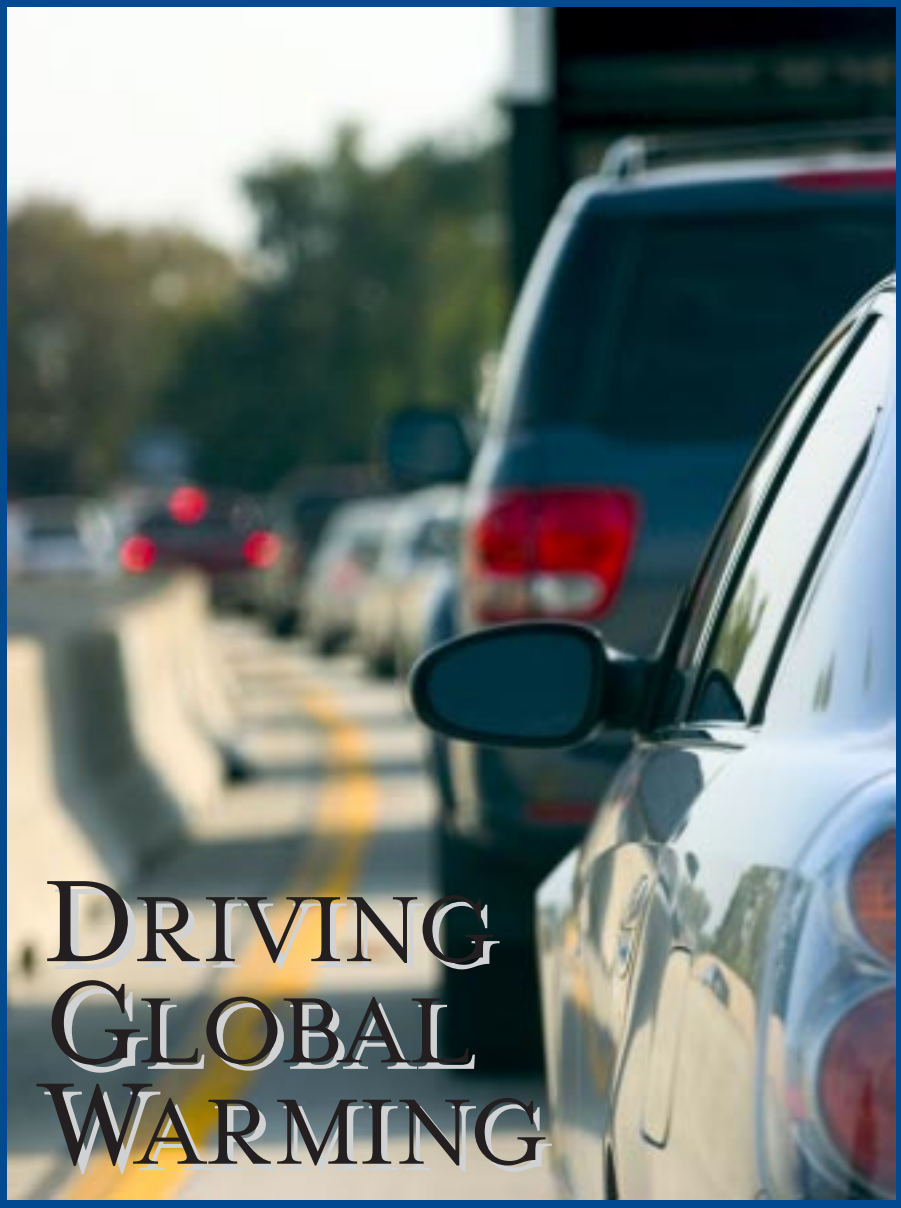

Driving Global Warming

Commuting in Maine and its Contribution to Global Warming

ENVIRONMENT MAINE RESEARCH AND POLICY CENTER

NATURAL RESOURCES COUNCIL OF MAINE

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With contributions from the New England Climate Coalition steering committee

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Executive Summary

Transportation is responsible for just under one-third of Maine's contribution to global warming – and the trips state residents make to and from work are a major contributor to the problem. Just over a quarter of all vehicle miles nationally are driven on trips to and from work. To reduce global warming emissions from cars and trucks – and to meet the state's climate protection goals – Maine must find ways to reduce the global warming impact of commuting.

In order to find the right policy options for confronting global warming pollution from commuting, it is necessary to know who is commuting where and by what mode of transportation. A review of data collected by the U.S. Census Bureau identifies which towns in the state are responsible for the greatest amount of commuting-related emissions of carbon dioxide (the leading cause of global warming) and suggests ways that the state can effectively reduce emissions.

Commuters living in bedroom communities in southeastern Maine produce the state's highest levels of per-commuter emissions – three to seven times greater than those of workers living in the state's largest cities.

- Per-commuter carbon dioxide emissions are largely a factor of the distance that commuters travel to work. For example, the average commuter from Waterboro, Naples, and Limington travels 17 to 19 miles to work and produces over 7,000 pounds of carbon dioxide pollution annually; while the average commuter from Bangor, Portland and South Portland travels 4 to 6 miles and generates less than 2,500 pounds of carbon dioxide pollution per year. (See Fig. ES-1.)

Fig. ES-1. Suburban Residents Produce More Global Warming Emissions Per Capita
(Annual Per-Worker Carbon Dioxide Emissions)

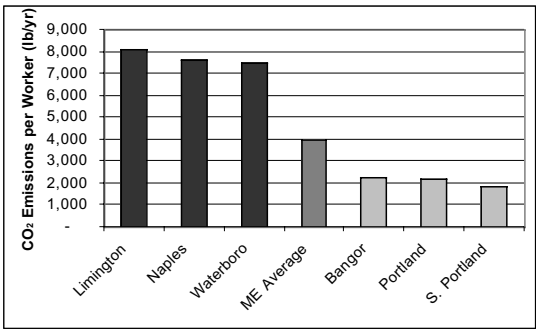
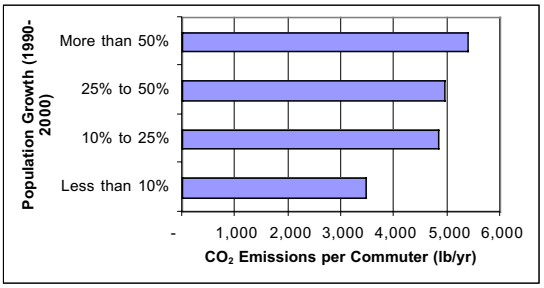


Fig. ES-2. Faster-Growing Communities Produce More Emissions per Worker



The explosion of sprawling residential development in formerly rural areas poses a major challenge to the state's efforts to reduce global warming emissions.

- Sprawling development dramatically increases the length of commuting trips. This is a worrisome trend given that the 3 percent of Maine commuters who travel at least 30 miles to work produce a disproportionately large share – around 15 percent – of the state's commuting-related carbon dioxide emissions.

- Many of Maine's fastest-growing communities are located on the extreme fringes of the state's metropolitan areas and in formerly rural areas where per-worker emissions are very high. (See Fig. ES-2.)

Shifting commuting away from drive-alone trips, developing an expanded transit network, fostering non-vehicular commutes, and encouraging home-based work can significantly reduce carbon dioxide emissions from transportation.

- Throughout Maine, 78 percent of all commuters drive alone to work. However, towns with a high reliance on alternatives to drive-alone commuting – regardless of their location within the state – tend to have lower-per worker emissions of carbon dioxide. (See Fig. ES-3.)

Maine should take a series of immediate and long-term actions to reduce global warming emissions from commuting. Among other actions, the state should:

- Implement vehicle global warming emissions standards and other measures to encourage the purchase of vehicles that produce less carbon dioxide per mile.

- Develop programs to encourage residents to live near their workplaces and to encourage employers to implement telecommuting.

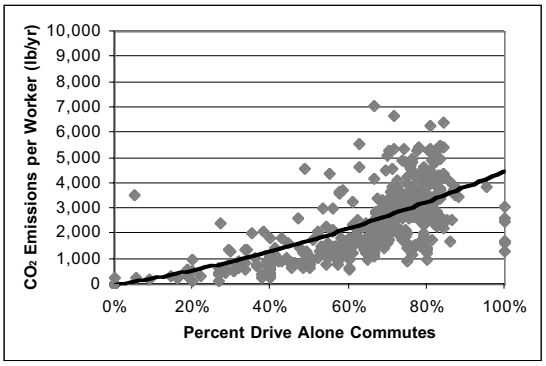
- Encourage carpooling, vanpooling and other programs that reduce the number of drive-alone commutes, while discouraging highway expansion projects that promote single-passenger commuting.

- Further integrate the state into the regional transit network by expanding rail service in Maine.

- Put the brakes on sprawling development in rural areas by encouraging urban redevelopment, transit-oriented development, the creation of more affordable housing, and mixed-use planning in new and existing suburbs, and by creating and implementing growth management plans in all towns.

- Hold suburban workplaces accountable for the carbon dioxide emissions they generate by requiring large employers to implement commute-trip reduction programs.

Fig. ES-3. Towns Attracting More Drive-Alone Commuters Produce More Global Warming Emissions



Introduction

The New England states have taken a position of leadership in the effort to reduce the threat of global warming. Beginning with the adoption of the New England/Eastern Canada Climate Change Action Plan in 2001, and continuing through the adoption of state climate plans and the Regional Greenhouse Gas Initiative process, the region has taken unprecedented steps forward, inspiring other states around the country to consider similar actions.

One of the most promising series of developments has been with regard to transportation. Five of the six New England states, including Maine, have moved to adopt the clean cars program, which will require the production of advanced-technology vehicles and set global warming pollution standards for all cars and light trucks. The impact of these initiatives will be substantial: by 2020, states adopting the full clean cars program can expect emissions from light-duty cars and trucks to roughly stabilize at today's levels.

But stability is not enough – transportation-sector carbon dioxide emissions increased by 12 percent New England-wide between 1990 and 2001 and now represent the largest source of emissions in the region. Achieving the region's global warming emission reduction targets will require the New England states, including Maine, to find ways to *reduce* global warming emissions from cars and trucks. And the most promising way to achieve that goal is by reducing the rate of growth in vehicle travel – particularly single-passenger travel in automobiles and light trucks.

A thoughtful approach to reducing vehicle travel must begin from a detailed assessment of who is driving, how much they are driving, why and where. The U.S. Census Bureau collects detailed survey data that enable us to come up with a detailed portrait of one important source of vehicle travel: the journey to and from work.

The analysis that follows suggests that wise land-use and transportation policies can reduce carbon dioxide emissions from the daily commute and can have ripple effects on other sources of vehicle travel. Mustering the political will to implement those policies may be challenging, but if the region is serious about addressing global climate change – and reducing the threats it poses to Maine – the time to do so is now.

The journeys Maine residents make to and from work have a large impact on the state's contribution to global warming. Reducing global warming emissions from commuting can have positive ripple effects both on other transportation-related emissions and on other aspects of quality of life in the state.

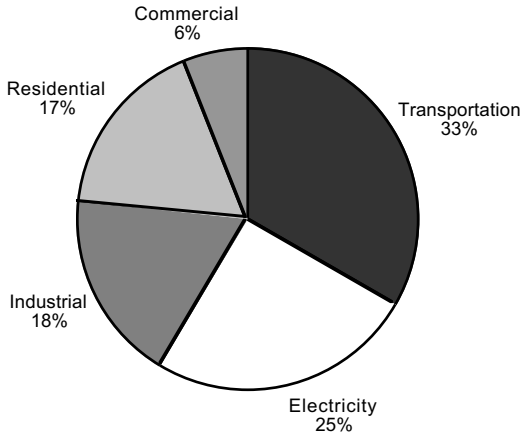
The Role of Transportation in Global Warming

The transportation sector is responsible for just under one-third of Maine's contribution to global warming and more than one-third of its releases of carbon dioxide.[1] (See Fig. 1.)

Cars and light trucks – such as pickups, minivans and SUVs – are the most important sources of global warming pollution within the transportation sector, responsible for about two-thirds of all transportation-sector emissions and about one-fifth of Maine's total global warming pollution.[2] Mainers are traveling more miles in their cars and light trucks than ever before. Between 1985 and 2002, the number of vehicle-miles traveled (VMT) annually on Maine highways increased from 9.4 billion miles to 14.7 billion miles – an increase of 56 percent.[3]

Given recent trends in vehicle travel and average per-vehicle global warming emissions, global warming pollution from transportation can be expected to increase over the next several decades. Carbon dioxide pollution from cars and light trucks in Maine could increase by approximately 41 percent over 1990 levels by 2020 unless action is taken to reduce emissions.[4]

Fig. 1. Maine's Carbon Dioxide Emissions from Fossil Fuel Consumption, 2001[5]



Reining in carbon dioxide pollution from the transportation sector is a key part of the regional Climate Change Action Plan – adopted in 2001 by New England governors and premiers of eastern Canadian provinces – which calls for overall reductions in global warming pollution to 1990 levels by 2010 and to 10 percent below 1990 levels by 2020.[6]

During the past three years, under the leadership of Governor John Baldacci, Maine has reinforced its commitment to achieving the regional emission reduction goals. In May 2003, the governor signed a law committing Maine to achieving the goals for reducing global warming pollution established in the regional Climate Change Action Plan. This law also required the state to develop a plan for meeting these goals. In December of 2004, the Department of Environmental Protection (DEP) released the *Climate Change Action Plan for Maine.* This plan recognizes that in order to curb transportation sector emissions, the state must go beyond setting strong emission standards; it must also find ways to stop the growth of vehicle-miles traveled.[7]

Reducing global warming pollution from commuting can play a key role in lowering overall transportation sector emissions. It can also lead to changes in development patterns, modes of travel, and personal decisions that can bring reductions in other, non-work related transportation emissions as well, and also produce other benefits for the state.

