Regional Planning and Sustainable Transportation in the Upper Connecticut River Valley

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Report Abstract

Sustainability is one of the most critical issues concerning the relationship between humans and the natural environment. The efforts and necessity of populations' establishing sustainable practices in various aspects of life is of paramount importance in both present and future contexts; this reality does not change when viewed from a localized perspective. The purpose of this report is to shed light on the relationship between regional planning and sustainable transportation in the Upper Connecticut River Valley, with regard to the associated environmental and socioeconomic impacts. In this area, there exist well-developed planning structures; however, their efficiency could be promoted by increased interaction between structural elements and more even dispersal of resources. A critical weakness is revealed in the lack of transparency within different planning entities with regard to their current plans and projects. With regard to the socioeconomic aspects of sustainable transportation, regional disparity of household income and population density epitomizes a variety of highly relevant demographic factors; this issue is compounded by rising housing costs and unsustainable commuter trends. The environmental impacts of road salting practices were found to be a particularly critical issue requiring further study and additional planning with an emphasis on biological hotspots such as wetlands. Public transit and alternative modes of transportation are evidently not a priority in the Upper Valley and planning has been decentralized and haphazard, without any long-term vision. Employer and town-based TDM programs would have a significant effect in promoting sustainability efforts. Above all, intelligent and coordinated planning visions must be implemented across the region to significantly reduce the environmental impacts of transportation activity.

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List of Acronyms

AT – *Advanced Transit*

BTS – *Bureau of Transportation Statistics*

CTS - *Community Transportation Services*

CRT - *Connecticut River Transit*

CV – *Contingent Valuation*

DRB - *Development and Review Board*

DHMC – *Dartmouth-Hitchcock Medical Center*

DEC - *District Environmental Commissions*

FY - *Fiscal Year*

GIS – *Geographic Information System*

LMA - *Labor Market Area*

NaCl – *Sodium Chloride (Salt)*

NERC – *New England Regional Commission*

RPCs - *Regional Planning Commissions*

RPSC – *Regional Planning Study Committee*

SD – *Sustainable Development*

SOV – *Single-Occupant Vehicle*

TDM - *Transportation Demand Management*

TRORC – *Two Rivers-Ottauqueechee Regional Commission*

EPA - *Environmental Protection Agency*

UVR - *Upper Valley Rideshare*

UVTMB - *Upper Valley Transportation Management Board*

USGS – *United States Geological Survey*

UVLSR – *Upper Valley-Lake Sunapee Region*

UVLSRPC - *Upper Valley-Lake Sunapee Regional Planning Commission*

UVTMA – *Upper Valley Transportation Management Association*

DEC - *Department of Environmental Conservation*

VMT – *Vehicle Miles Traveled*

VOCs – *Volatile Organic Compounds*

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CHAPTER ONE
Sustainability, Regional Planning and Transportation: an Overview

One of the most important issues in the relationship between humans and the environment is sustainability and how to attain sustainable practices in various aspects of life. The purpose of this report is to shed light on the relationship between regional planning and sustainable transportation in the Upper Connecticut River Valley in terms of the environmental and socioeconomic impacts.

SUSTAINABILITY

Sustainability is rapidly becoming the center of attention for many people including regional planners, economists, and environmentalists. As more people begin to consider sustainability in their daily lives and lifestyle choices, the debate about how to define sustainability continues to grow. One way to look at sustainability is through sustainable development, which is defined many different ways by various people and organizations. One such definition according to the World Commission on Environment and Development (1987) reads "sustainable development is one that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Greene and Wegener 1997, 178). Other definitions generally focus on continued growth into the future with various supporting caveats. Overall, efforts are being made worldwide to increase sustainability efforts in development patterns (Deakin 2003, 6).

One of the most important and contestable points for planners concerned with the environment is the definition of "sustainability," and coming up with ways to describe and quantify it. The development of environmental awareness has seen a torrential onslaught of academic papers attempting to define what exactly it means to act in a sustainable fashion, and how sustainable development (SD) can be implemented in the modern world – by some counts,

over 500 articles have been written on the subject (Kates 2003, 1). Some argue that intergenerational equity is the most key facet of sustainability, while others tout maximizing utility of all resources as the driving force. Considerable difficulty has arisen from the multitude of voices continuously being raised on the subject; without one universally accepted definition to route policy formation and by which to measure success, planners, developers, ecologists, environmental economists and many others have been stymied into inaction. As a result, sustainable development has been rendered into a far less potent force than it should be. "While strategic plans for implementing and monitoring sustainable development at national and local levels are numerous, these plans have been 'unconsolidated' and suffer from lack of a constituency either within or external to government channels" (Sneddon et al 2005). Comprehensive reform across municipalities and even governments is clearly key to success, whether it is within one solitary nation (eg: the United States) or on a global scale. It seems that at this point it is not achievable or desirable in the current political climate, with few changes outlined by the World Council on Environment and Development (WCED) enacted and "those that have been enacted have been so in ad hoc fashion" (Sneddon et al 2005). Support for developing countries is lacking, which is not particularly surprising since our country suffers from a lack of the awareness, drive, and citizen participation that is needed to keep SD on the national agenda.

Despite the tendency for definers of SD to argue with one another, they can generally agree on a few conclusive tenets that are fundamental to its definition. SD requires focusing on the holistic incorporation of economic, environmental and social factors, and their long term consequences, in any decision making process. As one newspaper puts it, "Sustainable urban development means improving the quality of life in a city without leaving a burden on the future

generations" (New Straits Times 2007, 13). Despite these widely accepted precepts, there is no consensus definition. Sneddon, Howarth and Norgaard offer an alternative to the shouting match of defining SD and suggest that scholars should instead focus their efforts to create a "revitalized SD [which] would be attentive to the political, cultural, technological, ecological and economic contexts of the array of local-global human communities, but also cognizant of more abstract and universal notions of justice and equity" (Sneddon et al 2005). The key for this effort is to avoid "cooptation on the part of powerful actors hoping to give unsustainable activities a 'sustainable' veneer" as well as the extremists who suggest that the only way for growth to be sustainable is to instigate an "overhaul of everything" (Sneddon et al 2005).

In the face of the considerable variation in implementing SD, the idea that an acute definition of "sustainability" may not be necessary has emerged. A broad set of sustainability guidelines should inform local level policy formation while leaving enough room for variation of local environmental conditions and deviations of demographics. Regional planners in an environmental context are heavily influenced by the battle to define SD, and the examination of planning agencies in the upper valley includes a study into their own concepts of what sustainability means to them. However, a brief look into the empirical context of SD in the literature suggests a whole alternate set of questions about the flow of information between the public, planners and legislators, as well as the ability of local actors (including ordinary citizens) to make their own voices heard in the debate on what exactly comprises "sustainability." In any planning agency, including those in the Upper Valley, it is imperative to examine the systematic lens through which policy is passed.

REGIONAL PLANNING

Any planning body must consider the current, future and past concerns of the community in order to create a 'sustainable' plan. Master planners must design their strategies with regard to long-term sustainability; their plans are expected to consider minimal negative impacts for future generations. As well as addressing intergenerational concerns, regional planners must incorporate economic, environmental, and social impacts into their master plans to provide for a sustainable future. First, sustainable economic practices require creating a community that can continue to thrive economically for upcoming generations; communities require this economic growth to evolve and remain vibrant. The utilization of existing infrastructures and resources and connecting them to future growth can help in this aim. Secondly, communities must develop in an environmentally sustainable fashion to promote ecological integrity for themselves and future generations. Environmentally sustainable development depends on preserving the natural resources currently available to insure their continued existence. Sustainable development must examine the impacts of development on the environment and construct a plan that creates the least amount of damage to the surrounding environment. The natural environment is beneficial for humans on a psychological and aesthetic basis, it has also been shown "that having natural elements in the view from the window is a source of psychological benefits" for residents, which reinforces the importance of environmentally sustainable development for human psychology (Kaplan and Austin 2004, 236). Finally, community planners must take into considerations concerns and desires of the local community itself. Planning will only be sustainable when it aligns with a community's own vision and desires for its future development.

Community and public involvement in the planning process is vital if the plans are to meet area needs. Environmental justice proponents believe that the optimal way to develop a

community is by engaging community members in the planning process, within a pluralist framework. However, the status quo more often than not utilizes an elitist approach, which places the decision making power in the hands of a select few who are chosen for their education rather than their connection with the community. Planning at the regional level has the potential to be an important player in this issue, being able to act as a liaison between local and state and federal concerns. The regional level of planning plays an important role here as Alexander Anthony argues, "The greatest improvements to sustainability are to be made at the regional planning level" in order to incorporate the most informed members of society for each community (Anthony 2006, 22). This follows the pluralist model of allowing the involved parties to be part of the planning process rather than invoke an elitist model that requires participation from professionals. Although professionals have studied the issues plaguing communities, they often have not personally experienced the community's problems. It is essential that the constituents participate in planning, and that planning is designed on the more personal regional level rather than the distant federal level. However, although the regional level does have the potential to be more personal than the state or federal levels, it too can be susceptible to being distant from local, community concerns. In order to provide valuable theoretical context for the methodology of regional planning activities, the many structural forms of decision-making processes, as well as a more detailed critique of top-down versus bottom-up transfers of information and communication, can be found later on in this report.

SUSTAINABLE TRANSPORTATION

It is a prominent fixture of our everyday lives, one whose significance is often overlooked. For many, it is a fundamental necessity. For others, it is a convenience usually taken for granted. Regardless of its perception on the individual level, transportation – in its countless

forms and facets – is one of the most crucial and influential forces on Earth. We are members of a highly dynamic, ever-growing global population that necessitates constant supplies of energy, material, consumer goods, and food. Such logistics are compounded by a whole host of influencing factors. In the present day, the distribution and abundance of natural resources has diminished overall. Raw materials are moved further and further away from their source at a speed constantly accelerated by consistently increasing demand. More often than not, whole oceans separate the most cost-effective facilities for their processing from their final destination.

The collective mobility of global populations has surged ahead on a parallel path. New routes, technology, and transportation hubs have emerged and the cost of travel has decreased. Once unheard-of distances are now our daily commutes. The price of unleaded gasoline has more than doubled in just two decades with little public outcry. There is virtually nowhere and nothing on Earth that one cannot experience with relatively minimal expenditure of time, money, or effort – it is merely a matter of transportation.

For the sake of human convenience and prosperity, time and space have been shrunk at apparently no cost whatsoever. Just as transportation's benefits are often observed subconsciously, though, its negative effects are generally ignored as well. The aforementioned extent to which transportation makes our lives possible does so at the expense of several important things. While time, energy, and money figure prominently in this equation, environmental health is the issue most relevant to this report. Greenhouse gasses, chemical runoff from roads, NO_x/SO_x emissions, and wildlife displacement are just a few of the many consequences transportation impresses upon our natural surroundings. As the number of people living on Earth – and engaging in such activities – continues to rise, so do the environmental challenges. Consistently upward usage trends accompanied by limited resources underscores the

importance of efforts to establish a viable level of sustainability in transportation. As there is doubtful to be a substantial downturn in the omnipresence of these services and means of travel anywhere in the near (or distant, for that matter) future, it is crucial that initiatives targeting alternative fuels, public transportation, hybrid vehicles, and other sustainable practices be encouraged. As it figures prominently in the necessary policymaking and associated enforcement of beneficial regulation, the political economy of transportation must be appropriately sensitized to and simultaneously integrated with environmental interests.

One aspect that is very important in sustainable development around the world and in developed nations in particular is transportation and all of its many facets (road planning, maintenance, traffic, fossil fuel consumption, etc.) (Deakin 2003, 6). Similar to sustainable development, sustainable transportation can be defined to include a variety of goals and objectives. One definition of sustainable transportation is as follows: "transportation that meets mobility needs while also preserving and enhancing human and ecosystem health, economic progress, and social justice now and for the future" (Deakin 2003, 6). It is important to include environmental, economic, and future needs when defining sustainable transportation because the solutions can vary greatly depending on how it is defined. For example, if it is defined only in terms of ecosystem health, resource depletion and climate change risks, fuel efficient and alternative fuel vehicles may be the best solution. However, these solutions do not resolve issues of congestion, safety, access, and other planning objectives (Litman 2008, 7).

Conventional planning assumes that transport progress is a linear “series model”, where newer modes replace the older ones and make them obsolete. Under this assumption, the promotion of public transit and walking would be “backwards”. On the other hand, sustainable

transport is a “parallel model”, which assumes that each mode can be useful and the system should be balanced (Litman and Burwell 2006). Coordinated planning is essential for change, and in order to incorporate sustainable transportation into future planning, planners must change their assumptions to a more sustainable mindset. Progress in this direction can be roughly measured with sustainability indicators, which Litman and Burwell state are generally lower fossil fuel consumption, lower vehicle emissions, lower per capita vehicle mileage, more transit ridership in the mode split, lower crash injuries and deaths, lower transport land consumption, and better roadway aesthetic conditions. However, as Litman and Burwell also note, it is important to use more comprehensive indicators as well, for sustainable solutions involve a diverse range of factors. They state that economic indicators include accessibility (commuting, land use mix, smart growth), transport diversity, affordability, facility costs, freight efficiency, and planning; social indicators are safety, health and fitness, community liveability, equity (fairness, non-drivers, disabilities), non-motorised transport planning, and citizen involvement; and environmental indicators are climate change emissions, other air pollution, noise pollution, water pollution, land use impacts, habitat protection, resource efficiency (337). By observing progress in all these areas, planners will be able to more effectively form a comprehensive transportation vision that yields substantial results and evaluate its progress.

As communities and regions seek to lessen environmental impacts and create more sustainable human-environment relations, improved public transportation and increased alternative modes of travel have become increasingly important in achieving those goals. There is widespread debate on the degree of resource conservation sustainability requires; however, most definitions agree that there is a need to conserve critical resources for future generations so that they may have the opportunities we have in the present. Ensuring these future opportunities

in the future involves mitigating the deleterious environmental impacts of human activity as well as limiting the rate at which we consume resources. Developing public and alternative transportation options in a coordinated manner will be effective in making a community's practices more sustainable and efficient.

UNIT OF ANALYSIS: THE "UPPER VALLEY" DEFINED

The Upper Valley can be defined in numerous ways, and indeed throughout our research we uncovered multiple definitions of what land areas should be included in a definition of the Upper Valley. However for our purposes, we define the Upper Valley according to the following map of the Upper Valley Land Trust Conserved Lands Map (see Figure 1.1).

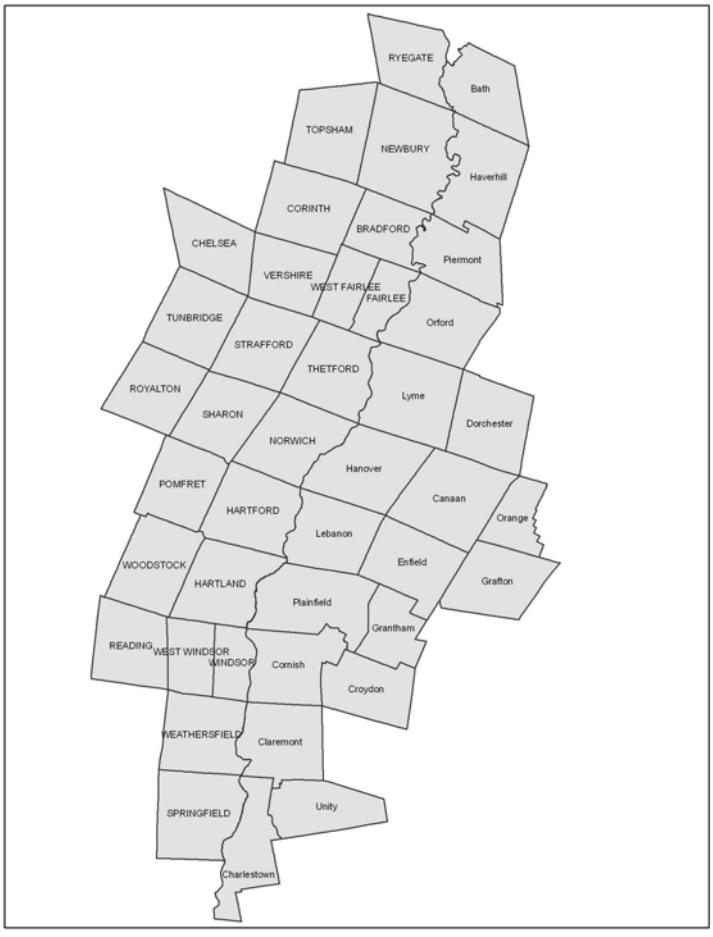


Figure 1.1: Municipalities included in the "Upper Valley" for the purposes of this report.

METHODOLOGY AND RESEARCH QUESTIONS

This report utilizes a mixed methods approach. The use of mixed methods has been corroborated by numerous papers as a "natural complement to traditional qualitative and quantitative methods" (Johnson 2004, 14) which offers considerable possibilities for enhancing research in a holistic fashion (McKendrick 1999, 40). Due to the value of using mixed methods, a large variety of research avenues were employed such as primary sources in the form of interviews, geographic information systems (GIS), census data (both state and municipal), reviews of regional and state political legislation, economic cost benefit analysis, historical research, and Unites States Geological Survey (USGS) data. These mixed methods were used with the goal of offering holistic views and analysis.

The authors of this report, within the context of the chapters outlined above, collectively sought to answer the following questions, which formed the cornerstones of our research:

Regional Planning

- What is the level of interaction between regional planning commissions?
- What does the current regional planning structure look like?
- What is the level of community participation and through what channels does it occur?

Socioeconomic

- What are the principal socioeconomic issues linked to regional sustainability?
- What are the most prominent demographic and transportation usage characteristics related to these issues?
- What are some of the more significant costs and benefits associated with the economics of regional public transportation?

Biophysical

- What are the environmental impacts of salting and plowing roadways in the Upper Valley?
- What are the costs of salting to regional governments?

Public and Alternative Transportation

- What characterizes the current system of public transportation in the Upper Valley and what are the primary obstacles to its efficiency?
- What are some viable alternatives to commuting by car in the region?
- Are there mechanisms and/or policies in place to encourage such sustainable alternatives?

REPORT OUTLINE

The report begins with a discussion of regional planning before moving on to specifically examining transportation issues, mainly socio-economic and biophysical concerns, and ends with a discussion of alternative transportation.

Chapter 2 begins with a brief history and overview of regional planning in the Upper Valley. Special emphasis is placed on current structures and decision making processes and the implications of community involvement, valuation, and policy formation. The chapter concludes with a look at four case studies, two from New Hampshire (Canaan and Lebanon) and two from Vermont (Hartford and Thetford).

In Chapter 3, this report addresses a variety of socioeconomic issues critically linked to sustainability efforts in the Upper Valley. Included in this comprehensive study are surveys of relevant demographic information and transportation usage data, as well as a cost-benefit analysis of regional public transportation.

Chapter 4 discusses the ecological importance of wetlands and the negative impacts road salting can have on such ecosystems. Additionally, the chapter presents case studies of four towns in the Upper Valley that discuss the salting practices of each town in addition to a spatial analysis showing wetland proximity to roadways. Finally, recommendations are made to decrease the harmful impacts of salt based on the spatial analyses and salting practices of each town.

Finally, Chapter 5 delves into the current public and alternative transit network in the Upper Valley and its history and current state. We then describe some viable alternatives to the current system, including TDM, biking and walking, and make suggestions to improve its coordination and efficiency.

CHAPTER TWO

Regional Planning in the Upper Valley: Sustainability, Community Involvement, and Administrative Fragmentation

INTRODUCTION TO STUDY

Although the purposes of this chapter are manifold, the primary one is to closely examine the structure and processes of regional planning in the greater Upper Valley area (see Figure 2.1).[1] Regional planning plays an important role in the development and growth of the Upper Valley, and we seek to offer both a general understanding of its structure and the factors involved in its decision making processes as well as to determine inefficiencies and inadequacies which can be improved to better serve the communities and residents of the area. By 'structure' we mean the actors, organizations, legislations, and regulations surrounding regional planning. For some time, professionals associated with regional panning have argued that the current approach to regional planning is no longer sufficient and that in order to develop a more effective approach we must recognize that change will not be immediate and that unique solutions must be applied to different regions (Roberts 1994, 786). We often find the same issues are prevalent in the Upper Valley, and wish to pinpoint inefficiencies in the planning process and put forward brief recommendations for potential improvements. We are targeting this report both at the general public and interested parties as well as the planning community itself, for as a relatively unbiased third party we may be able to offer insights and recommendations for improvements specific to this unique region.

