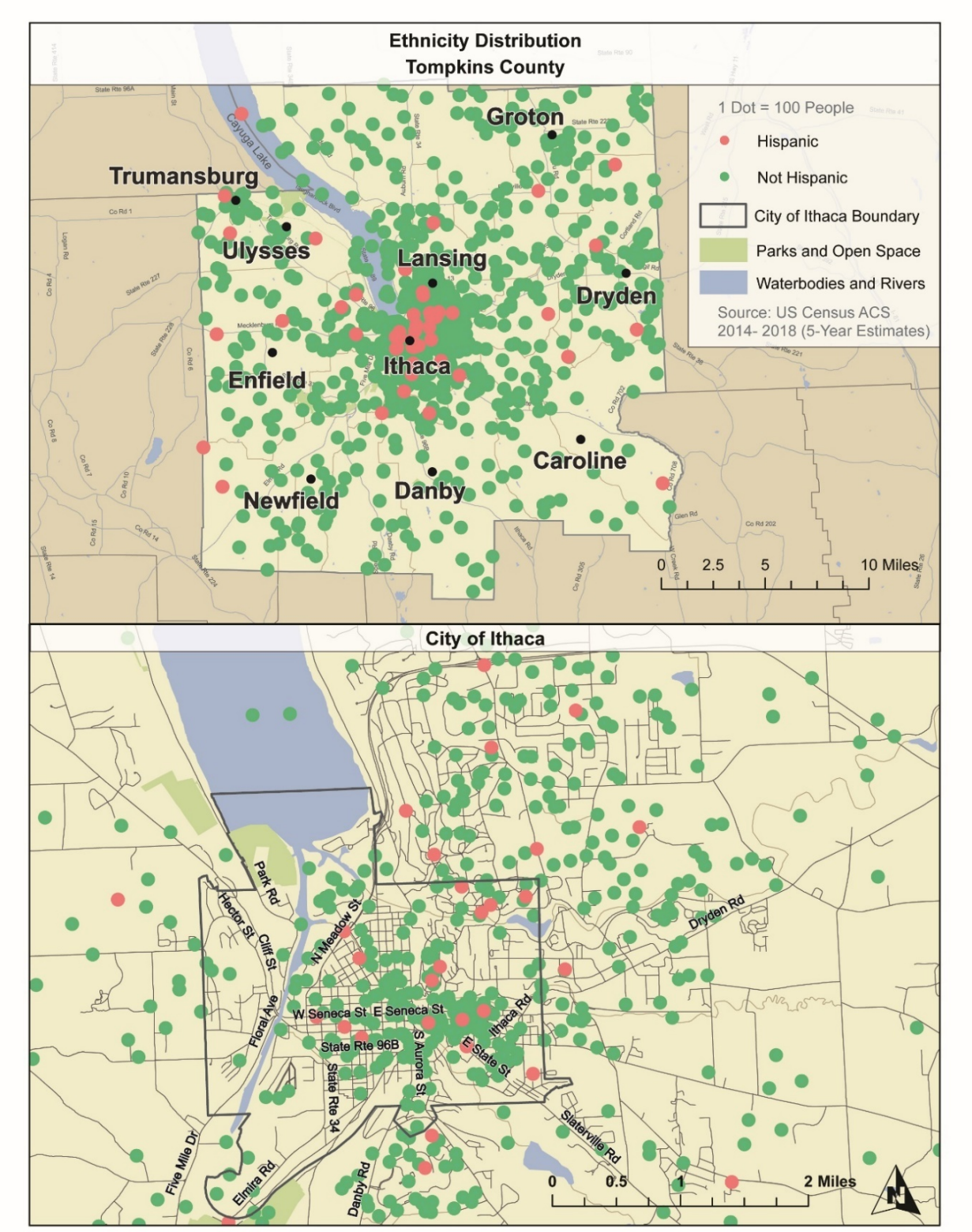

Race Distribution
Tompkins County
1 Dot = 100 People
American Indian
Native Hawaiian or Pacific Islander
Black
Asian
White
Two or more races
Some other race
City of Ithaca Boundary
Parks and Open Space
Waterbodies and Rivers
Source: US Census
ACS 2014- 2018 (5-Year Estimates)
Groton
Trumansburg
Ulysses
Lansing
Dryden
Ithaca
Enfield
Caroline
Newfield
Danby
0 2.5 5 10 Miles
City of Ithaca
Park Rd
Hector St
Cliff St
N Meadow St
Dryden Rd
W Seneca St
E Seneca St
Floral Ave
State Rte 96B
S Aurora St
E State St
Ithaca Rd
State Rte 34
Five Mile Dr
Elmira Rd
Danby Rd
Slaterville Rd
0 0.5 1 2 Miles
N

Figure 3.10

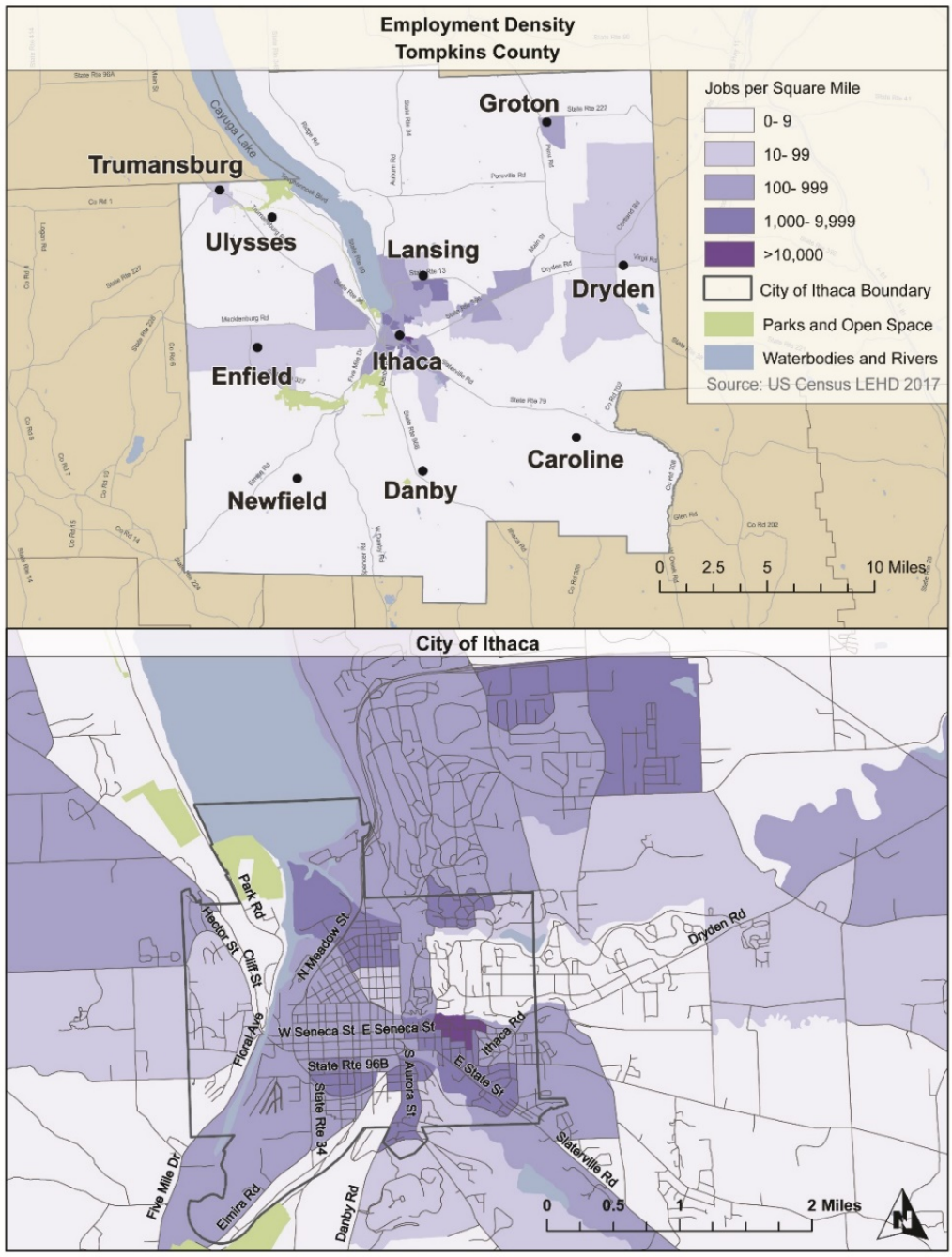

Ethnicity Distribution
Tompkins County
1 Dot = 100 People
Hispanic
Not Hispanic
City of Ithaca Boundary
Parks and Open Space
Waterbodies and Rivers
Source: US Census ACS
2014- 2018 (5-Year Estimates)
Groton
Trumansburg
Ulysses
Lansing
Dryden
Ithaca
Enfield
Caroline
Newfield
Danby
Cayuga Lake
0 2.5 5 10 Miles
City of Ithaca
Park Rd
Hector St
Cliff St
N Meadow St
Dryden Rd
W Seneca St
E Seneca St
Floral Ave
State Rte 96B
S Aurora St
Ithaca Rd
E State St
State Rte 34
Five Mile Dr
Elmira Rd
Danby Rd
Slaterville Rd
0 0.5 1 2 Miles
N

3.2 Employment and land use

3.2.1 Employment density and location of employment centers

Employment within Tompkins County is concentrated in Ithaca, with the highest concentration of jobs in Collegetown, near Cornell University. Employment density decreases moving farther away from Ithaca, with higher concentrations in Groton, Dryden, Trumansburg, and Enfield. **Figure 3.11** shows the employment density within Ithaca and Tompkins County.

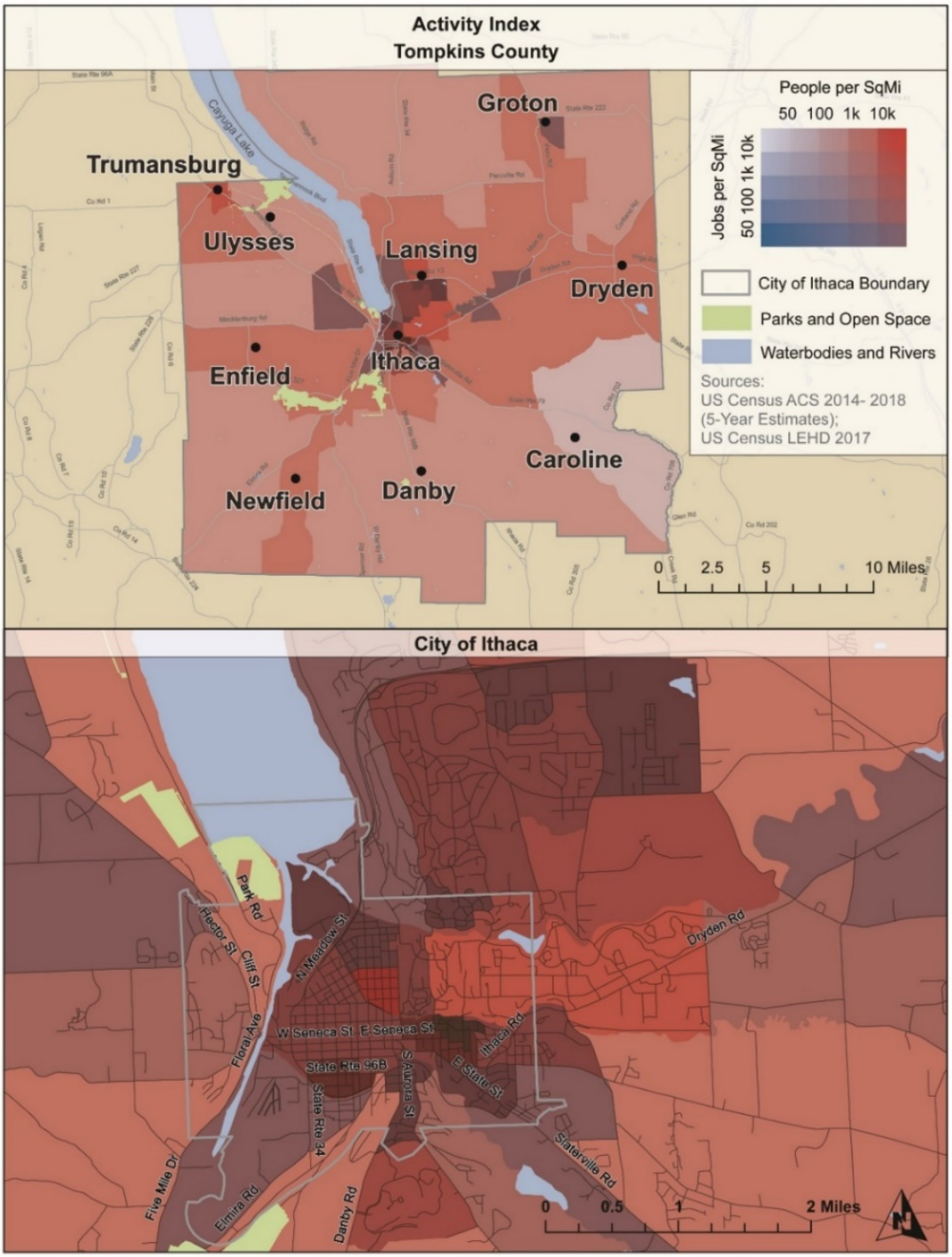
Figure 3.11



3.2.2 Employment and Population Composite

Figure 3.12 shows the activity index of Ithaca and Tompkins County. Areas that are primarily red indicate residential uses, areas that are blue have mostly commercial uses/jobs, and areas that are a purple have a mix of both. Overall, the city of Ithaca and its surroundings is mixed use, while the county is primarily residential.

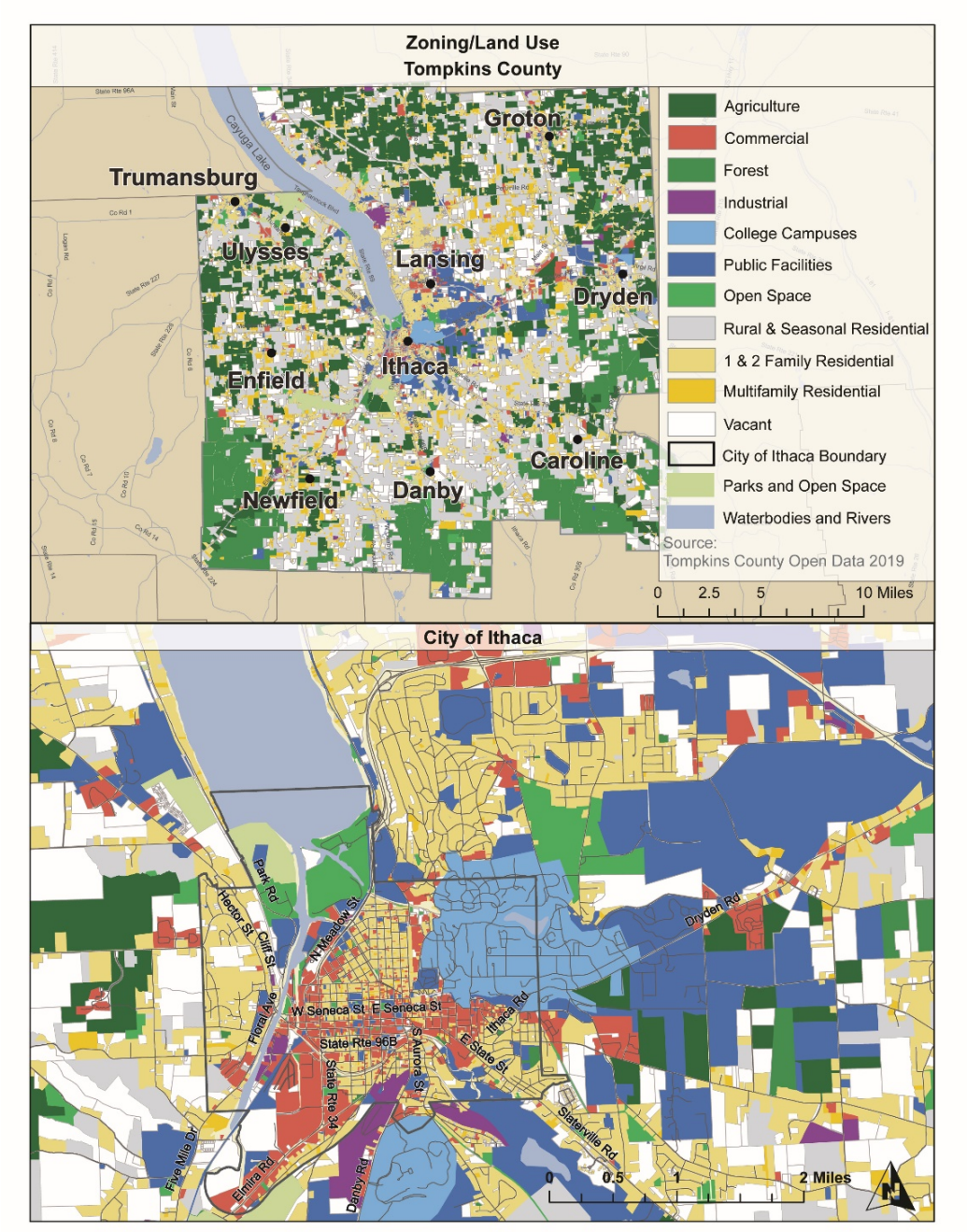
Figure 3.12



3.2.3 Land Use

The types and concentration of land uses impact the development of the county, particularly as it relates to the transportation network. Specific areas within the county have concentrations of land uses with much of Ithaca zoned for commercial and public facility uses. One- and two-family and multi-family housing is dispersed throughout the county with a large portion of the land being designated for agriculture, forest, and open space. **Figure 3.13** shows the land uses within Ithaca and Tompkins County.

Figure 3.13



3.2.4 Key transit destinations

Tompkins County

Tompkins County contains notable recreational, commercial, and educational destinations throughout the county. There are four state parks that attract locals and visitors alike, some of which may arrive via transit during the summer months.

Park and ride locations are also located throughout county with many residents of Tompkins County and nearby counties using them to commute to and from Ithaca.

City of Ithaca and Cornell Campus

Major destinations are located in Ithaca and the Cornell University Campus as these are the employment hubs within the county. Points of interest include Stewart Park on the southern shore of Cayuga Lake, Cass Park near the southeastern corner of Cayuga Lake, Ithaca Commons, and the Johnson Museum of Art.

Figure 3.14 and **Table 3.2** show key transit destinations within Tompkins County and Ithaca, as identified by the TDP team.