Why Commuting Matters

Maine's transportation system is designed with many goals in mind, but foremost among them is enabling people to travel conveniently to and from work. The effectiveness of the transportation system is largely judged by its ability to carry traffic at peak periods during the day, which tend to be those periods during which most people are driving to or from work.

Cars and Global Warming: A Primer

Global warming is caused by the release of pollution that traps the sun's radiation near the earth's surface. Over the past 250 years – and particularly since World War II – the concentration of these heat-trapping gases in the atmosphere has increased dramatically, and the earth's surface temperatures have begun to rise.

Scientists believe that continued releases of global warming gases – the most significant of which is carbon dioxide – will lead to increasing global average temperatures in the decades to come. Among the potential impacts of global warming are rising sea levels, more severe storms, changes in precipitation, and difficult-to-predict effects on wildlife, ecosystems and public health.

Carbon dioxide is released to the atmosphere mainly through the burning of fossil fuels, such as the gasoline consumed in cars and light trucks. Unlike other pollutants, which can be captured or otherwise eliminated through the use of emission-control devices, carbon dioxide is a natural product of fossil fuel combustion. As a result, there are three main ways to reduce carbon dioxide emissions from vehicles:

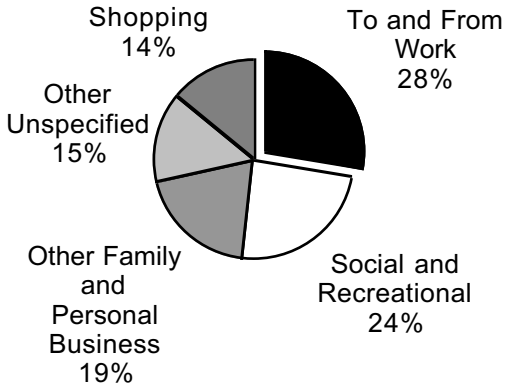
1) drive fewer miles
2) switch to low-carbon fuels
3) burn less fuel per mile

Cars and trucks also release small amounts of other chemicals that contribute to global warming, such as methane, nitrous oxide and fluorocarbons from vehicle air conditioning systems. Enhanced emission control systems and the substitution of coolants with less impact on the climate can reduce these types of emissions.

Transportation decisions have changed the state's landscape dramatically over the past several decades. The construction of Interstate highways in the 1950s and 1960s, among other public policies, enabled workers who had long lived in urban areas to construct homes in distant suburbs. At the same time, those highways facilitated the movement of jobs and industry away from the urban core.

The result of these decisions has been more and longer commutes. Nationally, the average commute is 12 miles in length, compared with 8.55 miles in 1983. And while commuting makes up a smaller proportion of vehicle travel than it has in the past (28 percent in 2001 versus one-third in 1969), it is still the leading source of vehicle travel.[8] (See Figure 2.)

Fig. 2. Vehicle-Miles Traveled by Trip Purpose, U.S., 2001



The public policies that help shape commuting behavior – such as residential and commercial zoning policies and transportation infrastructure investments – also impact other aspects of vehicle travel. Individuals who live in densely populated neighborhoods are more likely to walk or bicycle to engage in shopping, recreation or other opportunities.[9] Conversely, residents of low-density suburbs often have little choice but to drive their automobiles longer distances to conduct their daily non-work activities.

Transportation experts have noted the importance of "trip chaining"– the stringing together of trips for work, shopping, educational and other purposes. A typical trip chain might involve a worker who leaves home in the morning with his or her children, drops them off at school, stops by the dry cleaner, and picks up a cup of coffee before arriving at work. Again, a person living and working in an area of compact development might be able to conduct this mix of activities by transit or on foot (or with a combination of driving and transit), while a suburban worker might conduct all of them by car.

The need to conduct chained trips can also influence a worker's choice of transportation mode. A worker who must pick up children at day care on the way home from work, for example, might be unable to conform his or her schedule to public transit timetables – even when transit would be a more efficient and effective way to get to and from work.

The links among the various factors that influence commuting behavior – and the links between commuting choices and choices for non-work travel— are complex. It is clear, however, that commuting and commuting-related choices play a large role in transportation global warming emissions in Maine, and that policies that reduce carbon dioxide emissions from commuting may result in additional emission reduction benefits from other forms of travel.

Other Impacts of Commuting

While this report examines the global warming impact of commuting, work-related trips – especially single-passenger automobile commutes – have a series of other important impacts on the environment and society.

- **Air pollution** – Automobiles are major contributors to health-threatening air pollution in Maine. Cars and light trucks are responsible for about 51 percent of Maine's emissions of nitrogen oxides (NOx) and about 38 percent of emissions of volatile organic compounds (VOCs) – the two chemical components of ozone smog.[10] Vehicles also emit other health-threatening pollutants – such as particulate matter and toxic chemicals – in their exhaust.

- **Traffic** – In Maine, turnpike traffic has more than tripled over the past two decades, resulting in increased congestion, accelerated road degradation, and rising concerns about safety.[11] The recent widening of the Maine Turnpike from the New Hampshire border to Portland – while intended to relieve traffic – will likely spark additional vehicle travel that will add to congestion on other highways and, eventually, the turnpike itself. Single-passenger automobile commutes are key contributors to increasing vehicle traffic, and policies and practices that encourage single-passenger automobile commutes add to these problems.

- **Highway expenditures** – Increased traffic and congestion often bring calls for new or expanded highway capacity – both major highways and local roads and streets. Expansion of road capacity imposes large costs on state and local governments, both for highway construction and for ongoing maintenance. In 2003, the state spent nearly $579 million on highway construction, operation and maintenance.[12]

Policies that reduce global warming emissions from commuting can reduce many of these other costs as well.

Global Warming Emissions from Commuting in Maine

About the Study

In this report, we use data collected by the U.S. Census Bureau during the 2000 decennial census to estimate the carbon dioxide emissions produced by commuters traveling to and from various locations in Maine and neighboring states. This analysis, which uses a simple methodology, produces rough estimates of total and per-commuter emissions from commuting trips that are useful in evaluating how various factors influence commuting-related emissions.

However, the methodology has several limitations:

1) We use average carbon dioxide emission factors that are applied to all cars and transit vehicles in the state. As a result, this study does not take into account local variations in the amount of carbon dioxide produced per mile by vehicles – for example, the propensity of residents of one town to own less-efficient vehicles than those in another, or variations in ridership among commuter rail or bus lines.

2) To preserve individual privacy, the Census Bureau does not disclose information for trips that are taken by a small number of people. These low-frequency trips are not included in the analysis.

3) We use town-level geographic data to estimate the length of each trip. In effect, we assume that all trips are from the center of one town to the center of the other, and that trips within a town average the length of the radius of the town. The use of more detailed geographic data (for example, at the census tract level), might produce more robust results.

4) This analysis looks at commutes made to and from Maine's more than 480 cities, towns, and plantations; areas classified as unorganized territories (UTs), reservations or gores were not included. Although reservations, gores and unorganized territories represent more than a third of the state's geographic area, commuters to or from these areas are responsible for less than 1 percent of Maine's total carbon dioxide emissions.

5) The Census Bureau survey allows only one choice of commuting mode and asks respondents to choose the mode used most frequently and for the greatest distance. As a result, for example, individuals who drive to a park-and-ride and then take a bus will generally list their mode of travel as "bus." The automobile portion of this commute does not appear in the data and is not reflected in this analysis.

For a more detailed description of the methodology, see Appendix A. See Appendix A also for suggestions for further research to deepen and broaden the analysis presented here.

Commuting Emissions by Place of Residence

Statewide

Commuters residing in Maine were responsible for a little over 1 million metric tons of carbon dioxide emissions in 2000.[13] (See map on Page A of the color insert at the center of this report.) The list of the top 20 cities and towns whose residents generate the greatest amount of carbon dioxide emissions from commuting is dominated by cities and towns – such as Portland and Lewiston – located along the southern I-95 and I-295 corridors. (See Table 1.)

Interestingly, no one community dominates the list of the top 20 cities and towns with the highest commuting-related carbon dioxide emissions by place of residence. Rather, global warming emissions are highly dispersed among a large number of cities, suburbs, and exurbs – with the top 20 towns responsible for only 29 percent of total emissions statewide.

The average commuter living in Maine produced 3,970 pounds of carbon dioxide per year. Across the state there is wide variation in the per-commuter carbon dioxide emissions produced by place of residence. (See map on page B of the color insert.)

Many of the communities with the highest per-worker carbon dioxide emissions from commuting are in rural areas, where there are few residents and, as a result, a limited overall impact on statewide emissions.

Among the 50 communities with total emissions of greater than 5,000 metric tons per year, the top 10 towns for per-worker emissions are predominantly suburban or exurban bedroom communities located in the southern part of the state. (See Table 2.)

By contrast, the list of communities with the lowest levels of per-worker emissions (among those with at least 5,000 metric tons of annual emissions) is dominated by the state's largest cities and suburban communities located adjacent to these cities. (See Table 3.)

The degree of variation among residents of the state's towns is significant. According to these estimates, the average worker living Limington emits *almost four and a half times* the level of global warming pollution annually from his or her daily commute as the average worker living in South Portland.

In addition to Maine-based commuters, a number of people travel from New Hampshire and Massachusetts to workplaces in the Pine Tree State. These trips generate less than 11,000 metric tons of carbon dioxide each year – slightly more than 1 percent of the total emissions created by commutes made entirely within Maine.

Table 1. Commuting-Related Carbon Dioxide Emissions by Place of Residence, Top 20 Cities and Towns

City or Town	Total CO_2 Emissions (metric tons)
Portland	33,681
Sanford	20,666
Lewiston	19,146
Auburn	17,394
Windham	16,710
Biddeford	16,258
Bangor	15,405
Saco	15,294
York	14,426
Brunswick	14,228
Standish	12,971
Gorham	12,627
Scarborough	12,188
Augusta	11,403
Kennebunk	10,891
Wells	10,755
South Portland	10,142
Buxton	9,983
Lisbon	9,775
Waterboro	9,678

Table 2. Top 10 Cities and Towns for Per-Worker Carbon Dioxide Emissions by Place of Residence
(Communities with Greater than 5,000 Metric Tons of Emissions)

City or Town	CO_2 Emissions per Worker (lb/yr)
Limington	8,110
Naples	7,629
Waterboro	7,510
Hollis	6,901
Bridgton	6,736
Raymond	6,397
New Gloucester	6,000
Standish	5,890
Lebanon	5,863
Turner	5,859

Commuting Emissions by Place of Work

Another way to look at the impact of commuting on global warming is to look at emissions by place of work – that is, what towns in Maine attract commut-

Table 3. Lowest 10 Cities and Towns for Per-Worker Carbon Dioxide Emissions by Place of Residence
(Communities with Greater than 5,000 Metric Tons of Emissions)

City or Town	CO_2 Emissions per Worker (lb/yr)
South Portland	1,838
Portland	2,196
Bangor	2,270
Westbrook	2,516
Lewiston	2,656
Waterville	2,789
Falmouth	2,978
Augusta	3,054
Old Town	3,057
Presque Isle	3,169

ers who produce greater or lesser amounts of global warming pollution. Carbon dioxide emissions from commuters traveling to work in Maine totaled approximately 980,000 metric tons in 2000. The majority of commuters traveled to workplaces in major cities and in towns located in southern Maine. (See map on page C of the color insert.)

The list of the top 10 cities and towns for commuting emissions by place of work is dominated by the state's largest cities. (See Table 4.) Portland-bound commuters were responsible for more emissions than commuters heading to any other location in the state – 13 percent of the state's total commuting-related emissions.

The top 20 cities and towns are responsible for about 60 percent of total emissions – indicating the potential to achieve significant emission reductions through efforts targeted at reducing single-passenger commuting to these cities and towns. However, the growth of employment in suburban towns that are further down the list – such as Scarborough, Saco, Windham and Freeport – suggests that efforts to reduce emissions from suburb-to-suburb commutes are also important.