[1] The regional commissions, most notably the Vermont commission, encompass more land area than we have included in our definition of the Upper Valley (see Chapter One).

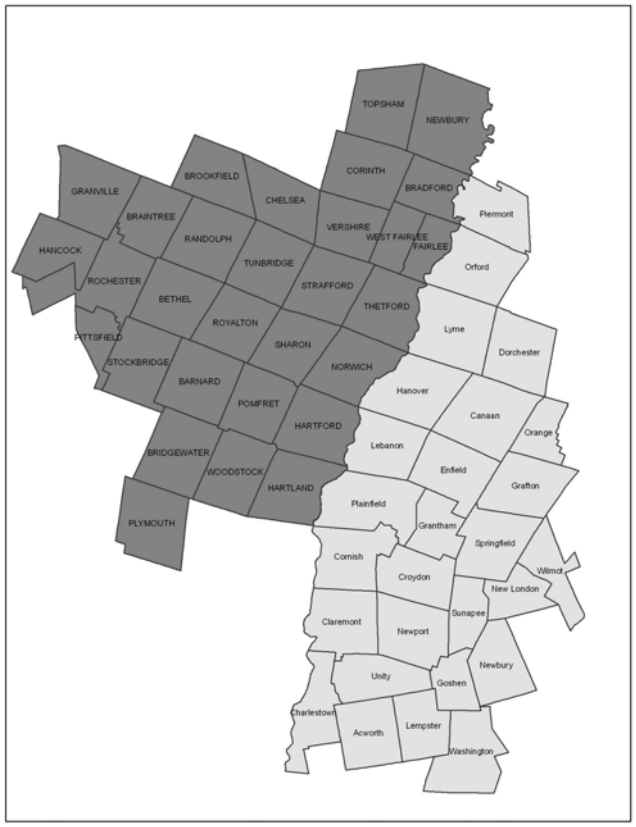


Figure 2.1: Map of all towns encompassed within the Two Rivers-Ottaquechee Regional Commission (darker shading) in Vermont and the Upper Valley Lake Sunapee Regional Planning Commission in New Hampshire.

A diverse array of methods was used for this study. A survey of the background literature of regional planning both in the nation and the Upper Valley served to situate our study in the broader literature and provide valuable understanding of the nature of the planning community and its driving forces. Current print media, such as local newspapers, were also utilized in order to gain an understanding of some of the current issues, disputes, and conversations in planning as they revealed themselves at local levels. Finally, interviews were a valuable source of information. We conducted interviews with representatives both from regional planning commissions and local planning boards. Representatives from Dartmouth College and DHMC were also interviewed as these two institutions represent the major employers and often drivers of growth for the region. Local townspeople involved in local planning boards were also interviewed in order to gain an understanding of community opinions.

This chapter begins with a brief discussion of some demographic trends in the Upper Valley region and some of the current issues it is facing which relate to planning. We especially emphasize the role of two major employers in the region, Dartmouth College and Dartmouth

Hitchcock Medical Center (DHMC), located in the New Hampshire towns of Hanover and Lebanon respectively. We then continue with an overview of the history of regional planning as a discipline, its history and development in the United States and the Upper Valley, and a focus on the two regional planning commissions which act in the Upper Valley: the Two Rivers-Ottauquechee Regional Commission (TRORC) in Vermont and the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) in New Hampshire. Third, we delve into the structure and decision-making processes of planning: the federal and state legislation involved, funding, the different levels of planning, and the interactions between them. Fourth, we examine the intersection between values and policy formation, with an emphasis on the role of community and public participation. We also discuss case studies from two Vermont municipalities, Hartford and Thetford, and two New Hampshire municipalities, Canaan and Lebanon, and the issues they raise. Finally, the report concludes with brief recommendations for improvements in the local planning community, and how regional planning processes in the Upper Valley might move forward to incorporate the goals of sustainability into their development.

OVERVIEW OF THE UPPER VALLEY: DHMC AND DARTMOUTH COLLEGE

The region is experiencing a number of trends, the most significant being an aging population and an increase in second/seasonal home buying. Population growth has been distributed unevenly among the municipalities in the region. In general, not the employment centers but the surrounding outlying towns are experiencing the most thorough expansion and new growth (TRORC 2007, 8).[2] This, in turn, has implications for transportation: the increased commuting times as people move to outlying towns away from employment centers and the need

[2] This finding comes from the Vermont regional planning group which focused on Vermont towns, and the assumption is that the same will be true for similar towns across the river in New Hampshire.

for public transportation to link them. Again, this connects to socio-economic concerns due to cost (in terms of both time and money) of longer commutes. The region's population growth has been mainly fueled by in-migration of an older population, aged between forty-five and seventy, looking for "a high quality of life, secure real estate investments, and changes in lifestyles" (TRORC 2007,16). The aging population also has implications for transportation as this aging population will need to rely more on public transportation.

The region of the Upper Valley is clearly very connected across state boundaries and needs to be understood and examined as one interstate unit. Neighboring townships are interdependent on each other and residents frequently and easily move across these jurisdictional boundaries for employment, recreation, and shopping (Haslach 2006, 3). This can be seen in the disparities between people's places of residence and their place of work. For example, approximately 13,000 people commute daily into Lebanon for work and in most towns, less than 20% of the population works in their town of residence (Haslach 2006, 3). In addition to Lebanon, the Dartmouth Hitchcock Medical Center (DHMC) and Dartmouth College are both large employers located in Lebanon and Hanover respectively. Indeed Lebanon, Hanover, and Hartford account for about 80% of all jobs in the area, with 18,000; 9,300; and 2,100 respectively (Haslach 2006, 32). This interconnection between towns, residence areas, and employment centers has repercussions for affordable housing and transportation, which are indeed the most prevalent and recurring issues and concerns in the region and will continue to resurface throughout this report. One interesting figure to keep in consideration with these concerns is that the home-work distance ratio is *inversely* correlated with salary earned: the lower salaried employees travel the greatest distances from home to work (Haslach 2006, 35). Thus, lack of affordable housing close to employment centers and lack of transportation choices

(combined with the rapidly rising cost of fuel) combine to place additional burdens on people with lower incomes who consequently need to live farther away from their places of employment and thus travel farther distances to get to them.

Both DHMC and Dartmouth College are connected to economic growth and development in the region and consequently to regional planning concerns. They are both very important players in the region and their growth and development (or lack thereof) has repercussions for the growth and development of the region as a whole. Thus any planning analysis and discussion of the region must examine the roles of these two institutions. Subsequently, a brief understanding and acknowledgement of their role as drivers of economic change and development is important in our discussion of planning in this chapter.

Dartmouth Hitchcock Medical Center

Dartmouth Hitchcock Medical Center (DHMC) is one of the largest employers in the area. The Center employs 6,414 full-time employees (as of 2006) with an additional 1,003 fellows and other graduate students (DHMC Facts and Figures 2006). The Center also indirectly impacts employment as it requires other services from waste management, construction and repairs, etc for both structural maintenance and support of its employees.[3] DHMC is the largest hospital in New Hampshire and defines its community as New Hampshire and eastern Vermont (DHMC FY 2007 Community Benefits Report). DHMC clearly plays a large role in the economic growth of the community and its planning concerns. Currently, there are plans for expansion at the Center including building a new ambulatory building, diagnostic and treatment spaces, a Rubin building, connector/mall and penthouses, and parking garage totaling over

[3] Unfortunately, no representative from DHMC was able to be contacted in time for this report so in depth description on DHMC's perspective on its relationship to the surrounding community and planning concerns cannot be included.

600,000 sq ft of new growth (DHMC Projects for Progress Key Facts). These expansions will most likely have some effects such as infrastructural growth as well more employees which in turn have implications for housing and transportation in the Upper Valley region. DHMC clearly plays a very strong role in the growth and development of the Upper Valley region, being a main employer and attracting patients from outside areas, and thus has great impacts on planning concerns in the region.

Dartmouth College

Dartmouth College is another large employer in the region, with 976 faculty members and 3,431 staff (not including faculty), both full time and part time (Office of Institutional Research 2007). The College also involves 5,849 students in its undergraduate and graduate programs (Office of Institutional Research 2007). Clearly, Dartmouth College has quite an impact on the region in terms of employment and housing and transportation concerns, and, subsequently regional planning for the Upper Valley. An interview with Joanna Whitcomb, Dartmouth's planner, reveals that the College is aware of these issues of lack of affordable housing and transit time, making attempts to alleviate them, as well as the need for coordination, or at least basic communication, among local groups. Whitcomb describes how on the local level, the College attempts to have a very close relationship with the town of Hanover; meetings between town and college officials take place around four times a year and the college interacts with the town on a weekly basis to get permits for various projects. On the regional level, in her first year at the college Whitcomb has attempted to coordinate lunches with regional planners from different commissions to discuss what's happening in the region in terms of growth and

development, a process which has proven difficult and infrequent not due to lack of desire or need, but due to lack of funding and time (Whitcomb 2008).[4]

Although the College has some communication with other regional groups, their main interactions are in the local community, especially in terms of the ever prevalent problems of affordable housing and transportation. Understandably, Dartmouth's concern with housing and transportation are in regards to its own employees. Whitcomb sits on the Upper Valley Transportation Management Board (UVTMB), the local umbrella organization for transportation issues. The college attempts to ease the transportation difficulties of its employees by partially funding Advance Transit (AT) so it can be a free service, working with AT to create and revise routes where employees need service, and paying for employees' bus fares if they live in more distant towns such as Randolph. In terms of trying to improve the availability of affordable housing to its employees, members of the Dartmouth community serve on affordable housing coalitions and the college supplies some housing in Hanover (Whitcomb 2008). However, a large number of Dartmouth employees still commute from town outside of Hanover.[5]

Although there is some interaction with regional and local planning entities, the College does have its priorities and needs for growth and development which occasionally come into conflict with other local interests and needs. Whitcomb cites one such example was with the moving and rebuilding of the main Mary Hitchcock Memorial Hospital of DHMC around fifteen years ago. The town of Hanover made a collective decision that they could not handle more

[4] Whitcomb emphasizes how New Hampshire planning is especially under-funded, thus making regional planning a low priority. This issue of differences in funding, and consequently political and economic clout, between Vermont and New Hampshire and the consequences will be a thread throughout this report.

[5] There are over 200 zip codes (areas of residence) recorded for Dartmouth employees with over 100 employees commuting from Lebanon, Enfield, Canaan. Etna, Lyme, and West Lebanon in New Hampshire and White River Junction and Norwich in Vermont. This data comes from a spreadsheet of employees and their zip codes gathered by Dartmouth College, department unknown.

growth and development in the area, and that the new hospital would have to be located elsewhere; the Board of Selectmen for the town subsequently sent a letter to Dartmouth College to that effect. Indeed, DHMC, which was eventually sited in Lebanon, has become the largest employer for the region. However, although small conflicts do occasionally emerge between the local community and Dartmouth College, in general the growth and development of the college has positive repercussions for the growth and development of the region. Whitcomb reflects that projects are often improved after these minor conflicts with neighbors and the community as new ideas and viewpoints are brought to the table. She observes, "There is always conflict where there is change, it is how the conflict is managed that matters" (Whitcomb 2008).

REGIONAL PLANNING BACKGROUND INFORMATION

What is Regional Planning?

Over the last century, the American definition of regional planning has been constantly changing along with the changing of American landscapes and the needs and concerns of the populace. The many layers of organizational structure, from the federal to the local level, add unique intricacies to regional planning's dynamic nature. What we refer to today as regional planning first surfaced in the early 1920's when a group of U.S.-based planners voiced their desire to deviate from the "dominant ethic of the era", which was centered around the belief that technology would be able to overcome the forces of economic development and resource use. This group of planners assumed a doctrine that aimed to create "a harmonious relationship between human beings and nature" and led to what we now call regional planning (Roberts 1994, 781).

The Regional Planning Association of America was formed in 1923 aiming to decentralize the urban population when Americans were primarily grouped into cities. The

primary goal was economically, rather than environmentally, focused and the Association encouraged the spread of electricity and transportation throughout the country in order to distribute industry and economic development into more rural areas at the expense of the natural landscape (Friedmann and Weaver 1979, 34-36). There was some argument against the decentralization of cities, focused mostly on "backward regions" primarily in the South, by a group of southern regionalists that valued the rural culture more than the economic growth of expanding urbanization, but it is infrequently focused on in regional planning history.

Ten years after the Regional Planning Association of America, the National Planning Board was formed in July 1933. The Board published "Plan for Planning" within the first year as a guide for state, regional and local planners to use in their efforts. The document summarized that all public and private groups involved in planning throughout the nation needed to join together, specifically with geographically adjoining groups, to achieve the highest success and greatest human welfare (Friedmann and Weaver 1979, 65). Their prediction in 1933 that the coordination of efforts and knowledge between groups would avoid many future problems, including transportation, sprawl, and sustainability, was probably correct but due to the segmented efforts still existing today across the nation and within the Upper Valley community we cannot be sure. However, issues such as administrative fragmentation and lack of coordination are still very prevalent issues in planning in the Upper Valley as will be discussed later in this report. These early planning agencies were created during a unique political and economic era of the United States, during the Great Depression and the New Deal and the consequent increase in federal programming to address massive unemployment and a host of related socioeconomic problems.

Since then, regional planning has received increasing recognition in the United States, particularly in recent decades as urban out-migration to suburban and rural areas has increased and become an important economic and land use concern. This has led to a constantly changing landscape and relationship between humans and nature. This urban to rural/suburban exodus has resulted in the emergence of a new scene: one that consists of "low-density developments, reliance on automobiles, lack of centralized planning, and segregated land uses and land covers" (Kaplan and Austin 2004, 235). It also has resulted in additional environmental and economic impacts – many of which carry political implications - such as an increased dependence on imported oil, more air pollution because of increased travel time, greater water pollution due to run-off from highways, and higher costs for public services (Daniels and Lapping 2005, 317). As this pattern continues, planning on the regional level will become even more imperative in establishing a balanced relationship between humans and nature.

Currently, regional planning normally includes the creation and organization of infrastructure across a district that can include several towns, cities, even stretching across state borders. There are three main objectives on which regional planners focus: exploring "forms of economic organization" that will have minimal environmental impacts; encouraging the implementation of "spatial forms and modes of social organization" that reduce resource use; and bringing together "sectoral and spatial elements" that make certain that planning and development within regions is sensible and balanced (Roberts 1994, 781). Regional planning is designated with the task of designing a master plan which, taking into consideration the many factors that impact the local populace and the environment, will be most beneficial for a community or multiple communities. In recent years, a trend toward sustainable master planning has been observed as overall global sustainability has become more important.

History of Regional Planning in the Upper Valley

The Upper Valley has a long history of human-nature interactions.[6] Prior to European settlement, the Connecticut River valley provided a bountiful supply of fish, game, fruits and nuts for the native populations that dwelled there. Although they practiced agriculture, raising primarily corn, beans and squash (MDEM 1990-4) and were well-adapted to seasonal changes. In time, this lifestyle was to be replaced by the highly regimented rural agrarian lifestyle brought over from the 'Old World.' Through large-scale forest clearing, damming of rivers, and cultivation of fields, the European settlers rearranged the landscape of New England (Cronon 1983). Urbanization and industrialization of the United States throughout the late 19th and 20th centuries heralded a new type of change, namely the migration of commerce to urban locales, which left the old agricultural centers and mill towns with stagnating economies. The advent of more practical long-distance transportation also reduced the comparative advantage of the river towns, which led to a stagnation of growth and development in many rural communities. For these dying towns, the primary priority became to reinvigorate growth in their local region, by determining what specific advantage their locality had to offer to the populace at large. For many New Hampshire and Vermont towns, this advantage came in the form of strong agricultural output, the ability to offer cheap commercial floor space, and the presence of a beautiful outdoor environment to be enjoyed recreationally (Ad. Hoc RPSC 1967-7).

Throughout the Upper Connecticut River valley, recent decades have ushered in a trend of dramatic growth. Economic growth has had the effect of reviving previously dying mill towns, providing more jobs and increasing family incomes, but has also incited a precipitous

[6] The Upper Valley can be defined in many ways, yet for our purposes it will be defined as the area which falls under the jurisdiction of the two regional planning commissions in the area: the Two Rivers-Ottauquechee Regional Commission (TRORC) in Vermont and the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC).

drop in open spaces, more low density residential sprawl and the development of strip malls. In more ways than one, the re-emergence of growth to previously dormant river communities has happened more quickly than it can be controlled, and their rapid expansion presents a significant challenge to the character of the towns themselves. Also at risk are the stock of affordable housing, natural resources, open space and public services (MDEM 1990). As previously mentioned, the presence of Dartmouth College and DHMC has greatly added to the rapid economic growth and development of the region.

In the face of these challenges, individuals and governments at both the local and regional levels have started to take steps to protect themselves from uncontrolled growth in the form of planning. The concept of sustainability has garnered increasing attention and respect among planners amid increasing public concern over the degradation of natural resources, cancer and health risks, and loss of biodiversity, animal habitats and open space. Numerous criticisms have been levied against current regional planning mechanisms concerning their economic focus and lack of rigorous environmental and sustainability standards for local development (Counsell et al 2001; Counsell et al 2003; Campbell 1996; Smith et al 2001). The most difficult part of achieving sustainable development is defining what the values of the stakeholders are, and figuring out what the best decision is to make those values realized.

On a broad regional level, New England states worked together to form the New England Regional Planning League in 1929 and the New England Regional Commission around the same time. The New England Regional Commission published a report on the Connecticut River watershed. Some sources believe that a "river basin is an appropriate and manageable area for regional development" because it ties together all involved groups based on the shared water

resource (Friedman and Weaver 1979, 78), and there may have been some of this sentiment involved in the NERC's focus on the Connecticut River valley.

What is now known as the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC), which covers 27 New Hampshire municipalities, began in 1963 but was at that time called the Upper Valley Development Council serving communities in and around Hartford, Vermont as well as Lebanon and Hanover, New Hampshire.[7] In 1968, the New Hampshire Governor's Office and Office of State Planning encouraged a regional planning initiative that transformed the Upper Valley Development Council into the Upper Valley Planning and Development Council which was officially a regional planning commission. A reduction of New Hampshire planning regions in 1972 combined the Upper Valley and Lake Sunapee regions into the Upper Valley Lake Sunapee Council, though the most recent change occurred only a few years ago. On July 1, 2004, at the behest of Secretary of the Vermont Agency of Commerce and Community Development, Kevin Dorn, the Vermont communities included in the UVLSRPC broke off to become part of the neighboring Vermont-only regional planning commission, thus rendering the UVLSRPC a NH-only regional planning commission from then on (UVLSRPC Commissioner's Handbook, 2). Peter Gregory, executive director of Two Rivers-Ottauquechee Regional Commission in Vermont, explained that the matter was also an issue of funding. As the Vermont regional planning commissions has more funding and state legislative support through devices such as Act 250, TRORC is able to offer more support and services to their member towns than the underfunded UVLSRPC (Gregory 2008). These issues will be discussed later in this report.

[7] New Hampshire municipalities included in UVLSRPC are determined by New Hampshire Office of Energy and are: Acworth, Canaan, Charlestown, Claremont, Cornish, Croydon, Dorchester, Enfield, Goshen, Grafton, Grantham, Hanover, Lebanon, Lempster, Lyme, New London, Newbury, Newport, Orange, Orford, Piermont, Plainfield, Springfield, Sunapee, Unity, Washington, Wilmot.

The UVLSRPC serves as an advisory group to help the communities within the Upper Valley Region to collaborate on planning issues and address future needs of the Region. As stated in the Bylaws of the Commission, their purpose is "to guide, coordinate and promote sound economic growth and development and to prepare, maintain and implement a comprehensive regional plan for the Upper Valley Lake Sunapee Region; to serve as a research agency and information clearinghouse for the Upper Valley Lake Sunapee Region; to assist local units of government with their plans and programs; and to establish a public information program in order to promote the health, safety and general welfare of the inhabitants of the Upper Valley Lake Sunapee Region." It is perhaps interesting to note that there are no *explicit* environmental goals in their stated mission. Currently, there are seven full time staff in the UVLSRPC office in Lebanon, NH: an executive director, an associate director, a senior planner, two regional planners, a GIS analyst, and an administrative assistant. This staff group offers expertise to member communities in comprehensive planning, land use regulations, development review, transportation planning, natural resource inventories, community/economic development, public participation, affordable housing and hazard mitigation planning as well as providing a much more detailed list of specific services provided free to member communities on their website.