Figure 3.14

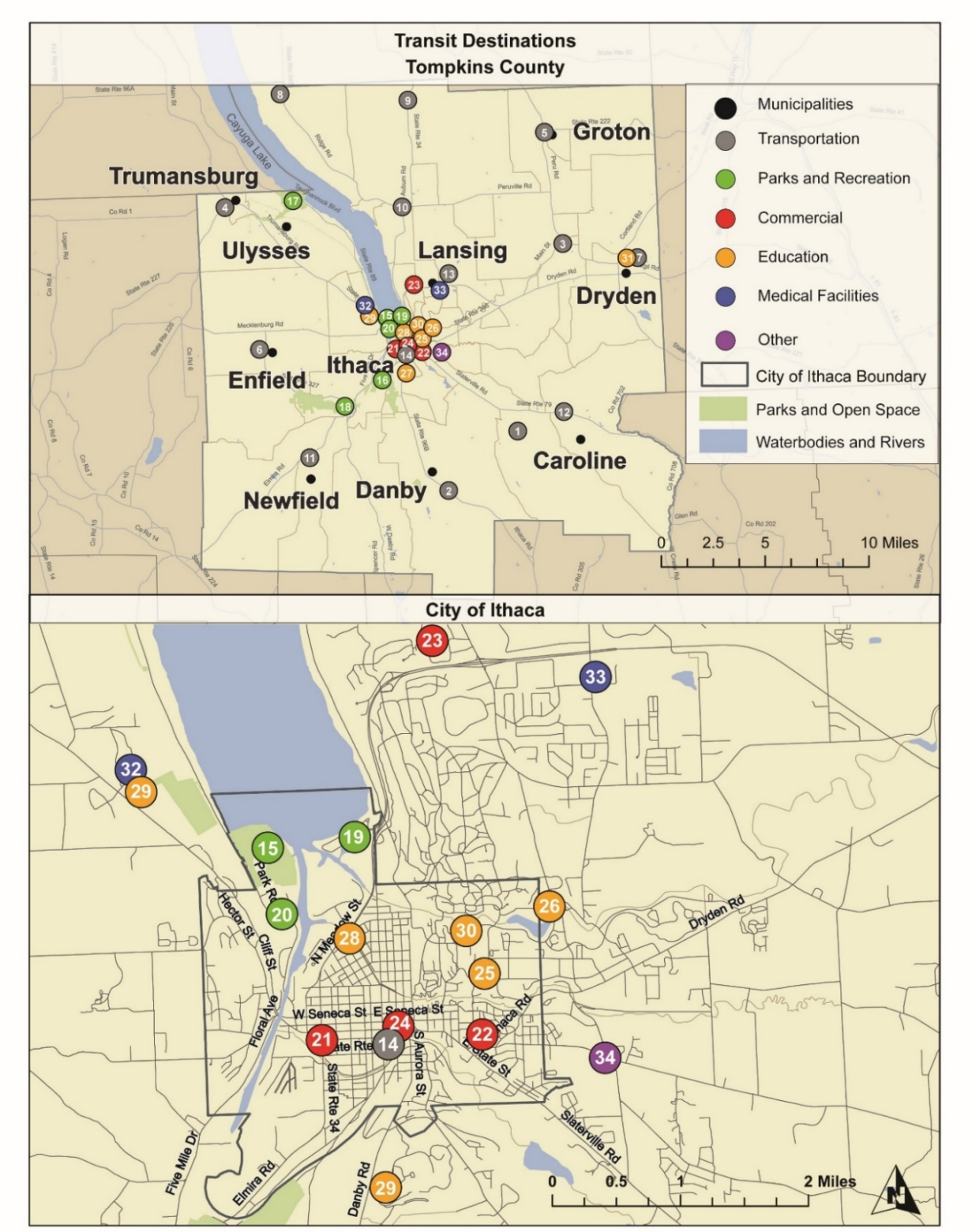

Transit Destinations
Tompkins County
Municipalities
Transportation
Parks and Recreation
Commercial
Education
Medical Facilities
Other
City of Ithaca Boundary
Parks and Open Space
Waterbodies and Rivers
Trumansburg
Groton
Ulysses
Lansing
Dryden
Ithaca
Enfield
Caroline
Newfield
Danby
Cayuga Lake
0 2.5 5 10 Miles
City of Ithaca
Park Rd
Hector St
Cliff St
Floral Ave
W Seneca St
E Seneca St
S Aurora St
State Rte 34
Five Mile Dr
Elmira Rd
Danby Rd
Dryden Rd
Slaterville Rd
0 0.5 1 2 Miles

Table 3.2. - Transit Destinations Look up Table

Transportation	
Map ID Number	**Destination**
1	Brooktondale Park-and-Ride
2	South Danby Park-and-Ride
3	Freeville Park-and-Ride
4	Trumansburg Park-and-Ride
5	Groton Park-and-Ride
6	Enfield Park-and-Ride
7	Dryden Park-and-Ride at Tompkins-Cortland Community College
8	Lansing Park-and-Ride (near county line)
9	Lansing Park-and-Ride
10	Lansing Town Hall Park-and-Ride
11	Newfield Park-and-Ride
12	Slaterville Springs Park-and-Ride
13	Ithaca Tompkins International Airport
14	Downtown Intercity Bus Terminal
Parks and Recreation	
15	Allan H Treman State Marina Park
16	Buttermilk Falls State Park
17	Taughannock Falls State Park
18	Robert H Treman State Park
19	Stewart Park
20	Cass Park
Commercial	
21	Route 13 Shopping District
22	Collegetown
23	Shops at Ithaca Mall
24	Ithaca Commons
Education	
25	Cornell University
26	Cornell University – North Campus Expansion Project
27	Ithaca College
28	Sciencenter
29	Paleontological Research Institution Museum of the Earth
30	Herbert F. Johnson Museum of Art
31	Tompkins-Cortland Community College
Medical Facilities	
32	Cayuga Medical Center
33	Convenient Care and Medical Offices Complex
Other	
34	Future Cornell mixed use development

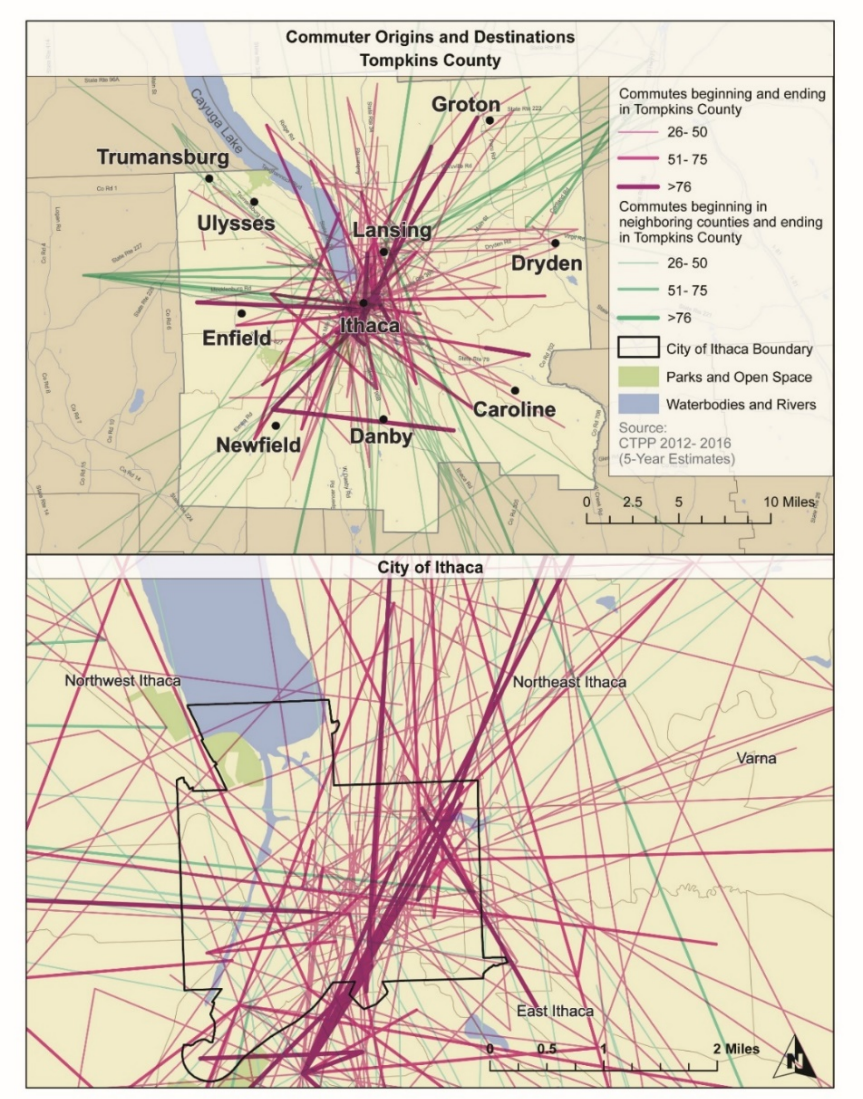
4. Traveling around Ithaca and Tompkins County

To identify the major travel patterns in Tompkins County and Ithaca, an analysis of origin-destination travel demand was produced. The analysis used trip tables from the US Census Transportation Planning Products (CTPP) and the American Community Survey (ACS) to illustrate and describe travel demand within the TCAT service area. To simplify the analysis, trips and commuting data were aggregated into Traffic Analysis Zones (TAZs) and Census Block Groups.

4.1 Travel Patterns

Figure 4.1 shows origins and destinations of workers within Tompkins County aggregated by TAZ. The top origin and destination pairs are trips in and around Ithaca with a high number of trips between Groton and Ithaca, Enfield and Ithaca, Newfield and Ithaca, and between Newfield and Caroline.

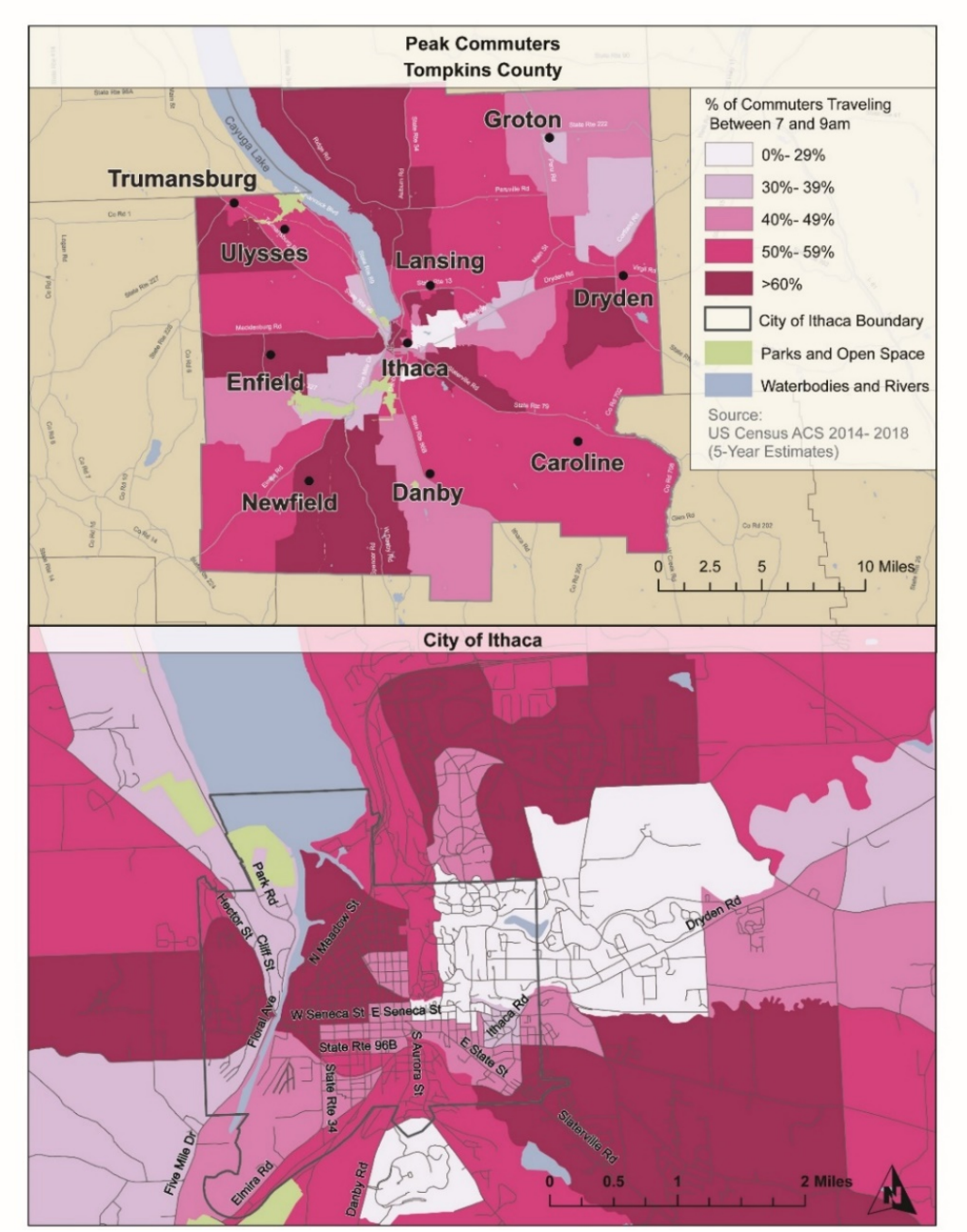
Figure 4.1



4.2 Average Commute Times

Commute times within Ithaca and the county are generally shorter than the statewide average of 33 minutes, with the average commute taking 16 minutes in Ithaca and 19 minutes in Tompkins County. Most commuters leave for work between 7 am and 9 am, with a noticeable exception in the Cornell Heights Historic District. This is likely do to the fact that this area has major student population; student journeys to class or other school-related activities are not captured by the Census data. **Figure 4.2** shows the percent of commuters traveling between 7 am and 9 am.

Figure 4.2



4.3 Mode Share

Ithaca is a walkable city, which is reflected in how residents commute to work (36.6 percent of Ithaca residents and 13.8 percent of Tompkins County residents walk to work). However, most of the population (61.3 percent) in Tompkins County drives alone to work, which is slightly higher than the share of the population statewide. **Table 4.1** shows the commuting characteristics for Ithaca and Tompkins County as compared to New York State.

Table 4.1. Commuting Characteristics

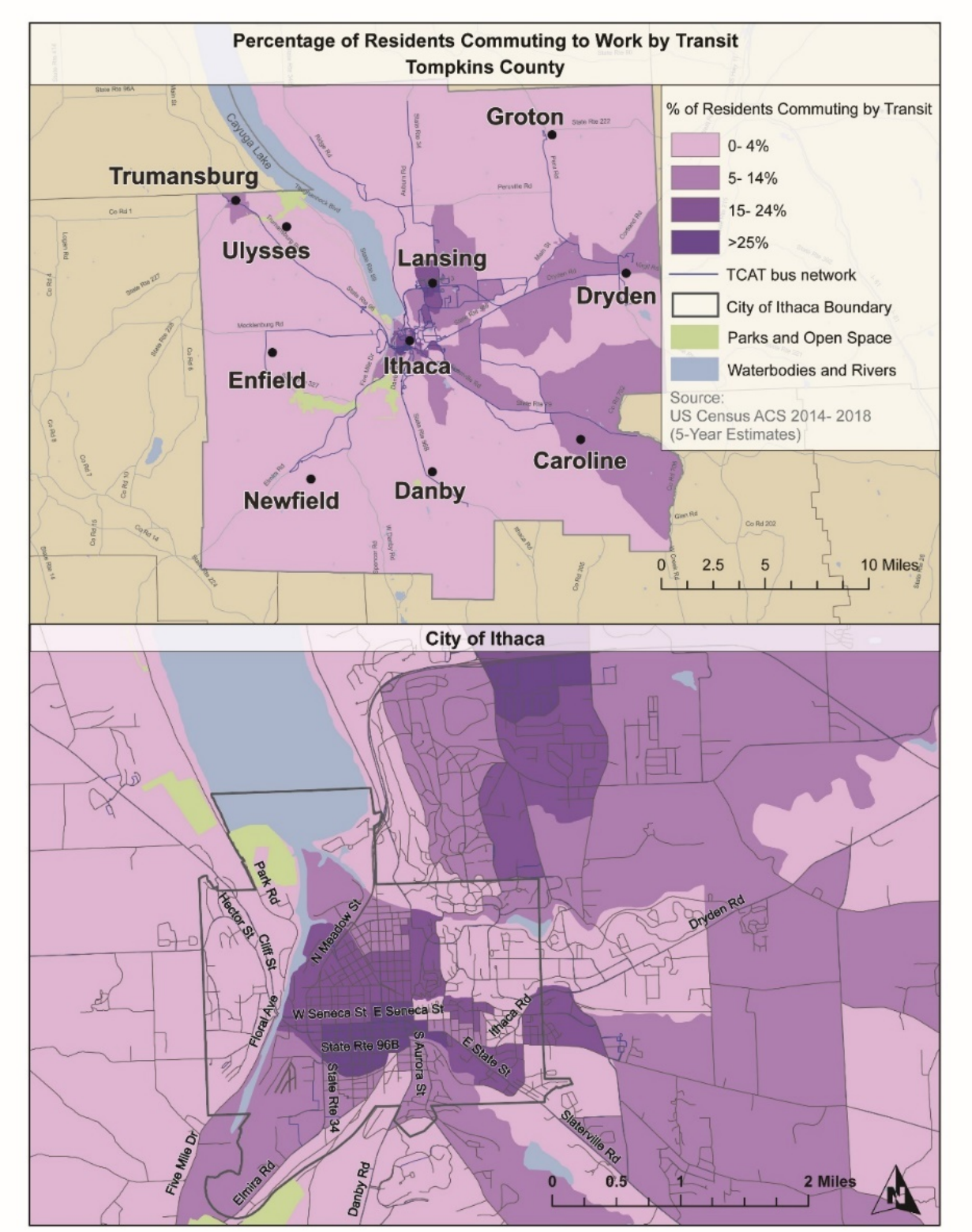
Mode	Ithaca	Tompkins County	New York State
Drive Alone	32.7%	61.3%	53.1%
Carpool	6.2%	9.7%	6.5%
Public Transportation	12.5%	6.5%	28%
Walked	36.6%	13.8%	6.2%
Bicycle	2.9%	1.6%	0.7%
Taxicab, Motorcycle, or Other	1.1%	0.7%	1.3%
Worked at Home	8%	6.4%	4.2%

Source: US Census, American Community Survey 2014-2018 (5-Year Estimates)

The portion of the population that commutes via transit is concentrated in Ithaca, where the bus network coverage is the greatest. A modest portion of the population commutes via transit outside of Ithaca, notably in Dryden, Caroline, and Trumansburg. A large percentage of Cornell students use public transit to get to school, however, this information is not captured in the US Census journey to work data. Figure 4.3 shows the percent of the population commuting by transit. It should be noted that the data is based on people's residence location rather than work location.