Table 4. Commuting-Related Carbon Dioxide Emissions by Place of Work, Top 20 Cities and Towns

City or Town	Total CO_2 Emissions (metric tons)
Portland	130,608
Bangor	65,830
Augusta	62,369
South Portland	42,717
Lewiston	35,030
Brunswick	30,295
Auburn	25,032
Scarborough	23,126
Bath	20,614
Westbrook	19,006
Kittery	18,611
Waterville	18,482
Saco	14,893
Biddeford	14,815
Freeport	13,936
Presque Isle	13,531
Ellsworth	12,627
Belfast	11,669
Sanford	11,443
Windham	9,746

Throughout Maine, per-commuter carbon dioxide emissions vary widely by place of work. (See map on page D of the color insert.) Among cities and towns with total inbound commuting emissions of 5,000 metric tons or more, the leading communities for emissions are in close proximity to major highways – such as Millinocket, Augusta and Kittery. (See Table 5.) The top three towns also have far more workers coming into the community each day than they do leaving for workplaces in other towns – suggesting that they draw workers from a wide geographic area.

Table 5. Top Five Cities and Towns for Per-Worker Carbon Dioxide Emissions
(Communities with Greater than 5,000 Metric Tons of Inbound Emissions)

City or Town	Total CO_2 Emissions (metric tons)
Millinocket	6,436
Kittery	5,457
Augusta	5,431
Wells	5,327
Hampden	5,287

Interestingly, the list of towns with the lowest per-capita inbound emissions does not include any large cities, but is dominated by towns – such as Bar Harbor, Camden, Rockland and Biddeford – located along Maine's coast. (See Table 6.)

Table 6. Bottom Five Cities and Towns for Per-Worker Carbon Dioxide Emissions
(Communities with Greater than 5,000 Metric Tons of Inbound Emissions)

City or Town	CO_2 Emissions per Worker (lb/yr)
Orono	2,514
Camden	3,097
Rockland	3,194
Biddeford	3,251
Bar Harbor	3,264

Out-of-State Commutes

Maine residents traveling to workplaces in other states generate 4 percent of the total emissions created by commuters living in Maine – about 43,000 metric tons of carbon dioxide each year. The majority of emissions from out-of-state commuters are generated on trips made to New Hampshire and Massachusetts.

Maine residents commuting to Boston generate more global warming emissions than commuters traveling to any other out-of-state town. Indeed, if Boston were a town in Maine, it would rank 20th on the list of communities generating the greatest amounts of in-bound global warming emissions. (See Table 7.)

Table 7. Top 10 Out-of-State Destination Cities and Towns for Carbon Dioxide Emissions Generated by Maine Residents

City or Town	Total CO_2 Emissions (metric tons)
Boston, MA	10,540
Portsmouth, NH	9,501
Dover, NH	3,693
Rochester, NH	2,396
Conway, NH	2,300
Newington, NH	1,524
Exeter, NH	1,207
Durham, NH	1,196
Somersworth, NH	929
Hampton, NH	929

Factors Influencing Commuting Emissions

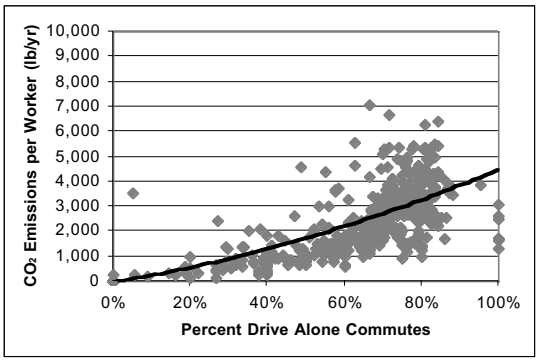
Across Maine's more than 400 cities, towns and plantations, global warming emissions from commuting can be explained by several factors, specifically: the use of transit and other transportation alternatives; the degree to which commuters live near their work; and population growth and patterns of sprawling development.

Use of Transit and Transportation Alternatives

Global warming emissions from commuting are directly correlated with the degree to which commuters drive to work in single-passenger automobiles. The use of transit and other transportation alternatives (such as carpools and vanpools, walking and biking, and telecommuting) can significantly reduce global warming emissions.

In Maine, 78 percent of all commuters drive alone when traveling to work. Throughout the state there is a strong correlation between single-passenger commuting and per-worker carbon dioxide emissions. As Fig. 3 shows, global warming emissions per worker increase as the percentage of commutes made in single-passenger vehicles increases.

Fig. 3. Percentage Drive-Alone Commutes vs. Per-Commuter Carbon Dioxide Emissions by Place of Work

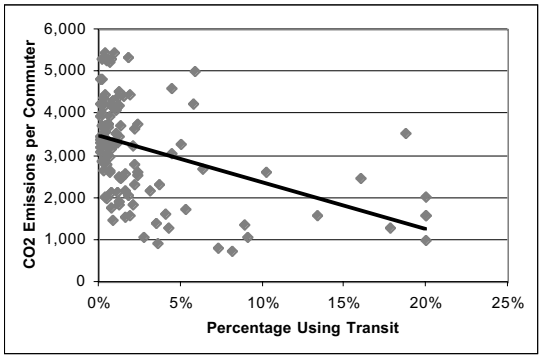


This graph clearly illustrates that towns attracting the highest percentage of drive-alone commuters also generate the greatest carbon dioxide emissions. Although Fig. 3 shows that many towns in Maine have less than half of inbound commuters driving alone to work, it is important to note that many of these towns are quite small and have a large proportion of work-at-home "commuters," which may include farmers working their own land.

The high reliance on drive-alone commuting is related to the fact that relatively few workplaces in Maine are served by transit. Indeed, there are only 58 communities in Maine in which more than 1 percent of inbound commuters use transit to get to work and only 18 communities where at least 5 percent of inbound commuters use transit to get to work.

However, looking closely at communities served by some form of transit (bus, rail or ferry), it is clear that per-worker emissions of carbon dioxide decline as the percentage of workers taking any form of transit increases. (See Fig. 4.)

Fig. 4. Percentage Transit vs. Per-Commuter Carbon Dioxide Emissions
(Workplaces Served by Transit)



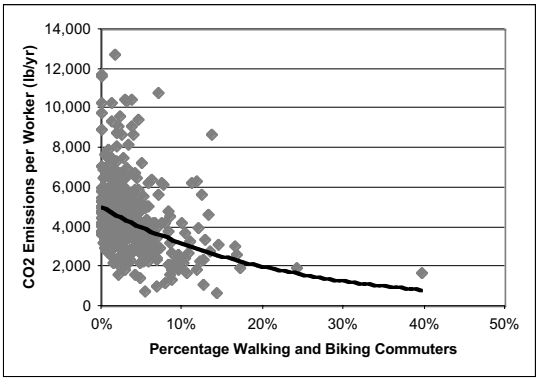
Although there is not much transit available in many parts of Maine, the relationship between per-commuter emissions and the percentage of people who ride the bus, train or ferry appears to be strong – towns in which more commuters use transportation alternatives to get to work generate lower levels of carbon dioxide emissions.

There are numerous challenges to providing transit in Maine, given that, outside of a few centers of population, population densities in Maine are relatively low. But even in Maine's biggest city, Portland, less than 3 percent of workers commute

using transit. Were Maine to increase levels of transit ridership, especially in the Portland metropolitan area and large towns in other parts of the state, the impact on carbon dioxide emissions would be significant.

Another alternative is walking or riding a bike to work. Looking more specifically at these types of non-vehicular commutes, the general trend is clear: towns with an increased percentage of pedestrian and bicycle commuting generate lower levels of carbon dioxide emissions per worker. (See Fig. 5.)

Fig. 5. Percentage Non-Vehicular Commutes vs. Per Commuter Carbon Dioxide Emissions by Place of Residence
(Towns with More Than 100 Commuters)



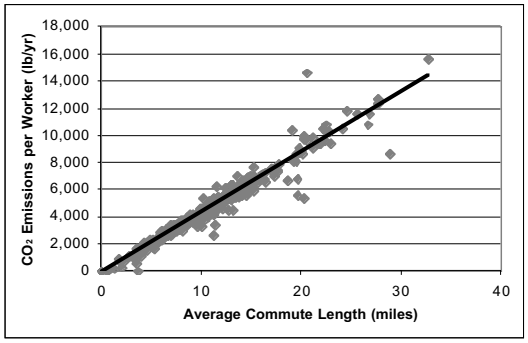
This relationship suggests that efforts to encourage more non-vehicular commutes – such as walking or biking to work – have the potential to significantly reduce carbon dioxide emissions from commuting. Expanding bike paths, creating dedicated bike lanes, and employing a variety of pedestrian-friendly traffic calming techniques should therefore be an important part of the state's transportation plans. In addition, ensuring that suitable housing is available for workers near their place of work would also enable more commuters to walk or bike to work.

Efforts to encourage alternatives to drive-alone commuting – such as transit and non-vehicular commutes – have the potential to yield significant reductions in carbon dioxide emissions from commuting. Promoting and broadening the availability of transportation alternatives must be a key component of any plan to reduce global warming emissions in Maine.

Population Density and Living Near Work

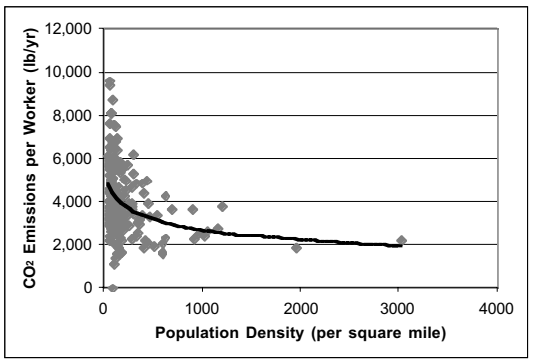
One simple, but often overlooked, way to reduce global warming emissions from commuting is to encourage commuters to live closer to their place of work. In fact, average commute trip length appears to have the strongest relationship of any factor with carbon dioxide emissions by place of residence. (See Fig. 6.)

Fig. 6. Average Commute Length vs. Per-Commuter Carbon Dioxide Emissions by Place of Residence



Thus, one of the most powerful steps Maine could take to reduce global warming emissions from commuting would be to encourage workers to live nearer their places of work. Traditional New England town design encourages this by placing residences close to town centers and by mixing residential and commercial development. Indeed, per-worker carbon dioxide emissions are also correlated with the population density of the towns in which they live. (See Fig. 7.)

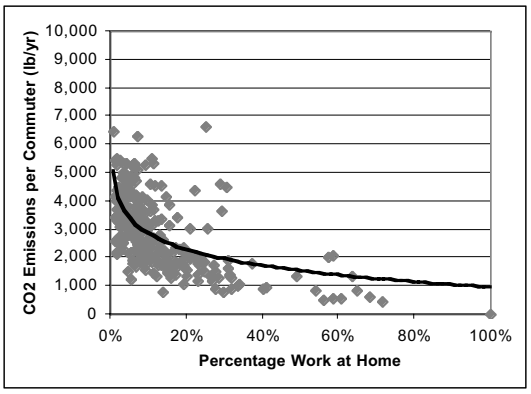
Fig. 7. Population Density vs. Per Commuter Carbon Dioxide Emissions by Place of Residence (Towns with At Least 50 Residents per Square Mile)



In other words, low-density, sprawling residential development encourages greater carbon dioxide emissions from commuters, while higher density development encourages low levels of global warming emissions. The reasons for this are open to debate, but there are several possible factors including the likelihood that, in more densely developed communities, jobs will be in closer proximity to homes and that transportation alternatives are more widely available.

Another way to reduce global warming emissions from commuting is by encouraging people to telecommute and work from home. Communities in Maine with the highest percentage of work-at-home commuters are located in rural parts of the state. These communities tend to have very low per-commuter carbon dioxide emissions. Indeed, there exists a very strong relationship between percentage of "commuters" who work from home and a town's average per-commuter carbon dioxide emissions. (See Fig. 8.)

Fig. 8. Percentage Work-At-Home Commuters vs. Per-Commuter Carbon Dioxide Emissions by Place of Work (Towns Attracting More Than 100 Commuters)



Towns with a very high percentage of workers who work at home are typically quite small and are often located in rural parts of the state or in towns with little other employment. Nevertheless, the robust relationship between commute length, population density and per-commuter carbon dioxide emissions is one that the state cannot ignore. Reducing global warming emissions from transportation should include efforts to promote living closer to work – and working from home – while preventing sprawling low-density land development and discouraging long-distance commutes.

Long-Distance Commutes

The average trip to work in Maine is approximately 9 miles, yet more than 19,000 Mainers routinely commute at least 30 miles to work. The 3 percent of commuters who make these long-distance trips are responsible for producing nearly 153,000 metric tons of carbon dioxide emissions each year – or 15 percent of total emissions created from commuting by Maine residents. Long-distance commuters generate four times the amount of carbon dioxide as the typical Maine resident.

In Maine, and all across the country, commutes have steadily become longer in the past several decades. Nationally, the number of workers making "stretch commutes" (those of 50 miles or more) has swelled to more than 3 million. The vast majority of these commutes – about 96 percent – are by personal vehicles.[14]

The town of Limington is a classic example of a long-distance bedroom community. The majority (62 percent) of all commutes from this formerly rural town are made to cities and regional employment centers located at least 20 miles away. (See Table 8.)