The Two Rivers-Ottauquechee Regional Commission (TRORC) is the planning group for the Vermont side of the Upper Valley. The commission was formed by a compact in 1970 between thirty municipalities in east central Vermont (TRORC 2008).[8] The commission is not part of the state government but is governed by a board of representatives from the member

[8] The thirty municipalities in alphabetical order are Barnard, Bethel, Bradford, Braintree, Bridgewater, Brookfield, Chelsea, Corinth, Fairlee, Granville, Hancock, Hartford, Hartland, Newbury, Norwich, Pittsfield, Plymouth, Pomfret, Randolph, Rochester, Royalton, Sharon, Stockbridge, Strafford, Thetford, Topsham, Tunbridge, Vershire, West Fairlee, Woodstock

towns. Their main goals are to advocate for the needs of their member towns and help bridge the opportunities and concerns that exist between towns and the state, while also to provide technical planning services to town officials and to act as a resource to local government. TRORC currently consists of eight full time staff: an executive director, an office manager, a GIS manager, a senior planner, three regional planners, and a senior transportation planner. The nine main areas of service they offer to their municipalities are community development, conservation, emergency management, GIS service center, housing, land use planning, technical assistance, transportation planning, and water quality (TRORC 2008).

Every five years the planning commission writes and publishes a regional plan which is "an expression of values and a vision for growth and management [of the region] for the next five years" (TRORC website 2008). The most recent plan was adopted on May 30, 2007 and became effective on July 4, 2007 (TRORC website 2008). The plan reveals the dominant issues currently affecting the region. The plan covers ten focus areas: land use, transportation, agriculture and forestry, natural resource, historic/cultural/archeological/scenic resources, housing resources, utilities/facilities/technologies, emergency management, energy, and economic planning (TRORC Regional Plan 2007). The two areas the plan most heavily emphasizes are transportation and housing, implying that these are the most critical issues facing the region today.

According to the plan, transportation has become a dominant issue due to voiced concerns by member municipalities and their populations. The largest concerns are not about congestion- annual traffic volume growth is only 1-1.5%- but rather that transportation improvement projects have not been able to keep pace with a deteriorating infrastructure (TRORC Regional Plan 2007, 63). Also there is a need to improve current insufficient public

transportation which must serve an aging population which is predicted to drive less and use public transportation more (TRORC Regional Plan 2007, 73). Subsequent chapters of this report focus precisely on these critical issues. Housing is currently another large concern as housing development has not kept pace with economic development, meaning that housing costs have been growing faster than incomes creating a worrisome affordability gap (TRORC Regional Gap 2007, 171). The housing market concerns tie back to transportation concerns since cheaper land is outside of the regional employment centers the average commuting time to work has increased (TRORC Regional Plan 2007, 171). The plan also emphasizes the unfavorable conditions in the disparities between housing costs and incomes in the Hartford/Lebanon market area.

REGIONAL PLANNING STRUCTURE AND POLICY

Throughout the Upper Valley, federal and state legislation play extremely varied roles in the current system of regional and local planning that should ideally move the region toward a more sustainable situation as the development and environmental concerns increase. Federally, the United States Environmental Protection Agency (EPA) is the main entity involved in planning. Both New Hampshire and Vermont lie within Region 1 of the EPA classification system. As will be shown for New Hampshire state legislation, there is minimal Federal interaction with New Hampshire planning groups because the regional planning commissions in New Hampshire tend to be resources used by municipalities only for advisory and informational purposes. On the other side of the Connecticut River, the Vermont Department of Environmental Conservation (DEC) works closely with representatives from the EPA to monitor progress “toward meeting defined indicators and proposed accomplishments” (Vermont Environmental Conservation 4). In the 2007 Annual Report dealing with the agreement between the DEC and EPA, it is stated that the EPA’s state program unit manager and the DEC’s

representatives will be in contact at least monthly to discuss any recently raised areas of concern so there is clearly strong, continuous communication between federal and state governments in Vermont. This federal to state interaction is important to keep all entities working toward the same goal and to provide as many funding opportunities as possible for the regional and local planning commissions.

Vermont Legislation: Acts 200 and 250

In Vermont, strong state legislation provides a base for development planning within local and regional entities. Act 200, collectively known as the Growth Management Act, is a 1988 amendment to the Vermont Municipal and Regional Planning and Development Act of 1967, concerned with land use planning. A major accomplishment of Act 200 was creating a new framework of land use goals, which included plans to pursue development that maintains the historic settlement pattern of compact villages and urban centers separated by rural countryside. Hence, intensive residential development is encouraged primarily in areas related to community centers, while strip development along highways is discouraged. Further plans are to provide a strong and diverse economy that provides job opportunities which maintain high environmental standards, but also broaden access to educational and vocational training with safe, convenient, economic and energy efficient transportation systems that respect the integrity of the natural environment, such as public transit options and paths for pedestrians and bicyclers. Under this same precept, plans to identify, protect, and preserve significant scenic roads, waterways, and other important natural and historic features of the Vermont landscape, such as lakes, rivers, and aquifers, through the efficient use of energy and the development of renewable energy resources can be found.

Additionally, the act pursued a greater integration at all levels of the planning process and an active consideration of the ripple effects to be produced by land use decisions of one town or region to another (State Statues 2008). To establish a coordinated, comprehensive planning process and policy framework and at the same time encourage citizen participation at all levels of the planning process, considering the use of resources and the consequences of growth and development for the region, state, and community in which it takes place, the implementation of detailed Planning Goals serve as a guide for managing communal growth, in support of this vision (State of Vermont 2008).

Hence, the changes made by the amendment were intended to improve the effectiveness, coordination, and comprehensive view of planning for the local, regional, and state level and required the input of a number of state agencies (see Figure 2.2). The mechanisms were established to provide coordination both between state agencies, and between local, regional and state levels. The Act also aimed to broaden public involvement and participation in the planning process, with the goal of ensuring that land use decisions were to be made at the most local level possible while being proportionate with the impact of the decision.

Fig. 2.2: State Agencies Required to Participate in the Act 200 State Agency Planning Process

Agriculture	Development & Community Affairs	Education
Human Services	Labor & Industry	Liquor Control
Military	Natural Resources	Public Safety
Public Service	State Buildings	State Colleges
Transportation	VT Housing & Conservation Board	VT Housing Finance Agency
VT Industrial Development Authority	VT State Housing Authority	

During the spring of 1970, Act 250 of Vermont law titled the Land Use and Development Act was passed in order to address concerns about increasing development pressures within the

state. New roads were built as development increased in order to make travel to the region easier and the new transportation routes fueled even further development. Interstate 89 running from northwest to east central Vermont and southwest through New Hampshire was built in sections throughout the 1960s to serve as an important Vermont highway because it runs through the capital, Montpelier, and Burlington, the largest Vermont city. At the Vermont and New Hampshire border, Interstate 89 intersects with Interstate 91 in the middle of the Upper Valley region forming an important travel area. After the opening of these two interstates brought more tourists during all months of the year, traffic increased, development spread, and the current infrastructure and local services were stressed. In 1969, in the absence of any environmental regulations or land-use controls in Vermont, state Governor Deane C. Davis acted to appoint a study commission that would write a law to tackle the growing concerns. Out of this study commission came Act 250 that created nine District Environmental Commissions (DEC). Following the creation of the Districts, any large-scale development projects had to be reviewed by the appropriate DEC to make sure it followed 10 distinct criteria outlined to protect the environment, community life and aesthetic character of Vermont. A summary of the criteria listed on the Vermont Natural Resource Board website are as follows:

1. Will not result in undue water or air pollution. Included are the following considerations: (A) Headwaters; (B) Waste disposal (including wastewater and stormwater); (C) Water Conservation; (D) Floodways; (E) Streams; (F) Shorelines; and (G) Wetlands.
2. Has sufficient water available for the needs of the subdivision or development.
3. Will not unreasonably burden any existing water supply.
4. Will not cause unreasonable soil erosion or affect the capacity of the land to hold water.
5. Will not cause unreasonably dangerous or congested conditions with respect to highways or other means of transportation.
6. Will not create an unreasonable burden on the educational facilities of the municipality.

7. Will not create an unreasonable burden on the municipality in providing governmental services.
8. Will not have an undue adverse effect on aesthetics, scenic beauty, historic sites or natural areas, and 8(A) will not imperil necessary wildlife habitat or endangered species in the immediate area.
9. Conforms with the Capability and Development Plan which includes the following considerations: (A) The impact the project will have on the growth of the town or region: (B) Primary agricultural soils; (C) Productive forest soils; (D) Earth resources; (E) Extraction of earth resources; (F) Energy conservation; (G) Private utility services; (H) Costs of scattered developments; (J) Public utility services; (K) Development affecting public investments; and (L) Rural growth areas.
10. Is in conformance with any local or regional plan or capital facilities program.

The system implemented by Act 250 has added more hierarchy to the Vermont State planning and in recent years, 600-700 applications for large-scale development projects are sent to the District Commissions annually. Only an average of 20% of all applications within the state require hearings by the standards of the District Commissions and 95% of all applications are approved, including ones with changes made before approval (Vermont Environmental Assistance Partnership Fact Sheet February 2004). One downfall of the approval program is the lack of personnel to visit the development sites and verify proper completion of activities after the construction, mining or logging begins; this personnel problem is due to a shortage of funds. Although, Act 250 has been efficient in controlling developmental sprawl because it requires new development projects to be contiguous to existing developments unless the additional tax revenue from the project is greater than the additional cost of providing services to the newly developed area. Act 250 has also heavily limited retail development in Vermont. For example, the first of only four Wal-Marts currently operating in Vermont was built in 1995 and three of the current stores are about half the size of normal Wal-Mart stores and did not require new development because they were situated in existing buildings (The Hometown Advantage 2008).

New Hampshire Legislation

In New Hampshire, there is minimal state involvement in regional and local planning. Thus, planning governance and structure are less hierarchical than in Vermont. The historical culture of New Hampshire has been one that promotes freedom of governance at the local level and most municipalities still maintain their independence to make planning decisions and promote sustainability. Therefore, New Hampshire has no parallel legislation to Vermont's Act 200 and Act 250 which is an important difference in the structure of regional planning between the two states.

Funding for Regional Planning Commissions

The annual budget for the Two Rivers-Ottaquechee Regional Planning Commission in Vermont is about $1,000,000 and about 75% of the funding comes directly from the federal government vis-à-vis agencies like the EPA and other federal grant programs that state agencies can apply for and distribute. State funds represent approximately another 20% of the total funding and the remainder is comprised of local municipality dues or contract fees for work the RPC does.

In New Hampshire, the Upper Valley Lake Sunapee Regional Planning Commission handles an annual budget around $628,000. About 45% or $300,000 of the total comes from grants and projects. The New Hampshire RPC maintains a contract that makes up another large portion of the budget for work to help the NH Department of Transportation and other agencies like the Department of Environmental Services. Community member dues make up about 15% or $95,000 and communities also pay for contract work that they request the RPC to help with separately. (need comparison and reasons why NH doesn't get nearly as many federal funds – *Claire hasn't heard back from Christine Walker so we aren't able to finish this part*)

Discussion of Regional Planning Structure

There are obvious discrepancies between the legislation and funding that shape the Regional Planning Commissions on each side of the Connecticut River that cause different goals and levels of success for each RPC. In New Hampshire, UVLSRPC struggles to find funding to support their actions throughout the region because the total funding coming from state and federal agencies is about half of what TRORC receives in Vermont annually. New Hampshire and Vermont each have the overall small town feel in many of the Upper Valley communities but Vermont seems to understand the need for overarching legislation that establishes a more coordinated network of development throughout the state and regions that is inline with the principles of Act 200. This is important to limit individual communities from developing without concern for surrounding towns that might be affected by the changes. In New Hampshire however, the most important focus throughout the state is the small town feel and freedom of each municipality to develop and maintain its own identity. Individual community development without looking at a regional impact causes problems for transportation, environmental conservation, project funding, and economic development. The aspect of transportation is affected by uneven development between towns which results in a forced expansion of roadways and increased congestion along main commuting routes through adjoining towns in addition with other transportation problems as addressed in further chapters of this report. Environmental conservation is not focused on as heavily when there is no consideration of regional impact because critical landscapes and habitat areas can only be addressed with a holistic view of the region is in place that often requires an integrated process between towns. The over-arching view is important to prevent one town from harming a wetland, habitat type or watershed that crosses municipal boundaries. Without the regional

mindset, funding and resources for projects also are not used efficiently between towns in close proximity to one another. For example, if two towns within the region are attempting similar development projects they each spend time finding funding sources when a regional planning group could supply the information to both towns with greater ease and together they might be able to develop a greater pool of resources. Finally, as towns develop separately from others, economic development is less efficient because each town builds their own commercial business area and as a region there is no longer a concentrated "urban" area that has the majority of the commercial development along appropriate access routes. This causes the road infrastructure to spread and strains the efforts of the municipality to maintain optimal functioning of the transportation.

The lack of town concern for the impacts to adjoining towns and the region from development changes seems to be caused in part by the lack of income tax in the state of New Hampshire which prompts each town to pursue more commercial development in order to lessen the tax burden. As the only state in the nation without an income tax, New Hampshire's position makes it even more difficult to maintain a regional planning structure that would benefit the collective area and that each municipality will support.

Valuation of non-market goods:

When examining the ability of planning bodies to incorporate sustainability into their operations, one must first understand the methods by which institutions value environmental goods, how issues are deliberated and discussed, and how these processes incorporate or violate sustainable development. Understanding the status quo of the planning process is necessary in order to set up our case studies in Upper Valley towns which follows later on in the report.

For any policymaker dealing with sustainability issues, a significant part of their job is determining how much the electorate values environmental quality, and comparing that value with the cost of conserving resources or implementing sustainability initiatives. This can be done in numerous ways – surveys (contingent valuation or CV), analysis of travel costs, market valuation of substitutable goods – but the majority of valuation techniques aim to assign a dollar value to environmental resources. The advantages of monetizing value are threefold: it allows for economic costs to be weighed against what are otherwise intangible benefits, it provides easily understandable justification of policy decisions, and it can serve as an "impartial" mediator between different groups of people with very strong opinions about environmental quality. However, despite the perceived benefits of methods such as CV, there is in fact no definitive proof that people can even conceptualize environmental resources in dollar terms accurately. "Research has suggested that although people do hold strongly felt values for nonmonetary aspects of goods, such values often are not cognitively represented in monetary terms" (Gregory at al. 1995).

Allowing the public to speak up about their own motivations in a deliberative setting might allow for a bottom-up transfer of information instead of educated scientists and scholars trying to study the populace and interpret the best course of action from observed behaviors. If virtually an infinite number of ways exist to describe what a person is doing at a particular instant, then at least a billion different preferences may be constructed or inferred from that behavior, depending on which description we happen to pick. The interpreters of these observed behaviors have a huge influence on the conclusions as to why those behaviors are being carried out, and as a result, the policy recommendations taken from them will be more a factor of the biases of the surveyors than the real values of the public. There are two options to deal with this

problem: scientists can avoid interpreting the observations and confine the study to epistemic observations in order to avoid ad-hoc explanations of the psychological causes of the behavior, or they can simply ask the public why they act in the ways they do, and provide outlets of discussion and deliberation.

The purpose of this brief critique of current SD methodology is not condemn the shortcomings of sustainability, but rather to highlight the importance of examining the process by which SD decisions are made. Sustainability is a highly variable concept and each application of SD will see different issues coming to the forefront, raised by different environmental characteristics and different value sets between communities. The ability of planners to adapt to variation is critical, and the way they grapple with community values is a fundamental avenue for bias. In the worst case, these local institutions will motivate their policy by assigning individual dollar values to personal preferences and aggregate them all together; assuming people act out of their own self interest exclusively denies morality and altruistic behavior altogether. The capacity of people to act out of ethical duty rather than personal interest is lost in a sea of dollars. At best, policymakers will involve their constituents in all stages of the legislative process, giving them opportunities to deliberate on environmental issues in an open forum and to reach a consensus. Environmental issues are an explicit example of altruistic behavior, which is why deliberation and public participation is so important to SD. Deliberative democracy works by subjecting issues, preferences and opinions to public scrutiny and debate, a process by which said preferences are often transformed. "The ideas and practices associated with deliberative democracy – open discussion, transparency of decision-making, forcing policymakers to be accountable, reasoned and respectful debate – may be idealistic, but they are fundamental to the creation of green public spheres where the multiple ideals of SD can

be debated and refined, and where an empowered SD social movement can coalesce" (Sneddon et al 2005). The notion of sustainable development is, in its most fundamental form, an attempt to answer the question: "what do we need to do to achieve a good and decent society?" This question is about more than individual preferences; it includes the overlap of peoples wants, desires, needs and conceptions of a "good and decent" society. As Sneddon et al conclude, "A first step towards realizing these aims, and towards strengthening sustainable development as a social movement, emphasizes the processes through which social and political changes occur, and these processes hinge crucially on notions of citizenship, participation and democracy" (Sneddon et al 2005). In the Upper Valley, it is critical to consider the growth of new deliberative spaces to allow for more discussion and debate of planning issues; without such forums, the true goals and preferences of all stakeholders will not be adequately represented.

CASE STUDIES

The following case studies will evaluate approaches to planning in four municipalities: Lebanon, Canaan, Hartford, and Thetford (see Figure 2.3). These municipalities represent the diversity of the Upper Valley through their size, infrastructure, and socioeconomic status. We hope that by analyzing two municipalities in New Hampshire and two in Vermont we can present the different approaches to planning in the two states and address some of the challenges faced by regional planning commission as they attempt to coordinate planning at a larger scale.

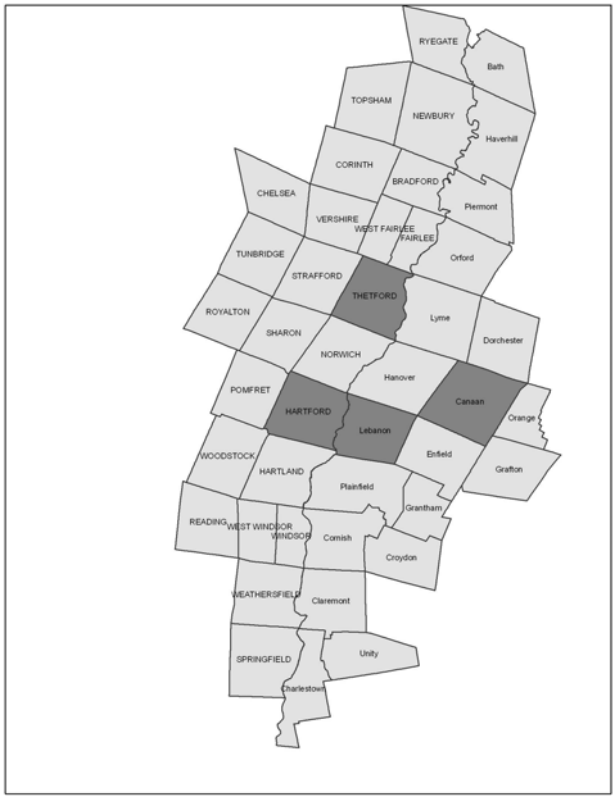


Figure 2.3: Map of the four case study towns, Lebanon, Canaan, Hartford, and Thetford, and their locations within the Upper Valley.

Lebanon, New Hampshire

The Upper Valley, for the purposes of our study, encompasses the region along the upper Connecticut River and includes parts of both eastern Vermont and western New Hampshire (see Chapter 1). Even though there are no precise boundaries for the Upper Valley that are agreed upon by all regional players, there is no question about the fact that Dartmouth College, Dartmouth-Hitchcock Medical Center, and the City of Lebanon serve as the principal providers of jobs in the region and are thus perceived as regional "centers".

Residents from across eastern Vermont and western New Hampshire (and sometimes further) commute on a daily basis to work at Dartmouth College, DHMC, or somewhere in the City of Lebanon. According to a study conducted by the Lebanon Planning Board in 2005, the daytime population of Lebanon was about 27,500 people and approximately 15,000 were commuting to Lebanon daily to work, shop, or access other services provided by the city (Lebanon Master Plan 1-10). The daytime population is more than twice the number of people that actually reside in Lebanon. These figures clearly indicate that Lebanon does feel the effects of changes within towns all across the Upper Valley. For that reason, we chose to evaluate specific issues that have arisen in Lebanon and demonstrate the complexity of planning in the Upper Valley.