Lime, a private transportation company that operates dock-less bikeshare with traditional pedal and electric bicycles, operated a dock-less bike pilot in Tompkins County from 2018 through 2020. A study conducted by the active transportation advocacy organization, Bike Walk Tompkins, found that there were 350-400 average daily trips taken on Lime. There is interest from the community in continuing to have a bikeshare system operate in Ithaca.

Figure 4.3


Percentage of Residents Commuting to Work by Transit
Tompkins County
% of Residents Commuting by Transit
0- 4%
5- 14%
15- 24%
>25%
TCAT bus network
City of Ithaca Boundary
Parks and Open Space
Waterbodies and Rivers
Source:
US Census ACS 2014- 2018
(5-Year Estimates)
Groton
Trumansburg
Ulysses
Lansing
Dryden
Ithaca
Enfield
Caroline
Newfield
Danby
0 2.5 5 10 Miles
City of Ithaca
Park Rd
Hector St
Cliff St
N Meadow St
Dryden Rd
W Seneca St
E Seneca St
Floral Ave
State Rte 96B
S Aurora St
Ithaca Rd
E State St
State Rte 34
Five Mile Dr
Elmira Rd
Danby Rd
Slaterville Rd
0 0.5 1 2 Miles

4.4 Bus ridership

4.4.1 Boarding and alighting by stop

Bus service within Tompkins County is mostly focused in downtown Ithaca with several routes providing connections between Ithaca and the neighboring towns. Bus ridership within the county is not evenly distributed with concentrations of transit activity around the Cornell University Campus, Ithaca Commons, and Dryden. **Figure 4.4** shows the average weekday boardings by stop and **Figure 4.5** shows the average weekday alightings by stop, both for the month of February 2019.

Figure 4.4

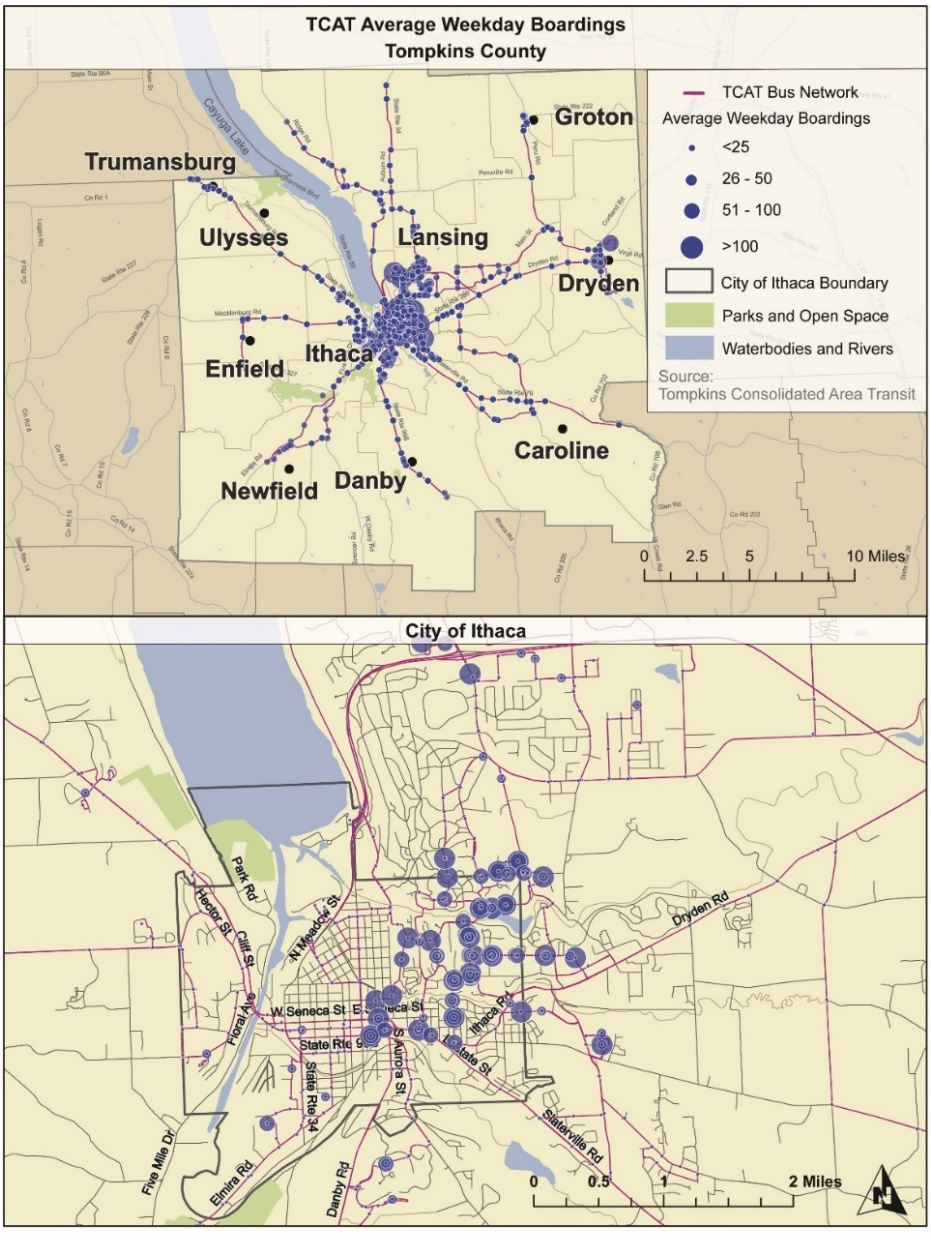
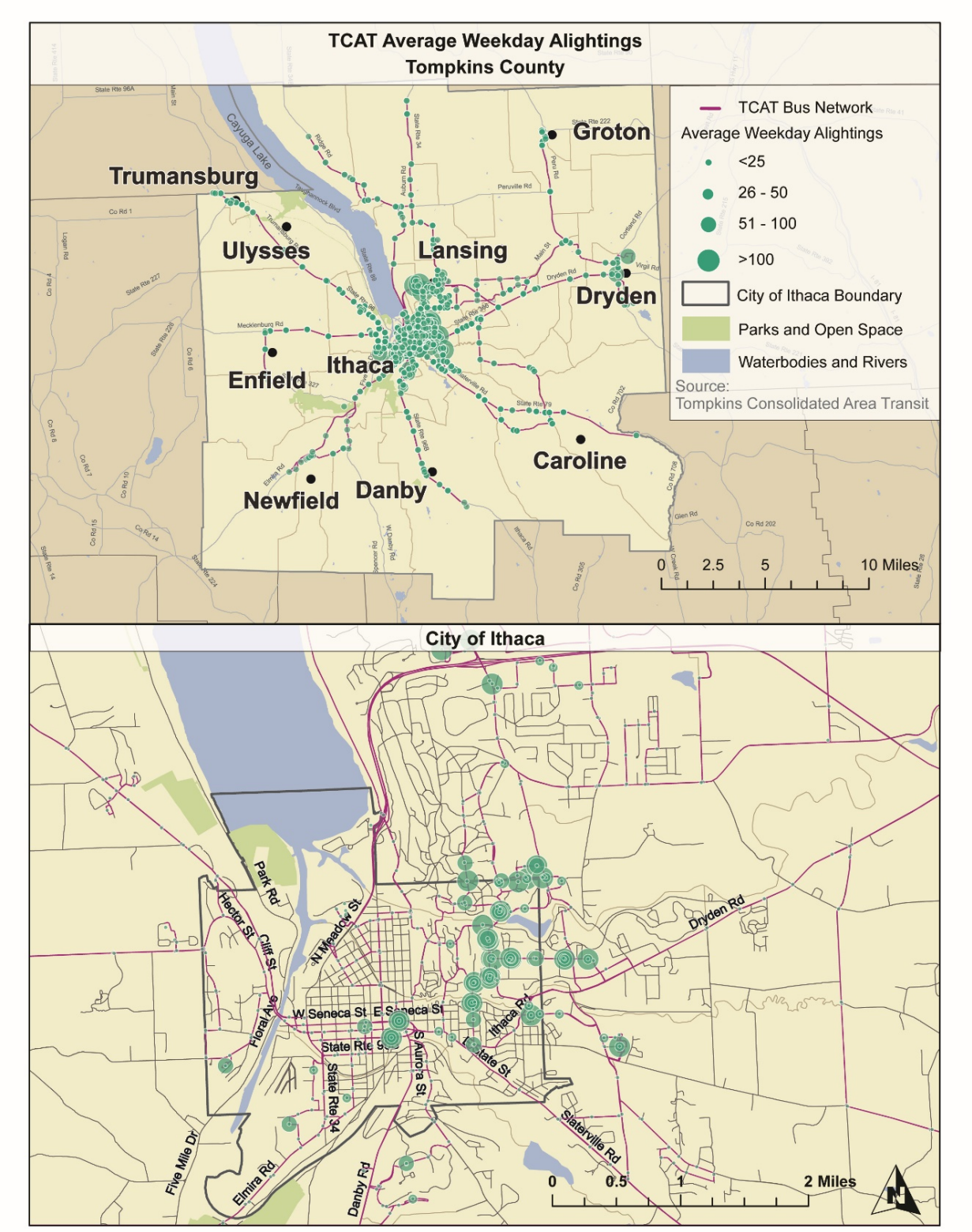


Figure 4.5


TCAT Average Weekday Alightings
Tompkins County
TCAT Bus Network
Average Weekday Alightings
<25
26 - 50
51 - 100
>100
City of Ithaca Boundary
Parks and Open Space
Waterbodies and Rivers
Source:
Tompkins Consolidated Area Transit
Groton
Trumansburg
Ulysses
Lansing
Dryden
Ithaca
Enfield
Caroline
Newfield
Danby
Cayuga Lake
0 2.5 5 10 Miles
City of Ithaca
Park Rd
Hector St
Cliff St
N Meadow St
W Seneca St
E Seneca St
Floral Ave
State Rte 96
S Aurora St
Ithaca Rd
E State St
Dryden Rd
State Rte 34
Five Mile Dr
Elmira Rd
Danby Rd
Slaterville Rd
0 0.5 1 2 Miles
N

5. Transit Amenities and Infrastructure

5.1 Bus Stops

Tompkins County Area Transit (TCAT) provides local fixed route bus service throughout Tompkins County and serves approximately 600 bus stops systemwide. These stops serve as the first point of contact between the passenger and bus service and play a critical role in attracting and retaining ridership as well as promoting the TCAT brand. Amenities at bus stops were observed using Google Street View and while amenities vary by stop, they can generally be categorized as follows:

- Flag Stops: In rural areas, passengers may be picked up where flagged, or dropped off on demand. There is no infrastructure provided at flag stops.
- Sign Only Stop: The base level of TCAT bus stop is indicated by a pole mounted bus stop sign as shown in **Figure 5.1**. In general, the bus stop sign contains many features to provide information to customers, including a bus icon, stop identifier and name, and routes that serve the stop. In some instances, a bus stop sign may share a pole with other signage, such as parking regulations.
- Shelter Stop: A number of stops throughout the TCAT system provide a shelter for waiting passengers, as shown in **Figure 5.2**. Further, some shelter stops provide additional amenities including trash receptacles and bicycle racks.
- Enhanced Shelter Stop: Beyond the typical shelter stops, a select number of stops provide an expanded bus shelter and seating, as shown in **Figure 5.3**. Enhanced shelter stops are typically located at major trip generators including shopping centers, and they provide additional amenities including bicycle racks and trash receptacles.

Figure 5.1 - Sign Only Bus Stop

Figure 5.2 - Shelter Stop

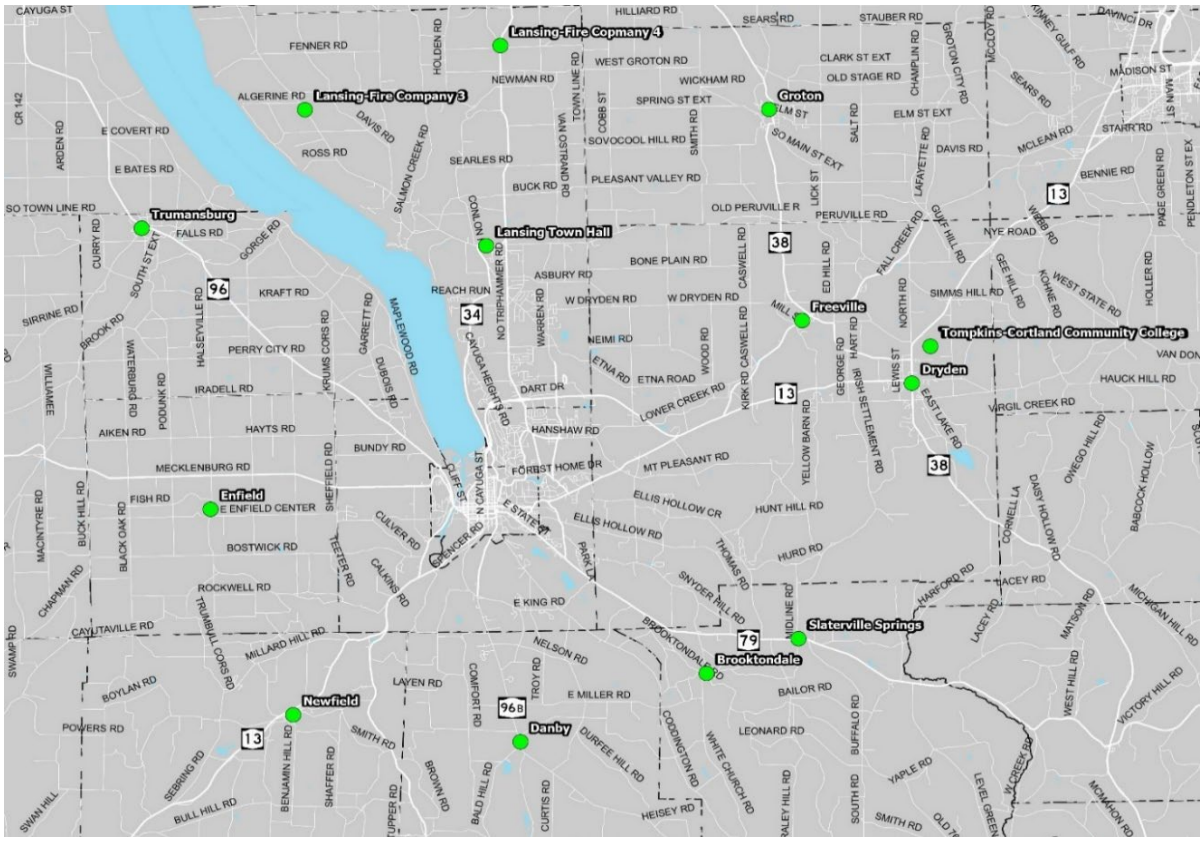
Figure 5.3 - Enhanced Shelter Stop

5.2 Park-and-Ride Facilities

TCAT currently serves 13 park-and-ride lots located in the towns and villages around Ithaca. These facilities are generally small parking lots that are shared with the adjacent land use (typically a church, municipal building, or park). Some park-and-ride facilities are denoted by a sign as shown in **Figure 5.4**, while others are unmarked. **Figure 5.5** shows the locations of the 13 park-and-ride facilities.

Figure 5.4 - Park and Ride Signage

Figure 5.5 - Existing Tompkins County Park and Ride Facilities

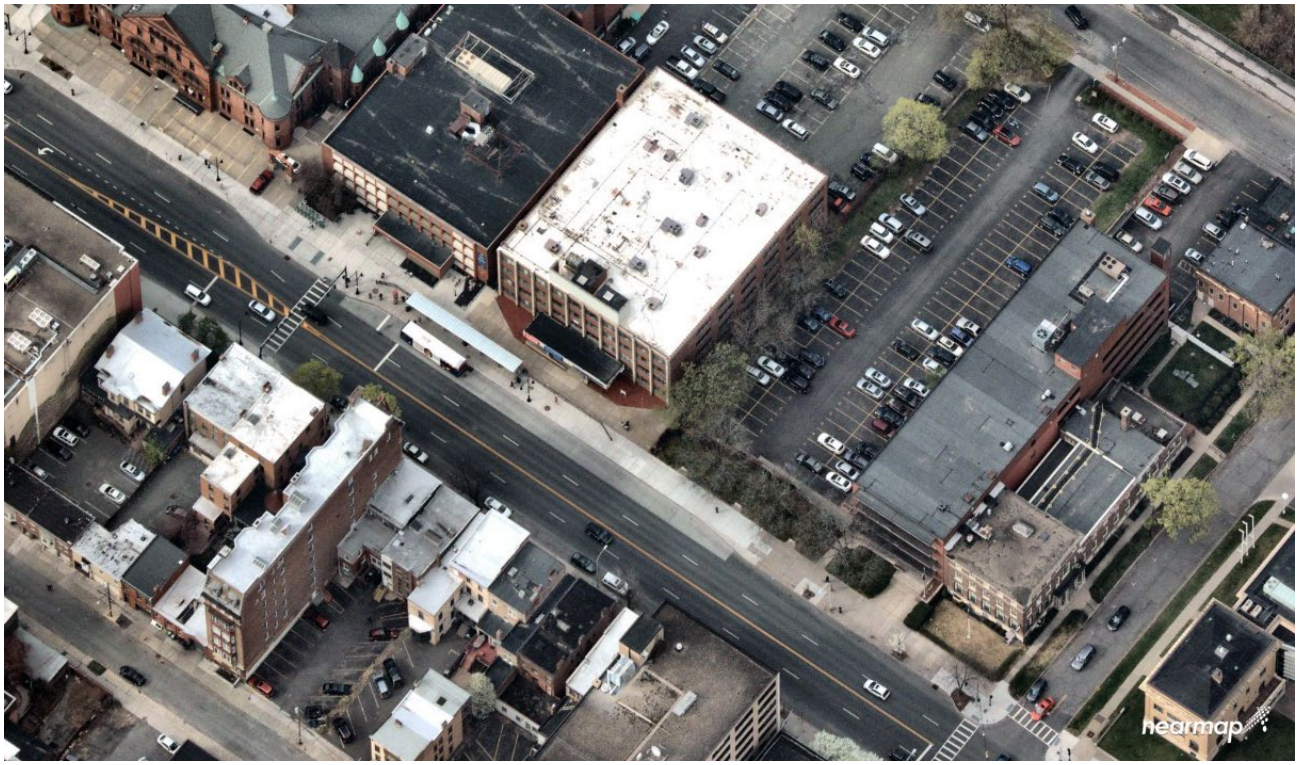


5.3 Transit Priority Treatments

Infrastructure that prioritizes the travel speed, reliability, and travel experience of transit over personal vehicles can be considered transit priority treatments. Treatments can occur on roadway segments, such as transit-only lanes, or at intersections, such as queue jumps, bypass lanes, and transit signal priority (TSP).