Table 8. Top 10 Destinations for Commuters from Limington, By Percentage of Total Carbon Dioxide Emissions

City or Town	Average Commute Length (miles)	% of Total Outbound Emissions
Portland	22	27%
South Portland	23	13%
Wells	29	9%
Westbrook	18	8%
Scarborough	20	7%
Gorham	13	5%
New Gloucester	26	4%
Windham	15	4%
Standish	7	4%
Lewiston	36	3%

Commuters traveling at least 20 miles to work produce 77 percent of Limington's outbound carbon dioxide emissions. Most of these commuters travel within Maine either to Portland or Portland's near suburbs. As there are almost no transit alternatives

available to these commuters, it is not surprising that 76 percent of them drive alone to work.

As sources of total emissions, towns like Limington (ranking 40th in terms of total emissions by residents) barely register on the map. Yet towns like Limington with a high percentage of long-distance commuters are sentinels of a broader movement toward sprawling development in Maine. Limington's population grew by 22 percent between 1990 and 2000. This type of rapid population growth in an area with such high per-commuter emissions has significant potential impacts on carbon dioxide emissions in the future.

Continued sprawl development in formerly rural regions poses a significant challenge to Maine's ability to control carbon dioxide emissions from commuting in the future. Therefore, adopting more compact development patterns, combining residential and commercial development, promoting transit oriented development, and reducing sprawl itself are potentially important steps the state could take to deal with this trend. The state's ongoing efforts to get towns to create and implement appropriate growth management plans will continue to be one of the most important tools to focus development in town centers and create more compact and mixed-use developments.

Getting it Right: College and Traditional Coastal Towns

Scattered throughout Maine are pockets of relatively low per-worker emissions – many of these communities have economies centered around colleges or tourism.

College Towns

Residents of Maine's college towns have some of lowest per-commuter carbon dioxide emissions in the state. For example, the average commuter living near the University of Maine, in Orono, produces less than 1,965 pounds of carbon dioxide per year – less than half the state average. Residents of towns near Bates College (Lewiston), Colby College (Waterville) and Bowdoin (Brunswick) also produce lower than average per-commuter emissions.

A major reason for low per-commuter emissions among residents of "college towns" is the relatively short length of commutes. For example, the average commute length in Maine is slightly more than 9 miles long, yet the average Orono resident has a 5 mile commute to work. Residents of Lewiston, Waterville and Brunswick also have shorter than average commute lengths.

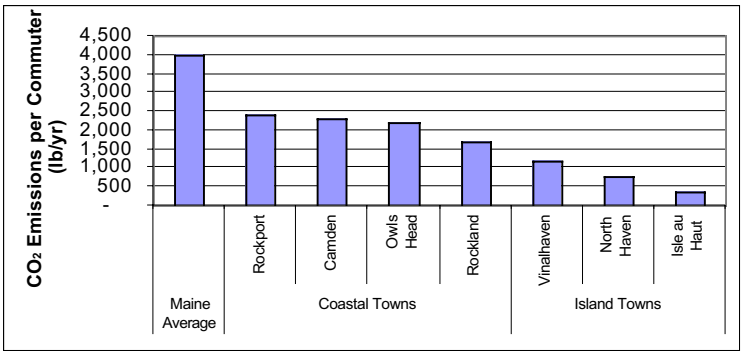
Because the average commute is quite short in college towns, more residents are able to bike or ride to work. Orono has one of the highest percentages of non-vehicular commutes in the state – 24 percent of residents walk or ride a bike to work. Similar patterns exist in Lewiston (9 percent non-vehicular commutes), Waterville (13 percent non-vehicular commutes) and Brunswick (11 percent non-vehicular commutes).

Coastal and Tourism Towns

Throughout its history, the costal area of midcoast Maine has served as a destination for visitors, as well as a home to thousands of Mainers who make their living from the sea. Scattered along this coast are a number of quaint New England villages and small communities with traditional downtowns. In addition to their natural resource-based jobs, these traditional towns have attracted residents and businesses who want a high quality of life – exemplified by MBNA's decision to locate in Rockland.

Looking more closely at commuting patterns in midcoast Maine's Knox County it is clear that residents of costal towns and island communities generate relatively low levels of per-commuter emissions (although the Census survey may not accurately capture all commuting-related emissions from island towns. See footnote.)[15] (See Fig. 9.)

Fig. 9. Per-Commuter Carbon Dioxide Emissions from Residents of Knox County



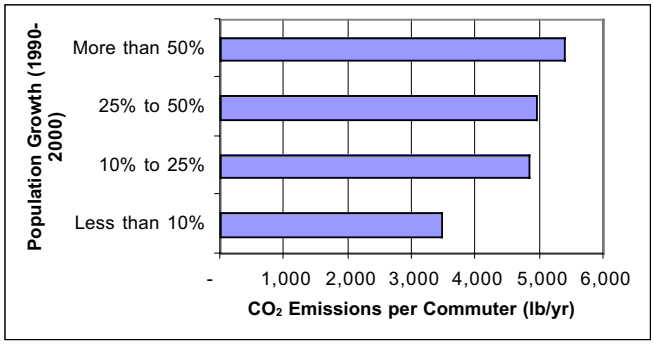
Relatively short commutes to work is the primary factor behind these low levels of per-commuter carbon dioxide emissions. The average commute from the coastal communities of Rockport, Camden, Owls Head and Rockland is 5 miles long. Limited by obvious geographic boundaries, the average commute from the island communities of Vinalhaven, North Haven and Isle au Haut is less than two-and-a-half miles long.

In some ways, college towns and small coastal towns are unique cases. However, they provide valuable lessons for communities throughout Maine. The short commute lengths and high percentage of non-vehicular commutes in these towns suggest the importance of living near work. They illustrate the "success" of traditional New England towns – ones with well defined town centers, a mix of residential and commercial development, and relatively short commutes to work. These types of communities provide alternatives to sprawling patterns of development occurring elsewhere in Maine.

Population Growth and Land Development

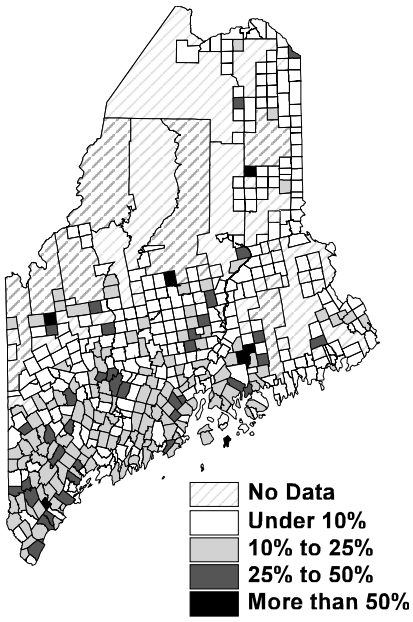
All across New England and around the country, suburban development patterns have played a major role in increasing automobile travel – and, by extension, increasing global warming emissions. In Maine, growth of formerly rural, residential "exurbs" has threatened to further exacerbate global warming emissions from commuting.

Fig. 11. Average Per-Commuter Carbon Dioxide Emissions (by Place of Residence) in Cities and Town with Various Rates of Population Growth



Over the past decade, there has been an explosive growth of "exurbs" in the southern portion of the Maine. Many formerly rural communities, located beyond the suburbs, are rapidly becoming bedroom communities for large urban areas and other centers of employment. (See Fig. 10.)

Fig. 10. Population Growth 1990 to 2000[16]



Generally, faster-growing towns have higher levels of per-commuter emissions, with residents of towns experiencing rapid (50 percent or greater) population growth between 1990 and 2000 producing more than one-third more carbon dioxide from their daily commutes than the state average. (See Figure 11.)

Sprawl development poses several problems from a global warming perspective. Most notably, sprawling "exurban" communities are distant from centers of employment and transit infrastructure, meaning longer commutes that are less likely to occur via transit.

Continued sprawl development in formerly rural regions poses a significant challenge to Maine's ability to control carbon dioxide emissions from commuting. Therefore, developing more compact development patterns, combining residential and commercial development, and expanding access to transit alternatives – while working to reduce sprawl itself – are potentially important steps the state could take to deal with this trend.

Policy Recommendations

The data presented in this report point the way to several conclusions regarding how Maine can reduce carbon dioxide emissions resulting from journeys to work.

Cleaner Vehicles

Maine can take immediate action to reduce global warming pollution from commuting by adopting and implementing the clean cars program, which will set strong emission standards for global warming pollution from cars and light trucks. The state should also consider other measures to encourage the purchase of vehicles that produce less carbon dioxide per mile.

Invest in Transportation Alternatives

The scarcity of transit alternatives in Maine leads to an increased reliance on drive-alone commutes and increased global warming pollution. The state must increase availability of transit alternatives, especially in southern Maine, where residents are responsible for producing the greatest amounts of carbon dioxide emissions from commuting.

Maine should invest in its transportation infrastructure in ways that will lead to reductions in global warming emissions. The state's transit needs are great – including the expansion of regional rail and commuter bus service and the provision of more frequent service at reasonable cost on existing transit routes. However, Maine's constitutional requirement that gasoline tax revenue be dedicated only to highways and bridges makes funding transit projects significantly more difficult than funding highway improvements. The state should continue to look for new funding sources for transit while avoiding highway projects (such as expansion of the Maine Turnpike without corresponding transit improvements) that would promote long-distance commuting by single passenger vehicles and increase global warming pollution.

Expand the Regional Rail Network

Expanding regional commuter rail service has the potential to significantly reduce carbon dioxide emissions from commuting. The Census data used in this report were collected before the launch of Amtrak's Downeaster rail service from Portland to Boston, but both ridership and revenues have exceeded projections. Building upon the success of this project, by bringing rail service north to Brunswick and beyond, would eventually allow the state to provide low-emission transit alternatives while reducing traffic congestion on Maine's busiest sections of Interstate highway.

However, the success of an expanded regional rail network as a global warming-fighting tool depends on the maintenance of high standards of service quality and affordable fares. Reductions in service quality or significant increases in fares that discourage transit use could set the region back in its quest to reduce transportation-sector global warming emissions and must be avoided.

Bus Service and Ride Sharing

Although expansion of the regional rail network is a step in the right direction, given the state's relatively low population density and dispersed commuting patterns, this alone is not enough; Maine must actively develop other transit alternatives.

A variety of bus services have the potential to provided transit alternatives to commuters traveling within, between, and to large metropolitan areas. When expanding bus services, it is critical that local municipalities work together to provide streamlined bus service throughout the larger metropolitan area. The state should focus on improving existing commuter bus services in the Portland metropolitan area, to other major employment centers, and to communities located along the Maine Turnpike – where the ZOOM Turnpike Express commuter bus service has proven successful.

The state can also increase transportation alternatives by expanding its successful efforts to promote

carpooling and vanpooling. The addition of several new vanpool routes to the Go Maine program, and Gov. Baldacci's efforts to encourage ride-sharing among state employees are good efforts in this direction and should be expanded upon.

In addition to facilitating the increased use of transportation alternatives among commuters, an expanded and better integrated transportation network has the potential to significantly increase the use of transportation alternatives by Maine's many tourists. The recent revival of seasonal operation from Brunswick to Rockland on a restored historic train may be a successful combined transit and tourism endeavor. Acadia National Park's successful Island Explorer buses are mainly designed for tourists, but are used by workers in the summer as well.

Hold Large Workplaces Accountable for the Emissions they Generate

Suburban workplaces are responsible for a significant portion of the carbon dioxide emissions generated by people working in Maine. Employers who choose to build in these areas must be required to mitigate the impact they have on the state's transportation network and the global climate. One way to do this is to require that employers with a certain number of employees implement commute-trip reduction plans aimed at reducing the number of single-passenger automobile commuters. Smaller employers in a given area could be required or encouraged to join together to support joint commute-trip reduction efforts.

Businesses should also be encouraged to participate in existing ridesharing and employee benefits programs such as Go Maine, and to locate new buildings along transit routes.

Encourage Mixed-Use and Transit-Oriented Development, Live-Near-Work and Telecommuting

As the data presented above show – and the experience of communities around the state demonstrates – living near work can be a powerful force to reduce carbon dioxide emissions.

Pedestrian commutes are often disregarded in transportation planning, but from a global warming perspective they are very important. However, pedestrian commutes are only possible when workplaces and residences are in close proximity and where pedestrian infrastructure (such as sidewalks and safe crossing points) exists. New England's traditional town centers provide a model of how to mix uses in a way that is beneficial to a community's character and its environment. The state and its towns should encourage mixed-use development in town centers and adopt practices – such as traffic calming techniques – that are friendly to pedestrian commuters.

These practices would be bolstered by efforts to encourage greater density in suburban developments and to encourage the redevelopment of urban areas. New suburban developments should be designed so that the automobile is not the sole means of transportation. Existing suburbs should be encouraged to promote "infill" development. And state investments should be directed to encouraging the redevelopment of existing properties in urban areas that would be sites for affordable housing or new commercial development.

Transit-oriented development – which incorporates compact, mixed-use development and pedestrian-friendly design – can create new centers of activity and employment that are not reliant on the automobile. The state should find ways to encourage transit-oriented development as a tool to promote better development patterns and to ensure the success of new or expanded transit services.