The city of Lebanon serves as a regional center for several reasons. It is near the intersection of Interstates 89 and 91 and is easily accessed by several other major highways including US Routes 4 and 5 and NH Routes 12A, 10, and 120. The Lebanon Airport also attracts many people from across the region (Lebanon Master Plan 9-1, 2008). The role Lebanon plays as the core of the Upper Valley is reflected in the city's approach to planning. The Planning Board and the Planning Department both play a role in planning projects in Lebanon. The Planning Board consists of nine members and all of them are nominated by the City Manager with the exception of the council representative. The Planning Department consists of five paid individuals who are responsible for assisting the Planning Board, preparing studies, maintain GIS information, and working with the Conservation Commission, the Historic District Commission, the City Council and other committees (City of Lebanon, 2008).

As economic expansion has occurred over the last couple of decades throughout the Upper Valley, Lebanon has felt the effects in many ways, but this case study will focus on the resulting increased traffic congestion and highlight the difficulties of achieving sustainable transportation in a largely rural region. Even though the City of Lebanon aims to manage the increasing traffic congestion, it is difficult because of the physical nature of the region. According to the Lebanon Master Plan the city strives "for a balanced, multi-modal transportation system that provides incentives for increased use of transit, bicycle, and pedestrian modes, supports compact, mixed-use development, and contributes to decreases in both traffic congestions and volumes" (Lebanon Master Plan 9-1, 2008). It is challenging, however, to implement such a system because the residents are scattered across a large area and, because it is not economically feasible to provide dispersed residents with alternative transportation, the majority of residents rely on personal automobiles (Lebanon Master Plan 1-9, 2008). The City of

Lebanon has attempted to decrease traffic congestion, but as recent examples show, solutions are complicated and many factors must be taken into account.

One ongoing situation that demonstrates the complexity of this issue is the School Street project. The proposal is a $2.7 million project that will widen the road, separate sewer lines from storm water drains, and install 5 foot bike lanes on each side of the road, one for bikers in each direction (Walk-Through Turns Testy, 2008). Due to protest from residents after a walk-through of the project in late April, city officials proposed an alternative plan that did not include the $40,000 installation of the bike lanes and, thus, would not have such a large impact on the lawns along the street. According to an article in the Valley News, with this second proposal "yards [could] grow by as much as five feet". It is not clear whether residents' lots will be five feet larger than they currently are or if the yards will be cut back 5 feet less than in the original plan (City Restores School Street Yards, 2008). A member of the Pedestrian & Bicyclist Advisory Committee did not believe the bike lanes should be completely removed from the project and proposed yet another solution. The final proposal included unmarked bike lanes and a smaller space between the edges of the road the sidewalk. This final proposal allowed for the installation of the bike lanes while having a smaller impact on the yards along the street (Hold on School Street, 2008).

The two alternatives were presented within a short period of just a few weeks around the end of April and the beginning of May. The fact that so many actions were taken in such a short period clearly indicates that this issue was a very political one. The reason the first alternative was proposed was due to residents' discontent because, according to an article in the Valley News, they would have lost several feet across the front of their lots (Walk-Through Turns Testy, 2008). In a personal interview, the City Planner, Ken Niemczyk, stated that the first

proposal did not intrude into resident's property. According to Mr. Niemczyk, the city has "legal means to pass over another's property" and that all of the proposed changes were within the city's right-of-way. In other words, there is simply a lack of understanding amongst residents that part of their yards belong to the city (Ken Niemczyk, 2008). There clearly is a misunderstanding somewhere. If the city had done no wrong by reducing the size of these yards, it is interesting that they worked so quickly to come up with an alternative plan that did not intrude upon residents' yards. Wherever the misunderstanding may lie, increased communication between residents and city officials could clarify such issues.

Another point of contention was the residents' claim that they had no knowledge of the project until the city began cutting down trees. Many residents were upset that they were not informed about the project before physical work was begun (Walk-Through Turns Testy, 2008). On the contrary, Mr. Niemczyk claimed that city officials had made the information available to residents in a public hearing two years ago. He also stated that the detailed plans for the project were on display during these public hearings (Ken Niemczyk, 2008). Interestingly enough, one of the residents is actually the former mayor and even he claimed that while he was aware of the project, he wasn't aware of the extent of the project and its effects. In a discussion with a Valley News reporter, the current mayor stated that no city officials were aware of the details of the project because the city engineer was mainly responsible for the project. To further complicate the issue, the city engineer recently retired and has not yet been replaced (Walk-Through Turns Testy, 2008). Once again, there is a large gap between what community members have to say about the issue and what current city officials are saying. This gap is even more puzzling since even former city officials claim to be unaware of the effects of the project. It seems that city

officials need to not only open up more lines of communication not only with residents, but with other city officials.

This case study exemplifies the difficulties of community planning. Even though project plans were presented at public hearings, the information did not reach all affected and interested individuals. Not only does this case study demonstrate the difficulties of communication between residents and city officials, but also the pressures a city faces with any type of changes, even changes that are an attempt to alleviate negative things such as traffic congestion and encourage positive trends such as use of alternative transportation.

Canaan, New Hampshire

In contrast to Lebanon, which serves as the core of the Upper Valley, Canaan is a rural community that is expected to grow at a much more moderate pace. According to the Canaan Master Plan, the Town of Canaan will "remain primarily a bedroom community", but economic opportunities will expand. While Lebanon is proposing to expand roads to increase access to the city and install bike lanes at a cost of $40,000, Canaan notes that residents will continue to rely on automobiles as the dominant form of transportation and only the "necessary roads" in the countryside will be transformed from dirt to pavement (Canaan Master Plan 5, 2008).

Canaan is a small town with only 3,319 residents (US Census Bureau, 2006C). According to the chair of the Canaan Planning Board, Andy Musz, approximately 80% of the employed residents are employed outside of Canaan. The majority of residents who do work within the town work at or own businesses that are just short of home businesses. Musz states that it is not uncommon for people to open an automobile repair shop and work out of their home. This sometimes creates concern in a residential area because of issues such as noise and increased traffic (Musz 2008).

There is a planning board in Canaan that is active in the planning of community projects, but their role is limited because there is no zoning in Canaan except for a historic district outside the center of town. The planning board consists of seven members plus one ex-officio selectman that is appointed each year. Members hold 2-3 year terms and the terms are staggered so that there are two positions available each year. The planning board is responsible for regulating excavations, enforcing the comprehensive Shoreline Protection Act, and creating the town master plan. The planning board makes information available to community members, as required by law, by posting it on the town website, bulletin boards in the center of town, putting articles in the Valley News, and notifying other towns that will be affected by a project deemed to have a "regional impact" (Musz 2008). It seems that, while the planning board has been able to work with developers and others with past issues, the absence of a zoning ordinance makes it difficult for the board to enforce specific regulations.

Mr. Musz compared "planning without zoning" to a "gun with no bullets". There is a historic zone that was created in 1984, but the town has been unable to implement a zoning ordinance for the rest of the town. About nineteen or twenty years ago the proposed zoning ordinance was defeated in a vote by residents. Only about 20% of residents were in favor of the ordinance. The town proposed another zoning ordinance in March of 2008 that was also defeated without about 550 residents against the ordinance and only 350 in favor of it. Mr Musz stated that the town held 14 meetings between the time the first draft of the most recent ordinance was presented and the time the final draft was finished. After each of these meetings the comments and concerns of residents were considered and, if possible were incorporated into the ordinance. According to Mr. Musz the same 10-12 people came to the meetings and, after doing a loose poll, they found that the majority of residents who voted against the ordinance had not even

looked at it (Musz 2008). It appears as though the major obstacle to the implementation of a zoning ordinance is lack of education amongst residents. Mr. Musz seemed to think that the majority of residents did not want a zoning ordinance simply because they did not want more rules to be imposed upon them. On the other hand, when someone proposed the construction of a shooting range, about 150 residents showed up at the planning meeting and all of them were against the construction of the shooting range. This is just one example of how the implementation of a zoning ordinance could protect residents from unwanted development (Musz 2008).

Hartford, Vermont

Hartford, Vermont, is included in this study as it represents a socioeconomically diverse community within a relatively urban environment. Considered 'Vermont's Gateway Community', Hartford's 10,367 residents inhabit five villages: Hartford, Quechee, West Hartford, White River Junction, and Wilder (US Census Bureau 2006A). The constituents of Hartford over the age of 25 years old are recorded to have obtained higher levels of education compared to the national averages with 88.7% holding a high school diploma (US, 80.4%) and 32.4% with a bachelor's degree or higher (US, 24.4%) (US Census Bureau 2006A). Due to the higher degree of education, there is also greater participation in the labor force with 67.8% of people over 16 employed compared to the national average of 63.9% (US Census Bureau 2006A). Of the 67.8% employed, the mean travel time is 19.3 minutes which is shown in Figure 1: Hartford Commuting Map 2000. The yellow section of the map following Route 91 has a lower average travel time of 15.9 minutes while the green section has an average time of 21.9 minutes (US Census Bureau 2006A). The dependence on highway travel correlates with crossing over the state boundary and the increased speed of highway travel. The yellow section appears to be split

by Interstate 89 which is the main travel corridor to Dartmouth Hitchcock Medical Center and Dartmouth College. Due to the proximity of Dartmouth College and Dartmouth Hitchcock Medical Center to the town of Hartford, these businesses "provide a wealth of jobs and business opportunities" for the town of Hartford (Kaminsky 2001).

The town of Hartford has a Department of Planning and Development Services which "is responsible for community planning projects which include the preparation and implementation of town and village plans, grant writing and administration, and special project planning" (Smith 2000). This community board is responsible for developing a master plan for Hartford every five years including 'sections on land use, population, housing, economic development, transportation, community facilities and services, recreation and natural resources" (Smith 2000). The goal of the Department of Planning and Development is "to provide efficient and professional planning and development assistance and service to the Hartford community, while preserving the history, character and uniqueness of Hartford" (Hartford Development Corp. 2008). Historically, Hartford has been an entryway into Vermont for many travelers due to its proximity to the border and the relatively large concentration of public transportation which runs through the town, the planning commission hopes to embrace this image while planning for a sustainable future.

The last master plan available on their website is from 1998 representing a lag in updating available information to maintain current relevancy (Smith 2000). Individual villages provide extensive information regarding their unique master plans. White River Junction provides a Revitalization Plan Progress Blog for its constituents and planners to remain informed. This blog updates viewers about the current processes and provides a section for comments. This creates a forum for discussion between residents and planners while keeping

everyone informed and involved. The website also provides a timeline of upcoming events so that the viewers are aware of future plans. Hartford presents a transparent record of its proceedings by posting the community's administration's meeting agendas and minutes for public viewing. On Hartford's town website there is a link to subscribe to a Hartford focused discussion group which allows residents to communicate their feelings about Hartford, this aids the "mission (which) is to encourage community engagement using the Internet" (Smith 2000), this page also includes 'help with using computers' for those who are less technologically savvy.

Recently, the planning commission granted permission for a proposed adult homeless shelter to be constructed in Hartford. This structure is important to the community because there is a great need for a safe place for adults without children to live and because it will alleviate pressure on the current available shelter. For three years, the existing Haven worked with the commission and local residents to determine the possibility of constructing this space and it has finally been approved. Initially proposed to the Lebanon planning board and denied, by a vote of three to two, the Upper Valley will now be able to house more homeless people in this adult shelter (Upper Valley Haven 2008). Lebanon denied the proposal stating that the shelter would be residential while existing in a commercial lot (Swanson 2008). The Lebanon planning commission also received negative feedback from local residents who "expressed concern" for the proposed project (WCAX 2006). In Hartford, local residents also expressed fear that building an adult homeless shelter may bring in more crime and may endanger the children in the nearby family shelter (Swanson 2008). The planning board decided to go ahead with the proposal after adapting the plan for rainwater treatment, parking, and listening to residents' concerns. The Hartford Planning Commission combined both statistical research and local

feedback to reach a decision which is satisfactory for the Haven, local residents, and the Planning Commission.

Thetford, Vermont

Thetford was selected to be included in this report because it represents the small rural towns in the Upper Valley. Comprised of five villages and 2,617 residents, Thetford remains a close knit community with a focus on agriculture (US Census Bureau 2006B). Many of the jobs available within the boundaries of Thetford include working for the local schools, farms and the Pompanoosuc Mills (A member of the Thetford Planning Commission 2008). The residents of Thetford are highly educated with 90.6% having obtained a high school diploma and 44.7% with at least a bachelor's degree and an overall mean income of $48,333 (US Census Bureau 2006B). The average travel time for a resident of Thetford is 24 minutes and the majority of people work outside of Thetford (US Census Bureau 2006B; A member of the Thetford Planning Commission 2008). This data is represented in Figure 2: Thetford Commuting Map 2000 which shows the average commuting time is consistent throughout the community. Three main transportation routes intersect Thetford: Vermont Route 113, Interstate 91, and US Highway 5; all of these roads provide quick transportation throughout the community to surrounding towns. Since Thetford contains many dirt roads which require slower transportation speeds, these thruways provide an essential passage to neighboring communities and jobs.

Two years ago, the Thetford Zoning Board of Adjustment and Planning Commission split into two distinct entities to manage sustainable development in Thetford. At the time of the separation, it had been recognized that with the members comprising the zoning and planning boards, little time was available to actually plan. Now as a unique entity, the Planning Commission devotes its expertise to writing specific zoning regulations and the town plan.

According to one of its members, the Planning Commission works alongside the Development and Review Board (DRB) to design constructive and enforceable regulations.9 It is the responsibility of the DRB to implement the bylaws and oversee individuals' zoning and subdivision applications. The members of the planning commission are appointed by the local select board and are currently comprised of three members of the original combined board who have experience planning and implementing regulations, two residents, a couple who are large landholders in Thetford, run a dairy farm and whose family has resided in Thetford for many generations, and the rest are interested individuals. It is important to note that the husband and wife pair is extremely valuable to Thetford as they depend largely on agriculture for their income as do many residents of Thetford. The influence of the agriculture community distinguishes Thetford from the other case studies included in this report.

Thetford represents a small town within rural Vermont and the planning process is organized to complement its size. Each member of the community is invited to be part of the Thetford list serve which emails updates to the community regarding happenings in Thetford. Sign ups for this list serve are available online and have provided a new method of interacting with the community using current technology (Smith 2000). The Planning Commission uses the list serve to share information and provide community members with up to date information. Although the list serve is available to everyone in theory, in practice it may only be received by those members of the community who have internet access and email addresses. Since Thetford is currently planning to increase its elderly population, is rural and lacks a more urban infrastructure, high speed internet access is not available to all members of the town. Supplementing the list serve are more traditional methods of communicating public information

9 Much of the information in this section was attained during an interview with a member of the Thetford Planning Commission, April 2008.

with the community. There is a town newsletter, bulletin boards for posting notices, large public sandwich boards for displaying large posters, and, for very important meetings, an advertisement in the Valley News. For any proposed new zoning regulations, a public hearing is set to allow the residents a direct avenue for participation. At these hearings every comment is recorded and later responded to, this insures that each community member's voice is heard and included in the decision making process. Thetford's planning commission utilizes many methods to communicate with the local residents that are appropriate and effective in a small rural town.

Since growth of a single community is most effective when viewed as part of the regional development, Thetford examines neighboring town's plans to visualize their impact on nearby communities. By recognizing the impact of their decisions on other communities, Thetford is able to construct regional plans that are beneficial for the town without inflicting damage on surrounding towns. For example, when developing a flood plain within its boundaries, Thetford recognized its effect on neighboring Norwich and Lyme. If Thetford allows development in the floodplain that diverts water to or from these towns, it has the ability to impact the amount and availability of water flowing from the Connecticut River to these towns. Thetford is trying to decipher the best method of developing along the Connecticut River which will enable them to preserve the natural resource and avoid negatively impacting nearby towns.

Both Hartford and Thetford rely heavily on technology to communicate with their residents. Although this method works with many of their constituents, it's important to recognize that not all community members have easy access to the internet or a computer, or that they may be lacking the skills to utilize these services. The implementation of more traditional methods of sharing information work well in Thetford due to its smaller size and the clustering of villages which help spread the information.

While the issues addressed in these four municipalities are different, there are common solutions that arise from the four case studies. One common solution is implementing more thorough communication between city officials and residents. All of the towns are currently meeting the requirements put forth by law, but more steps can be taken to insure more transparency. We suggest that the towns continue with their current approach but utilize newer technology to share information among a broader cross-section for community residents. The town list-serve's provide an opportunity for community involvement through email which caters to younger generations, broadening the range of constituents with access to information. The towns should implement a bi-weekly or weekly newspaper briefing about the planning commission's actions and decisions to increase public awareness about current happenings (the frequency of such publication may be determined by budgeting constraints and correlating the committee's meetings and decisions). These actions supplemented with current methods of communication will create a greater awareness among the residents about current planning issues and allow them to play a greater role in the planning process.

CONCLUSIONS

In the 21st century, the need for planning new development and resource use will continue to be an important topic for all levels of government from local and regional to state and federal. Without a plan for future development, humans will no longer be able to maintain supplies of important natural resources and each person will worry about their own needs without looking at the overall picture moving forward. Three goals for successful regional planning in the current global environment should be: to allow for necessary economic growth while minimizing environmental harm and use of natural resources in order to develop

sustainably, to account for the needs of all involved entities and an often broad range of residents' opinions while also keeping all parties informed, and to focus on maintaining the character of the region by limiting overdevelopment with zoning ordinances and regional plans that bring smaller municipalities together to share resources.

In recent years, the concept of establishing "sustainability indicators" by which to measure the attainment of sustainability goals has gathered momentum. Finding ways to assess the sustainability of policy initiatives has proven just as difficult as defining what sustainability actually means. The use of indicators helps to allow for variation across environmental zones, and shows great promise. The problem occurs when one tries to define a particular set of indicators to universally measure sustainability: local variation in the environment renders certain indicators critical in some areas and irrelevant in others. The fact that one concrete definition of sustainability does not exist further complicates the problem. With other less normative issues, like the diagnosis of a medical condition or a translation from one language to another, the issues being assessed are more or less static and can be "solved" with a "right answer" (although the contestability of those terms is up for discussion, it is not particularly important here). By trying to define sustainability in one shot, scholars are attempting to "solve" the problem universally instead of recognizing that there is no explicit definition of sustainability, only broad-based guidelines that can be expanded and elaborated upon to meet the needs of each particular circumstance.

The dilemma with accepting this definitional vagueness is that it requires the expertly trained researchers and scholars to relinquish their control, at least partially, in order to allow locals to help determine what sustainability means in their own scenario. Although the risk of uninformed and uneducated decisions does exist when the public is allowed to contribute, that

does not mean that experts should avoid allowing local stakeholders the means to define their own goals of sustainability. It simply means that the burden falls upon scientific experts to educate localities to make their own informed policies instead of trying to create a universal definition of sustainability. The ability of local decision-making bodies to include the voices of all stakeholders in their designation of indicators is critical to the success of any project. What is required is an amalgamation of expert-led, research based analysis and indicator evaluation and participatory processes contextualizing issues at the local scale (Reed et al 2006).

The Upper Valley planning community needs to continue to address the issue of community involvement. With a very broad range of socioeconomic classes and commuting distances represented throughout the Upper Valley it is not realistic to expect all community members to attend town meetings and planning commission events in order to keep themselves updated on planning issues and express their opinions. Some towns, including Thetford and Hartford, currently use a listserv to disseminate information to the community, which seems like it could be a good addition to all community information circles. In addition, radio and newspaper advertisements after planning meetings can be an efficient way to get a summary of the topics discussed at the meeting out to residents, especially those without high-speed internet access that cannot download meeting minutes from a website. Summaries should also be dispersed in multiple languages to engage residents that do not speak English as a first language, who might have opinions different from native English speaking populations. Towns usually follow requirements about quantity and place of posting and often those requirements generally do not specific posting locations that are spread apart from each other or placed in high visibility locations. Currently, many towns are required to post announcements about meeting time and place in a certain number of locations. Those locations are not required to be spread apart from.

Under these guidelines, If there were an issue that a planning committee did not want contested or knew will be highly disputed they could theoretically choose to post their meeting information in three relatively private or overlooked spaces within a block of each other, disregarding the majority of the town area. More comprehensive posting requirements in order to improve visibility and distribution of information should be considered throughout the Upper Valley and held consistent throughout the region.

Through the research for this project, important strengths and weaknesses of regional planning within the Upper Valley were apparent. The Upper Valley has well-developed layers of planning structure, but the interaction between layers and dispersal of even resources and ideas across certain layers needs some change in order to make the structure work most efficiently. One important weakness of the current situation is the transparency within different planning entities with regard to their current plans and projects. Working together between levels of government is very important for development planning because each level has different experience and a different big picture in mind. We suggest that RPCs consider meeting with each other on an annual basis in order to review the past year of achievements and intentions for future projects.