Currently there are no transit priority treatments in Tompkins County. However, the City of Ithaca has submitted a grant application to the FHWA for TSP improvements. It may also be possible to convert existing bus pull-offs/turnout lanes at major downtown stops into queue jumps, pending parking impacts. An example of a bus turn-out lane converted into a queue jump within a dense urban environment is shown in **Figure 5.6.** Capital District Transportation Authority (CDTA) converted this turnout lane in Downtown Albany into a de-facto queue jump by recessing the stop bar for general traffic and installing actuated signal pre-emption to allow buses to exit ahead of general traffic with priority.

Figure 5.6 - Bus Queue Jump Converted from Turnout Lane on Washington Avenue, Albany, NY



6. Transit Gap Analysis

A gap analysis is an exercise that identifies areas where transit service could more successfully achieve agency priorities. Gaps or deficiencies may be identified by measuring and analyzing critical factors such as ridership, service investment levels, and potential demand. This gap analysis focuses on two aspects of how transit service is allocated:

1. Alignment of transit service with demand throughout the region
2. Alignment of transit service with TCAT's aspirational goals

Different areas of the gap analysis represent different perspectives, from system-level efficiency to ensuring appropriate coverage and social equity. The different perspectives may suggest conflicting directions in some cases, while in other cases they may reinforce each other. Once gaps have been identified, some may be dismissed as justified. For the remaining gaps, a typology of potential responses (such as improving frequency, shifting service, or substituting a different mode) may be offered to set the stage for transit enhancements.

Note that subsequent analyses also consider potential gaps in the actual performance of specific transit services compared with performance targets. The first step of our systemwide supply/demand analysis is to understand the current allocation of TCAT's services.

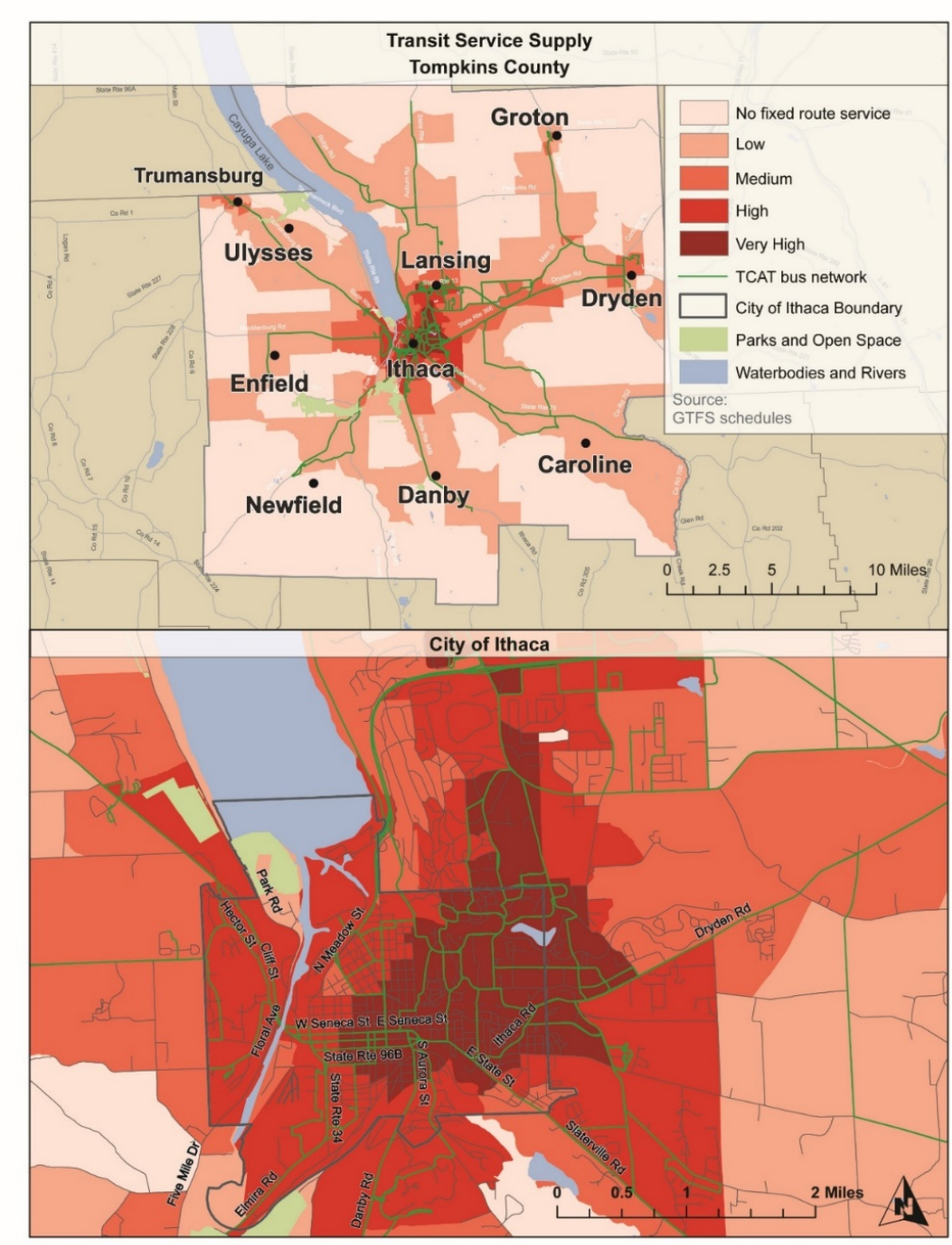
6.1 TCAT's Current Service Allocation

Transit service in Tompkins County is concentrated in a core area (Ithaca, Cornell University, and Ithaca College) but also offers connections for several rural communities. The pattern appears closely tailored to local land use and different community needs. To analyze the geographical distribution of transit, a mapping exercise was undertaken that visualizes the distribution of service hours per square mile throughout the county. This can also be thought of in terms of service spending per square mile.

Figure 6.2 shows the geographic allocation of fixed-route service. Service hours were based on each route's scheduled operating hours added up for a typical week in February 2019. Every variant of each bus route was assumed to serve an area within ¼ mile walking distance, and its service was assumed to be distributed evenly over that area. The service hours of various bus routes then were aggregated at the Census Traffic Analysis Zone (TAZ) level to create a summary visual.

The result shows that service is most concentrated in the urban center of Ithaca, including Cornell University and Ithaca College. A lower level of service extends radially in many directions to provide coverage to outlying locations such as Dryden and Trumansburg.

Figure 6.2 - Geographic Distribution of Fixed-Route Service Provided (February 2019)



6.2 Demand for Transit Service

Identifying gaps between transit supply and demand requires a clear understanding of the demand for public transit. To achieve this, a transit demand index was created that combines five factors that are strongly correlated with transit demand. **Figure 6.3** summarizes how these different factors are weighted into a composite score.

Job density and population density are counted as the most important factors, with 25% weights each. Literature shows that these factors explain a dominant portion of travel demand.[3] The remaining factors represent demographic characteristics that increase transit utilization: households without access to a car, those earning incomes below 150% of the poverty level, and the student share of the population.[4, 5, 6]

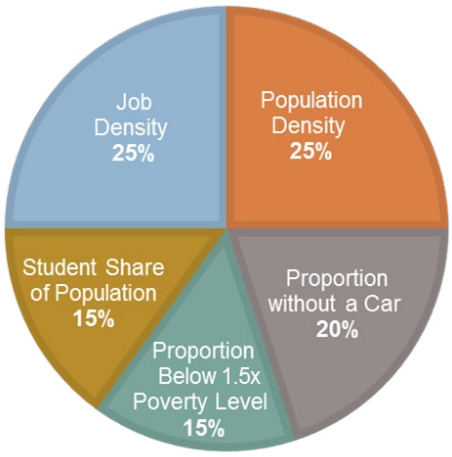


Figure 6.3 - Transit Demand Index Factors

The transit demand index resulting from this calculation is visualized in **Figure 6.4**. The map summarizes the Transit Demand Index into a range from Very Low to Very High. Ranges are based on the distribution of results and review of example locations.

Transit demand is strongest in the urban area of Ithaca, areas near Ithaca College, areas near Cornell University, and areas immediately to the north. Cornell's actual campus shows surprisingly low demand, because the index does not include factors that represent commutes to school. The map also shows several more remote areas exhibiting transit demand, including Groton, Dryden, and Trumansburg. While the rest of the county's rural areas generally are categorized as having low or very low demand, the far southeast and far northwest of the county exhibit the lowest transit demand. Service coverage for rural areas should also be guided by social vulnerability analysis, which will be addressed in a subsequent section.

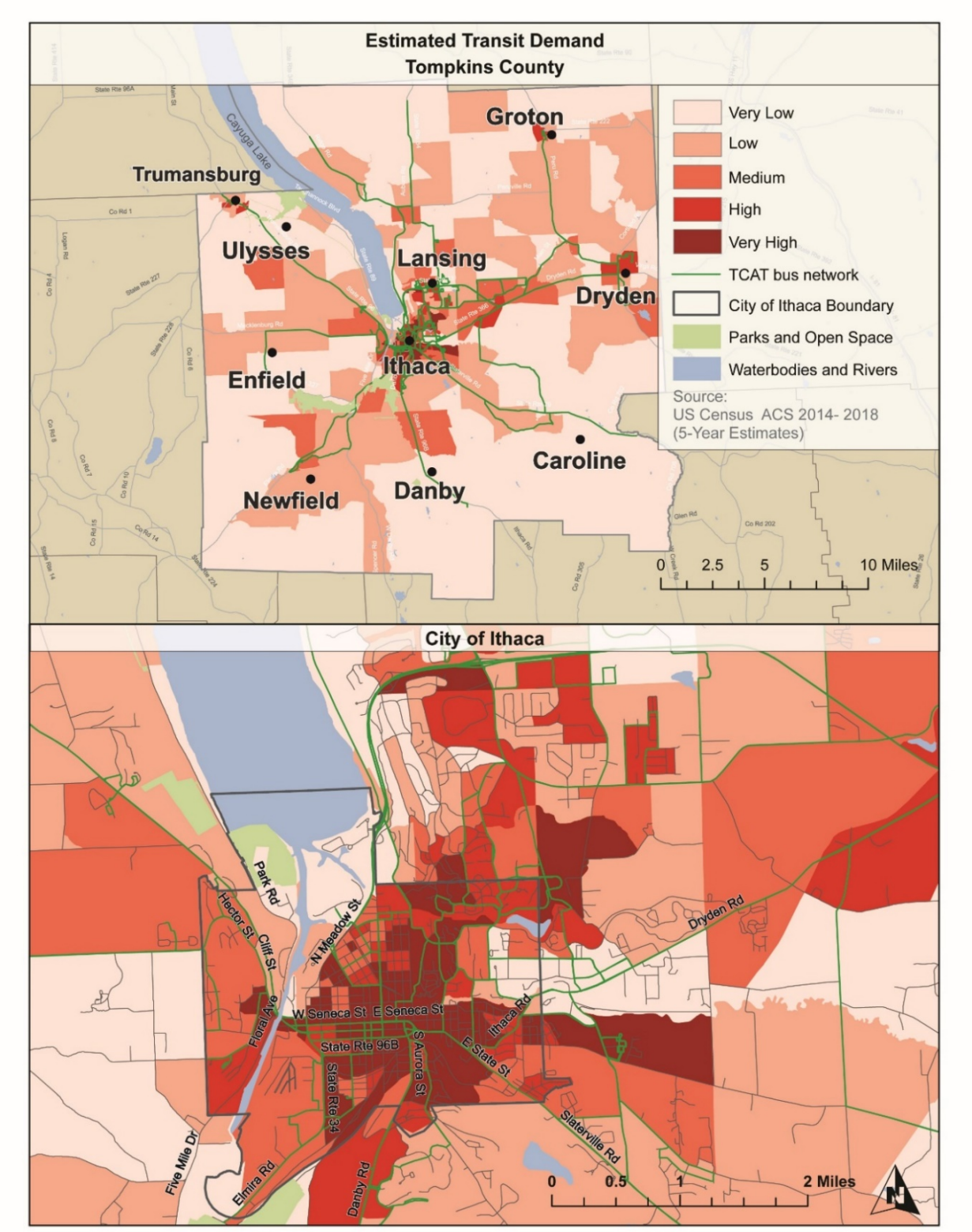
[3] The Public Policy Institute of California. (2011). Making the Most of Transit. https://www.ppic.org/content/pubs/report/R_211JKR.pdf

[4] R. Cervero and E. Guerra. UC Berkeley Center for Future Urban Transport. (2011). Urban Densities and Transit: A Multi-dimensional Perspective. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.261.4156&rep=rep1&type=pdf

[5] UCLA Institute of Transportation Studies. (2003). The Factors Influencing Transit Ridership: A Review and Analysis of the Ridership Literature. http://www.reconnectingamerica.org/assets/Uploads/ridersipfactors.pdf

[6] Transportation Research Record. (2013). Predicting Transit Ridership at the Stop Level: The Role of Service and Urban Form. https://nacto.org/wp-content/uploads/2016/04/1-3_Dill-Schlossberg-Ma-and-Meyer-Predicting-Transit-Ridership-At-The-Stop-Level_2013.pdf

Figure 6.4: Map of Estimated Transit Demand



The next step in identifying supply-demand gaps is to compare the fixed-route transit supply presented earlier with the transit demand index presented above. We identified each TAZ where fixed-route supply and demand were closely aligned, at low, medium, or high levels.[7] We also identified TAZs that exhibit potential gaps where either fixed-route supply significantly exceeds demand or demand significantly exceeds fixed-route supply.[8] **Figure 6.5** summarizes these gaps.

Several areas are identified in **Table 6.1** and **Table 6.2**, where the analysis indicates that relative supply/demand gaps are present. Most of these gaps also have potential explanations indicating likely reasons for the gap. Note that this is not an exhaustive list of the areas that could receive further review based on this analysis.

Table 6.1 - Select gaps where demand is relatively greater than service supply

Location	Potential Explanation
Groton	Destination is isolated; surrounding low-demand areas make Groton difficult to serve efficiently.
Dryden	Destination is isolated; surrounding low-demand areas make Dryden difficult to serve efficiently. The planned TConnect on-demand service could also help fill this gap.

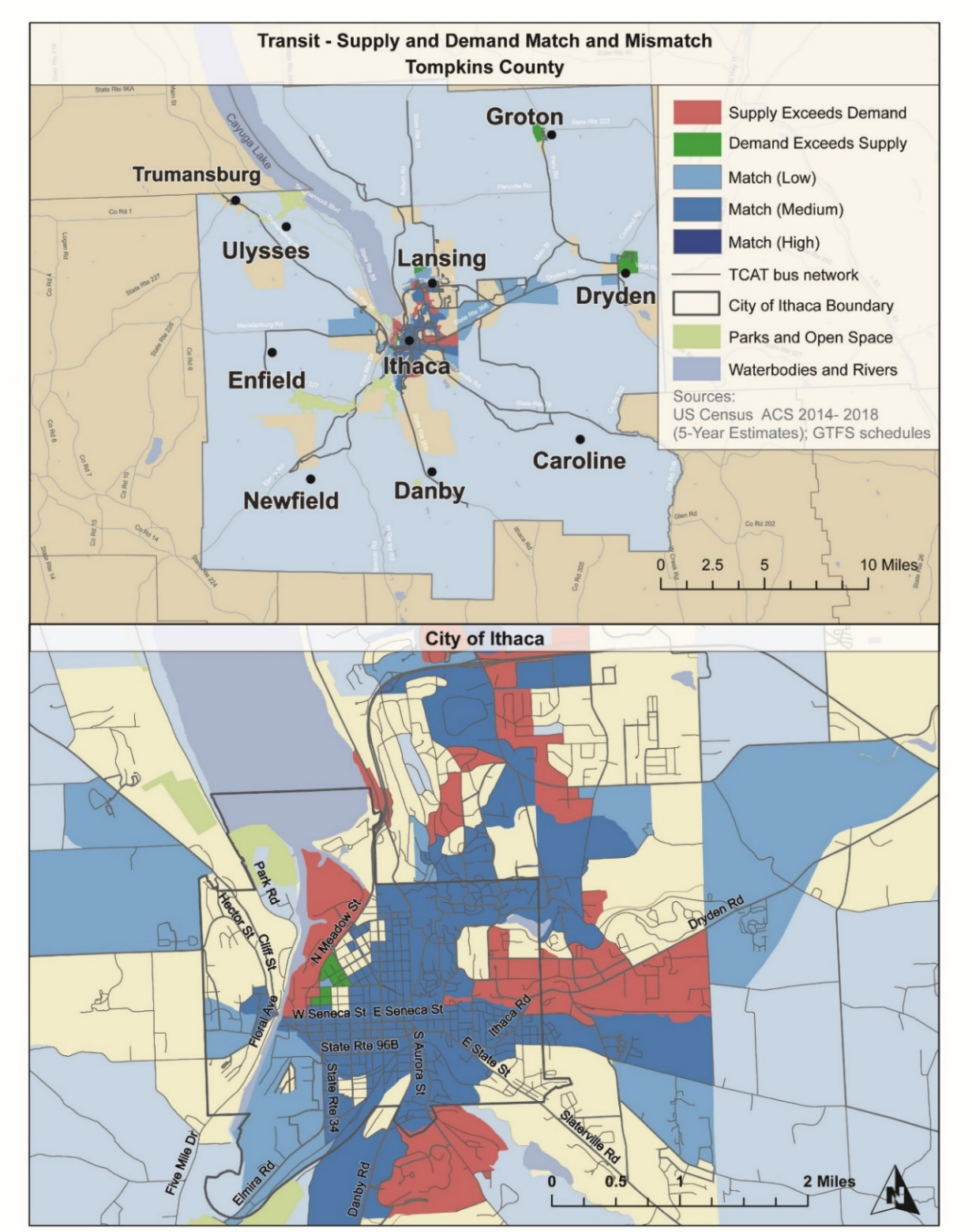
Table 6.2 - Select gaps where service supply is relatively greater than demand

Location	Potential Explanation
Ithaca Waterfront	High level of service due to garage location and proximity to downtown.
Northern Ithaca	Area may be overserved en route to the Shops at Ithaca.
Cornell University	Demand Index does not fully reflect the transit demand of educational institutions.
Ithaca College	Demand Index does not fully reflect the transit demand of educational institutions.

[7] The five categories of service and demand were consolidated into three, with very low and low considered "low" and very high and high considered "high."

[8] A gap is defined when there is a discrepancy of more than one sequential category in the level of service and demand. For example, if demand is categorized as "very high" and supply is categorized as "medium."