The state, towns and employers should explore novel ways to encourage commuters to live near their work or near transit. Commuters who live near their place of work not only reduce global warming emissions, but also reduce the strain on the state's transportation infrastructure. They should be rewarded for their choices.

Telecommuting also holds promise to reduce the number and length of commuting trips made. Employers should be encouraged to develop telecommuting alternatives for their employees.

Put the Brakes on Sprawl

The growth of sprawling "exurbs" – formerly rural areas that are now being converted long-distance bed-

room communities – is one of the most ominous trends for Maine's efforts to reduce global warming emissions from transportation. These areas are unlikely to ever have the population density or truly mixed-use development that can make alternatives to driving possible. They are likely to remain permanently automobile dependent.

Slowing sprawl requires both carrots and sticks. Providing incentives for people to live closer to their place of work, and guaranteeing that there are affordable housing options near major centers of employment, would be part of the solution. For example, several states, including Massachusetts, have created programs to help people qualify for larger mortgages if they choose to live near transit lines.

Among the sticks that can be used to slow sprawl are policies that require sprawling developments to pay their own way. State dollars should not be used to support transportation and infrastructure improvements that will facilitate further sprawl, but should rather be targeted towards areas in which growth is desirable. Towns' implementation of well-designed growth management plans, with the assistance of the State Planning Office, could be a strong force in redirecting growth and maintaining traditional town centers. The state should also investigate how to adopt tools developed in other states – such as municipal service boundaries, community preservation funds and priority funding areas – to fit within New England's strongly held tradition of home rule.

Appendix A: Methodology

Calculation of Carbon Dioxide Emissions

This analysis is based on journey-to-work data collected by the U.S. Census Bureau during the 2000 decennial Census. Maine data for county subdivisions was downloaded from the Census Bureau on January 10, 2005.

Distance between towns was calculated based on latitude and longitude coordinates for each county subdivision downloaded from the Census Bureau on January 11, 2005. Distance in miles was calculated by applying the Haversine formula to the latitude and longitude coordinates in radians. The formula is as follows:

3956*(2*ASIN(MIN(1,SQRT(SIN((latwkrad-latresrad)/2)^2 + COS(latwkrad)* COS(latresrad)*(SIN((longwkrad-longresrad)/2))^2))))

Where:

latwkrad = The latitude of the work location in radians
longwkrad = The longitude of the work location in radians
latresrad = The latitude of the residential location in radians
longresrad = The longitude of the residential location in radians

For commutes within a town, we assumed that the average trip length equaled SQRT(areares/3.14), where "areares" equals the land surface area of the town. This method could result in higher-than-warranted emission estimates for towns with a very large surface area and lower-than-warranted estimates for very small towns.

Pounds-per-mile carbon dioxide emission factors for each transportation mode were calculated as follows:

- **Drive-alone commutes**: Per-mile emissions were based on the assumption that a gallon of gasoline results in emissions of 19.6 pounds of carbon dioxide, per carbon coefficients and heat content data from U.S. Department of Energy, Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2001*, Appendix B. Average, on-road fuel economy for cars and light trucks was based on year 2001 data obtained from U.S. Energy Information Administration, *Annual Energy Outlook 2004*. Emission factors for both cars and light trucks were estimated by multiplying carbon dioxide emissions per gallon of gasoline by the inverse of on-road MPG. These values were then weighted by the ratio of registered cars to light trucks in Maine per Federal Highway Administration, *Highway Statistics 2003*.

- **Carpooling**: Emissions from carpools were obtained by dividing the emission factor for drive-alone commuters, calculated above, by the number of people in the carpool. For carpools of 4-5 commuters, 4.5-person carpools were assumed; for carpools of 6-7 commuters, 6.5; and for carpools of 7 and more, 7-person carpools were assumed.

- **Transit**: Emission factors for each transit mode were based on fuel consumption and passenger-miles data from the Federal Transit Administration, National Transit Database 2003. Data for Maine transit agencies reporting energy use data to the data base were aggregated by mode, with the sum of energy use divided by passenger-miles for each mode to arrive at energy consumption per passenger-mile of travel. Carbon dioxide emissions were estimated by multiplying energy consumption by carbon coefficients from U.S. Department of Energy, Energy Information Administration, *Fuel and Energy Source Codes and Emission Coefficients* downloaded from www.eia.doe.gov/oiaf/1605/factors.html, 17 January 2005. Emissions from transit modes consuming electricity were based on the average electric-sector carbon dioxide emissions per kilowatt-hour derived from U.S. Energy Information Administration, *State Electricity Profiles 2002*. For transit modes in which Maine transit agencies did not report energy use data, New England averages were used, calculated according to a similar methodology as described above.

- **Taxis and motorcycles**: Per-mile emissions from taxis were assumed to be the same as the per-mile emissions from cars and light-duty trucks derived above. Emission factors for motorcycles were based on an average fuel economy for motorcycles of 50 miles per gallon, per U.S. Environmental Protection Agency, *Updating Fuel Economy Estimates in MOBILE 6.3*, draft report, August 2002.

- **Non-motorized commutes and other**: Bicycling, walking and work-at-home commutes were assumed to produce zero emissions of carbon dioxide, as were commutes listed under the "other" category.

Other Notes

Emissions "per commuter" or "per worker" are based on total emissions either from a place of residence or place of work, divided by the number of commuters driving to or from that town.

This paper does not include an analysis of global warming emissions from international commutes – such as those made between Maine and Canada.

Our analysis looks only at emissions from Maine's cities, towns, and plantations – geographic areas classified as gores, reservations, or unorganized territories are not included. Given the choice of estimation method used in this paper, extreme variations in the size of these areas would have artificially introduced errors when calculating the total and per-commuter carbon dioxide emissions. It is worth noting however, that even given these methodological constraints, these areas are responsible less for than 1 percent of the state's global warming emissions.

Limitations and Suggestions for Further Research

As noted in the text, the simplified methodology used in this report appears to be sufficient to show general trends, but suffers from several limitations. We suggest several areas future researchers may wish to explore to add detail and depth to this analysis:

- Integrating vehicle registration data into the analysis to factor in variations in fuel economy among the vehicles used by residents of various towns.

- Accounting for regional differences in transit energy consumption and ridership to more accurately reflect emissions from transit modes.

- Using more detailed geographic analysis comparing transit use based on proximity to rail lines and other sources of transit infrastructure.

- Integrating more recent population and transportation data to update this analysis prior to the next decennial census.

Appendix B: Emissions and Commuting Data by Place of Residence

(Cities, Towns and Plantations Where Residents Generate At Least 500 Metric Tons of Carbon Dioxide from Commuting)

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Acton town	84%	7,647	23	2,829	109
Addison town	78%	3,319	263	720	282
Albion town	78%	6,155	55	2,297	125
Alfred town	82%	5,147	119	2,445	122
Alna town	77%	5,280	112	646	294
Alton town	78%	5,412	104	935	249
Andover town	76%	3,976	209	642	296
Anson town	84%	5,269	114	2,132	133
Appleton town	78%	5,286	111	1,257	203
Arundel town	87%	4,078	203	3,160	93
Ashland town	83%	4,553	163	1,366	197
Athens town	76%	4,969	135	619	303
Auburn city	79%	3,427	254	17,394	4
Augusta city	77%	3,054	281	11,403	14
Baileyville town	81%	2,612	304	831	261
Baldwin town	74%	7,530	25	1,746	163
Bangor city	77%	2,270	314	15,405	7
Bar Harbor town	66%	1,971	322	1,935	148
Bath city	70%	2,381	310	4,697	54
Belfast city	77%	2,722	300	3,297	90
Belgrade town	81%	5,716	77	3,611	77
Belmont town	81%	3,725	234	545	319
Benton town	89%	4,466	168	2,162	128
Berwick town	82%	5,534	95	7,685	27
Bethel town	75%	3,090	278	1,573	179
Biddeford city	79%	3,672	239	16,258	6
Bingham town	71%	4,815	144	766	273
Blaine town	83%	5,635	87	848	258
Blue Hill town	78%	3,537	246	1,664	172
Boothbay Harbor town	69%	1,861	325	799	267
Boothbay town	79%	2,566	305	1,458	186
Bowdoin town	78%	5,646	85	3,349	87
Bowdoinham town	80%	5,840	71	3,371	84
Bradford town	73%	7,338	27	1,461	185
Bradley town	83%	3,826	219	1,014	239
Brewer city	85%	1,588	330	2,899	105
Bridgewater town	89%	5,670	82	701	286
Bridgton town	77%	6,736	38	5,894	38
Bristol town	79%	2,906	290	1,394	194
Brooks town	72%	4,540	165	912	251
Brooksville town	66%	3,428	253	626	301
Brownfield town	80%	5,072	124	1,118	221
Brownville town	70%	5,903	67	1,189	210
Brunswick town	73%	3,311	264	14,228	10
Buckfield town	74%	5,593	89	2,126	134
Bucksport town	85%	4,316	182	3,933	67
Burlington town	81%	11,685	2	568	312
Burnham town	79%	5,549	93	1,095	228
Buxton town	87%	5,560	91	9,983	18
Calais city	83%	2,794	295	1,556	180
Camden town	71%	2,286	313	2,484	119
Canaan town	76%	5,142	120	1,825	156
Canton town	77%	6,206	54	917	250
Cape Elizabeth town	82%	2,341	311	4,481	56

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Caribou city	77%	3,297	266	5,178	46
Carmel town	86%	5,747	74	2,939	101
Casco town	78%	6,805	34	4,995	51
Charleston town	81%	7,180	29	1,733	164
Chelsea town	78%	3,604	243	1,777	160
Cherryfield town	76%	3,911	215	629	300
Chester town	84%	9,078	15	796	268
Chesterville town	79%	4,751	148	1,030	236
China town	83%	5,683	79	4,844	53
Clifton town	79%	5,090	123	831	262
Clinton town	86%	5,020	130	2,921	103
Corinna town	77%	5,519	97	1,944	147
Corinth town	79%	5,774	73	2,900	104
Cornish town	74%	9,592	11	2,407	124
Cornville town	82%	4,657	158	1,022	238
Cumberland town	86%	3,689	237	5,114	48
Cushing town	72%	3,720	235	1,097	227
Damariscotta town	73%	2,317	312	763	275
Dayton town	84%	6,008	60	2,466	120
Dedham town	83%	5,385	106	1,708	168
Deer Isle town	69%	2,173	319	714	284
Denmark town	76%	5,972	64	1,154	217
Dexter town	74%	4,729	149	3,182	92
Dixfield town	78%	3,570	245	1,395	193
Dixmont town	79%	7,944	22	1,647	173
Dover-Foxcroft town	78%	4,569	162	3,406	82
Dresden town	79%	5,671	81	1,848	155
Durham town	81%	5,517	99	4,476	57
East Machias town	79%	3,144	277	839	259
East Millinocket town	81%	3,943	212	1,174	213
Easton town	79%	3,515	248	900	252
Eastport city	71%	2,089	320	578	309
Eddington town	82%	4,179	197	1,962	145
Edgecomb town	78%	3,456	251	735	278
Eliot town	80%	3,462	250	3,903	69
Ellsworth city	75%	3,785	227	5,196	45
Embden town	77%	5,060	125	642	295
Enfield town	80%	9,372	13	2,875	108
Etna town	72%	6,223	53	1,095	229
Eustis town	70%	5,636	86	769	272
Exeter town	74%	6,007	61	1,046	235
Fairfield town	79%	3,439	252	4,408	60
Falmouth town	85%	2,978	284	5,976	37
Farmingdale town	81%	2,960	288	1,668	171
Farmington town	70%	3,084	279	4,051	65
Fayette town	85%	6,653	39	1,318	201
Fort Fairfield town	80%	5,010	131	3,222	91
Fort Kent town	75%	3,773	230	2,958	99
Frankfort town	82%	5,129	122	977	245
Franklin town	76%	4,911	137	1,241	205
Freedom town	77%	5,632	88	545	318
Freeport town	79%	4,551	164	7,810	26
Frenchville town	85%	3,679	238	816	264
Friendship town	71%	4,195	195	896	253