Another area of weakness is the lack of interaction both between individual towns and between town officials and community members. We believe it would improve communication on many levels if the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) and Two Rivers Ottaquechee Regional Commission (TRORC) agreed together to each hold meetings with all of their member towns at least annually to address some of the most important regional issues which may be attempted currently and simply need a more focused effort. This seems drastic in some ways because the regions covered by each RPC are very expansive and

communities in one area do not believe they have anything in common with communities from the opposite side of the region. Collaboration between these smaller groups is especially important for environmental resources and habitats that cross municipal boundaries and economic issues, like employee transportation or affordable housing for workers, which spread further than the main business district.

State, regional and local planning in New Hampshire and Vermont has successfully maintained the small-town feel that is so vital to the culture and excitement of these New England states. Unfortunately, without some changes the planning entities might begin to face more pressure than they can handle to develop within and surrounding the towns that symbolize this region as it is currently known. Funding has been increasing for regional planning in the Upper Valley also, thanks to the devoted efforts of planning professionals, town employees and concerned volunteers, and more funding can always be put to good use in new projects. We think it would be extremely beneficial to the two RPCs within the Upper Valley to implement better communication and overlap between groups due to the strong river valley watershed connection. Some or most of these recommendations are being considered or addressed to varying degrees. For example, Peter Gregory of the TRORC currently sits in on most meetings for the UVLSRPC as an invited member which is very important for communication between the two RPCs. These recommendations would help to address some of the limitations our research showed in the current Upper Valley planning community. It is apparent that coordinating work between multiple jurisdictional levels is extremely difficult, but if some of these changes are possible, they might help to move the structure of Upper Valley planning forward in order to cope with continuing development in a more sustainable fashion.

CHAPTER THREE

The Socioeconomics of Sustainable Transportation

INTRODUCTION

Existing in the middle ground between transportation's environmental detriments and the quest for its sustainability are socioeconomic issues crucial to the mitigation of the former and success of the latter. These include matters of public awareness and education, economic costs both general and specific, access to and "ridership" of public transportation, population and housing densities, commute length, and so on. Additionally, such structural demands are complicated by the omnipresent factor of individual decision-making; while the benefits of transportation are manifested clearly, negative externalities stemming from users' actions are often much more diffuse. Analyzing and applying problem-solving strategies to these dilemmas will have significant positive connotations for both environmental health as it stems from transportation usage and sustainability efforts as well. As noted in this report's opening chapter, sustainable transportation is linked directly to human populations, the transport needs of whom it seeks to satisfy efficiently while minimizing economic and environmental costs alike. A productive understanding of sustainable transportation requires simultaneous insight into the demographics and usage trends that characterize the individuals sustainable practices would hypothetically serve. This chapter will explore these critical connections as they specifically pertain to the Upper Valley.

In 2007, the population of the United States collectively consumed nearly twenty-one billion barrels of oil per day, more than any other country in the world (CIA World Factbook 2007). More specifically, the new millennium saw Americans surpassing their global neighbors on an individual basis as well, each utilizing the energy equivalent to 8.35 tons of oil annually

(IEA 2001). The aforementioned symptoms of this so-called epidemic carry significantly unique implications for more rural, less developed areas of the country where, although per capita energy consumption is by and large similar, the anthropogenic environment is less structured and ecosystems more vulnerable. In such areas, the prevalence and growth of transportation is dependent on dynamic factors such as population growth, local travel, and regional industry; more simply, demand is a fundamental regulator. Socioeconomic factors, however, come into play as vital influences when sprawl inevitably begins to occur and transportation becomes an increasingly important component of achieving sustainability.

Such is the case in the Upper Connecticut River Valley, covering roughly 1200 square miles and over thirty towns of Vermont and New Hampshire (LWV 2006). The Upper Valley, as it will be referred to henceforth, is characterized by a relatively low population density and a relatively large wealth disparity among municipalities; for example, the median family income in Hanover, at the heart of the Upper Valley and New Hampshire's wealthiest town, is roughly double that of neighboring Lebanon (NHES 2007). In the context of this report, the region is also distinguished by escalating housing costs and its location along a major travel corridor.

This chapter explores a variety of areas in which socioeconomic aspects of the Upper Valley figure prominently in the identification, analysis, and resolution of transportation issues. Evidence of this significance is reflected in the region's demography and transportation usage trends, as explored via census data and the "Master Plans" of local municipal governments; this information is used to delineate the socioeconomic reality of structured transportation resources, which are presently strained by burgeoning populations, the rising cost of housing, and objectives of environmental protection. Additionally, this chapter focuses on the Upper Valley public transportation system that is currently provided to the surrounding areas of Lebanon,

Norwich, Hanover, Dartmouth Hitchcock Medical Center, and Hartford. A related cost-benefit analysis, modeled on a research study of the Advanced Transit bus system, adds the insight of an economic perspective by applying monetary values to changes in externalities stemming from cutbacks in transportation usage. Collectively, the topics covered in this chapter paint a comprehensive portrait of transportation in the Upper Valley as it specifically relates to regional populations and their impact on the environment.

A SHORT HISTORY OF TRANSPORTATION IN THE UPPER VALLEY

The examination of transportation issues within a relative microcosm such as the Upper Valley requires an exploration of how they have developed over time, to the end of understanding the sources from which current problems have stemmed. In this context, a brief survey of the history of regional transportation is beneficial to the proper framing of the more overarching problem at hand.

In the past, the Upper Valley's transportation concerns were not linked to environmental matters such as biophysical impacts or sustainability; simple efficiency and carrying capacity were the paramount concerns. Prior to the introduction of extensive paved road networks, "the railroads dominated valley transportation" (Waterman 1961, 14); beginning around 1848 when the Northern Railroad Company reached White River Junction, VT, this period of rule lasted roughly eighty years (13). The latter decades of the railroad era overlapped with more overarching changes in the region, as "most New Hampshire communities were irrevocably changed from their bucolic beginnings after their entrance into the industrial age"; such impacts were compounded as "…new economic opportunities brought new social and political changes" to the Upper Valley (Heffernan and Stecker 1996, 150). By the mid-20th century, regional growth

had far surpassed categorization as merely "healthy rural expansion" (88) and required "the rapid expansion of federally funded roadbuilding" (187), which took place largely in the 1950s. The results are evident today, as the Upper Valley "has an extensive network of highways, including two interstate highways, two U.S. highways and several state highways that provide access through and within [the region]. These highways provide excellent north-south connections within the…area and to other areas. East-west connections are limited by three locations crossing the Connecticut River." (VHB/CRA Report 1988, 5-6). The Upper Valley's public transportation systems – principally local bus routes - have existed for less than a half-century, but today offer service throughout the region. Collectively, several networks overlap within this section's more specific study area; additional description and objective discussion of these establishments can be found in Chapter 5 of this report.

UPPER VALLEY POPULATION DEMOGRAPHICS

The goal of this section is to gain a better understanding of recent demographic and transportation trends in the Upper Valley. To this end, regional demographics will be represented by data from the adjoining townships of Hanover, Lebanon, and Canaan, all located in New Hampshire's Grafton County. The town of Hartford, VT will be examined as an additional representative sample population. Each of these regions has been chosen to exhibit different levels of socioeconomic classes in both rural and more densely populated areas. The data collected for the respective towns will focus on population and density, income, number of houses, cost of housing, and real estate price trends. These trends are discussed as pertinent to the Upper Valley as a whole.

Each of the selected areas is unique to the Upper Valley because they represent a different slice of socioeconomic demographic portion of the population. The most recent data collected from each town and city is to be compared to State averages shown in Table 3.1 to place where each town stands relative to the entire state.

Table 3.1: General Demographic Statistics, NH & VT 2005 Averages

States	**Population 2005**	**Pop. Density**	**MHI, 2005**	**AHP, 2005**
Vermont:	623,908	65.8	$45,686	$173,400
New Hampshire:	1,314,895	137.8	$56,768	$240,100

(Source: City-Data.com 2008) [MHI – Median Household Income; AHP – Average Home Price]

Hanover, Lebanon and Hartford are all classified as cities because they have over 6,000 people while Canaan is classifies as a village because it has under 6,000 residents. (City-Data 2008, 2) Canaan is also representative of the rural areas due to its relatively low population density when compared to the state average of 137.8. Lebanon, NH represents the lower socioeconomic class with a median household income of $46,800, $9,968 below the state average. Trends in Lebanon, NH are also important to note because the city has a very high public transportation rider rate; specifically for the Advanced Transit system currently over 40% of the riders are from the Lebanon city area alone. Hanover represents the highest socioeconomic strata with a median household income $12,232 higher than the state average (UVTMA 2006, 4). Hanover has a very high population density; over ten times higher than the state average. Trends in Hanover, NH are important to look at because it is one of the wealthiest and densest cities in New Hampshire, which will give it the more leverage in the direction the development of public transportation will take. In regards to private transportation over 62% of Hanover residents surveyed are dissatisfied with traffic and parking, exceeding both taxes (50%) and cost of housing (49%), spread across each age class. (Hanover Master Plan 2003, 4) This dissatisfaction has the potential to drive residents to look for alternate forms of transportation;

such as public alternatives. Hartford is the last city selected to represent an area in Vermont that has a baseline close to the state's averages. Table 3.2 provides data for population, density, changes in median household income, and changes in average home price in each of these four towns.

Table 3.2: Demographic Statistics for Towns in Focus Area, 2000 & 2005

Towns:	**Hanover, NH**	**Canaan, NH**	**Lebanon, NH**	**Hartford, VT**
Population	10,850	3,319	12,568	10,367
People/Mile^2	1792	65	312	239
MHI, 2000	$62,143	$43,220	$42,185	$42,990
MHI, 2005	$69,000	$48,000	$46,800	$46,800
AHP, 2000	$269,300	$97,900	$123,100	$120,600
AHP, 2005	$484,200	$176,000	$221,400	$195,500

(Source: City-Data.com 2008) [MHI – Median Household Income; AHP – Average Home Price]

While each of these regions are clearly not homegenous in population, population density and wealth, every area shows similar trends in increasing median household income and average home prices from 2000-2005. Hanover, Lebanon, and Canaan all have a 44.4% increase in average home prices from 2000 to 2005, with only a 10% increase in median household income. Hartford is comparable to the New Hampshire areas with a 38.3.% increase of average home prices, and a 9% increase in household income. While home prices are increasing at a much greater rate than income, according to Tables 3.3, 3.4, and 3.5 home sales per quarter spiked in 2005; meaning people are still purchasing real estate.

Year	**Median Price**	**Peak Price**	**Lowest Price**	**# Sold**
2003	$294,250	$350,000	$230,000	60
2004	$279,750	$295,000	$210,000	99
2005	$297,500	$340,000	$275,000	115
2006	$280,000	$415,000	$190,000	70
2007	$310,000	$360,000	$275,000	43

Table 3.3: Homes Sold in the Town of Hanover, 2003-2007

Year	Median Price	Peak Price	Lowest Price	# Sold
2003	$127,500	$205,00	$75,000	69
2004	$215,000	$222,000	$205,000	233
2005	$209,000	$221,000	$190,000	396
2006	$220,000	$250,000	$185,000	183
2007	$212,250	$240,000	$179,000	134

Table 3.4: Homes Sold in the City of Lebanon, 2003-2007

Year	Median Price	Peak Price	Lowest Price	# Sold
2004	$108,750	$145,000	$61,000	91
2005	$125,000	$159,000	$81,000	158
2006	$131,000	$200,000	$81,000	81
2007	$133,500	$180,000	$60,000	79

Table 3.5: Homes Sold in the Town of Canaan, NH, 2004-2007

(Source: City-Data.com 2008)

There are common themes in the Upper Valley that are driving the forces behind the need for increased development in transportation; primarily the increase of real estate prices rising at a rate much higher than the median incomes. Correlating with the rising house prices from 2000, The Upper valley has seen a large increase in the usage of public transportation, rising at a rate of 10% each year since 2001. Furthermore, between 2000 and 2005 the AT's fixed route was adjusted in 2000 to meet more employment and shopping needs, and ridership has nearly tripled. The Advanced Transit is one of the largest public transportation lines in the Upper Valley (Advanced Transit Study Final Report). From 1994-2005 boarding has gone from 119,499 people to a projected 367,884 people in 2006. This is over a 208% increase over the past ten years. (Advance Transit Study Final Report 2006)

The important takeaway from this section is that despite the heterogeneous socioeconomic and population density selected areas, each of these regions are facing many of the same problems. The cost of housing has been rising at a much higher rate than the median income of the residents of each respective town. Trends in both Hanover and Lebanon suggest

that residents are using public transportation as a means of alleviating financial burdens because both areas show increasing ridership rates correlating to an increase of cost of housing. Issues regarding public and private transportation will be further discussed in the next section.

REGIONAL TRANSPORTATION USAGE: TRENDS AND CHARACTERISTICS OF PRESENT DEMOGRAPHY

The region of the Upper Connecticut River Valley is the area of focus for this research. In particular, this chapter focuses on the Upper Valley public transportation system that is currently available for the surrounding areas of Lebanon, Hanover, Hartford, Canaan, and the Dartmouth Hitchcock Medical Center which will all be discussed. The modes of public transportation include four commuter service companies and two rideshare programs that currently service the growing population of the Upper Valley. Advanced Transit, Inc. offers free bus services in Canaan, Enfield, Hanover, Hartford, Lebanon, and Norwich. With all the towns we are researching represented in serviced areas by Advanced Transit, it will be interesting to see the demographics of these towns and compare it with modes of transportation commuting to work and the number of cars per household, among other factors.

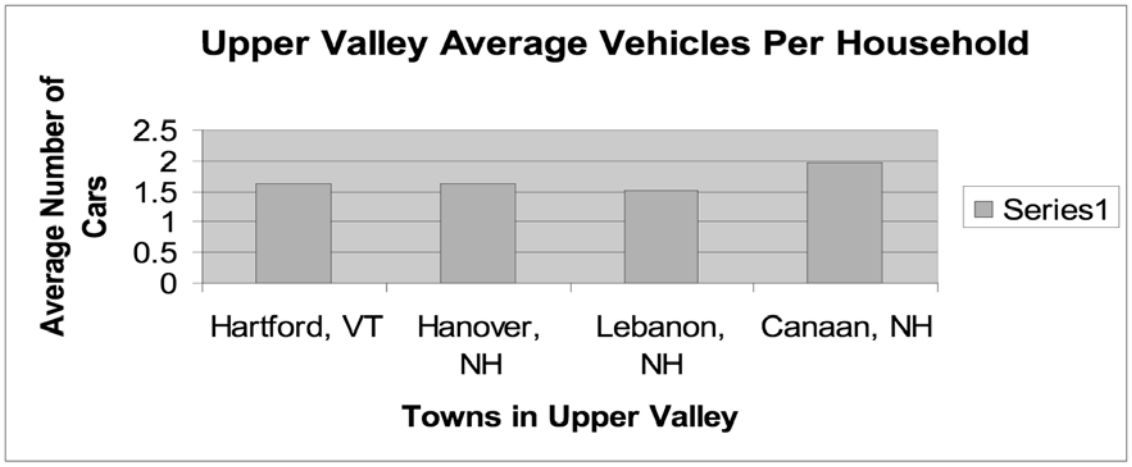
In a recent article published in the Valley News, New Hampshire residents express their feelings about public transportation as a result of increasing fuel prices. “Lebanon—Despite the recent spike in gas prices and local efforts to expand public transportation, many Upper Valley employees who live far away from the workplace have no choice but to use personal vehicles for their commute” (Lim 2008). It is interesting to compare this mindset with transportation techniques of the residents of the previously mentioned towns that all have access to public transportation services within their towns.

The two main job sources in the Upper Valley area are the Dartmouth Hitchcock Medical Center that is located in Lebanon, New Hampshire and Dartmouth College located in Hanover, NH. These two organizations are also the main contributors of the Advance Transit. "DHMC and Dartmouth College—two of the area's largest employers—see many commuters driving their cars to work each day. College spokeswoman Genevieve Haas spends at least one hour in the car every morning" (Lim 2008). We will later try to explain the benefits in using public transportation, which include a decrease in your carbon footprint but also a substantial financial savings for numerous reasons (vehicle value—less miles driven, gas money, etc).

The Upper Valley has seen a large increase in usage of public transit, rising at a rate of 10% each year since 2001. The money for the public transportation comes from local funding, i.e. it is "traditionally derived from individual municipalities served by carriers" (UVTMA 2007, 4). The municipal contributions have not been increasing at the same rate as the ridership rate, however. The funding must cover issues including highway construction and maintenance, health care/human services, law enforcement and environmental protection (UVTMA 4). These costs spread over widespread areas, yet the funding has to be done on a small localized scale. This means that payment is problematic because it is very difficult to match funding at the local level due to the disparity of wealth across the Upper Valley. Additionally, the Upper Valley straddles the Vermont-New Hampshire border, which further complicates issues in funding coordination (UVTMA 2007 4). Hartford, VT – one of the towns on which this study focused - is a good representation of a lower-middle-class community. In order to maintain these public transportation systems, the local areas are pressured to increase their taxes. This is problematic because the wealthier towns are going to be less inclined to raise their taxes for public transportation because a higher percentage of the residents own private vehicles. The less

privileged areas have a higher need for public transportation, but lack the monetary funds for sustainable transport. As a result there is an overall decrease in effectiveness and efficiency in transportation.

Table 3.6: Average Number of Vehicles Per Household (Source: City-Data.com, 2008)

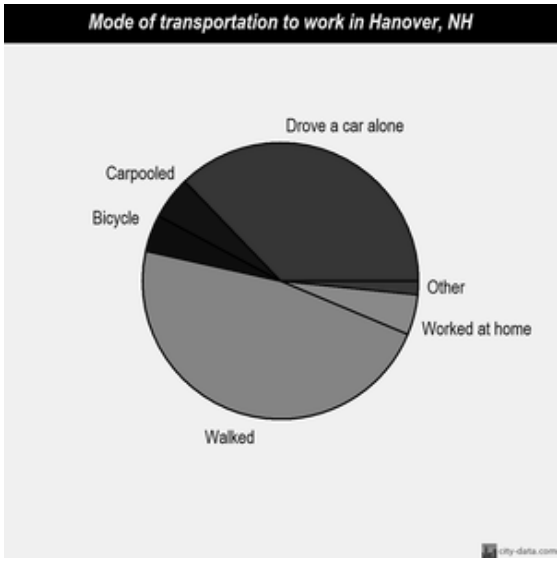


From this data there is no clear variation among towns, however from this information I was able to attain percentage of households that have 2 cars or more. Surprisingly Hanover only has 51 percent of its households with two or more vehicles while Canaan has 71 percent of its households with two cars or more. This goes against what we originally thought about the abundance of wealth in Hanover and how it would have a direct correlation with more cars per household. But by taking a look at the information below, Hanover residents do significantly less commuting than the other towns, and when they do commute use more than 50% of sustainable transportation (walking, biking, car pooling). Other reasons behind this data could be that Hanover is a fairly environmentally conscious community along with many residents living in close proximity to their workplace.

Figure 3.1: Travel Time to Work - Hanover, NH

(Source: City-Data.com, 2008)

Figure 3.2: Mode of Transportation to Work – Hanover, NH



(Source: City-Data.com, 2008)

As you can see from the information at left, it is quite evident that Hanover has walking and biking at 50% for its residents' means of transportation to work. Figure 3.1 illustrates the fact that a large portion of Hanover's population works locally and does not commute more than 20 minutes. It is evident that Hanover is a prominent labor magnet, given the location of Dartmouth College – thus, more people are commuting to Hanover than out of Hanover.

Figure 3.3: Travel Time to Work - Lebanon, NH (Source: City-Data.com, 2008)

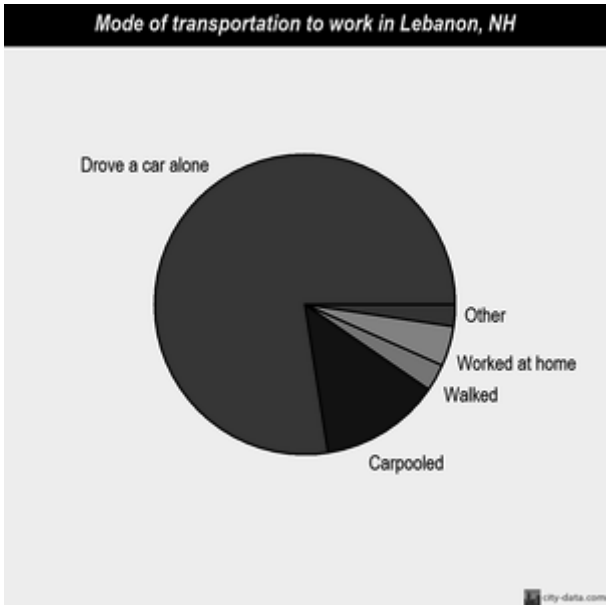


Figure 3.4: Mode of Transportation to Work – Lebanon, NH

Here is a clear illustration of the problem driven by regional commuting, an obvious form of non-sustainable transportation. Figure 3.3 reflects Hanover's attraction of workers from Lebanon. Figure 3.4 reveals that more than 75% of them make the commute alone, by way of individual vehicles.