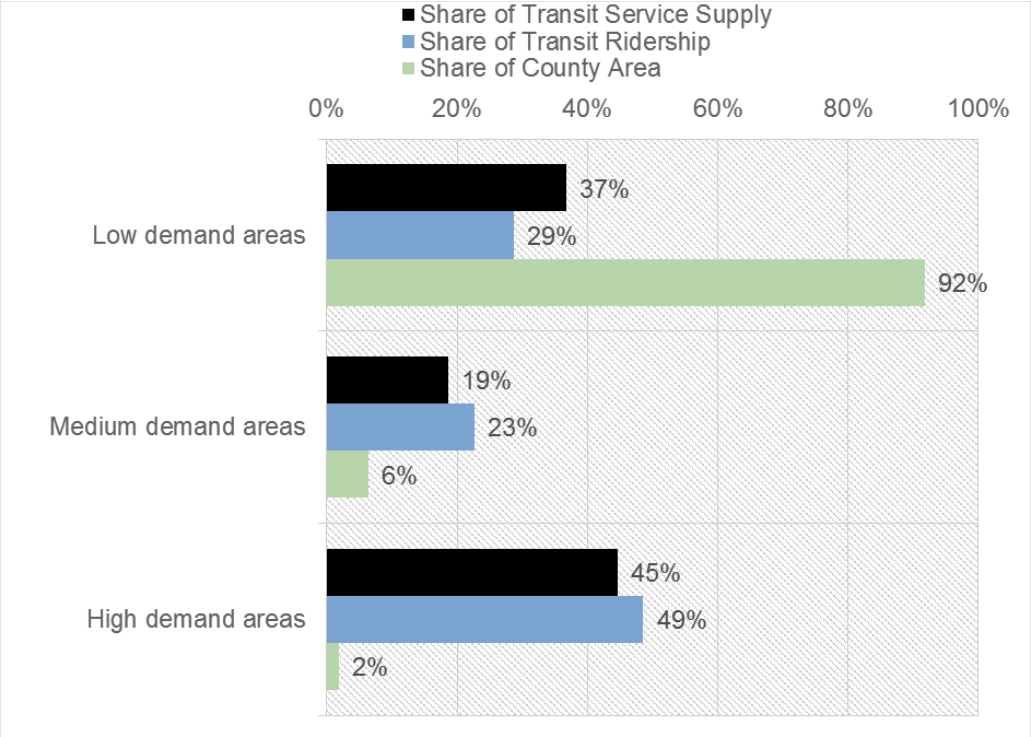
Figure 6.5 - Where Transit Supply and Demand Are Aligned or Misaligned. No-data reflect areas where supply/demand categories only differ by one level, indicating there is no exact match nor a clear discrepancy.



6.3 TCAT's Service Distribution

Mapping transit supply and demand can generate insight into how TCAT currently approaches areas with different demand levels. **Figure 6.6** below shows how transit service supply, transit ridership, and county land area break down according to low, medium, and high areas of transit demand. In general, transit supply and demand are closely aligned. Most of TCAT's bus ridership comes from only 8% of Tompkins County area that has high or medium levels of demand. However, TCAT still provides a robust portion of its service (37%) to low demand areas to ensure adequate coverage.

Figure 6.6 - Share of service spending, ridership, and service area by low, medium, and high demand areas



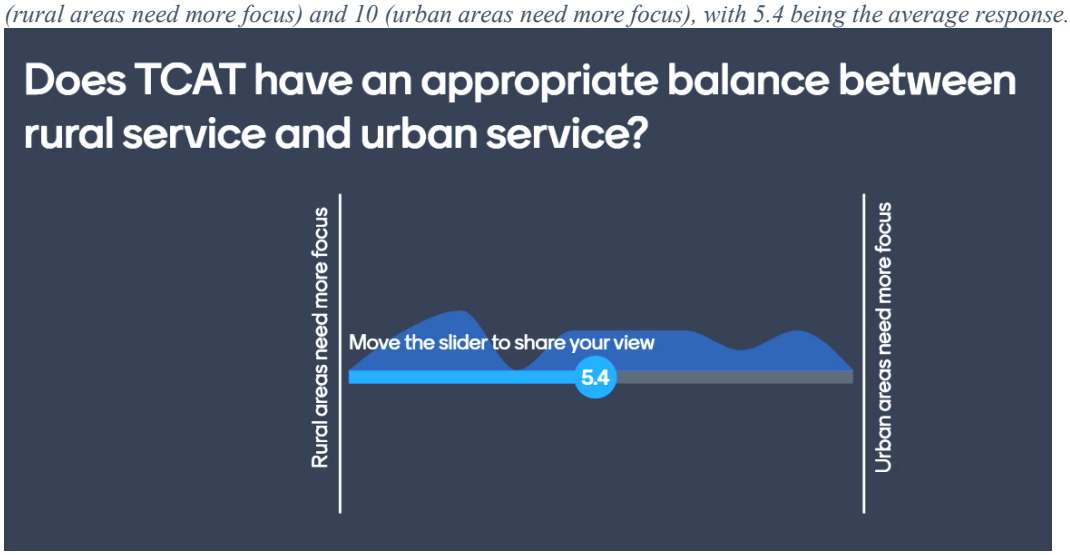
6.4 Gaps Based on TCAT's Goals and Aspirational Service Allocation

Transit agencies have other goals beyond simply matching service supply with demand. TCAT plays an important social service role, especially in rural communities where it provides access to transportation for individuals without other options. While TCAT does not have formal policies for allocating its "coverage" services, there is a general mandate to provide basic coverage for outlying rural communities. As a first step towards evaluating these aspirational priorities, members of the TDP Technical Advisory Committee (TAC) were asked a series of questions about service tradeoffs. This feedback provides general guidance.[9]

[9] The TAC's feedback may not represent the views of TCAT leadership or patrons.

First, the balance between urban service and rural service is a crucial question for an agency with a disparate service area such as TCAT's. Approximately 22% of TCAT's service supply is comprised of infrequent routes that serve outlying rural communities, while 78% of TCAT's service is focused on the urban core of Ithaca. The TAC had a range of views regarding whether this represents an appropriate balance, as shown in **Figure 6.7**. Some participants responded at either end of the spectrum, but overall, there was not a consensus to change TCAT's urban/rural service balance.

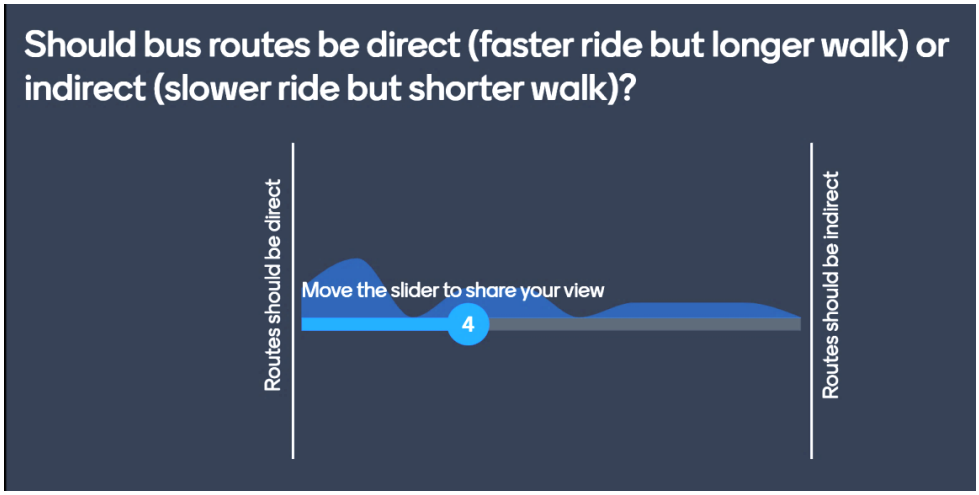
Figure 6.7 – TAC survey responses regarding TCAT's balance of rural and urban service. Responses were distributed between 1 (rural areas need more focus) and 10 (urban areas need more focus), with 5.4 being the average response.

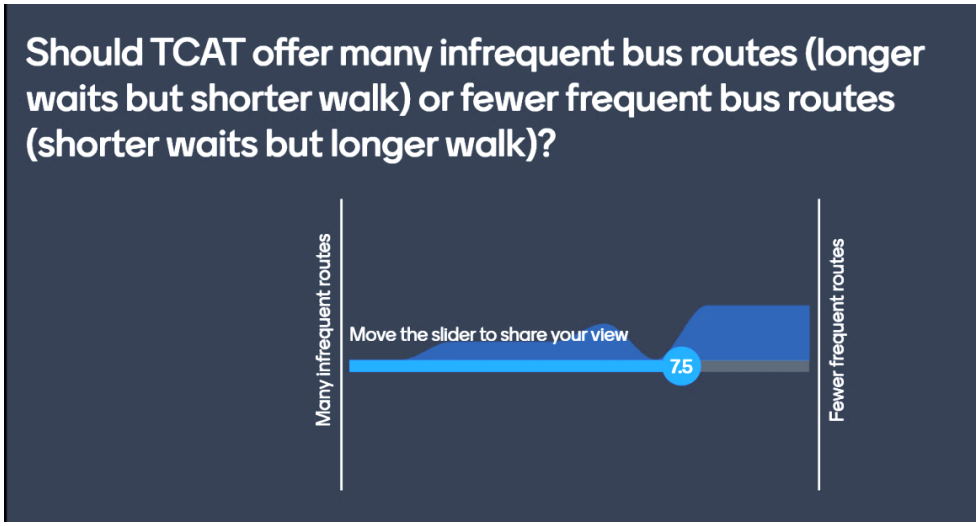


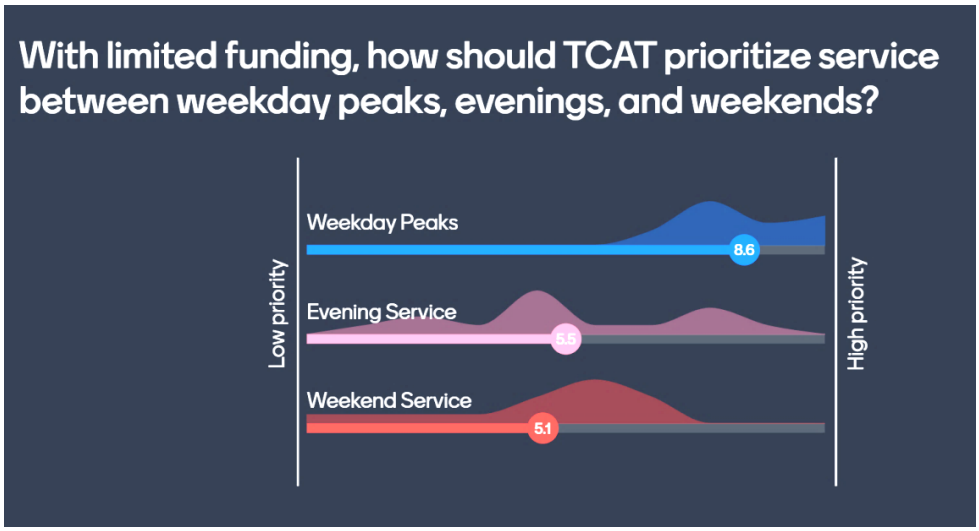
The TAC also noted that certain demographic factors should be prioritized when planning coverage-focused services based on equity/fairness. For example, coverage service might prioritize senior populations (**Figure 3.6**), racial and ethnic minorities (**Figure 3.9** and **Figure 3.10**), and zero-car households (**Figure 3.3**). Fortunately, the areas that would be prioritized based on these considerations are currently served by the rural network, including Groton and Trumansburg based on senior population, Enfield based on minority populations, and Dryden based on low car ownership. The only potential gap based on these factors might be the area between Newfield and Danby, which also has a high senior population.

Finally, the TAC was asked for feedback on various service design tradeoffs. The results are presented in **Figure 6.8**. The guidance provided in these responses will be most useful later in this study as we examine detailed service planning route performance. In general, participants felt that bus routes should be direct even if that requires longer walks to access the service. Similarly, most participants felt that it would be preferable to have a smaller number of high-frequency routes even if this increases walking distances. Regarding TCAT's schedules, participants generally agreed that weekday peak periods should be prioritized, while evenings and weekends should have a medium level of priority. Committee members also noted that these service design preferences may be different in walkable urban areas compared with rural contexts. For example, rural service should focus on coverage options during peaks and evenings, while frequency is only appropriate for the urban core.

Figure 6.8 – TAC Survey responses regarding various service design question; Responses were distributed between 1 and 10; the blue circled numbers reflect the average responses.







7. Coverage Analysis

Area and Population Covered

An important function of public transit is to provide "coverage" of communities, meaning that transit service is available to provide people the *opportunity* to travel. Transit coverage can be important even when actual ridership levels are low. Our previous analysis of TCAT's transit supply and demand showed that 37% of service supply went to low-demand areas, likely for coverage purposes. As discussed earlier in this report, a survey of the TDP Technical Advisory Committee members suggested that the overall level of service in these lower-demand areas was appropriate.

The coverage of a transit network can be measured in various ways. This section measures coverage first by considering area and population served, and then in more detail by considering the level of need in different areas served.

Geographic analysis was conducted of the area covered by TCAT's bus service. We assumed that transit coverage extends within a typical walking distance of ¼ mile of each route. The result showed that TCAT's routes cover 70.2 square miles, or 15% of Tompkins County. Similarly, we calculated the resident population within walking distance of each bus route. The result is shown in **Table 7.1**.

Coverage is an important aspect of TCAT service. The results of this analysis will be used to assure the TDP recommendations account for social equity, essentially go beyond the productivity and cost-benefit considerations. TCAT will continue to serve vulnerable communities, even if they are in lower-demand areas.

Table 7.1- Coverage statistics for TCAT bus routes, including population and Social Vulnerability Index within the area served

Route	Population (Within 1/4 mile of longest regular-service variant)	Social Vulnerability Index (Weighted average; higher value indicates more vulnerability)
10	12,000	0.369 (Medium)
11	8,600	0.263 (Low)
13	8,000	0.307 (Low)
14	6,400	0.432 (High)
15	4,700	0.559 (Very high)
17	13,800	0.325 (Low)
20	6,700	0.302 (Low)
21	13,200	0.352 (Medium)
30	15,300	0.341 (Medium)
31	13,100	0.359 (Medium)
32	14,200	0.352 (Medium)
36	14,100	0.284 (Low)
37	13,900	0.363 (Medium)
40	12,600	0.366 (Medium)
41	12,800	0.357 (Medium)
43	13,200	0.366 (Medium)
51	12,700	0.342 (Medium)
52	12,300	0.297 (Low)
53	14,800	0.258 (Low)
65	11,900	0.299 (Low)
67	12,500	0.534 (Very high)
70	15,000	0.354 (Medium)
72	14,700	0.361 (Medium)
74	12,100	0.387 (High)
75	7,400	0.350 (Medium)
77	5,600	0.352 (Medium)
81	2,400	0.424 (High)
82	4,700	0.377 (Medium)
83	5,400	0.421 (High)
90	11,800	0.402 (High)
92	10,400	0.378 (Medium)
93	10,400	0.326 (Low)
14S	3,100	0.500 (Very high)

Social Vulnerability Index

Transit service coverage is often prioritized to serve areas with higher levels of need or disadvantage. The TDP Technical Advisory Committee noted that coverage-focused services should prioritize equity/fairness including senior populations, racial and ethnic minorities, and zero-car households. To help evaluate the social service need for transit coverage, we used a tool called the Social Vulnerability Index developed by the Centers for Disease Control and Prevention.[10]

The Social Vulnerability Index (SVI) combines 15 social factors grouped within four general themes of socioeconomic status, household composition/disability, race/ethnicity/language, and housing/transportation. The SVI was created to identify communities that would likely need assistance in responding to emergencies, but it is also valuable for broader use to measure social vulnerability. **Table 7.2** lists all the factors included in this index:

Table 7.2- Variables included in the CDC's Social Vulnerability Index, grouped under four themes

Socioeconomic Status	Household Composition/Disability	Race/Ethnicity/Language	Housing/Transportation
• Poverty • Unemployed • Per Capita Income • No High School Diploma	• Aged 65 and Over • Aged 17 and Younger • Single-parent Household • Aged 5 and over with a Disability	• Minority • English Language Ability	• Multi-unit • Mobile Homes • Crowding • No Vehicle • Group Quarters

The following figures map the overall SVI for Tompkins County and the four theme areas. In addition, the average SVI overall rating for each TCAT bus route is listed in **Table 7.1**. This information is valuable for understanding which coverage routes are serving areas with the highest needs, and what areas may have a lower need for coverage-focused transit service.

Figure 7.1 shows vulnerability related to socioeconomic status; this is highest along a corridor to the southwest and northeast of Ithaca. **Figure 7.2** shows vulnerability related to household composition/disability; this is highest in Trumansburg, Newfield, and near the county's edges. **Figure 7.3** shows vulnerability related to race, ethnicity, and language; this is highest in the area within about five miles of Ithaca and quite low elsewhere. **Figure 7.4** depicts vulnerability related to housing and transportation; this is highest in the areas around Dryden and just southwest of Ithaca. Finally, **Figure 7.5** shows the composite SVI throughout Tompkins County; the area of greatest vulnerability is located between Ithaca and Robert H. Treman State Park to the southwest. Overall, TCAT's bus routes cover the high-vulnerability areas well, but there may also be opportunities for improved coverage.