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Fryeburg town	72%	3,272	269	1,926	149
Gardiner city	82%	4,378	175	5,533	43
Garland town	81%	6,474	47	1,092	230
Georgetown town	80%	3,998	208	756	276
Glenburn town	86%	3,802	224	3,447	81
Gorham town	81%	3,902	216	12,627	12
Gouldsboro town	68%	4,242	190	1,674	170
Gray town	86%	5,724	75	9,379	21
Greenbush town	82%	6,869	33	1,973	143
Greene town	83%	4,372	176	4,173	63
Greenville town	79%	2,734	299	788	269
Greenwood town	84%	5,028	129	773	271
Guilford town	71%	3,169	274	893	254
Hallowell city	83%	2,182	317	1,125	219
Hampden town	83%	3,217	272	4,365	61
Hancock town	81%	4,574	161	2,044	141
Harmony town	68%	4,338	180	597	306
Harpswell town	77%	5,007	132	5,143	47
Harrington town	71%	3,941	213	607	305
Harrison town	77%	8,157	20	3,711	73
Hartford town	87%	6,756	36	1,225	206
Hartland town	70%	4,718	151	1,538	183
Hebron town	70%	4,229	192	1,052	234
Hermon town	88%	3,280	268	3,362	86
Hiram town	77%	8,906	16	2,154	130
Hodgdon town	80%	2,835	292	633	298
Holden town	84%	2,957	289	1,727	166
Hollis town	83%	6,901	32	6,791	32
Hope town	86%	3,768	231	1,082	231
Houlton town	85%	2,830	293	3,003	94
Howland town	80%	9,472	12	2,161	129
Hudson town	80%	5,652	84	1,583	178
Industry town	86%	5,178	118	617	304
Island Falls town	79%	5,213	116	754	277
Jackman town	82%	6,286	51	871	255
Jay town	84%	4,208	193	4,122	64
Jefferson town	78%	6,102	57	2,926	102
Kenduskeag town	87%	4,644	159	1,167	214
Kennebunk town	84%	5,301	109	10,891	15
Kennebunkport town	75%	3,652	240	2,291	126
Kingfield town	82%	3,743	233	830	263
Kittery town	77%	3,375	260	6,789	33
Knox town	77%	5,277	113	578	310
Lagrange town	85%	9,823	10	1,174	212
Lamoine town	78%	3,883	218	1,117	222
Lebanon town	78%	5,863	69	5,743	41
Lee town	83%	10,489	5	1,554	181
Leeds town	73%	5,514	100	2,271	127
Levant town	80%	5,041	128	2,415	123
Lewiston city	73%	2,656	302	19,146	3
Liberty town	76%	5,927	66	808	266
Limerick town	81%	8,718	18	3,808	72
Limestone town	83%	2,960	287	1,117	223
Limington town	76%	8,110	21	5,824	40
Lincoln town	81%	6,410	49	4,968	52
Lincolnville town	74%	3,238	270	1,416	190
Linneus town	80%	4,442	171	590	308
Lisbon town	80%	4,838	141	9,775	19

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Litchfield town	83%	6,505	44	4,317	62
Littleton town	81%	3,520	247	646	293
Livermore Falls town	82%	5,417	103	2,635	114
Livermore town	90%	6,553	41	2,577	117
Lovell town	87%	6,742	37	1,063	233
Lowell town	91%	10,295	8	538	323
Lubec town	72%	2,245	315	544	320
Lyman town	84%	5,547	94	4,450	59
Machias town	73%	1,617	329	593	307
Madawaska town	81%	2,416	307	1,861	153
Madison town	79%	3,422	256	2,551	118
Manchester town	83%	3,356	261	1,777	161
Mapleton town	83%	3,224	271	1,370	196
Mars Hill town	77%	3,975	210	1,107	225
Mattawamkeag town	84%	12,753	1	1,443	187
Mechanic Falls town	78%	4,691	154	2,996	96
Medway town	89%	6,102	56	1,478	184
Mercer town	80%	5,393	105	696	287
Mexico town	75%	1,632	328	705	285
Milbridge town	61%	3,047	282	576	311
Milford town	85%	4,096	201	2,616	115
Millinocket town	83%	2,406	308	1,925	150
Milo town	79%	5,590	90	2,094	136
Minot town	84%	4,016	206	2,068	138
Monmouth town	84%	5,527	96	4,459	58
Monroe town	77%	5,258	115	779	270
Monticello town	80%	4,717	152	630	299
Montville town	72%	5,510	101	964	246
Morrill town	74%	3,775	229	549	316
Moscow town	83%	5,991	63	561	313
Mount Desert town	78%	2,974	285	1,325	200
Mount Vernon town	83%	6,478	46	2,064	139
Naples town	81%	7,629	24	5,011	50
New Gloucester town	81%	6,000	62	6,845	30
New Portland town	71%	4,197	194	557	314
New Sharon town	79%	4,841	140	1,312	202
New Sweden town	82%	4,832	142	505	330
New Vineyard town	72%	4,235	191	514	326
Newburgh town	79%	4,761	146	1,539	182
Newcastle town	75%	3,395	258	1,218	208
Newfield town	77%	8,697	19	2,060	140
Newport town	78%	6,772	35	3,340	88
Nobleboro town	78%	3,351	262	1,150	218
Norridgewock town	76%	4,463	169	2,891	106
North Berwick town	81%	4,702	153	3,933	68
North Yarmouth town	83%	4,661	157	3,369	85
Northport town	80%	2,905	291	725	280
Norway town	76%	4,122	200	3,373	83
Oakfield town	82%	4,980	134	552	315
Oakland town	84%	3,414	257	3,825	71
Ogunquit town	68%	6,230	52	1,221	207
Old Orchard Beach town	84%	3,792	226	7,920	25
Old Town city	78%	3,057	280	5,073	49
Orland town	83%	4,281	185	1,790	159
Orono town	59%	1,965	323	3,667	75
Orrington town	88%	2,747	298	2,148	132
Otis town	79%	5,314	108	541	321
Otisfield town	86%	6,597	40	1,871	152

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Owls Head town	78%	2,181	318	682	288
Oxford town	73%	3,794	225	2,992	97
Palermo town	73%	5,519	98	1,119	220
Palmyra town	74%	4,784	145	1,726	167
Paris town	76%	4,245	189	4,033	66
Parkman town	84%	4,247	188	510	329
Parsonsfield town	78%	10,283	9	2,991	98
Passadumkeag town	89%	10,432	6	673	290
Patten town	77%	10,806	4	2,102	135
Pembroke town	75%	4,969	136	653	291
Penobscot town	78%	4,136	199	985	244
Perry town	79%	3,817	222	512	327
Peru town	82%	4,348	178	1,160	215
Phillips town	82%	5,187	117	858	257
Phippsburg town	77%	3,920	214	1,730	165
Pittsfield town	73%	5,680	80	4,531	55
Pittston town	83%	5,049	127	2,754	110
Plymouth town	79%	6,523	42	1,619	175
Poland town	86%	5,549	92	5,852	39
Porter town	75%	9,129	14	2,677	111
Portland city	71%	2,196	316	33,681	1
Pownal town	82%	5,291	110	1,763	162
Presque Isle city	77%	3,169	275	6,317	34
Prospect town	82%	4,911	138	621	302
Randolph town	77%	3,636	241	1,413	192
Raymond town	85%	6,397	50	6,077	36
Readfield town	79%	4,256	187	1,954	146
Richmond town	78%	6,074	58	3,589	78
Rockland city	69%	1,697	327	2,603	116
Rockport town	75%	2,403	309	1,611	176
Rome town	82%	10,415	7	1,799	157
Rumford town	73%	3,394	259	3,626	76
Sabattus town	79%	3,749	232	3,903	70
Saco city	82%	3,947	211	15,294	8
Sanford town	78%	4,988	133	20,666	2
Sangerville town	78%	2,988	283	676	289
Scarborough town	84%	3,200	273	12,188	13
Searsmont town	79%	4,688	155	1,029	237
Searsport town	74%	3,304	265	1,630	174
Sebago town	83%	8,795	17	2,451	121
Sedgwick town	75%	3,572	244	718	283
Shapleigh town	75%	6,963	30	3,323	89
Sherman town	73%	7,266	28	991	243
Sidney town	83%	4,605	160	3,674	74
Skowhegan town	78%	4,339	179	6,834	31
Smithfield town	85%	4,822	143	811	265
Solon town	73%	3,824	220	636	297
South Berwick town	88%	5,059	126	7,141	29
South Portland city	82%	1,838	326	10,142	17
South Thomaston town	81%	2,660	301	723	281
Southwest Harbor town	73%	1,891	324	735	279
St. Agatha town	88%	3,510	249	527	324
St. Albans town	77%	6,514	43	2,153	131

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
St. George town	78%	4,382	174	2,092	137
Standish town	82%	5,890	68	12,971	11
Stetson town	74%	6,014	59	1,099	226
Steuben town	70%	4,331	181	839	260
Stockton Springs town	79%	4,722	150	1,339	198
Strong town	77%	4,758	147	1,012	240
Sullivan town	75%	5,316	107	1,242	204
Sumner town	79%	6,481	45	1,063	232
Surry town	76%	3,627	242	1,009	242
Swanville town	81%	4,025	205	1,012	241
Thomaston town	82%	2,631	303	1,692	169
Thorndike town	79%	5,130	121	546	317
Topsham town	85%	3,783	228	7,489	28
Tremont town	74%	2,792	296	936	248
Trenton town	80%	4,005	207	1,158	216
Troy town	75%	5,783	72	860	256
Turner town	84%	5,859	70	6,271	35
Union town	78%	4,394	172	2,043	142
Unity town	64%	4,674	156	1,596	177
Van Buren town	73%	3,713	236	1,393	195
Vassalboro town	78%	4,287	184	3,546	79
Veazie town	86%	2,081	321	764	274
Vienna town	71%	6,435	48	521	325
Waldo town	76%	4,050	204	512	328
Waldoboro town	75%	3,810	223	3,481	80
Wales town	80%	4,444	170	1,206	209
Warren town	77%	3,165	276	2,640	113
Washburn town	80%	4,183	196	1,415	191
Washington town	80%	5,656	83	1,432	188
Waterboro town	82%	7,510	26	9,678	20
Waterford town	79%	6,933	31	1,853	154
Waterville city	66%	2,789	297	8,264	23
Wayne town	83%	5,952	65	1,326	199
Wells town	80%	5,702	78	10,755	16
West Bath town	82%	2,961	286	1,110	224
West Gardiner town	82%	4,383	173	2,650	112
West Paris town	77%	4,091	202	1,186	211
Westbrook city	84%	2,516	306	9,172	22
Whitefield town	76%	4,482	167	1,915	151
Wilton town	79%	3,895	217	2,877	107
Windham town	85%	4,866	139	16,710	5
Windsor town	78%	4,368	177	1,797	158
Winn town	83%	11,645	3	651	292
Winslow town	87%	3,425	255	5,238	44
Winter Harbor town	76%	2,795	294	540	322
Winterport town	79%	4,534	166	2,999	95
Winthrop town	78%	4,278	186	5,658	42
Wiscasset town	78%	3,820	221	2,943	100
Woodland town	81%	5,486	102	1,419	189
Woodstock town	77%	4,157	198	950	247
Woolwich town	81%	3,282	267	1,969	144
Yarmouth town	86%	4,299	183	7,991	24
York town	85%	5,723	76	14,426	9

Appendix C: Emissions and Commuting Data by Place of Work

(Cities, Towns and Plantations Where In-Bound Commuters Generate At Least 500 Metric Tons of Carbon Dioxide)

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Acton town	70%	5,116	18	1,174	106
Alfred town	76%	3,738	68	1,023	117
Anson town	74%	2,622	141	686	146
Arundel town	84%	4,333	40	1,731	90
Ashland town	78%	5,271	16	2,025	79
Auburn city	83%	3,735	70	25,032	7
Augusta city	84%	5,431	8	62,369	3
Baileyville town	88%	3,476	85	1,721	91
Bangor city	83%	4,317	41	65,830	2
Bar Harbor town	71%	3,264	106	5,227	38
Bath city	67%	4,200	49	20,614	9
Belfast city	80%	4,227	47	11,669	18
Benton town	77%	4,308	45	1,776	89
Berwick town	78%	3,679	73	2,515	70
Bethel town	73%	3,250	109	2,295	77
Biddeford city	82%	3,251	108	14,815	14
Bingham town	76%	3,666	74	848	132
Blue Hill town	76%	3,119	115	1,598	92
Boothbay Harbor town	79%	1,510	160	898	127
Boothbay town	73%	1,989	156	760	139
Bradley town	82%	10,471	2	2,475	72
Brewer city	84%	3,398	92	7,121	31
Bridgton town	79%	3,772	65	2,926	60
Bristol town	67%	2,325	150	769	138
Brunswick town	78%	4,315	43	30,295	6
Bucksport town	87%	3,710	72	3,921	48
Buxton town	56%	3,036	121	690	145
Calais city	83%	3,413	90	2,564	68
Camden town	74%	3,097	116	5,074	40
Cape Elizabeth town	67%	1,807	157	1,425	98
Caribou city	81%	3,471	86	5,901	37
Carrabassett Valley town	76%	4,997	19	927	125
Castine town	51%	1,796	158	575	154
Charleston town	76%	4,565	29	693	144
Corinth town	71%	4,545	30	1,331	101
Cumberland town	68%	2,033	154	1,002	120
Damariscotta town	87%	3,549	82	3,356	55
Deer Isle town	69%	3,313	102	1,041	115
Dexter town	72%	2,832	132	2,145	78
Dixfield town	67%	2,781	134	827	133
Dover-Foxcroft town	80%	4,439	34	4,342	44
East Millinocket town	83%	5,497	6	2,846	63
Easton town	79%	4,638	27	1,537	95
Eastport city	72%	2,214	151	786	136
Eliot town	73%	4,148	53	2,334	75
Ellsworth city	82%	4,892	21	12,627	17
Fairfield town	81%	4,523	31	5,915	36
Falmouth town	79%	4,178	51	8,021	27
Farmington town	77%	3,376	95	7,576	30
Fort Fairfield town	73%	2,959	127	944	124
Fort Kent town	77%	3,566	81	3,426	52
Freeport town	84%	4,988	20	13,936	15