With information of transportation provided on many of the towns in the Upper Valley it is easy to see that driving alone to work is a common practice of many residents. And the fact that the Upper Valley being made up of so many small towns, for many commuting to larger cities or towns is the only means of getting to work. With sky-rocketing gas prices this transportation is becoming increasingly difficult for many. Other issues come into play such as what type of vehicles are most commonly used and without much debate it is commonly known that many New Englanders enjoy 4 wheel drive SUV's in order to withstand the long cold winters. "Sport Utility Vehicle (SUV) registrations in New Hampshire increased 17 percent between 1997 and 2002. SUV registrations

jumped from 105,900 in 1997 to 124,000 in 2002" (Census Bureau 2002). Climate also plays a role in transportation, with much of the yearly weather being snow, ice, or rain as well as freezing temperatures; people tend not to want to walk or bike to work.

With the demand in place, it is strange that these means of public transportation are threatened by a lack of funding. "Usage increased to over 70 percent in 2006, according to John Zicconi, Vermont Agency of Transportation communications director" (Lim 2008). We need to urge politicians to increase research and funding in order to expand current practices as well as develop new sustainable means of transportation. "Several Upper Valley employees said they would like to use alternative means to commute, but live in areas that lack public transportation" (Lim 2008). Public transportation has to be society's next large-scale transition in order to cope with current issues of fuel costs and global warming.

ADVANCE TRANSIT CASE STUDY AND COST-BENEFIT ANALYSIS

Four commuter service companies and two rideshare programs currently service the growing population of the Upper Valley. Advanced Transit, Inc. offers free bus services in Canaan, Enfield, Hanover, Hartford, Lebanon, and Norwich. Stagecoach Transportation Services, Inc. provides transportation services to the elderly, persons with disabilities, and otherwise general public of Bradford, Hanover, Hartford, Lebanon, Randolph, Royalton, Sharon, and Wells River. Connecticut River Transit, Inc. offers a variety of transportation options including commuter buses, between-town buses, in-town buses, dial-a-ride, and rideshare to the general public in Ascutney, Lebanon, Hartford, Hanover, Springfield, and Windsor. Community Transportation Services supplies bus services to the public in Newport and Claremont. Upper Valley Rideshare is a free carpool matching service operating in 125 towns across Vermont and

New Hampshire. New Hampshire Rideshare is a similar service run by the Department of Transportation that operates only in New Hampshire. Other transportation services are available to members of the Upper Valley at cost through Dartmouth Coach, Vermont Transit, Amtrak, and Big Yellow Taxi. Of all of the programs, the services offered by Advanced Transit are the most widely used.

In an effort to quantify the value of the public transportation services provided by Advanced Transit, and in response to increasing demand for public transportation in the Upper Valley, the Lebanon City Council ordered an impact study to be completed in 2005. The study was completed and then updated in 2006 by the Upper Valley Transportation Management Association and includes analyses of "personal vehicle use, fuel consumption and exhaust emissions as well as an assessment of the costs, feasibility and policy issues of instituting fares" (UVTMA 2006, 1). The study finds that use of the AT is heavily weighted toward residents of Lebanon, people traveling to Lebanon or West Lebanon, and people making work-related trips (UVTMA 2006, 2). It also details the socio-economic impacts of the service in terms of increased labor supply and decreased cost of transportation, as well as other benefits including decreased environmental stress and traffic congestion (UVTMA 2006, 3). As a result of these and other benefits, there is an increasing demand for AT services, as well as an increasing demand for the other commuter bus services in the Upper Valley. The constantly increasing demand for commuter bus has resulted in a funding strain on the Advanced Transit lines in recent years. The study finds that the municipal funding of the AT is not keeping up with the increasing demand and, as a result, the public transportation services offered in Vermont and New Hampshire are threatened by inadequate funding (UVTMA 2007, 3). In an effort to increase funding toward programs like Advanced Transit, while avoiding unpopular tax hikes,

the UVTMA recommends a number of non-traditional revenue raising methods to augment the current funding scheme (UVTMA 2007, 4).

As part of the study conducted by the UVTMA, social, environmental, and economic benefits and costs related to the Advance Transit bus system are valued (UVTMA 2006, 42-48). In what follows, these valuations are updated and revised in order to ensure a thorough view of the services provided by the Advance Transit system. While we will not attempt to make a concrete determination of the overall benefit or cost of the system, due to the problems associated with comparing the different types of services provided, the valuation should allow for a better understanding of the value of Advance Transit and possibly help in decisions about whether to expand the service to meet increasing demand for public transportation.

Air pollution valuation

When people use public transportation instead of driving private vehicles, there are presumably fewer vehicles out on the road. It follows that fewer vehicles would equate to less pollution and CO_2 emission in total, but this may not be the case. Diesel buses (like those used by the Advance Transit bus service) produce more total pollution per miles than do typical private vehicles, but they also carry more people. This means that the use of diesel buses in public transportation may result in lower air pollution if ridership is high enough. The UVTMA used the following data on average emissions from cars and light trucks as compared to diesel buses to estimate the difference in annual air pollution as a result of the use of Advance Transit (UVTMA 2006, 42).

Table 3.6: EPA Mobile-6 Emissions Assumptions for Autos and Buses (all values are grams per vehicle mile)

	Hydrocarbons	**Carbon Monoxide**	**Oxides of Nitrogen**
Cars & Light Trucks	1.063	12.600	1.014
Diesel Bus	0.594	3.882	14.925

In 2005, the Advance Transit system replaces an average of 3,016 vehicle miles traveled (VMT) per day in the Upper Valley (note that the service only operates 254 days per year) (UVTMA 2006, 42). The buses themselves travel about 1,629 miles each day (UVTMA 2006, 43). Using these numbers, the Advance Transit bus system results in an average of 1,254 pounds of hydrocarbons and 17,742 pounds of carbon monoxide less emitted. However, it also results in 11,900 pounds more nitrogen oxides emitted. The emissions numbers used in this calculation were obtained using the EPA Mobile 6 model, but are significantly different from a number of other published emissions numbers. In order to ensure the most effective estimates, the following table includes the results of the same calculation using different emissions ratings (EPA 2000, BTS 2007).

Table 3.7a: Emissions of Light Gasoline Private Vehicles

EPA emissions rates:	**Emissions per mile (g)**	**Total annual emissions (lbs)**
Hydrocarbons	2.80	4718.95
Carbon Monoxide	20.90	35223.62
Nitrogen Oxides	1.39	2342.62
Carbon Dioxide	416.36	701714.62
BTS emissions rates:		
Hydrocarbons	0.85	1435.91
Carbon Monoxide	9.29	15656.82
Nitrogen Oxides	0.72	1213.45

Table 3.7b: Emissions of Heavy Diesel Vehicles

BTS emissions rates:	**Emissions per mile (g)**	**Total annual emissions (lbs)**
Hydrocarbons	0.48	808.96
Carbon Monoxide	2.66	4483.01
Nitrogen Oxides	9.50	16010.74

In order to best estimate the impact of the Advance Transit bus system on air pollution, we calculated average emission rates using all of the above-mentioned sources. These rates and the resulting total annual emissions of the avoided VMTs and those traveled by the buses.

Table 3.8: Comparative Emission Rates, Light Gasoline Vehicles & Diesel Buses

Light Gasoline Vehicles	**Emissions per mile in grams**	**Total annual emissions (lbs)**
HC	1.57	2648.79
CO	14.26	24038.58
NO	139.37	234879.00
Diesel Buses		
HC	0.54	905.03
CO	3.27	5512.75
NO	12.21	20582.22

Using these averages, Advance Transit saves 1,743.77 pounds of hydrocarbons, 18,525.83 pounds of carbon monoxide, and 214,296.78 pounds of nitrogen oxides from being emitted into the atmosphere. Note that the original UVTMA study found a negative impact of the bus system with respect to nitrogen oxide emissions. Depending on which emission rate is used, the system may or may not be 'good' for air quality.

Private vehicle mileage valuation

The UVTMA estimated that there were about 125,944 private trips avoided through use of the Advance Transit bus system in 2004, and that the average distance of the avoided trips was about 5.4 miles (UVTMA 2006, 46). There are a few (increasingly complex) ways to value the private money saved by using the public bus system for these trips. The first of these approaches values saved trips simply in terms of money saved on gasoline. If we assume that most cars and light trucks on the road average around 20 mpg, then the total gallons saved by avoided private trips in 2004 is 34004.88 gallons. Since gasoline prices have been around $3.50 for most of 2008, this amounts to $119,017.08 in total savings to consumers on gasoline from avoided trips. Another valuation uses the IRS Standard Mileage Rate as the cost per mile instead of gasoline price. This number is updated yearly and is based on the fixed and variable costs of operating a vehicle, including fuel cost, insurance, and depreciation. In 2004, the Standard Mileage Rate

was 37.5 cents, so the savings to consumers from avoided private trips is $255,036.60 – more than twice the savings from gasoline alone (UVTMA 2006, 46). Moreover the Standard Mileage Rate has been rising dramatically over the past few years, reaching 50.5 cents in 2008 (IRS 2007). Using this revised number, the savings amount to $343,449.29 – almost three times the savings on gasoline alone.

Labor supply effects valuation

A previous survey conducted by the UVTMA found that about 111 people who rode Advance Transit in 2004 were dependent on the bus system as their only means to get to work (UVTMA 2006, 46). If we assume that these people were employed in the best jobs available to them, then the bus system must necessarily have been a partial cause of better gainful employment. Since it is likely that at least some of these people would otherwise have gotten some other form of employment absent the bus system, we cannot claim that all benefits resulting from their employment are net benefits of the bus system, no can we easily quantify those benefits. Rather, we can at least say that a significant number of people were allowed better job opportunities as a direct result of the Advance Transit system.

Cost of running Advance Transit system

Perhaps most importantly, even with the social and environmental benefits of the Advance Transit system, the large costs associated with running a free service of its scope may not be economically feasible in the long run. The Advance Transit bus system offers a number of services, each with its own budgeted costs. The 2005 budget for fixed route buses was $1.4 million (UVTMA 2006, 2). The 2005 budget for shuttle operations, which is covered by

Hanover, DHMC, and Dartmouth College, was $674,134 (UVTMA 2006, 2). The system also includes a rideshare and carpool services with a 2005 budget of $94,337 (UVTMA 2006, 2). Advance Transit has been a completely fare free bus system since January of 2002, a policy that has promoted significantly higher ridership during its tenure (UVTMA 2006, 3). The dramatic jump in ridership associated with the move to a fare free system coupled with rising demand for public transportation resulting from population growth in the Upper Valley has contributed to average increases in ridership of about 6% per year in recent years (UVTMA 2006, v). While the increasing demand for the Advance Transit service may allow new opportunities for the growth of public transportation, with potential benefits for the local economy, individual consumers, and the environment, expanding the service to meet the new demand will be in financially difficult unless new and substantial revenue sources can be devised (UVTMA 2006, v). New direct taxes are often not a viable option for raising revenue for public works projects given the political climate of New Hampshire. A number of other revenue sources, including voluntary fares, sponsorship and advertising, or partial fares could help make up the difference between public funding and the cost of expanding the Advance Transit system to meet rising demand. Further, if the values that public transportation provides to the local economy and private citizens (including those described in the previous sections) are taken into account when making policy decisions, it is not unreasonable to assume that at least small financial sacrifices should be made to support public transportation services.

AREAS OF FUTURE PLANNING AND STUDY

Demographic analysis of transportation trends in the Upper Valley, coupled to an awareness of transportation history and a rethinking of costs and benefits, exposes a number of

socioeconomic issues that necessitate attention in the context of sustainable transportation goals. The cross-referencing of public transportation availability – as reflected in coverage maps – with population distribution could produce insights into a lack of equity with regard to average income within the region. While the economic cost of such public services is distributed relatively equally via taxation, both their environmental externalities and, conversely, their benefits may be diffused unequally from a geographic perspective. The 2005 study of the Advance Transit bus system, referenced earlier in this chapter, exemplifies the research that must be actively undertaken in the future to further explore – and hopefully reconcile – the inherent inefficiencies of rural transportation networks. With regard to the biophysical impacts linked to transportation, sustainability efforts will benefit immensely from heightened popular awareness of the ecological costs of both public and private use. Information programs and other educational elements can serve to improve individual knowledge and promote environmentally conscious choices. The source and distribution of economic costs relating to transportation – such as maintenance, public transport, congestion mitigation, traffic control, and so on – is another area whose significance warrants further study.

Similar initiatives have been undertaken in the recent past with some positive impact, and current plans reflect encouraging progress. A local organization, the Upper Valley-Lake Sunapee Regional Planning Commission, is central to such efforts (see Chapter Two). In 2003, the UVLSRPC released a report assessing the park-and-ride "needs and priorities" of commuters, with the eventual objective of structuring "an integrated…region-wide transportation network that would provide frequent service and connectivity between employment centers, commercial service areas, and large residential areas." (UVLSRPC 2003, 2). The Commission's identification and targeting of the Hartford-Lebanon-Hanover Labor Market Area, or LMA,

epitomizes the type of population-specific delineation critical to the effective overhaul of human-based transportation networks in the region; this underscores the importance of linking dynamic people groups to the sustainable transport systems they utilize on a daily basis (2). The ongoing Route 120 Corridor Management Plan, funded by the NH Department of Transportation; is an inter-community endeavor to address land-use and development issues along one of the Upper Valley's most congested and mismanaged thoroughfares (UVLSRPC, 2008). In the Vermont portion of the Upper Valley, the Two-Rivers Ottauqueechee Regional Commission dedicates 1200 hours annually to the planning of regional transportation initiatives (TRORC, 2008). The Upper Valley Transportation Management Association, which undertook the 2005 AT study, released a report documenting the need for increased funding of public transportation, based on evidence that "…municipal contributions have not kept up with the public's need for transit services." (UVTMA White Paper Executive Summary 2007, 2). This paper is especially noteworthy for its focus on the socioeconomic issues complicating a move towards sustainability.

CONCLUSIONS

In the context of the Upper Valley, a comprehensive survey of demographic data and transportation usage statistics reveals regional populations faced with the collective challenges of rising oil prices, skyrocketing housing costs, and the attraction of a labor market area increasingly dependent on commuters; against the backdrop of income disparity, public transportation is struggling with its duty to provide transport equitably and efficiently. There are a variety of factors at odds with the sustainable integration of these socioeconomic realities, though they are not insurmountable. This chapter's cost-benefit analysis of the Advance Transit bus system reveals the very tangible economic and environmental profits stemming from a

decreased reliance on individual automobiles. Regional initiatives both recently past and current emphasize the areas of study and attention critical to the promotion and positive evolution of sustainable practices with regard to transportation in the Upper Valley area; with appropriate public education and participation, and applied knowledge of the populations it serves, the region's public transportation systems can complement and support its economic prosperity while expanding upon its future livelihood.

CHAPTER FOUR

Environmental Aspects of Transportation in the Upper Valley

INTRODUCTION

This chapter focuses on environmentally sustainable transportation in the Upper Valley. This can be defined as "transportation that does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources at below their rates of regeneration, and (b) use of non-renewable resources at below the rates of development of renewable substitutes" (Litman 2008, 4). Focusing on environmentally sustainable transportation is important because transportation produces many environmental externalities resulting from the energy used to move, the effects of the infrastructure needed to facilitate movement, and other indirect effects on land use and development patterns (Feitelson 2002, 108).

There are three main components that make up this chapter. First, the environmental impacts of road maintenance on water resources are discussed in detail. Next, there are four case studies, each on a different town, which discuss their individual salting practices and include a spatial analysis of wetlands and their proximity to roads. Lastly, we make recommendations to decrease environmental impacts on water resources based on our spatial analysis.

BIOPHYSICAL ASPECTS OF TRANSPORTATION

Transportation produces air and water pollution, solid wastes, noise pollution and disturbance and destruction of habitats (Greene and Wegener 1997, 178). Although transportation in general creates a wide range of environmental impacts, the current debate on sustainable transportation emphasizes the consumption and combustion of fossil fuels as a

central problem (Greene and Wegener 1997, 179). Greene and Wegener state that transportation poses a threat to sustainability not because of the possibility of running out of oil, but rather due to the increasing economic and environmental costs of continuing our current usage of oil (1997, 180). In the US, many pollutants are produced by transportation, specifically motor vehicles: 45% of oxides of nitrogen, 37% of VOCs (volatile organic compounds), and 78% of CO emissions. In addition to the aforementioned pollutants, road dust in the US makes up over 40% of fine particulate emissions. These pollutants cause far reaching environmental problems such as acid rain from oxides of nitrogen as well as increasing global temperatures due to carbon dioxide emissions (Greene and Wegener 1997, 179). Current estimates state that one-fifth of the land in the US is directly impacted ecologically by the road system (Forman and Deblinger 2000, 37).

The environmental impacts of transportation are wide ranging, but the effects of transportation – mainly the effects of roadways – on water resources are especially important in the context of sustainability. The impacts on water resources are sometimes overlooked when focusing only on fossil fuels and their effects on the environment. Water pollution and the loss of wetlands are both long-term problems for sustainability (Black 1996, 151) as they may decrease ecosystem health and thereby affect human health and economic and intrinsic value. The ecological importance of wetlands can be understood through their provision of ecosystem services for humans. Wetlands provide services to humans that help sustain our life; wetlands can offer commodities such as timber, forage, natural fibers, biomass fuels, pharmaceuticals and seafood. In addition to these goods, wetlands also provide important ecological services such as waste assimilation, recycling of nutrients and the maintenance of biodiversity. The aesthetics and

cultural benefits of wetlands add to their importance and to the need for their protection in our increasingly human altered environments (Chee 2004, 549).

Wetlands must be taken into account when analyzing sustainability and transportation. Transportation encompasses factors such as highway and road runoff as well as the construction and maintenance of roadways. Roads are generally constructed of impervious surfaces, which alone can change the physical aspects of a watershed as well as affect stream quality due to runoff (Deacon et al. 2005, 1). Roads also affect aquatic habitats by changing the amount, timing and course of runoff water, and these effects can be more disturbing to small streams (Trombulak and Frissell 2000, 22).The chemical make-up of surface runoff varies between areas due to the level of development in the region (Deacon et al. 2005, 1). Within watersheds, increased urbanization, which has lead to increased roadway and impervious surfaces, has been shown to lead to degraded water quality (Deacon et al. 2005, 12). Roads can also change subsurface flows in wetland soils in addition to surface runoff. Drainage passages and groundwater flows can be blocked by road crossings and can lead to alteration both upstream and downstream (Forman and Alexander 1998, 218). The alteration of surface or groundwater flow can both destroy and create wetlands by causing erosion, downcutting, or new debris flows (Trombulak and Frissell 2000, 22). Sediment yield from roads is another important physical factor that carries implications for wetlands such as erosion and vegetation changes. Sediment yield is determined by the type of road as well as by maintenance on the road (Forman and Alexander 1998, 218). Sediment runoff from roads can increase turbidity in streams and consequently reduce productivity and the survival of aquatic animals such as fish (Trombulak and Frissell 2000, 22). In a study done by the USGS, the measures of conductivity, turbidity, and macroinvertebrate community data in the

watershed were all significantly correlated with measures of urbanization (Deacon et al. 2005, 12).

A serious consequence roadways and transportation create for wetland areas is chemical transport due to de-icing practices. A significant part of chemical transport occurs in stormwater runoff and can have ranging effects on flora, fauna and road infrastructures. Sodium chloride, or salt (NaCl), is the major component of de-icing mixtures, and it is toxic to plants and many aquatic animals. NaCl also contaminates human drinking water and can corrode both roads and motor vehicles (Forman and Alexander 1998, 219). De-icing salts such as NaCl can be transported in runoff and delivered to nearby rivers and streams (Blasius and Merritt 2002, 219). Airborne NaCl from de-icing and plowing can travel up to 120 m from the roadway and place stress on plants, while NaCl accumulates in the soil up to 5m from the roadway and can affect plant growth (Forman and Alexander 1998, 220).