[10] US Centers for Disease Control and Prevention. (2019). CDC Social Vulnerability Index. https://www.atsdr.cdc.gov/placeandhealth/svi/index.html

Figure 7.1- Map of Socioeconomic Status theme as an element of vulnerability for Tompkins County

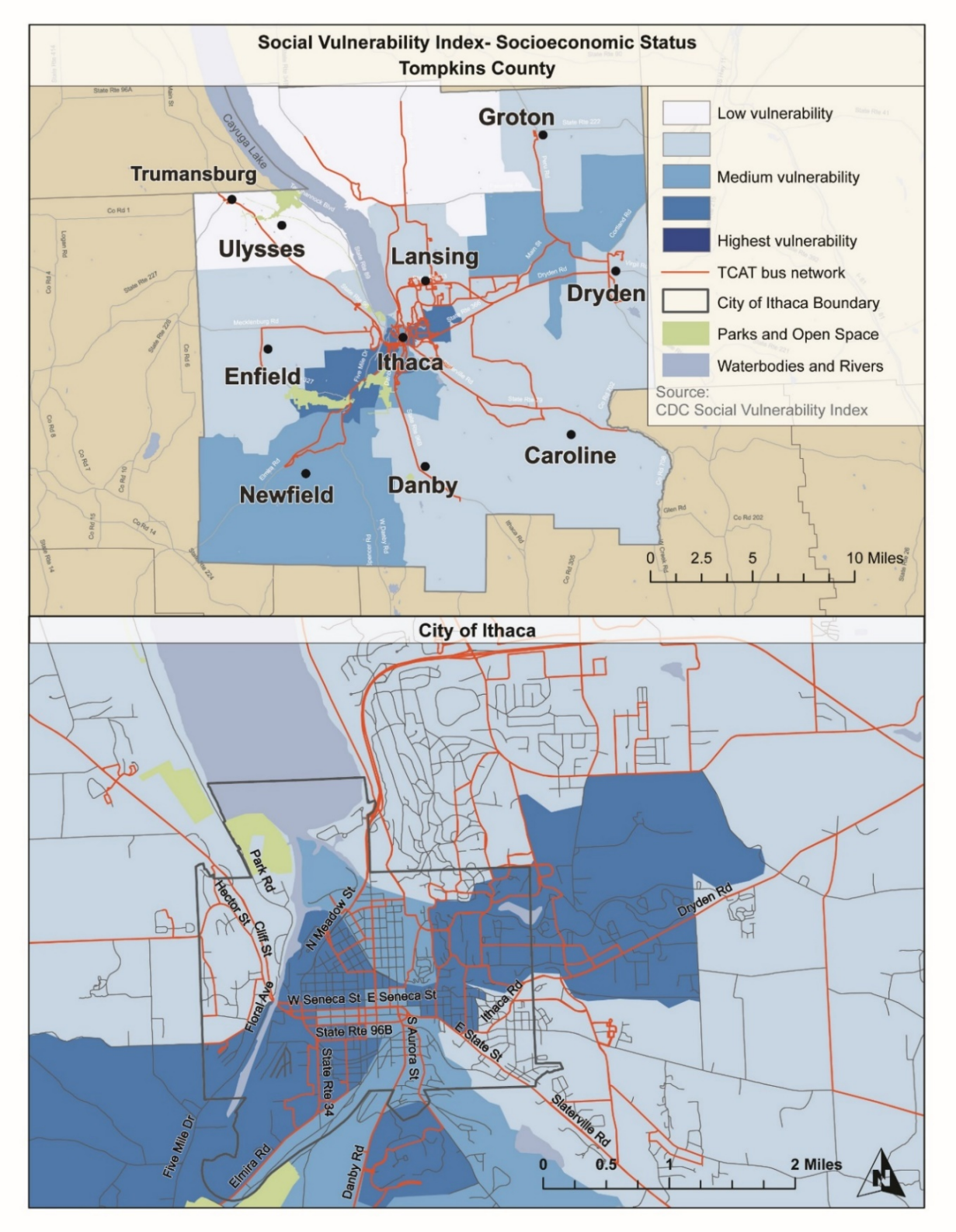


Figure 7.2 - Map of Household Composition/Disability theme as an element of vulnerability for Tompkins County

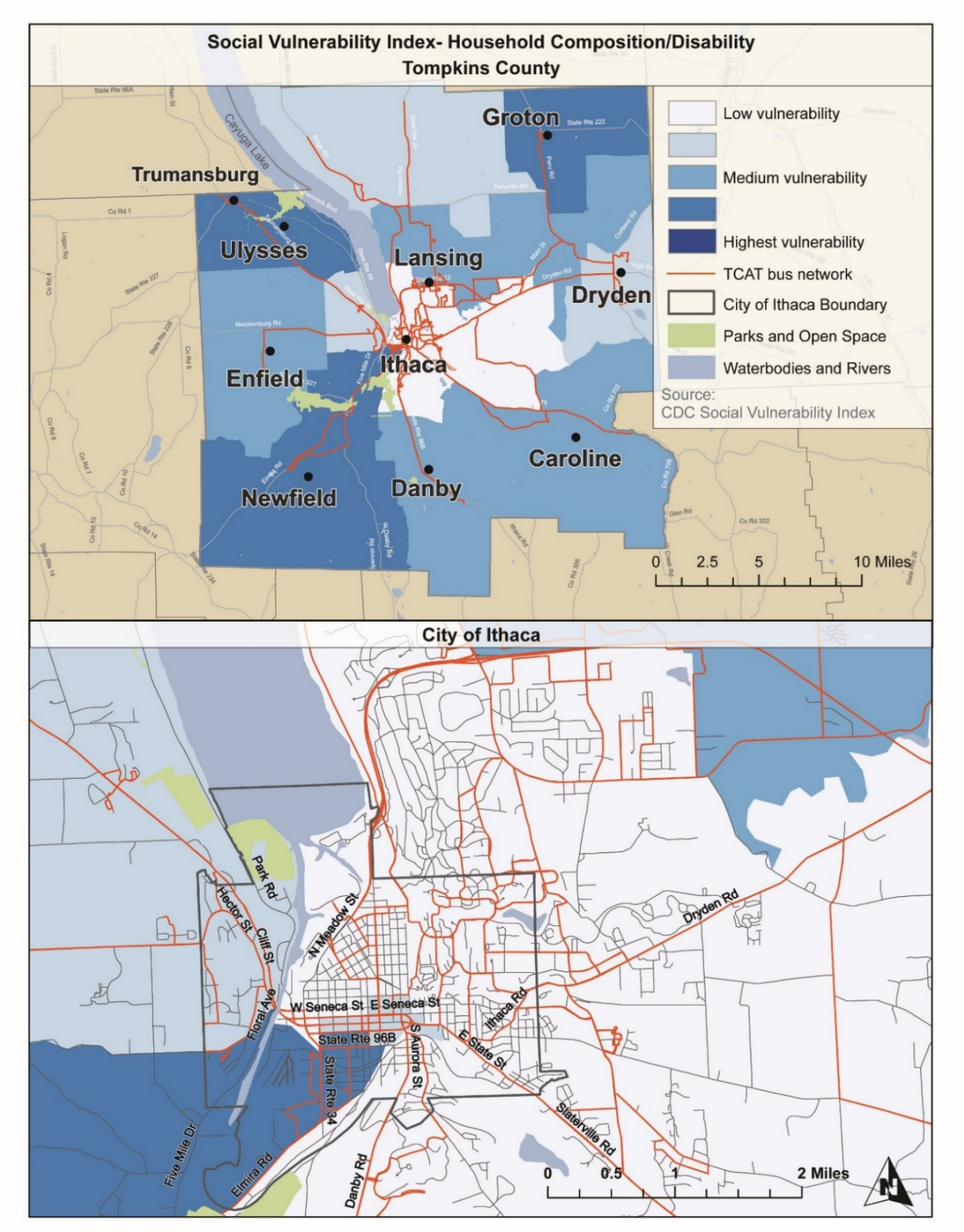


Figure 7.3 - Map of Race/Ethnicity/Language theme as an element of vulnerability for Tompkins County

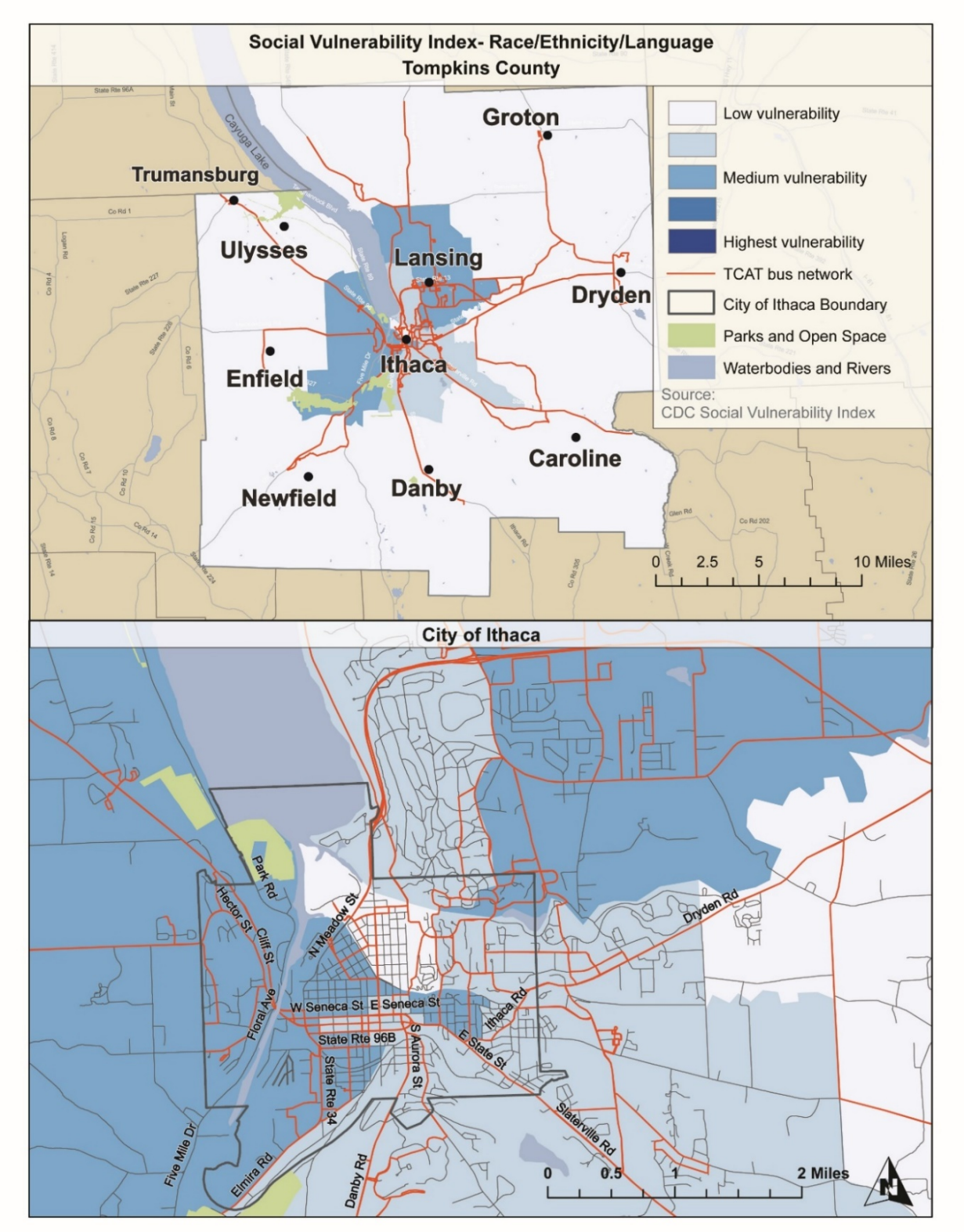


Figure 7.4 - Map of Housing/Transportation theme as an element of vulnerability for Tompkins County

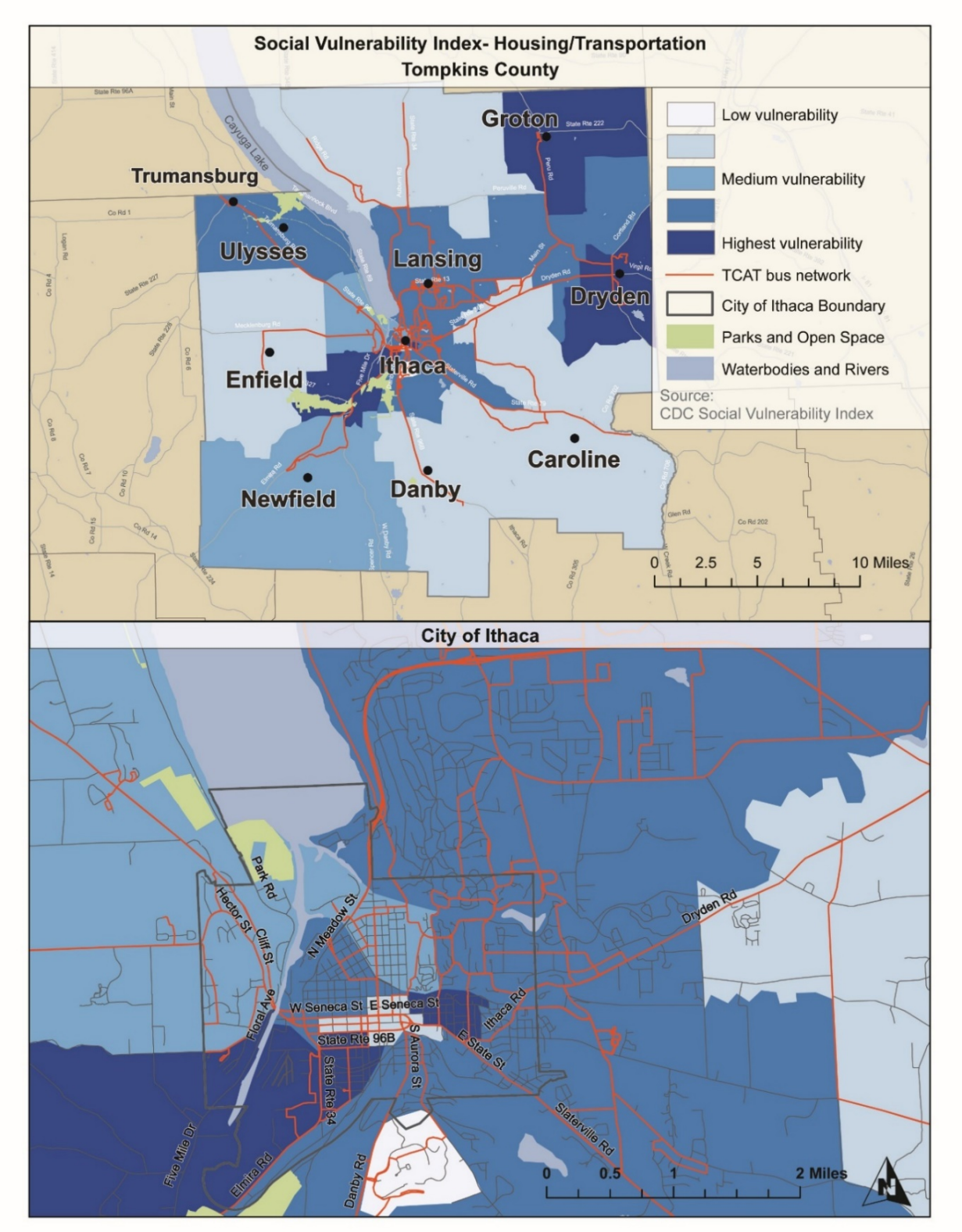
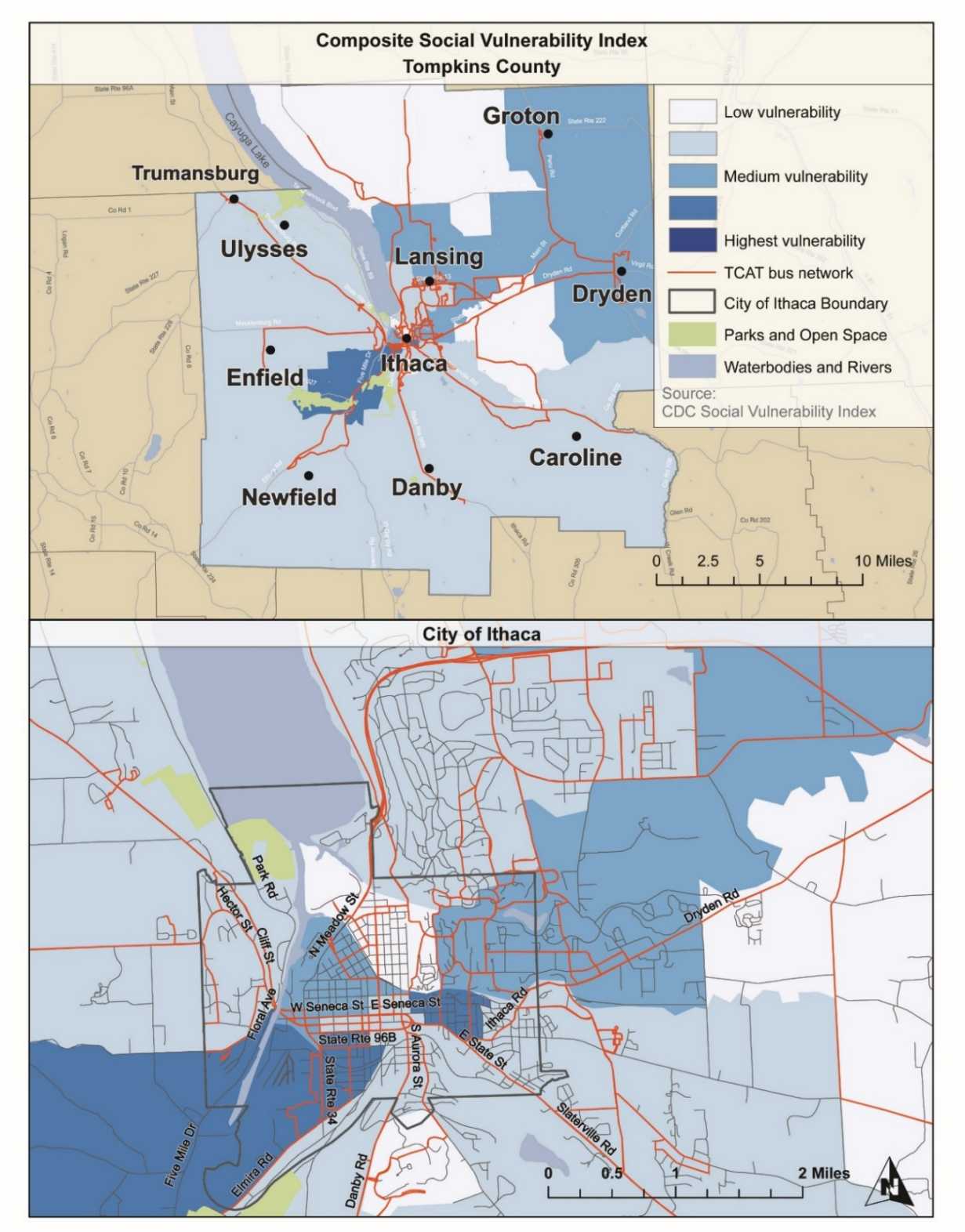


Figure 7.5 - Map of composite Social Vulnerability Index for Tompkins County



8. Network Performance Review

The following section analyzes network performance based on data from February-March of 2019. This period was selected to represent "typical" conditions and TCAT's peak service level. At the time of this writing TCAT ridership is dramatically suppressed as a result of the COVID-19 pandemic, but our analysis focuses on conditions that should be more representative of post-pandemic performance.

Service Network

TCAT classifies its bus routes in seven categories based on service type and area. The largest category is ***Campus Urban*** routes, which operate 27% of TCAT's service hours and attract 39% of TCAT's ridership. The Campus Urban routes connect the Cornell University campus with adjacent urban neighborhoods and downtown Ithaca. Graphs summarizing the service hours and ridership are shown in **Figure 8.1**, while maps of the areas served are shown in **Table 8.1**. **Table 8.2** lists TCAT's route by category.