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Fryeburg town	70%	2,968	125	1,542	94
Gardiner city	80%	2,856	130	2,394	74
Glenburn town	70%	2,618	142	679	148
Gorham town	75%	3,921	61	9,150	23
Gouldsboro town	67%	2,850	131	925	126
Gray town	80%	4,471	32	5,209	39
Greene town	77%	3,470	87	1,153	109
Greenville town	80%	3,075	119	1,046	114
Guilford town	74%	3,291	104	1,870	86
Hallowell city	82%	2,370	149	1,037	116
Hampden town	80%	5,287	15	6,417	34
Hancock town	72%	2,717	135	542	156
Harmony town	75%	3,376	94	758	140
Hermon town	80%	5,301	14	3,048	58
Holden town	75%	4,018	57	1,136	110
Houlton town	86%	4,150	52	7,877	28
Jackman town	81%	4,399	37	706	142
Jay town	87%	3,907	62	4,312	45
Kennebunk town	80%	3,831	64	8,418	26
Kennebunkport town	70%	3,352	98	1,973	80
Kingfield town	81%	4,215	48	1,011	118
Kittery town	78%	5,457	7	18,611	11
Lewiston city	79%	3,375	96	35,030	5
Limestone town	76%	3,430	89	1,874	84
Lincoln town	83%	4,129	54	3,207	56
Lisbon town	72%	3,254	107	3,149	57
Livermore Falls town	88%	3,770	67	1,316	102
Lubec town	71%	2,493	147	638	150
Lyman town	72%	3,859	63	1,288	103
Machias town	83%	3,771	66	3,581	50
Madawaska town	83%	3,366	97	3,370	54
Madison town	81%	2,904	128	1,900	82
Mars Hill town	78%	3,095	117	595	153
Mattawamkeag town	59%	17,050	1	775	137
Mechanic Falls town	76%	2,641	140	719	141
Medway town	81%	6,302	4	610	151
Mexico town	75%	2,161	152	561	155
Milbridge town	71%	2,142	153	504	160
Milford town	82%	5,232	17	1,455	97
Millinocket town	84%	6,436	3	8,645	25
Milo town	81%	2,576	144	802	135
Minot town	69%	3,148	114	651	149
Monmouth town	76%	4,859	23	2,973	59
Mount Desert town	72%	3,651	77	1,401	100
New Gloucester town	58%	3,655	76	987	122
New Sharon town	55%	4,374	39	537	157
Newcastle town	70%	2,711	136	861	129
Newfield town	63%	5,529	5	817	134
Newport town	81%	4,428	35	2,590	67
Newry town	59%	3,734	71	516	159
Norridgewock town	70%	2,379	148	863	128
North Berwick town	82%	4,816	25	6,335	35

City or Town	Pct. Drive Alone Commutes	CO_2 Emissions per Worker (lb/yr)	Per-Worker Rank	Total CO_2 Emissions (metric tons)	Total Emissions Rank
Norway town	77%	3,045	120	2,324	76
Oakland town	81%	3,160	113	2,600	64
Ogunquit town	74%	4,883	22	2,859	62
Old Orchard Beach town	74%	1,757	159	1,006	119
Old Town city	77%	3,349	99	4,178	46
Orono town	66%	2,514	146	6,572	33
Orrington town	71%	3,657	75	696	143
Oxford town	75%	3,394	93	3,487	51
Palmyra town	63%	4,626	28	1,001	121
Paris town	81%	3,268	105	2,877	61
Pittsfield town	77%	3,966	59	4,757	41
Poland town	78%	4,388	38	2,407	73
Portland city	81%	4,471	33	130,608	1
Presque Isle city	81%	4,016	58	13,531	16
Rangeley town	73%	3,568	80	1,096	111
Raymond town	78%	3,649	78	1,800	87
Readfield town	72%	3,328	100	1,873	85
Rockland city	80%	3,194	111	9,084	24
Rockport town	77%	3,181	112	4,087	47
Rumford town	82%	4,181	50	7,671	29
Sabattus town	76%	3,002	124	1,074	113
Saco city	79%	4,080	55	14,893	13
Sanford town	83%	3,576	79	11,443	19
Scarborough town	82%	4,833	24	23,126	8
Searsport town	78%	2,564	145	971	123
Shapleigh town	76%	4,714	26	1,155	108
Sidney town	72%	3,405	91	1,187	105
Skowhegan town	82%	3,938	60	9,183	21
South Berwick town	75%	3,459	88	2,539	69
South Portland city	84%	4,407	36	42,717	4
Southwest Harbor town	79%	3,029	122	1,791	88
Standish town	75%	4,228	46	4,593	43
Stonington town	65%	1,990	155	523	158
Thomaston town	79%	2,647	139	1,470	96
Topsham town	77%	3,091	118	3,687	49
Trenton town	73%	3,536	83	600	152
Turner town	70%	3,020	123	1,090	112
Unity town	68%	2,582	143	854	131
Van Buren town	77%	3,246	110	1,173	107
Veazie town	74%	5,339	9	1,915	81
Waldoboro town	76%	3,317	101	2,494	71
Warren town	77%	2,673	138	1,199	104
Washburn town	71%	5,336	11	859	130
Waterville city	80%	3,307	103	18,482	12
Wells town	81%	5,327	12	9,165	22
West Gardiner town	70%	5,304	13	1,574	93
West Paris town	83%	2,864	129	682	147
Westbrook city	84%	4,312	44	19,006	10
Wilton town	78%	2,959	126	1,418	99
Windham town	81%	4,316	42	9,746	20
Windsor town	83%	5,338	10	3,392	53
Winslow town	78%	2,792	133	2,597	66
Winthrop town	73%	2,678	137	1,898	83
Wiscasset town	78%	3,514	84	2,599	65
Yarmouth town	82%	4,076	56	6,768	32
York town	76%	3,736	69	4,661	42

Notes

1. Natural Resources Council of Maine, Environment Maine Research and Policy Center, *Cars and Global Warming: Policy Options to Reduce Maine's Global Warming Emissions from Cars and Light Trucks,* Fall 2004.

2. Environment Maine Research and Policy Center, *Ready to Roll: The Benefits of Today's Advanced-Technology Vehicles for Maine,* March 2005.

3. VMT estimates and projections from Edward Hanscom, Bureau of Planning, Maine Department of Transportation, personal communication, 23 October 2003; Natural Resources Council of Maine and Environment Maine Research and Policy Center, *Cars and Global Warming: Policy Options to Reduce Maine's Global Warming Emissions from Cars and Light Trucks,* Fall 2004.

4. See note 1.

5. Based on data compiled for New England Climate Coalition, *Getting on Track: New England's Rising Global Warming Emissions and How to Reverse the Trend*, February 2005. Percentages do not add up to 100 percent due to rounding.

6. Conference of New England Governors and Eastern Canadian Premiers, Climate Change Action Plan 2001, August 2001.

7. Maine Department of Environmental Protection, *A Climate Change Action Plan for Maine*, 1 December 2004.

8. U.S. Department of Transportation, Federal Highway Administration, *Summary of Travel Trends: National Household Transportation Survey 2001*, December 2004.

9. See Jayanthi Rajamani, Chandra Bhat, et al, *Assessing the Impact of Urban Form Measures in Nonwork Trip Mode Choice After Controlling for Demographic and Level-of-Service Effects*, presented at 2003 Annual Meeting of Transportation Research Board, 15 January 2003 and similar studies.

10. Sue Jones, Natural Resources Council of Maine, *Testimony in Support of L.D. 1465, the Cleaner Cars Sales Goals Resolve,* Testimony delivered to the Natural Resources Committee, 12 April 2005; Maine Department of Environmental Protection, Bureau of Air Quality, *The Influence of Close-Range Pollution on Maine's Air Quality During the Peak Ozone Episodes in 1997*, November 1997.

11. Maine Turnpike Authority, downloaded from www.maineturnpike.com, 20 April 2005.

12. Federal Highway Administration, *Highway Statistics,* "State Funding for Highways-Summary-2003," November 2004.

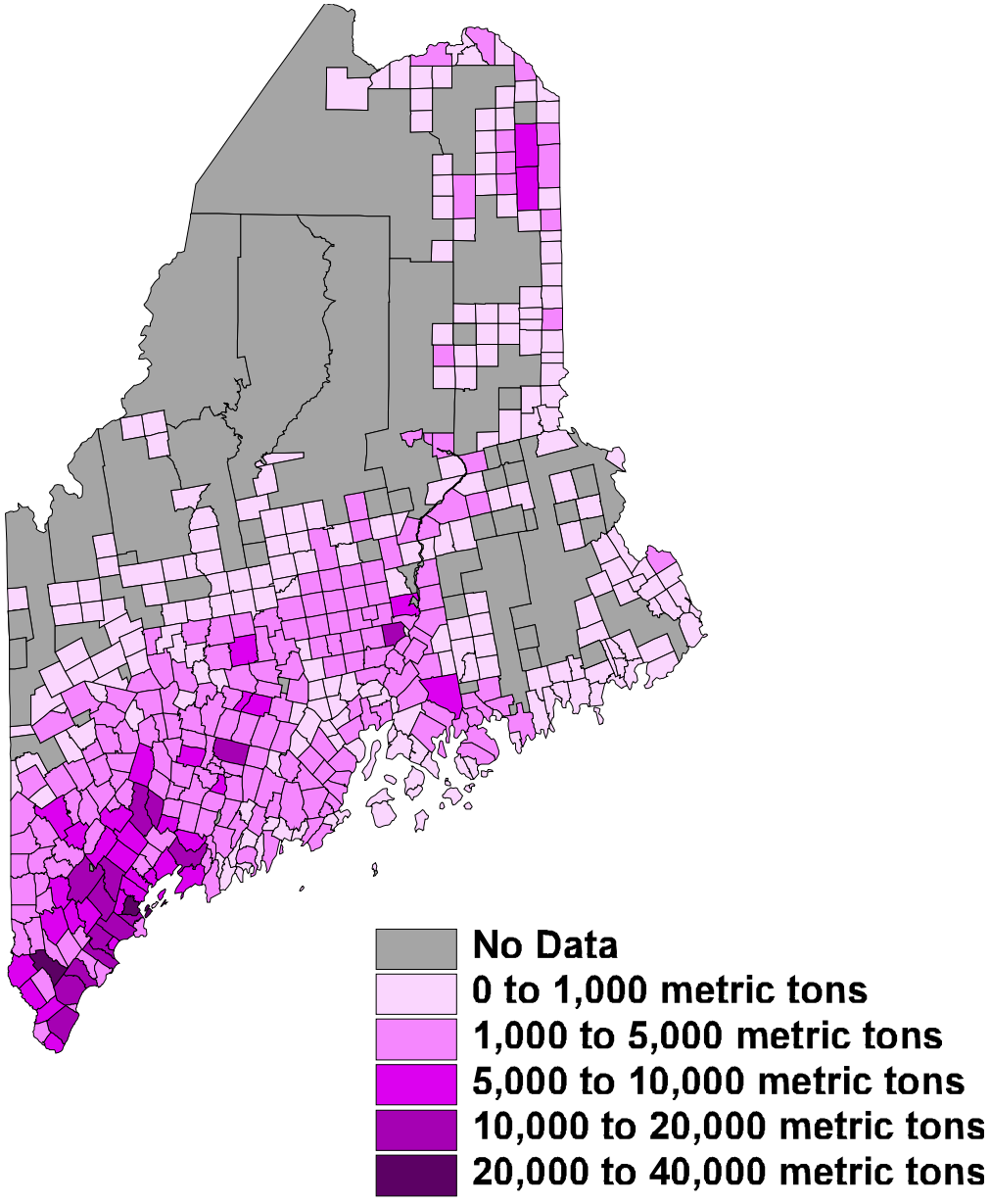
13. This figure includes emissions from residents of Maine commuting to workplaces in other states. See "Methodology" for more details.

14. U.S. Department of Transportation, *BTS Reports that 3.3 Million Americans are "Stretch Commuters" Traveling at Least 50 Miles One-Way to Work*, press release, 12 May 2004.