The pollution of wetlands due to runoff contaminated with de-icers is very common in both the northern and the northeastern United States as the weather patterns in these regions dictate the need for de-icing during the winter months (Rosenberry et al. 1997, 179). The town of Lebanon, New Hampshire located in the Upper Valley posts that its mean annual snowfall is 76 inches and has continuous coverage for 92 days a year ("About Lebanon and the Upper Valley"). The accumulation of chloride from de-icers in groundwater can result in high concentrations of chloride even during the summer months and can lead to long-term baseline salinity of surface waters (Kaushal et al. 2005, 13519). Salts used as deicing agents are also found to increase the mobility of other pollutants in soils such as heavy metals (Forman and Alexander 1998, 220). Heavy metals can occur at elevated levels within 200 m of a roadway, and can amass in the

tissues of plants and become detrimental to their growth and health (Trombulak and Frissell 2000, 23). The effects of de-icers and heavy metals in streams near roadways have been shown to cause elevated mortality in fish populations as far as 8km downstream (Forman and Alexander 1998, 221), and can also cause changes in the cycles of aquatic plant succession (Trombulak and Frissell 2000, 23). The runoff of de-icers causes ions to be added to soil and water and thereby changes the pH and chemical composition. When salt is added to water it also increases the density of the water. As more salt enters wetlands from de-icing runoff, the stratification and mixing cycle of a body of water such as a lake can be dramatically changed and alter all ecological processes and life cycles within the lake (Trombulak and Frissell 2000, 23). One study claims that if the current rate of salinization continues to increase linearly then within the next century freshwater resources in the northern US will not be potable for humans and will be toxic to many freshwater organisms (Kaushal et al. 2005, 13518). This same study also states that "the accumulation of road salt in aquifers and groundwater…in the northeastern United states… may persist for decades even if use of salt is discontinued" (Kaushal et al. 2005, 13519). Because road salt has obvious ecological implications and has the potential to contaminate drinking water, it should be regulated as a significant threat and pollutant.

ROAD MAINTENANCE PRACTICES IN THE UPPER VALLEY

Research Design

Given the importance of developing a sustainable transportation system and the challenges associated with this in New England, this chapter of the report will specifically focus on the road maintenance practices, particularly de-icing practices, and their environmental impacts in four towns of the Upper Connecticut River Valley. Two of the chosen towns are in Vermont

(Thetford, Hartford) and two are in New Hampshire (Canaan, Lebanon). These towns were chosen based on their proximity to Dartmouth as well as their representation of either a rural area or more urban area. A rural area (Canaan, Thetford) and an urban area (Lebanon, Hartford) from each state were chosen because road usage tends to vary between rural and urban areas as people and destinations are further spread in rural areas and more localized and dense in urbanized areas. Also, roads vary in surface type in rural and urban towns. In rural areas more roads tend to be unpaved. After assessing the current road maintenance practices of these towns through a review of available secondary literature and interviews with local road commissioners, a spatial analysis of wetlands with roads in close proximity will be exhibited. Finally, we will propose possible alternatives or changes to the current maintenance practices that may help to create more sustainable transportation services in the Upper Valley.

The four towns also reflect the particular regional character of commercial sprawl interspersed amongst rural towns. Traffic realities of heavily traveled urban corridors such as Lebanon (NH) and Hartford (VT) necessitate greater road networks and maintenance efforts. As these traffic corridors are essential to the commercial activities of the Upper Valley, the study of these high profile roadways will help broaden the understanding of how development and salting impacts affect nearby surface waters and in the Upper Valley as a whole. In addition, each site contains at least one major paved road structure within their borders and proximity to, and or located directly on, a river or lake. The following section details some important demographic and geographic information of our chosen case studies.

Because New England winters demand heavy salting practices, and road salt as a form of non-point source pollution is difficult to track, we have chosen to adopt a “hot spot” specific

approach to the evaluation of the salting impacts in the Upper Valley. In addition to choosing the four towns to use as case studies, it was necessary to define the concepts of wetlands and hotspots in this study. Wetlands are essentially defined as any standing water that is visible from the air because the data used for the spatial analysis was collected using aerial photography. As a result of using aerial photography to collect the data for the wetlands database it is likely that some wetlands were missed, especially ephemeral water bodies such as vernal pools, but most are present. Any wetlands in the selected towns that are within 5m to roads are defined as hotspots as they may be particularly vulnerable to the effects of road salt. GIS maps were used to determine which townships were located near wetlands such as lakes, rivers, or marshes. Additionally, the towns were rated in terms of commercial development, as we were concerned for equal representation of rural and urban communities in both New Hampshire and Vermont.

Case Studies

As mentioned above, this study focuses on four towns as case studies, two in New Hampshire and two in Vermont. Each of the studies looks primarily at the current salting practices in the towns and a spatial analysis of the towns' wetlands in relation to the roads. In general, several bodies and levels of government maintain the roads of the Upper Valley. Local governments clear approximately 75 percent of public roads in the United States, while state transportation departments clear around 20 percent. Nevertheless, state transportation departments use approximately the same amount of salt because local governments maintain a number of less traveled roads that do not need to be cleared as often (Transportation Research Board 1991). This division of labor likely occurs in the Upper Valley as well as within its network of federal, state, and local roadways.

Both states focus on clearing roads as soon as possible, but both also seek to reduce the usage of road salt to save money and protect the environment. Both classify roads by type and traffic to determine the quantity of salt that should be applied under certain conditions. Neither state applies salt to road surfaces when it becomes ineffective below 20 degrees F. Additionally, both states do not apply salt or abrasives when conditions are cold, dry, and windy when such application causes snow packing. In New Hampshire drivers control the salting application rate from their trucks (NH DOT, VT AOT 2005).

The spatial analysis for each of the four towns looks at the proximity of wetlands to roads. Using GIS methods we looked at how many wetlands in each town fell within buffers of 5 meters, 15 meters, 30 meters, 60 meters, and 120 meters of any type of road which are displayed in the following figures with a grayscale with the darkest being closest to the road and lightest farthest away. We created buffers around the roads for each of the specified distances and determined which wetlands were within the different buffers. Additionally, the acreage for each of the wetlands that fell within the various buffers was calculated, along with the total acreage for all the wetlands, the smallest and largest wetland, and the average size.

New Hampshire Cases

Canaan

The small township of Canaan (see Table 4.1) is located in Grafton County. Canaan sits on the Mascoma River, a tributary of the Connecticut, and has several small bodies of water located in the township proper (Foster 1995).

Table 4.1: Characteristics of Canaan, NH

Total Area	55.0 square miles
Total Population	3,319
Population Density	62 persons/square mile
Median Household Income	$43,220
Median Age	48 years

(Source: American FactFinder. United States Census Bureau. Retrieved on 2008-01-31.)

No data are available for road salting figures from Canaan because the Road Agent was just hired in March and does not have the figures. The town has only 35 miles of paved roads out of about 100 total, so the amount of salt applied is likely significantly less than the other towns (Scott 2008). Salt is a line item in the Highway Department's budget. The Road Agent did not specify further how this works, but he made clear that budgetary limitations put a cap on how much salt the town can use (Scott 2008). Canaan's winter road maintenance equipment is as much as 8 years old with some more recent equipment. It stores its salt in a wood shed with an asphalt floor, which is not impermeable, so it may be possible for saline water to escape the facility (Scott 2008).

The town appears to lack specific techniques to efficiently salt roadways. However, the Road Agent did stress that the town applies salt before storms so that it can be more effective (Scott 2008). The Road Agent stated that the town does not use any alternative chemicals and it has not thought about making an investment in more advanced road salting technology. He said that budget limitations have mostly been the reasons for this (Scott 2008). Canaan has a number of lakes, and the Highway Department does have a number of "no-salt zones," primarily around Goose pond. This seemed to be more of a specific designation suggesting that a town department outside of the Highway Department was involved in making that decision. The residents of that area apparently have complained recently about the no salt zone, and the Road

Agent said that popular pressure may force the town to resume salting around Goose Pond (Scott 2008).

The results for the spatial analysis for Canaan, New Hampshire, shown in Table 4.2, display critical findings. First, the largest wetland in the township falls within 5 meters of a road. Also, more than 85% of the town's wetlands fall within 5 meters of roadways. Lastly, the average size of the wetlands that fall within the various buffers decreases as the buffer increases. This indicates that larger, perhaps more significant wetlands, are closer to roads than small wetlands.

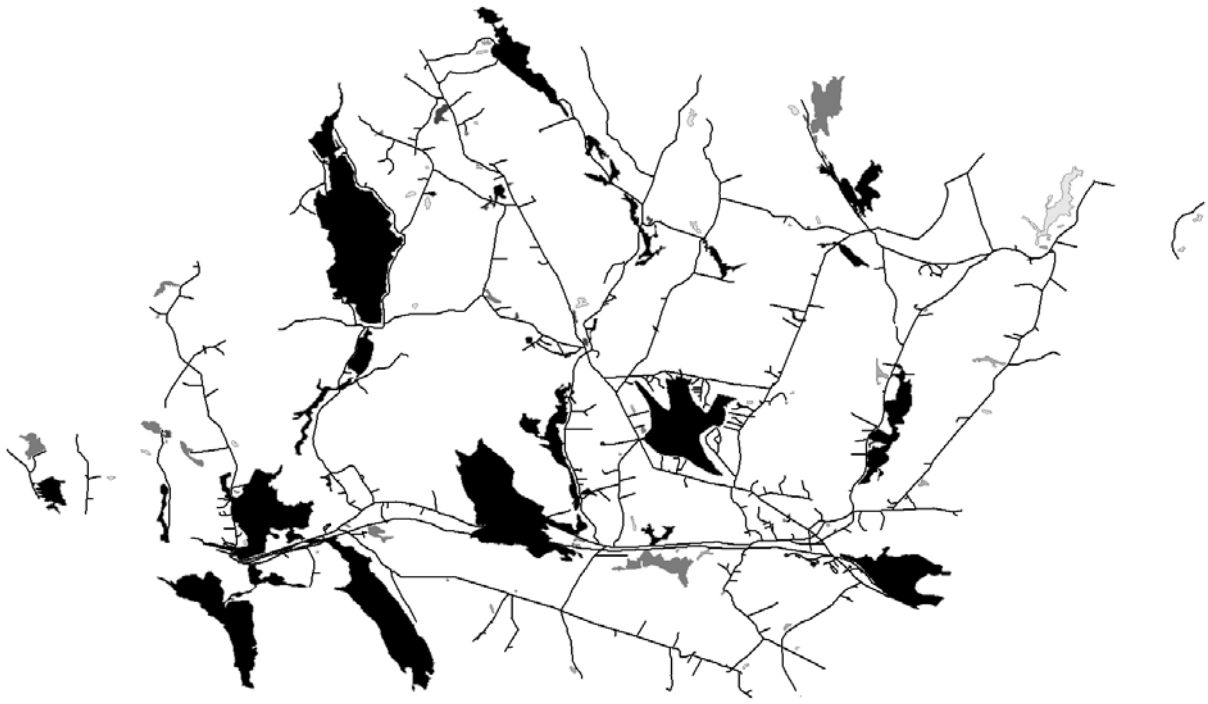


Figure 4.1: Canaan Roads and Wetlands

Table 4.2: Wetlands Information

Distance from road (m)	5	15	30	60	120
Count	37	49	70	89	121
Smallest (Acres)	0.6	0.4	0.3	0.2	0.2
Largest (Acres)	639.0	639.0	639.0	639.0	639.0
Mean Acreage	90.3	68.7	51.2	40.6	30.7
Total Acres	3339.4	3365.4	3585.1	3613.7	3719.5

Lebanon

Lebanon (see Table 4.3) is notable as one of the larger commercial centers of Northwestern New Hampshire. Located in Grafton County, Lebanon is the site for the Dartmouth-Hitchcock Medical Center. The main water bodies located near the town are the Connecticut River and Mascoma Lake. Like Hartford in Vermont, Lebanon is situated at the junction of I-89 and I-91. Large scale development practices along Rout 12A are underway in the township (Foster 1995).

Table 4.3: Lebanon, NH

Total Area	41.4 square miles
Total Population	12,568
Population Density	311 persons/square mile
Median Household Income	$42,185
Median Age	37 years

(Census 2000)

On average, the city of Lebanon applies between 4,000 to 5,000 tons of salt to its 100 miles of paved roadways each year. This rate of application has been consistent for the past two decades. Conservatively, that equates to 40 tons per mile (Labonte 2008). The Lebanon Public Works Department services the 100 miles of paved road and state route sections that fall inside the compact zone. The salt application rate is, on average, 200-250 pounds per lane mile per application. Depending on the temperature and precipitation, the application rate can go up to 300 pounds per lane mile. Hill roads are serviced with the same rate, but have greater application

frequencies, necessitating earlier re-appliances than roads with less runoff. The average salt use for each winter storm is 100-120 tons if every mile of paved road is salted (Labonte 2008).

Salting costs are incorporated into the overall highway budget. The city of Lebanon allocates $185,000 per year for the purchase of both salt and sand. 75% is spent on road salt, putting Lebanon's annual salt costs at $140,000. Two of the city's trucks contain computer controlled salting capabilities, while the remainder employ the regular salt spraying mechanism at the back of the truck. The oldest equipment is 10 years old, the newest, 2 years old (Labonte 2008). Lebanon does use alternative chemicals, such as IceBan™, to alleviate some of the salt application. According to the Road Commissioner, IceBan™ increases the capability of road salt, decreasing the application rate. However, there is no particular policy with regard to "hotspots" or sensitive ecological areas. Most of Lebanon's roadways run by rivers and thus are all salted equally. The only instance of reduced salting is around wells and other groundwater sources (Labonte 2008). Lebanon currently stores it's salt outdoors, in a wooden shed. A new storage facility is planned within a structured building with a concrete base and walls to be completed this year (Labonte 2008).

The Lebanon, New Hampshire spatial analysis results are displayed in Table 4.4. Again, the largest wetland area in the town falls within 5 meters of a road. Overall, more than 65% of the town's wetlands are 5 meters or closer to a road. Lastly, similar to the previous town, the average acreage for the wetlands decreases as the distance from roads increases.

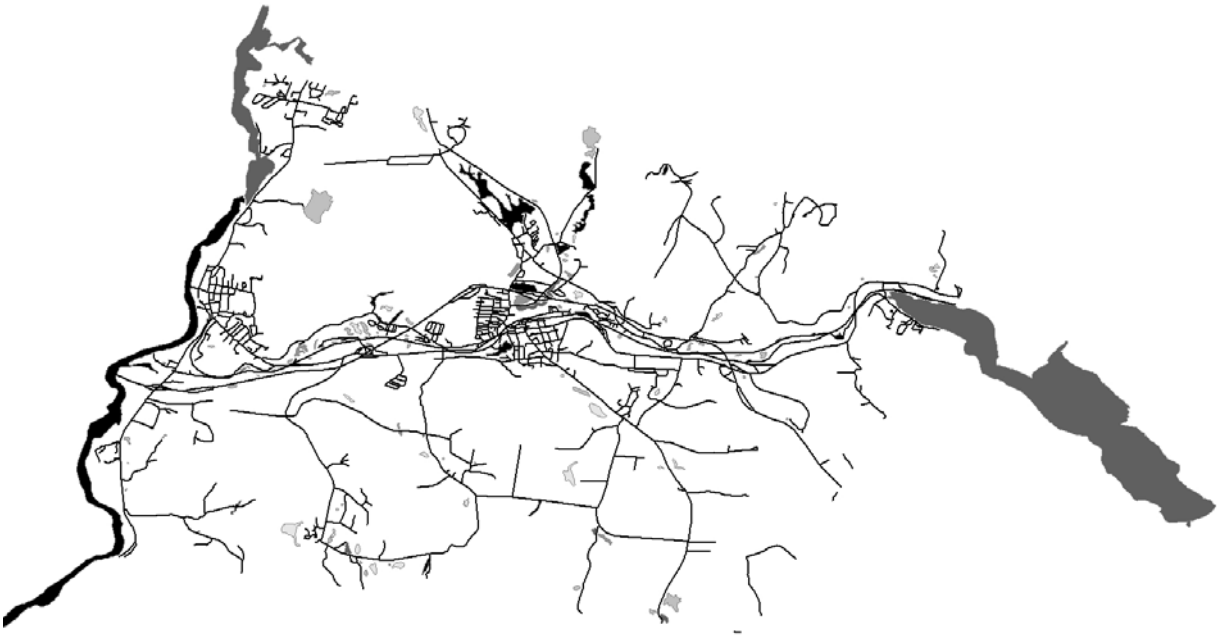


Figure 4.2: Lebanon Roads and Wetlands

Table 4.4: Wetlands Information

Distance from road (m)	5	15	30	60	120
Count	21	34	50	90	124
Smallest (Acres)	0.4	0.2	0.2	0.1	0.1
Largest (Acres)	3295.2	3295.2	3295.2	3295.2	3295.2
Mean Acreage	165.3	144.2	98.7	56.1	41.4
Total Acres	3471.0	4903.8	4932.8	5049.7	5133.1

Vermont Cases

Hartford

Hartford (see Table 4.5) is located in Windsor County and is notable not only as it straddles the Ottauquechee River, but also as the confluence site of both the White and the

Connecticut Rivers. It is located at the junction of I-91 and I-89, which makes it a significant study site in relation to large scale road infrastructures (DeLorme 1996).

Table 4.5: Hartford, VT

Total Area	45.9 square miles
Total Population	10,367
Population Density	230 persons/square mile
Median Household Income	$42,990
Median Age	40 years

(American FactFinder. United States Census Bureau. Retrieved on 2008-01-31.)

Hartford applies 3,000-3,300 tons of salt annually on average, which amounts to 35-39 tons per mile of paved road. The town used 2,600 tons of salt last year; this is significantly lower than the average amount of salt applied due to lack of supply. The figure would be lower, except that the town has 35 miles of gravel roads that are not salted (Ricker 2008). The Highway Division receives a set amount of money each year. To some degree, this caps how much salt it can purchase and apply. When more salt is needed than normal, the department cuts back on other projects like paving, graveling, and drainage to make up for the deficit (Ricker 2008).

The town purchases plow trucks on a 7-year rotation, so their equipment is up to date. The trucks that dispense salt have computer-aided systems that determine the flow rate based on the speed of the truck so that the amount of salt applied per mile remains constant. The trucks have a 20 second blast button so that they can drop larger amounts of salt around busy intersections without raising the amount of salt applied for mile. The salt is stored in a modern covered facility that is designed so water cannot leave the building, preventing groundwater contamination from the salt pile (Ricker 2008).

The town pre-treats every paved road each year with salt soaked in IceBan™, a byproduct of the beer-making process that resembles molasses. This causes the salt to adhere to

the road and allows salt to melt snow at lower temperatures than it normally does, slowing the initial buildup of snow and ice on the roads, allowing the town to use less salt later in the winter. The Highway Department determines how much salt to apply thereafter to roads based on how much traffic they facilitate (Ricker 2008). The Highway Commissioner expressed concern that decreasing salt usage too much makes greater sanding necessary. As the town has to clean up sand in the spring, excessive sanding costs the Highway Department time and money. Consequently, there is clearly a limit to how much they can reasonably reduce salt application. The Highway Commissioner had little interest in experimenting with chemicals or technology that would require a bigger capital expenditure. Using IceBan™ did not require a large initial expenditure outside of the cost of the chemical itself because the town simply converted the calcium chloride tanks that it was no longer using (Ricker 2008).

Hartford does not take biological hotspots into account in how much salt it applies, although it does avoid salting around areas with wells. The Highway Commissioner felt that there was enough of a buffer between the road and sensitive ecosystems (Ricker 2008).

Results for the Hartford, Vermont spatial analysis are shown in Table 4.6. These results show that once again, the largest wetland in the township lies within 5 meters of a road. The total acres statistic indicates that more than 70% of Hartford's wetlands fall within 5 meters of a road. Lastly, the average acreage of the wetlands greatly decreases as the buffer size increase which reveals that the larger wetlands lie closer to roads.