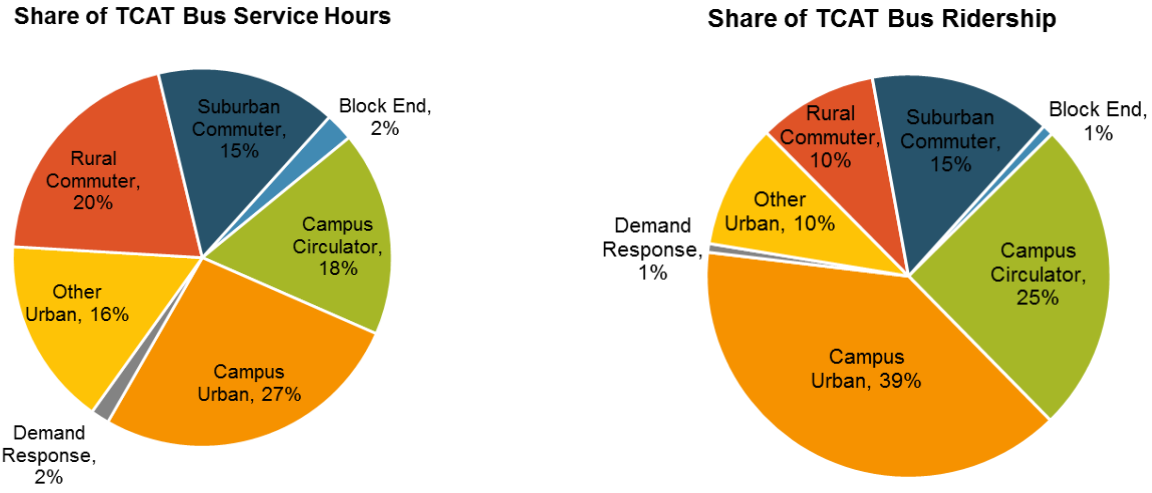
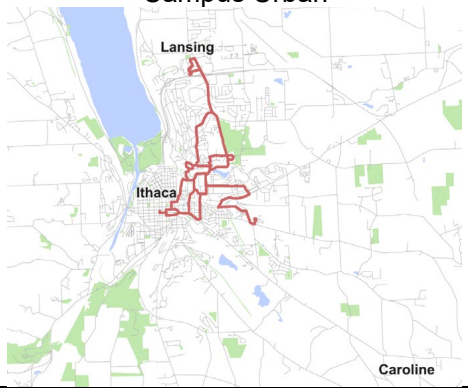
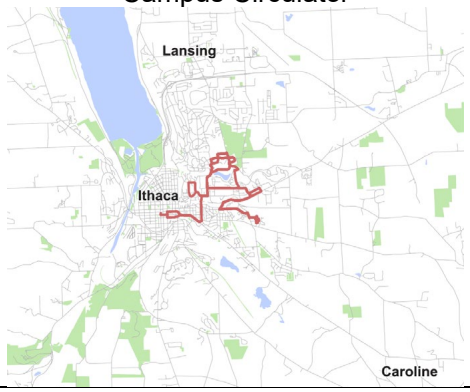
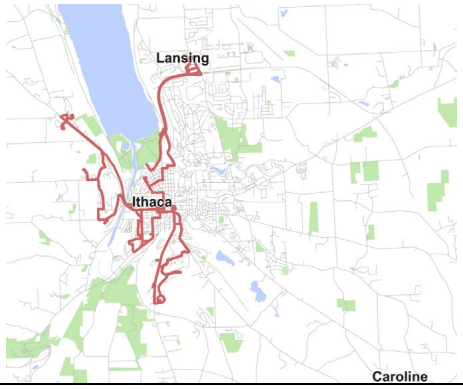
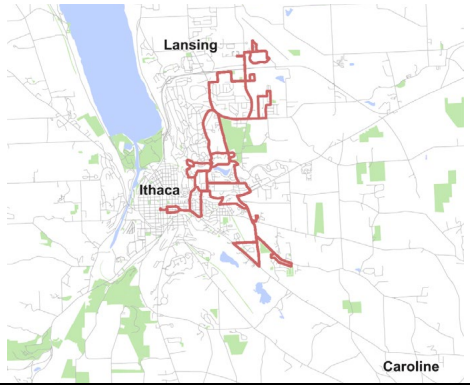
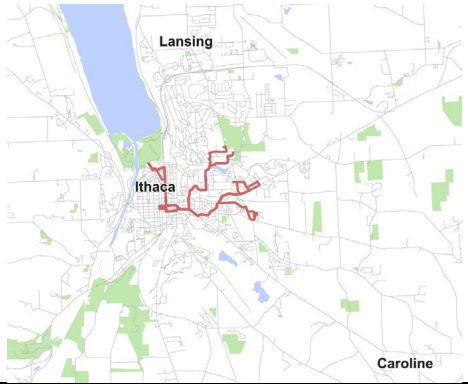
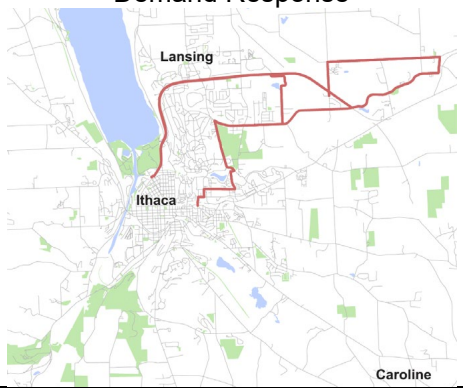
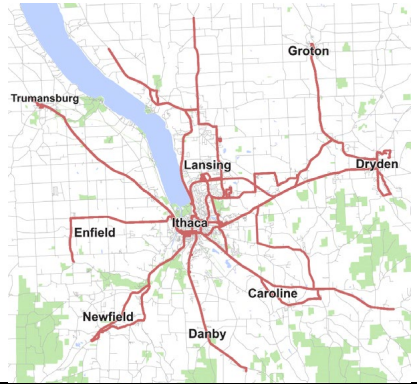


Figure 8.1 - Distribution of service hours and ridership for TCAT bus route categories

Four route categories operate between 15-20% of TCAT's service; these are Campus Circulator, Other Urban, Suburban Commuter, and Rural Commuter routes. The ***Campus Circulator*** routes connect destinations primarily within the Cornell University campus; they generate 25% of TCAT ridership. The ***Other Urban*** routes connect downtown Ithaca with communities to the immediate south, west, and north, generating 10% of ridership. The ***Suburban Commuter*** routes link outlying communities to the northeast and southeast of Ithaca with downtown via Cornell, generating 15% of ridership. ***Rural Commuter*** routes extend to destinations such as Dryden and Trumansburg, generating 10% of ridership.

Two small service categories each operate 2% of TCAT's service hours and attract 1% of TCAT's ridership. ***Block End*** routes run to and from the TCAT bus garage near Lake Cayuga. These operations only exist so that buses can get in position to begin or end work. However, since these trips pass through a high-demand area and connect with other routes, TCAT has made them a revenue service (Route 17) instead of running them out-of-service. The other small service category is ***Demand Response***, which includes a single route that serves Cornell and the area just to the northeast based on customer requests.

Table 8.1 - Maps of the areas where each TCAT bus route category operates

Campus Urban 	Campus Circulator 
Other Urban 	Suburban Connector 
Block End 	Demand Response 
Rural Connector 	

Service Levels

TCAT's bus routes use a variety of different service models, from high-frequency routes that can be used without a schedule to limited-service routes that only operate three round trips per day. Table 2 lists the service hours and headways of each route.

The Campus Circulator and Campus Urban routes generally offer high-frequency service on weekdays and 30-minute frequencies on weekends. Exceptions to this include Route 90, which only operates during evening hours, and Route 70, which only operates on weekends. In addition, Route 92 only runs evening service on weekdays but operates all day on weekends. These schedules are atypical but tailored to the specific university markets served. The Campus Circulator routes tend to operate peak-focused service, while the Campus Urban routes tend to operate more hours of the day.

The Other Urban and Suburban Commuter routes generally operate medium frequencies on weekdays (20 to 60 minutes) and hourly service on weekends. Exceptions include Route 72, which only operates on weekends, and Route 93, which only operates evening service.

Finally, the Rural Commuter routes generally operate 30-60-minute headways on weekdays and a limited set of trips on weekends. Exceptions include Routes 74, 75, and 77, which only operate on weekends. Five of these routes operate peak-only service on weekdays, and another five of these routes only operate on weekdays.

TCAT's service standards advise that Urban routes should operate at least 30-minute headway peak service and 60-minute midday service. The standards recommend that Urban routes operate 8am-10:30pm on Saturdays and 9am-8:30pm on Sundays.

TCAT's service standards advise that Campus Shuttle routes should operate at least 15-minute headway AM peak service and 20-minute midday service. The standards recommend that Campus Shuttle routes operate 9am-2am on Saturdays and 9:30am-11pm on Sundays.

Table 8.2 – Service Span and Service Headways by Route

Service Span by Route

Routes by Category	Weekday	Saturday	Sunday
Block End			
17	5am to 2am	6am to 2am	6am to 1am
Campus Circulator			
81	4am to 4pm	N/A	N/A
82	7am to 7pm	N/A	N/A
83	8am to 5pm	N/A	N/A
90	9pm to 2am	11pm to 2am	6pm to 9pm
Campus Urban			
10	7am to 7pm	N/A	N/A
30	6am to 11pm	10am to 6pm	10am to 5pm
70	N/A	7am to 11pm	9am to 6pm
92	7pm to 2am	8am to 2am	7am to 2am
Demand Response			
41	6am to 5pm	N/A	N/A
Other Urban			
11	7am to 2am	7am to 2am	9am to 6pm
13	6am to 7pm	8am to 7pm	N/A
14	6am to 9pm	7am to 7pm	9am to 6pm
14S	10am to 3pm	10am to 2pm	10am to 2pm
15	7am to 8pm	8am to 8pm	7am to 5pm
Rural Commuter			
20	6am to 6pm	9am to 7pm	7am to 5pm
21	5am to 9pm	7am to 6pm	7am to 6pm
36	6am to 6pm	N/A	N/A
37	6am to 7pm	N/A	N/A
40	6am to 5pm	N/A	N/A
43	6am to 9pm	N/A	N/A
52	5am to 7pm	7am to 6pm	N/A
53	7am to 5pm	N/A	N/A
65	6am to 6pm	8am to 6pm	N/A
67	5am to 8pm	6am to 5pm	7am to 6pm
74	N/A	7am to 8pm	7am to 4pm
75	N/A	8am to 9pm	7am to 5pm
77	N/A	10am to 6pm	N/A
Suburban Commuter			
31	7am to 10pm	N/A	N/A
32	7am to 11pm	N/A	N/A
51	6am to 6pm	6am to 6pm	9am to 6pm
72	N/A	8am to 11pm	7am to 6pm
93	6pm to 12am	6pm to 12am	6pm to 12am

Service Headways by Route

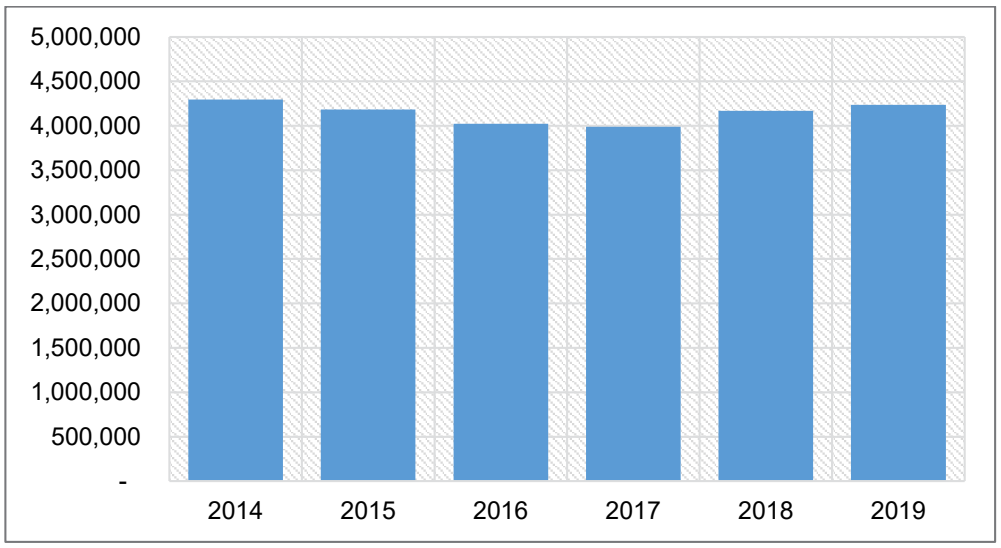
Routes by Category	Weekday Peak	Weekday Midday	Saturday	Sunday
Block End				
17	every 6 min	every 24 min	every 48 min	every 60 min
Campus Circulator				
81	every 12 min	N/A	N/A	N/A
82	every 8 min	every 9 min	N/A	N/A
83	every 15 min	N/A	N/A	N/A
90	every 30 min	N/A	every 30 min	every 30 min
Campus Urban				
10	every 4 min	every 8 min	N/A	N/A
30	every 11 min	every 13 min	every 30 min	every 30 min
70	N/A	N/A	every 30 min	every 30 min
92	every 30 min	N/A	every 60 min	every 60 min
Demand Response				
41	every 60 min	every 60 min	N/A	N/A
Other Urban				
11	every 20 min	every 30 min	every 30 min	every 30 min
13	every 40 min	every 60 min	every 60 min	N/A
14	every 60 min	every 60 min	every 60 min	every 60 min
14S	every 60 min	every 60 min	every 60 min	every 60 min
15	every 30 min	every 60 min	every 44 min	every 60 min
Rural Commuter				
20	every 40 min	N/A	Limited	Limited
21	every 30 min	every 80 min	Limited	Limited
36	every 30 min	N/A	N/A	N/A
37	every 40 min	Limited	N/A	N/A
40	every 40 min	N/A	N/A	N/A
43	every 30 min	every 120 min	N/A	N/A
52	every 40 min	Limited	Limited	N/A
53	every 60 min	N/A	N/A	N/A
65	every 60 min	N/A	Limited	N/A
67	every 60 min	Limited	Limited	Limited
74	N/A	N/A	Limited	Limited
75	N/A	N/A	Limited	Limited
77	N/A	N/A	Limited	N/A
Suburban Commuter				
31	every 30 min	every 60 min	N/A	N/A
32	every 24 min	every 60 min	N/A	N/A
51	every 24 min	every 120 min	every 60 min	every 60 min
72	N/A	N/A	every 60 min	every 60 min
93	every 60 min	N/A	every 60 min	every 60 min

Ridership Trends

TCAT bus ridership has been stable over the period 2014-2019, only seeing a slight decline of 1.4%. This is impressive, given that general economic trends are causing ridership declines for most transit agencies in the United States. Over the same period, the following external trends were occurring:

- Gas prices in New York State fell by 26.2% (Source: EIA)
- Nationwide bus ridership declined by 11.4% (Source: APTA)
- Ithaca College enrollment declined by 5% (Source: Ithaca College)
- Cornell enrollment increased by 10% (Source: Cornell)

Figure 8.2 – Annual TCAT Bus Ridership Trend



While total ridership was stable, individual routes saw significant growth and decline over this period. Of the routes that operated for the whole period, the largest changes are highlighted below:

- Route 11 annual ridership declined by 93,000 or 42%, likely due to a significant reduction of Ithaca College ridership.
- Route 30 annual ridership increased by 101,000 or 13%, which may be associated with increased service at the midday from 30 to 15 minutes headway.
- Route 32 annual ridership declined by 58,000 or 21%.
- Route 81 annual ridership declined by 362,000 or 70% (route was restructured).
- Route 82 annual ridership increased by 309,000 or 77% (route was restructured).
- Route 90 annual ridership increased by 26,000 or 46%.

Ridership data also exhibits dramatic seasonal swings. As shown in **Figure 8.4**, TCAT's ridership is greatest in the spring and fall, when universities are in session and the local population is greatest. Ridership is consistently lower during the summer and winter periods when school activity is reduced. The seasonal drop in ridership is most pronounced among the Campus Circulator, Campus Urban, and

Suburban Commuter route categories. It is important to note that TCAT adjusts bus service levels to accommodate the seasonal changes in demand.

Finally, ridership also declined during the first months of the 2020 pandemic; the overall reduction during this period was about 76% below average conditions.