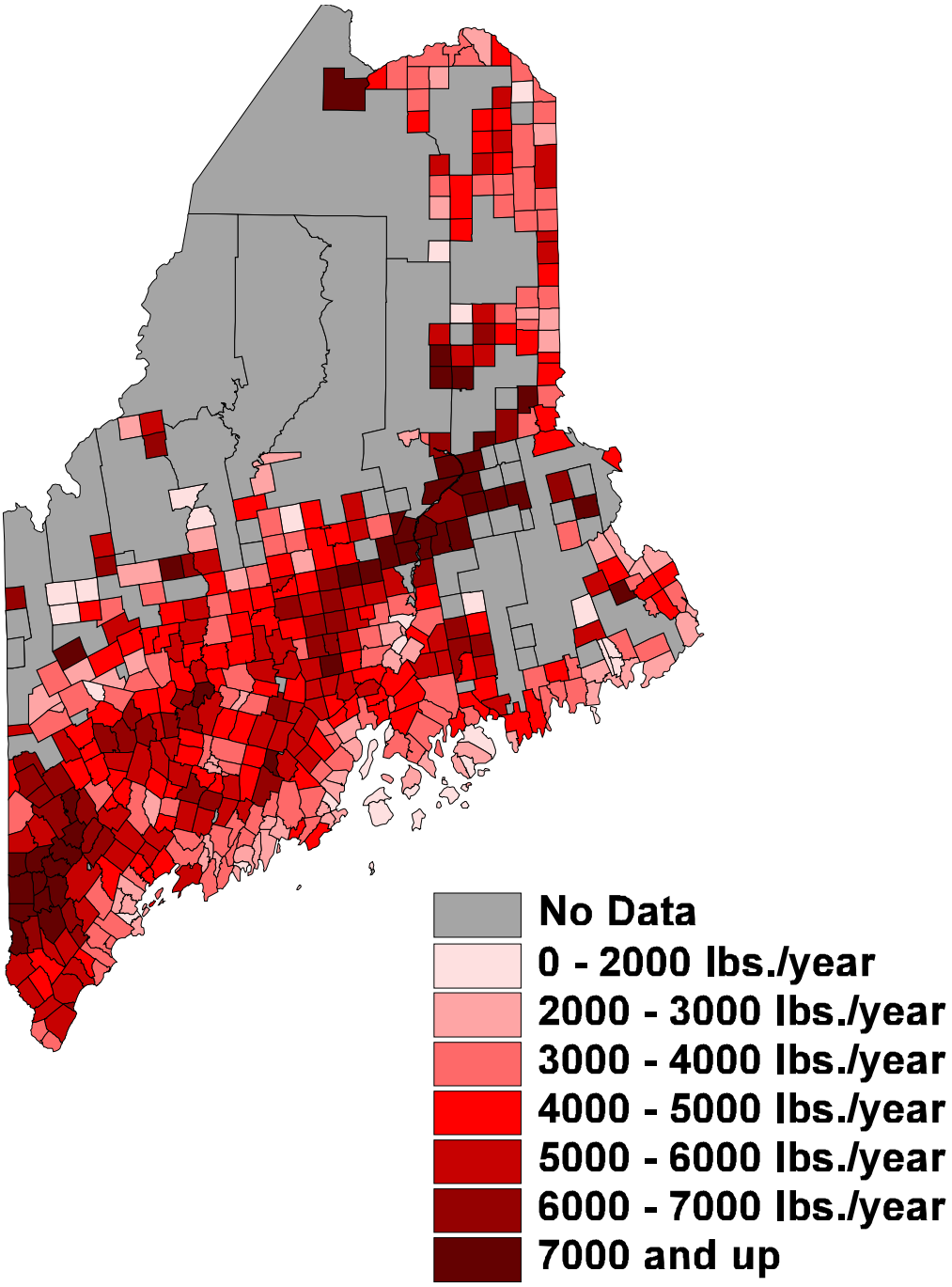
15. The Census Bureau survey does not include an option for commuting by personal watercraft, though it does include an option for commuting by ferry. As a result, the Census survey may underestimate emissions from island towns, though not likely by enough to change the conclusion that most such towns are responsible for very low levels of commuting-related emissions.

16. Maine Office of GIS, *GIS Data Catalogue*, downloaded from musashi.ogis.state.me.us/catalog/, 20 April, 2005.

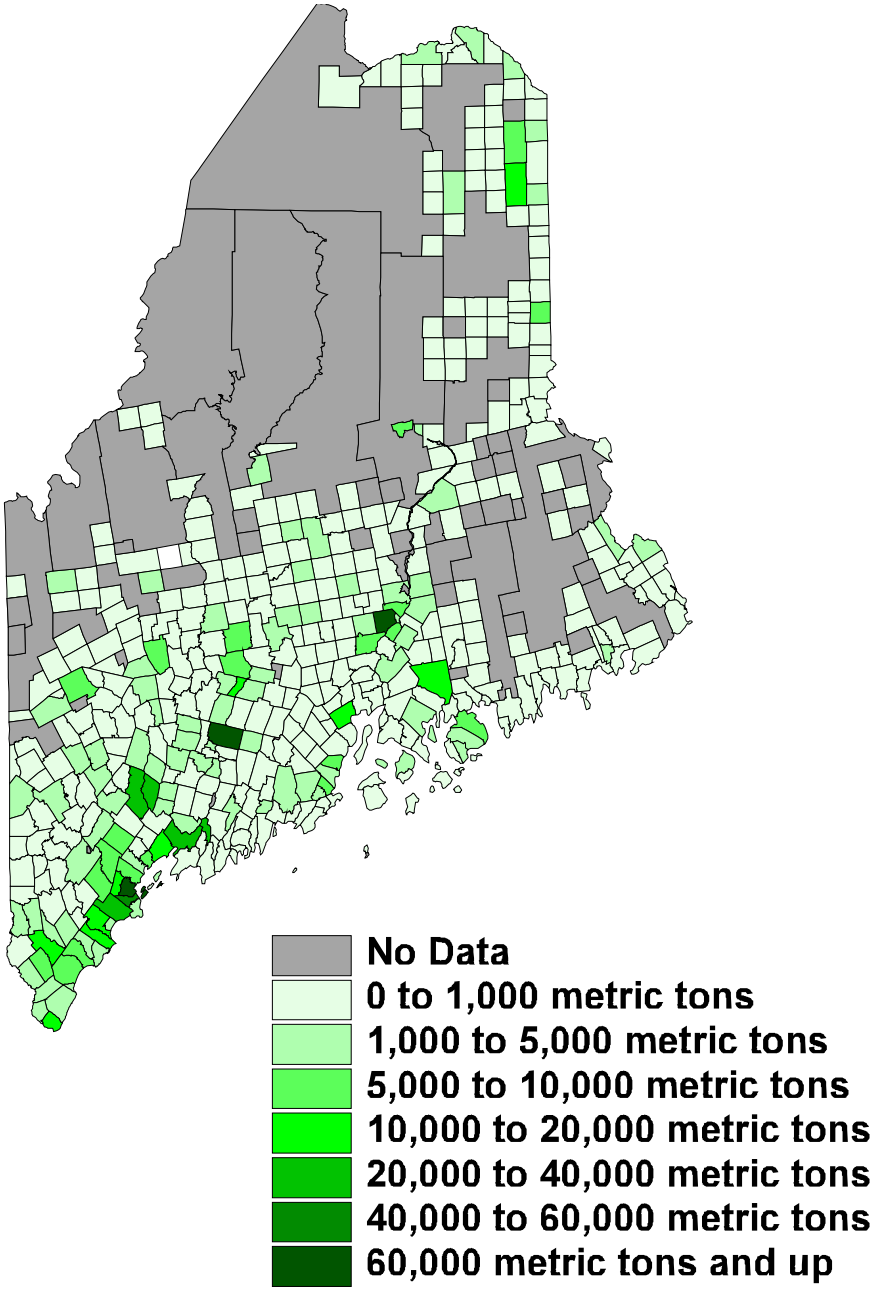
Total Carbon Dioxide Emissions by Place of Residence



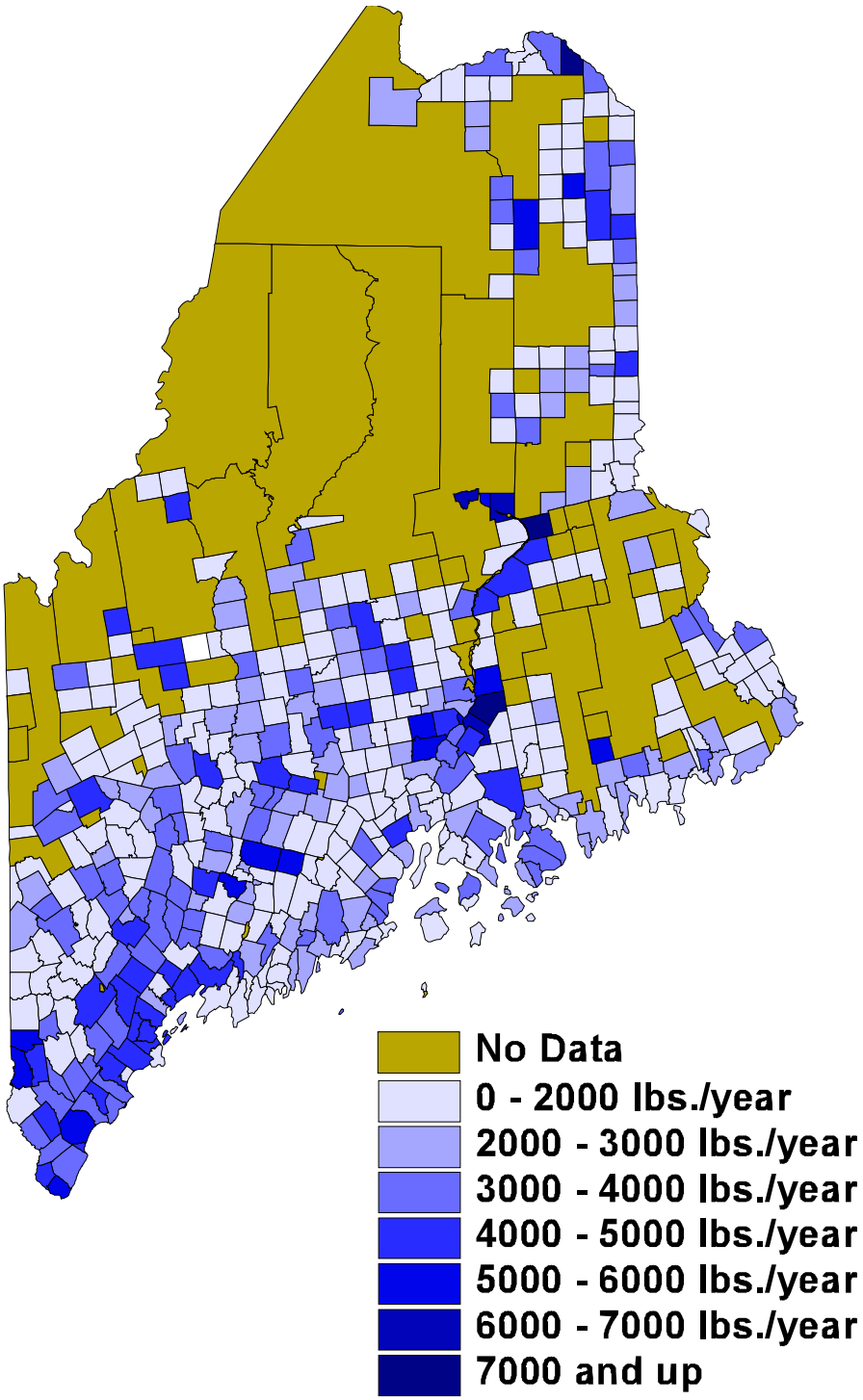
Per-Worker Carbon Dioxide Emissions by Place of Residence



Total Carbon Dioxide Emissions by Place of Work



Per-Worker Carbon Dioxide Emissions by Place of Work



The New England Climate Coalition

The New England Climate Coalition (NECC) is a coalition of state and local environmental, public health, municipal and religious organizations concerned about the effects of global warming. NECC supports reductions in emissions of global warming gases sufficient to protect the region's environment and economy from the dangers posed by global warming.

For more information about NECC visit our web site at www.newenglandclimate.org, or contact the following NECC founding organizations:

Connecticut

- Clean Water Fund, 645 Farmington Avenue, 3rd Floor, Hartford, CT 06105, 860-232-6232, www.cleanwateraction.org/ct
- ConnPIRG Education Fund, 198 Park Road, 2nd Floor, West Hartford, CT 06119, 860-233-7554, www.connpirg.org

Maine

- Natural Resources Council of Maine, 3 Wade Street, Augusta, ME 04330, 207-622-3101, www.maineenvironment.org
- Environment Maine Research & Policy Center, 39 Exchange St., #301, Portland, ME 04101, 207-253-1965, www.environmentmaine.org

Massachusetts

- Clean Water Fund, 262 Washington St., Room 301, Boston, MA 02108, 617-338-8131, www.cleanwateraction.org/ma
- MASSPIRG Education Fund, 44 Winter Street, 4th Floor, Boston, MA 02108, 617-292-4800, www.masspirg.org

New Hampshire

- Clean Water Fund, 163 Court St., Portsmouth, NH 03801, 603-430-9565, www.cleanwateraction.org/nh
- NHPIRG Education Fund, 30 S. Main St., Suite 101, Concord, NH 03301, 603-229-3222, www.nhpirg.org

Rhode Island

- Clean Water Fund, 741 Westminster St., Providence, RI 02903, 401-331-6972, www.cleanwateraction.org/ri
- RIPIRG Education Fund, 11 South Angell Street, #337, Providence, RI 02906, 401-421-6578, www.ripirg.org

Vermont

- Vermont Public Interest Research & Education Fund, 141 Main St., Suite 6, Montpelier, VT 05602, 802-223-5221, www.vpirg.org