Figure 8.3 – Average Monthly Ridership Throughout a Year

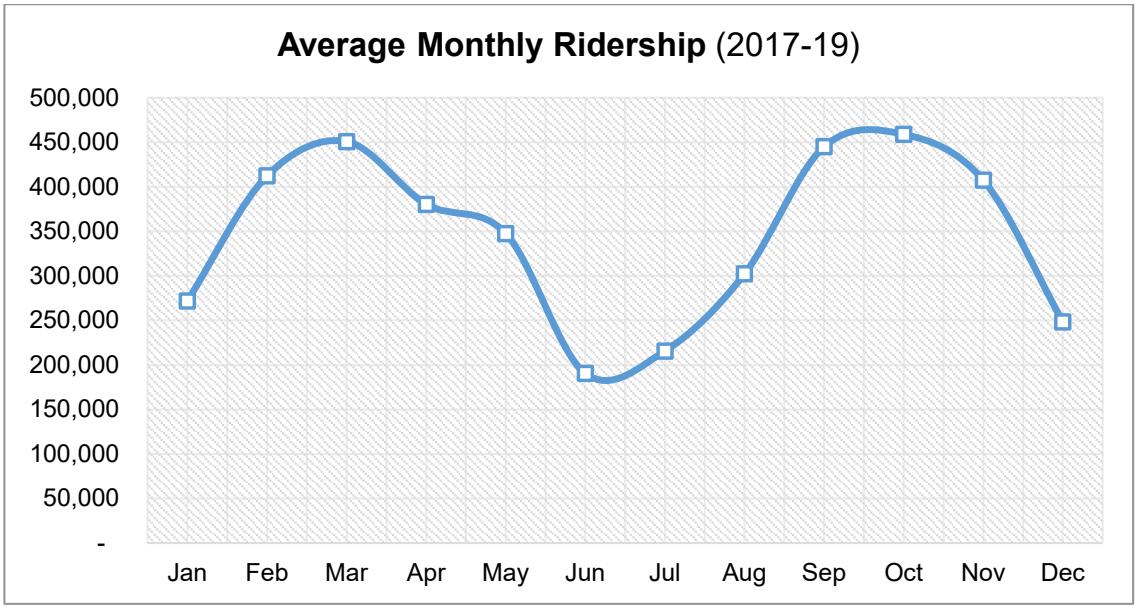
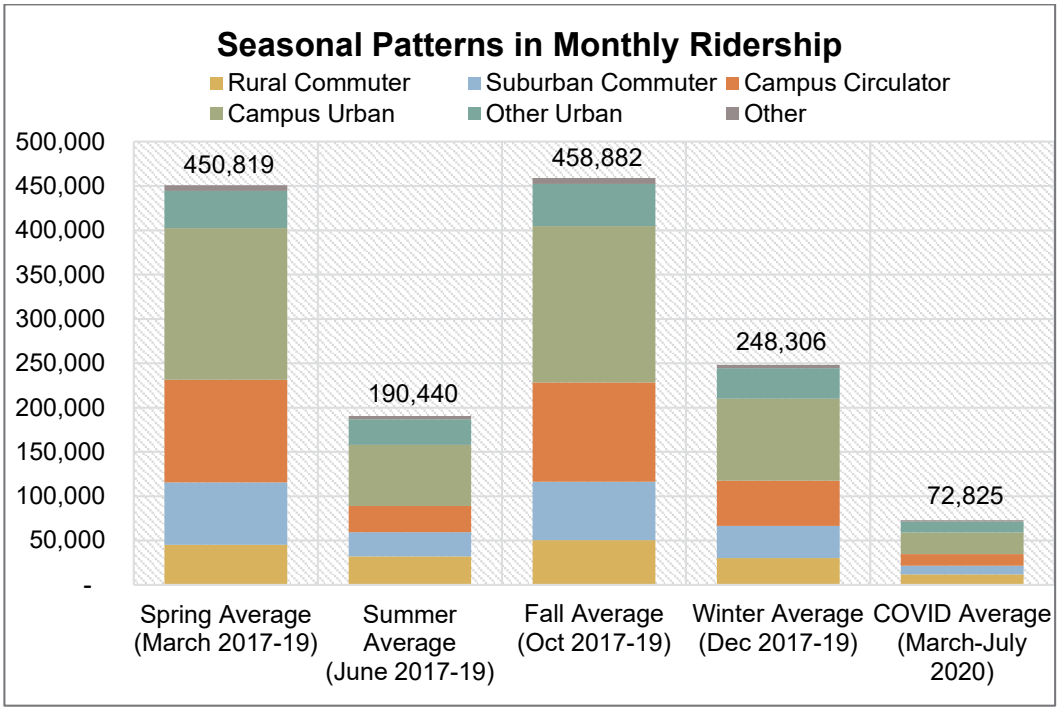


Figure 8.4 – Seasonal Patterns in Monthly Ridership, broken down by route category



Route Efficiency (Productivity)

Productivity is defined as the number of passengers a route serves per hour of bus operations. It is a common measure of efficiency: service that carries a high number of passengers per hour is often targeted for increased service, while service with a low number of passengers per hour may be considered for restructuring (unless it is serving a non-ridership purpose).

Figure 8.5 – Graph of Weekday Productivity (Passengers per Hour) by Route

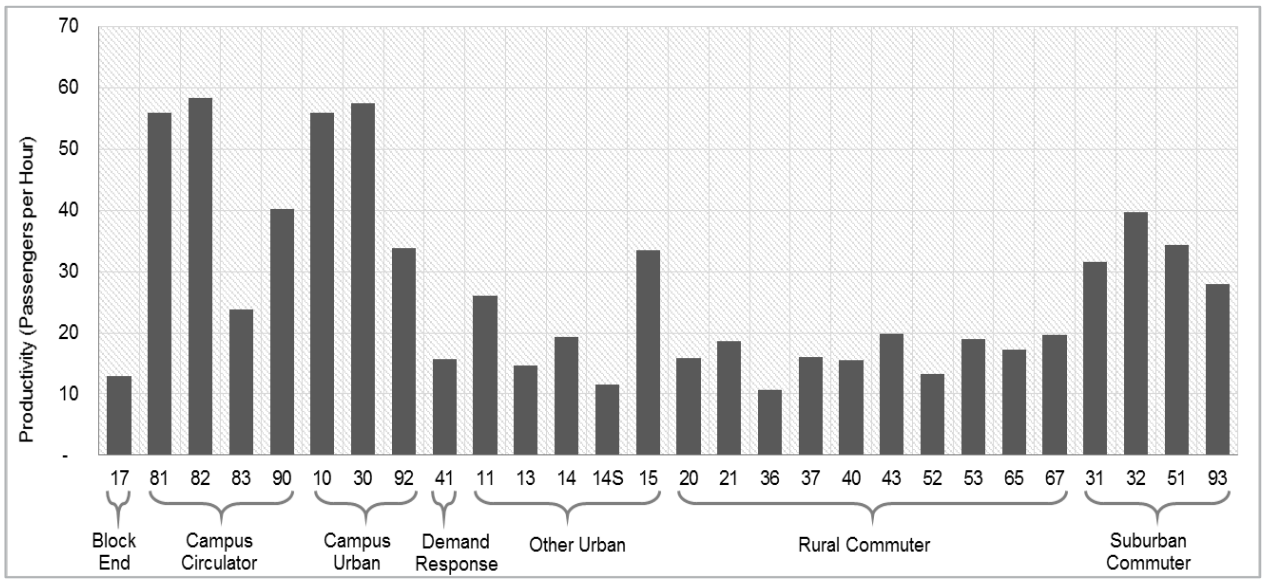


Figure 8.6 – Graph of Saturday Productivity (Passengers per Hour) by Route

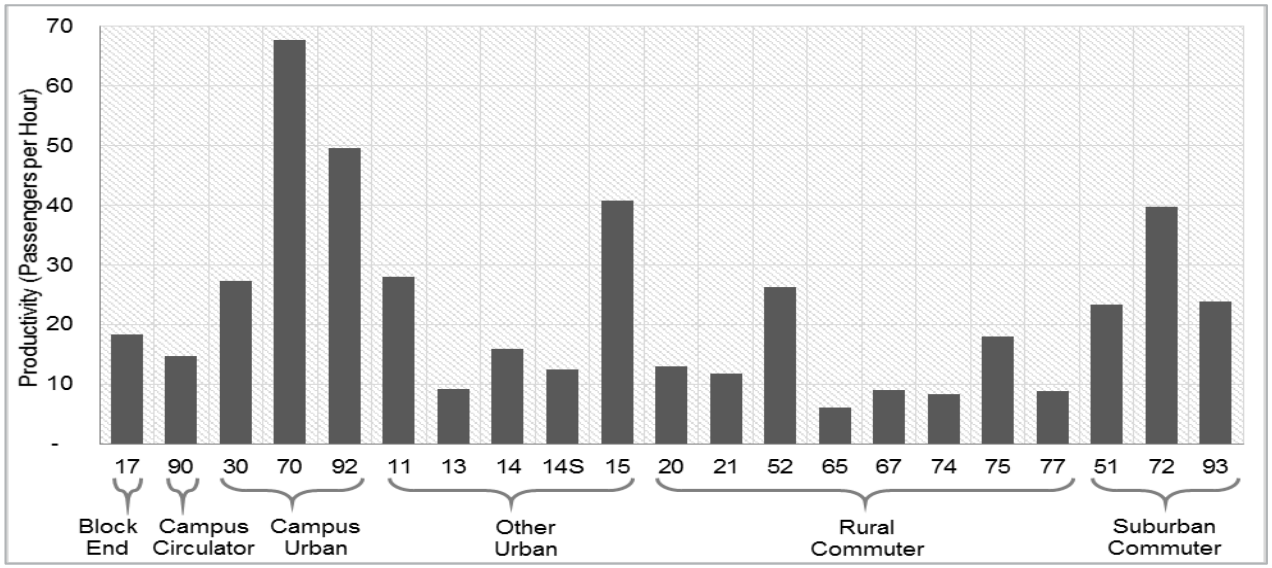
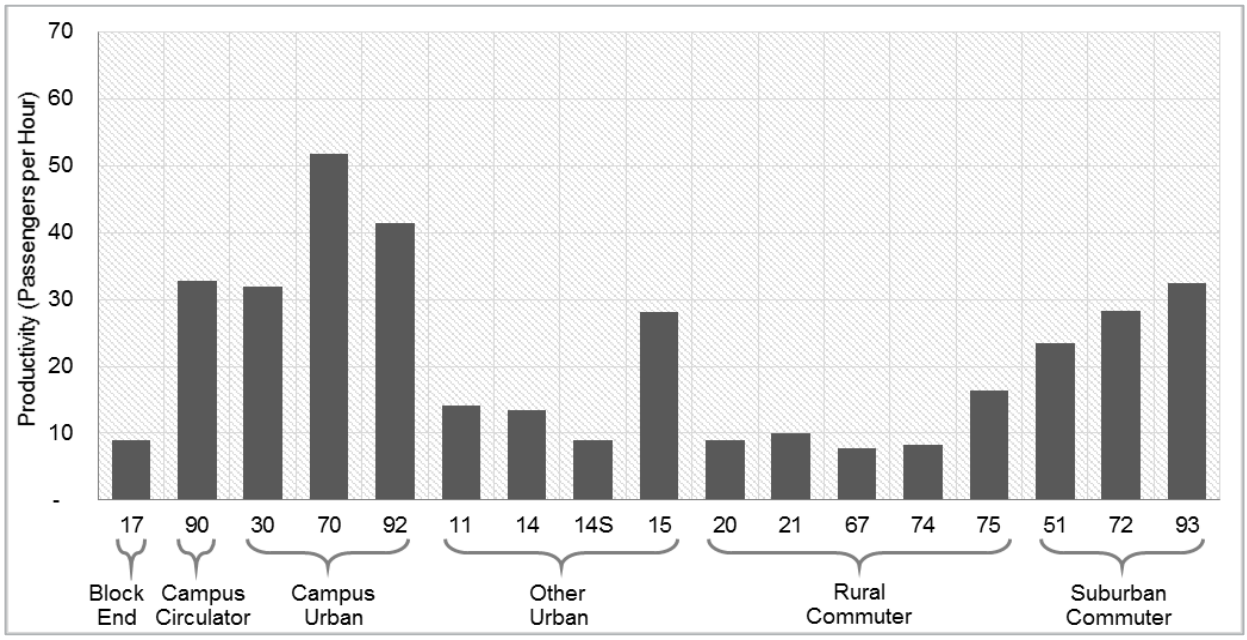


Figure 8.7 – Graph of Sunday Productivity (Passengers per Hour) by Route



Many of TCAT's routes exhibit very high levels of productivity. The Campus Circulator and Campus Urban routes generally serve more than 40 passengers per hour, and in some cases exceed 50 passengers per hour, suggesting that there may be demand for increased service on these routes. In cases where productivity is high but service is relatively infrequent, this represents an opportunity to increase frequency. Examples of this might include the weekday service of Route 90, the weekend service of Routes 70 and 92, and the Saturday service of Route 15. In cases where productivity is high and service is already frequent, TCAT should plan and schedule service with an eye toward managing the maximum loads.

TCAT's Other Urban and Rural Commuter routes experience lower productivity that reflects the fact that these routes primarily serve coverage purposes. These routes operate infrequently, often running once an hour or less. High productivity should not be expected from coverage-focused routes, but when it does occur, it may indicate a growth market. Conversely, when productivity is low enough, TCAT might consider alternative solutions for providing coverage service such as on-demand zones.

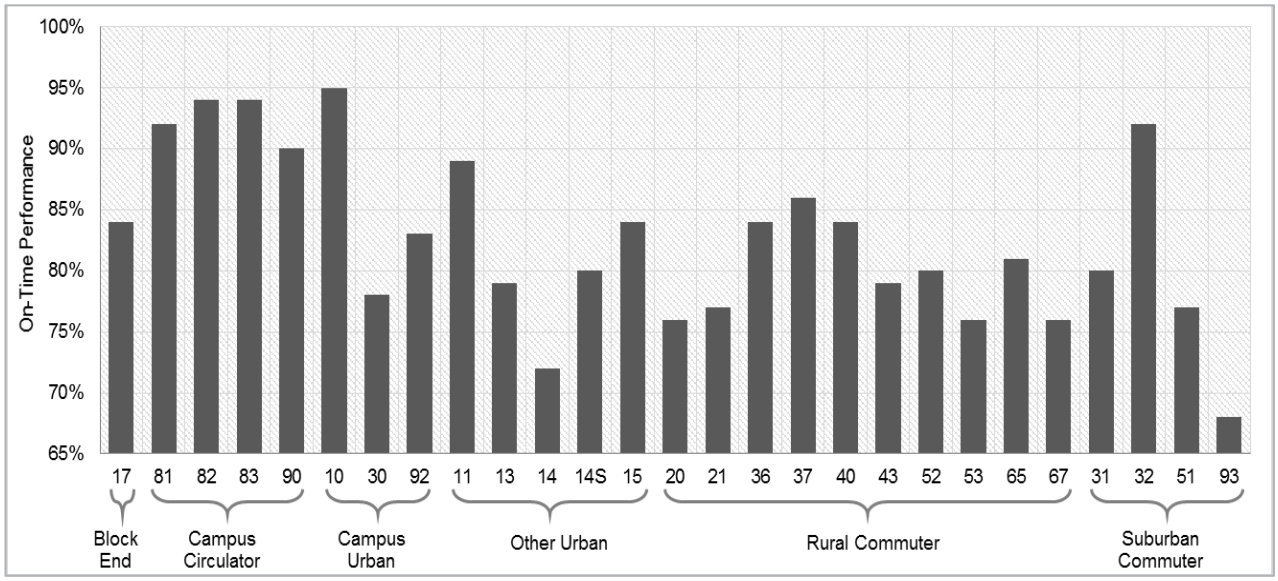
Meanwhile, the Suburban Commuter routes tend to have a medium-high level of productivity, between 20 and 40 passengers per hour. Peer rural/suburban agencies would consider this strong performance, especially since many of the routes only operate hourly service. Routes with high productivity (close to 40 passengers per hour) despite only operating hourly likely have additional latent demand.

On-Time Performance

The on-time performance of TCAT's bus network is quite strong overall. Most service achieves the agency's target of departing timepoints 80% on-time. On-time performance is especially high for the Campus Circulator routes, which may be a result of short route lengths and short operator shifts. The on-time performance data point to a few specific routes where TCAT could investigate improvements:

- Route 90 has relatively low on-time performance on Sundays
- Route 14 has relatively low on-time performance on all service days
- Route 72 has relatively low on-time performance on Saturdays
- Route 93 has relatively low on-time performance on Weekends

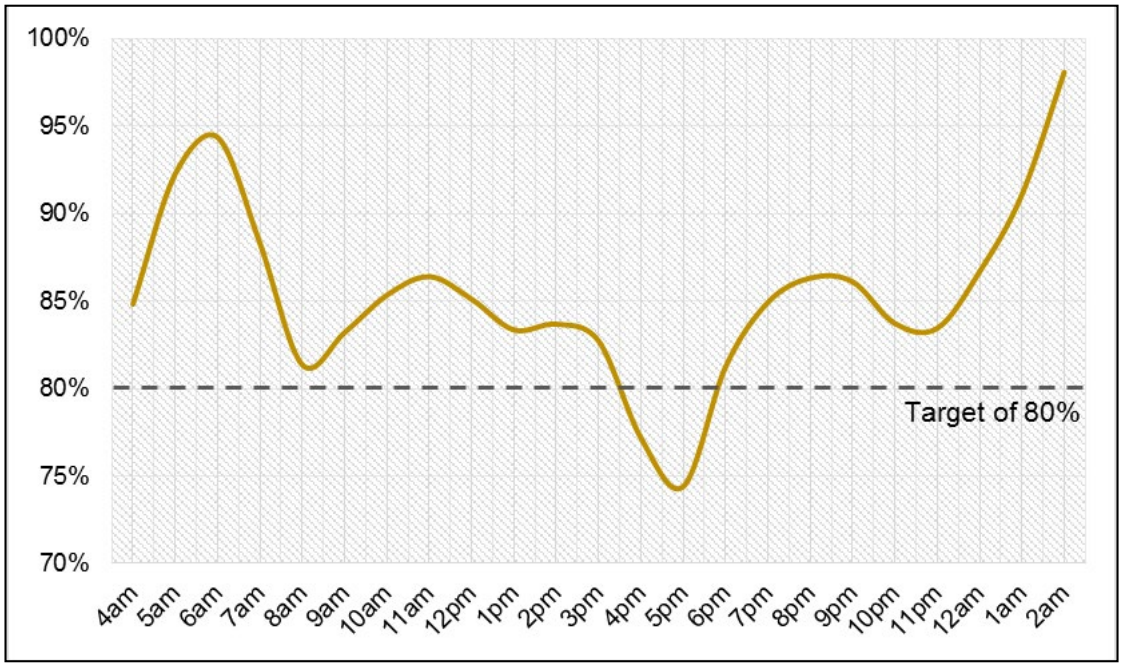
Figure 8.8 - Average Weekday on-time performance by route



Many factors can cause on-time performance issues for these routes. Often bus routes are created with schedules that are accurate for their current operating environment, but then over time traffic patterns change and buses need more time to complete their route. It should be noted that TCAT has been adjusting scheduled running-times based on the newly available bus location data. This has improved on-time performance.

Figure 8.9 shows clear impacts of peak traffic patterns on the average weekday; on-time performance drops significantly during the morning and evening rush hours. One solution may involve updating the routing to remove deviations, saving time. Another solution may be to update running times and/or layover times to accommodate the new traffic reality. Additionally, investment in bus prioritization infrastructure by the local municipalities can significantly improve on-time performance and schedule reliability.

Figure 8.9 – Average weekday on-time performance by hour



Performance Review Conclusions

The current TCAT bus network is a radial system focusing on the two nodes of Downtown Ithaca and Cornell University. It allows customers to travel anywhere in the TCAT service area simply by making transfers at a central hub.

TCAT provides a diverse set of routes for a service area with diverse needs. This includes very frequent bus service focused on Cornell University, where the region's transit demand is strongest. These Campus-focused services are highly productive/efficient and reliable. Suburban Commuter routes serving Ithaca's near northwest and southeast suburbs are relatively productive commuter markets. Finally, TCAT provides a moderate level of coverage service for Tompkins County's rural communities and lower-demand urban areas. These are mostly (but not entirely) low productivity, but they provide an important lifeline.

At the time of this writing, TCAT ridership is dramatically suppressed as a result of the COVID-19 pandemic. However, ridership patterns prior to the pandemic indicate a high level of resiliency/inelasticity to various macroeconomic trends. This suggests that, once the pandemic subsides, TCAT ridership may rebound more quickly than at other transit agencies. However, it still will take a long time for ridership to return to 2019 levels, especially for services used by professionals who are able to work from home. All analysis in this memorandum should be interpreted with this reality in mind.