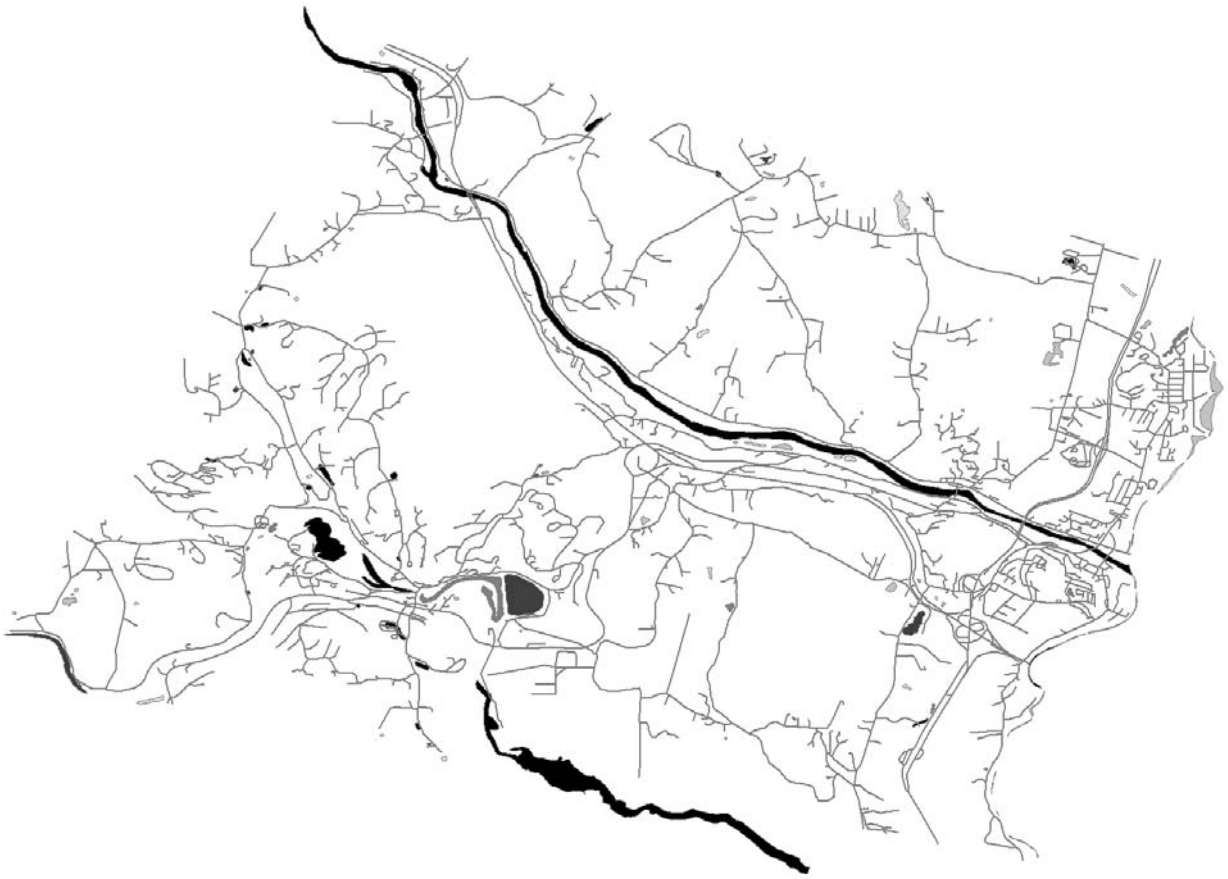


Figure 4.3: Hartford Roads and Wetlands

Table 4.6: Wetlands Information

Distance from road (m)	5	15	30	60	120
Count	21	33	48	73	112
Smallest (Acres)	0.5	0.4	0.2	0.02	0.0001
Largest (Acres)	308.8	308.8	308.8	308.8	308.8
Mean Acreage	29.4	21.6	15.9	11.3	7.8
Total Acres	618.0	712.3	763.1	827.3	869.3

Thetford

Thetford (see Table 4.7) is located in Orange County and is comprised of five villages. According to the Thetford Town Plan, the topography of Thetford is rather hilly and most of the

township is comprised of moderately steep to steep hillsides. The largest road feature is I-91 which runs through the eastern section of the township. Thetford is adjacent to the Connecticut River and the principle branch of the Ompompanoosuc River flows through the town (DeLorme 1996).

Table 4.7: Thetford, VT

Total Area	44.2 square miles
Total Population	2,617
Population Density	60 persons/square mile
Median Household Income	$48,333
Median Age	39 years

(American FactFinder. United States Census Bureau. Retrieved on 2008-01-31.)

Last year the town of Thetford applied 600-625 tons of salt to its 73 miles of roads. This was reportedly slightly higher than average. No information was available on the fraction of roads that are paved, but paved roads likely run for significantly less than 73 miles. This comes out to 8.4 tons per mile (Stone 2008). The town budget allocates a certain amount of money for the purchase of road salt as a line item. Thetford's budget runs from January 1-December 31st, so if they use a larger than normal amount of salt in the winter, they hope for a mild and warm fall. If they go over, they can compensate by reducing other parts of the highway budget (Stone 2008). The town's trucks are mostly new models from the last two years except for one manufactured in 2000. The trucks have a mechanism that sprays the salt out in front of the truck instead of behind. The rate at which salt is dispensed is entirely controlled by the driver as opposed to having more automated equipment (Stone 2008).

The highway department mixes all of its salt with sand to provide traction as well as melting capacity. He noted that sand helps the salt adhere to roads. He did not seem particularly concerned with some of the problems with sand such as erosion and spring cleanup (Stone 2008). The town at one point had equipment for applying an unspecified liquid calcium substance, but it

sold it. The highway superintendent did not say why, but it is probable the chemical or system maintenance was too expensive (Stone 2008). Thetford does take hotspots into account;the highway superintendent stated that they avoid salting on roads near lakes and other aquatic ecosystems. He did not go into detail on how they determine which areas to use less salt, and it appears that it may be mostly up to the driver's discretion. However, the town's sensitivity to hotspots is laudable (Stone 2008).

Thetford stores its salt in a wooden facility. The superintendent did not specify how old the facility is or if it is located near sensitive ecosystems, but it is clear that it is not state-of-the-art and thus not leak-proof (Stone 2008). The Thetford spatial analysis results are presented in Table 4.8. The results for Thetford are very similar to the results of the previous three case studies. The largest wetland in the town falls within 5 meters of a road, almost 60% of roads fall within 5 meters of a road, and the average wetland size decreases with increasing distance from a road (Stone 2008).

Figure 4.4: Thetford Roads and Wetlands

Table 4.8: Wetlands Information

Distance from road (m)	5	15	30	60	120
Count	30	45	77	119	158
Smallest (Acres)	0.1	0.1	0.002	0.002	0.002
Largest (Acres)	469.1	469.1	469.1	469.1	469.1
Mean Acreage	21.0	17.1	11.2	8.8	7.2
Total Acres	631.4	770.3	862.2	1053.1	1133.9

DISCUSSION

The four towns of the Upper Valley described in this chapter have implemented standard winter road management strategies to use road salt efficiently. These include applying salt before storms and applying less salt to roads that receive less traffic. Budget limitations of various forms also effectively limit salt consumption. This reduces the cost to the taxpayer, corrosion of vehicles and infrastructure, and environmental damage that results from excessive salt use.

The two larger towns, Lebanon and Hartford, employ more advanced technology that maintains how much salt is dispensed per mile regardless of truck speed, preventing excess salt application when the truck slows down. The smaller towns have their drivers control the rate of salt application, which is likely less than precise and could lead to overuse of salt. At the same time, the smaller towns use much less salt, so perhaps the equipment is unnecessary. The two bigger towns also invested in Iceban™ used to pre-treat the roads.

Overall, the spatial analysis for the four towns selected in this study shows that there are large areas of wetlands that are in very close proximity to roadways. At least 60% of each town's wetlands are within 5 meters of a road. Also, the larger wetlands in each of the towns are found closer to roads. These results confirm the notion that there are significant quantities of wetlands or "hotspots" which are situated very close to many of the roads.

Thetford and Canaan both take biological hotspots into account; Lebanon and Hartford on the other hand do not. In Lebanon and Hartford a large amount of roads run next to rivers and it would be impractical to apply significantly less salt on those roads, especially on heavily trafficked roads. However, these towns do salt less around wells, which suggests that they could do so around non-river wetlands. Out of all the towns, Canaan is the only one to have a

specifically designated “no-salt zone” as part of its winter road maintenance policy. The Highway Superintendent from Hartford made the point that reducing salting without increasing sanding makes roads difficult to negotiate in the winter, as evidenced by the protests of the residents of no-salt zone. Still, no-salt zones seem to be a sufficient method for protecting hotspots. Although the towns do not seem to overuse salt, there is almost certainly room for them to reduce the environmental impact of winter road maintenance without major adverse effects, especially in protecting hotspots.

CONCLUSION

Further studies are needed to better understand the impacts of transportation on the environment, and more specifically there is a need for research to understand the ranging effects of road salt on aquatic ecosystems. Many studies encountered during research for this section stated the basic known ecological effects of sodium and chloride from de-icing runoff, yet most studies also stated that there is not enough information on this topic to date. Long-term studies are needed in order to comprehend any future damage that could be currently avoided.

Road salting practitioners need to take biological hotspots into account to a greater degree. Even the towns that do avoid salting in sensitive areas could better define hotspots and give their drivers clearer guidelines on where to salt less or not at all. This might be achieved through collaboration with other town departments such as conservation commissions. Towns could produce inventories of wetlands and other bodies of water, perhaps jointly with the state, the Connecticut River Joint Commission, or local universities if they do not have the necessary resources for the study. Highway departments already use different amounts of salt on different roads depending on how much traffic they experience. With the results of an inventory of

biological hotspots, towns could further differentiate between roads based on ecological sensitivity as well as traffic, which would minimize salt use in general and protect important ecosystems.

Towns in the Upper Valley could reduce their salt usage without high costs. These towns should consider purchasing computerized salt dispensing equipment if they do not already have it and it is financially feasible for them. This is certainly the case for larger towns, as Hartford uses computerized equipment and Lebanon is starting to, and smaller towns should at least investigate the possibility. This equipment saves taxpayer money that goes to purchase salt and reduces overall salt contamination. These towns should also explore the use of more environmentally friendly alternative chemicals like calcium magnesium acetate, especially around biological hotspots. Vitaliano's (1992) cost-benefit analysis suggests that the net cost of road salting to society may make such alternative chemicals worth their greater cost, and such cost-benefit analysis arguments would likely apply to purchasing more advanced salt application equipment as well.

For the most part, the impacts of road salt and sand sit low on the list of environmental concerns for Upper Valley towns. For example, the Lebanon Conservation Commission has identified areas of the watershed and protected lands that are sensitive to the environmental effects of commercial development, but there is little mention about run-off from surface roads or plans to negate them (City of Lebanon 2006). This is most likely due to the fact that road salt is a form of non-point source pollution that is both difficult to track and assess, but also a very necessary winter safety measure. In addition, such are the layout of roads in these communities

that separating road from wetland is widely unrealistic. In this light, the adoption of alternate chemicals or technologies seem to be the most environmentally sound solution.

However, the costs of alternate chemicals and the necessary equipment upgrades that go along with new technologies prevent budget constrained municipalities from converting completely. For example, calcium magnesium acetate, one of the two commercially available alternatives to road salt, costs about $600/ton as compared to the $40/ton cost of salt (“Road Salt and Water Quality). In addition, the full environmental effects of these alternatives are not fully known.

CHAPTER FIVE

Public and Alternative Transportation in the Upper Valley

INTRODUCTION

In regions where many are traveling from diffused residential areas to a concentrated business locale for work or social services, public transportation can reduce the amount of individual cars on the road. Bus systems running regular routes with frequent, convenient stops allow large amounts of commuters to consolidate their trips to work. This lessens road congestion, decreases the wear and tear of the infrastructure of roads and cuts down on fossil fuel consumption and subsequently carbon emissions—the leading cause of global climate change. Though most buses burn fossil fuels, the ability for public transportation to consolidate trips and limit the amount of carbon-emitting cars on the road lowers emissions, thereby lessening environmental impacts.

Additionally alternative forms of transportation such as rideshares, biking or walking reduce the amount of carbon emitted by a given region (Upper Valley Rideshare 2008). Rideshares, also known as carpools, connect people traveling to the same destination so that they can drive to a meeting place nearby their home and then ride the rest of the way in the same vehicle. This prevents individuals from driving their personal vehicles with empty seats to the same place at the same time as other people, reducing the number of cars on the road and making for a much more efficient commute with less congestion and environmental impact. Both biking and walking are even more environmentally friendly ways of commuting if the distance and weather makes it feasible. There are also health benefits to both of these active forms of transportation. Biking or walking paths help make these alternative commuting practices both safer and easier (Meyer 1999).

Thus the potential for a significant increase in a community's sustainability lies within public and alternative rural transportation; however, for a transport system to be effective coordination and planning is crucial. Regional planners must work to evaluate the success of a transport network over time (Wise 2008) so as to continually meet the demand for transportation and also limit redundant routes or excess stops. Funding must be planned for and managed. Coordination across various towns and sectors must be handled in order for a system to operate successfully and sustainably. Many transportation planners in the U.S. and elsewhere have found the principles of Transportation Demand Management (TDM), can work toward the goal of reducing the number of people in single occupancy vehicles and getting fewer cars on the road (Meyer 1999).

This chapter will first present the various issues that arise when coordinating a rural public transportation system, from efficiency to sustainability to funding. Next, it will examine the current Upper Valley public transportation situation, looking at past and current numbers of ridership of the most prominent bus system and what sort of rideshare programs are offered. In addition to public transportation, it will also look at current alternative transportation methods such as biking and walking and how these could be more successfully increased. The chapter will conclude with a case study of a successfully planned and coordinated transport system in a specific rural region and what the Upper Valley might be able to take away from this successful case.

CURRENT RURAL PUBLIC TRANSPORTATION ISSUES

Public transportation in a non-metropolitan setting presents various challenges that are distinct from urban transportation issues because of the scattered nature of the population. Most

residents of rural areas rely heavily on personal automobiles in order to drive from their homes to work or town centers, which results in more fossil fuel use and carbon emissions. There is great potential in public transportation such as buses or rideshares in order for rural or semi-rural towns to improve their sustainability. To successfully create a network of public transportation within a rural setting, regional planning and coordination must work to overcome various issues such as isolation of those living in rural areas, how sustainable the system will be, coordination and efficiency of the network, and finally the large issue of funding. Having sufficient funding can help fully implement public transportation and alternative programs. This section explores these challenges surrounding rural public transportation so that regional planning may be better prepared to remedy these issues in implementing a transport network in the Upper Valley.

Isolation

The issue of rural isolation from access to services and employment is central in the argument for provision of more public transportation. Unlike urban transportation, in a rural setting the issue is often not congestion, but isolation, requiring very different measures of performance than that of urban transport systems (Coogan 2006). Eighty percent of rural counties in the U.S. have no public bus service, compared with two percent for urban areas (Dewees 1998). One in ten Americans lives in a “micropolitan” area (a region with a dominant town of 10,000 to 50,000 population), yet few policies have been designed to address public transit in these areas (Coogan 2006). The lack of public transit in these “micropolitan” areas means that those without cars have limited access to jobs, health care, welfare and other services not found locally. A lack of public transportation often leaves more people in need of social sources because they have no means of commuting to a job and this hurts economic development for the same reason. This also applies even more to certain demographics within a community

such as handicapped or elderly people who cannot provide transportation for themselves. With the demographic trend of many elderly moving to rural areas while the young move away to the cities, public transit in rural areas holds increasing importance. A successful transport system would be accessible for these certain demographics to overcome the issue of isolation.

Murray (1998) defines accessibility in terms of transportation: “Accessibility is the suitability of the public transport network to get individuals from their system entry point to their system exit location in a reasonable amount of time. Thus, accessibility encompasses the operational functioning of a system for regional travel” (320). He asserts that proximity of a service, its cost, and other barriers to access affect whether or not the service is used. Figure 5.1 shows the flow of accessibility within the system.

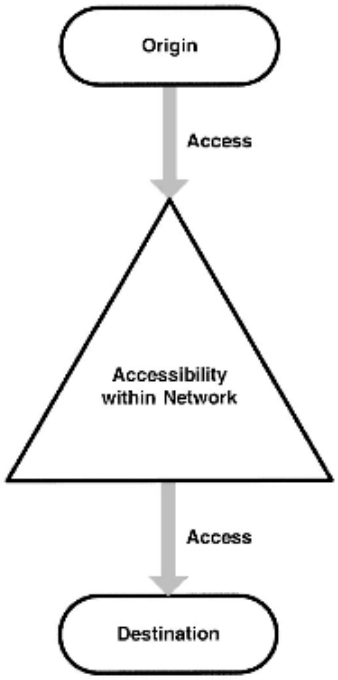


Figure 5.1: Public Transport System Access

Rural public transportation seeks to improve accessibility in order to boost ridership and decrease the isolation of "micropolitan" residents. In order to improve accessibility and to work against isolation coordination and planning must determine the best routes, stops, fare and frequency in order for the transport network to alleviate the issue of isolation.

Sustainability and Emissions Reductions

Sustainability is less often addressed in the rural public transit debate, but is becoming more important as concerns rise over global warming and other environmental challenges. Sustainability can be seen as the responsibility a population has to preserve the natural resources and systems we use now so that future generations enjoy their equal benefits. The U.S. Environmental Protection Agency defines this term sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." (EPA 2008) Automobile transportation presents a multitude of threats to a community's sustainability. Our ever-increasing dependency on fossil fuels, a finite resource, to run our transportation vehicles is unsustainable. Additionally, the carbon emissions from automobile use present great threats to the health of our future environmental systems and human populations. Limiting the amount of individual automobile use through public transportation can make a community more sustainable.

As Coogan (2006) states, "for the rural American who wants to take the bus or the train to or from a rural area, very little help or encouragement is provided to the individual who seeks a sustainable alternative to the automobile" (4). The benefits of public transit in terms of sustainability are many. Murray (1998) states that while public transit has important implications for social and economic welfare, the more important elements of sustainability of a region "stem from the energy and environmental consequences of excessive single vehicle automobile travel"

(320). If the network is coordinated effectively with well placed stops and good service routes it can greatly reduce the amount of fuel that is used within a community (Murray 1998). Non-metro regions also often place great value on the preservation of their "rural sense of place" (Brown 2004), which is put in danger by overdevelopment, traffic, and excessive single vehicle travel. If a rural transport system is well coordinated and planned so that its practices are sustainable, it can greatly add to the environmental health of a community and the preservation of rural characteristics.

Coordination and Efficiency

The coordination and efficiency of a transit network holds an important position in making a rural system work. Much of the literature and discussion of non-metro public transit systems focus on making them more efficient and coordinated in order to make them more viable and effective in meeting the needs of rural residents. Sych (1999) mentions that coordination between districts helps to overcome financial hurdles faced by public rural transportation systems, as well as makes the goals of different districts congruent and therefore more efficiently achieved. There is also the issue of maintaining the transport systems efficacy over a period of time. As Murray (1998) explains "transportation planners need to establish means by which the transportation system may be evaluated and monitored so as to ensure that short and long term objectives care capable of being sustained or achieved." (320) Therefore it is clear that a planning and coordination body is crucial in ensuring the efficacy of a rural public transportation network for a given region.

Among the many aspects of a transportation network that a coordinating committee must plan is infrastructure, the placement of stops, frequency and volume of vehicles and the ability to adapt to changing demands. Transportation demand is fluid over time, continually changing;

therefore it is important for planning committees to continually examine the efficiency of the system with regard to the redundancy and suitability of stops and travel routes (Murray 1998). An effective and successful planning committee will be decentralized and involve voices from sectors varying from citizens, state and private agencies (Sych 1999).

Funding

Non-metro public transit highlights the difficulty in funding transit in these areas. Public transit in rural areas is costly due to low population densities and bad road conditions (Dewees 1998). Many rural systems are currently funded under the Federal Transit Act, a grant program for assistance to public transit systems in areas with populations less than 50,000 (Brown 2004). Although the Act provides some funding to systems, cost is still very prohibitive in these areas, and is a difficult problem to overcome. Often social service programs will fund public transit in rural areas as well, but providing a comprehensive system that meets residents' needs is still very difficult at present and funding through grant programs remains tenuous. The confusion surrounding the funding of rural public transportation systems stems from the many different types of funding one network of public transportation may receive. This is especially difficult when transportation systems provide service to multiple towns that may have different governance arrangements or even may be in different states as is the case with public transportation in the Upper Valley (see Chapter Two on Regional Planning of this Report) Again, these issues of funding for transport systems can be partly rectified through coordination and planning ensuring that funds are efficiently used so that benefits to a community's sustainability through public transportation outweigh and costs of funding the system.

TRANSPORTATION ISSUES IN THE UPPER VALLEY

A recent study prepared by the Upper Valley Transport Management Association (UVTMA) has found that "all of the region's nonprofit public transit providers report operating at or near capacity during peak periods on their fixed routes and are handling record numbers of boardings. Simultaneously their costs are rising—especially for fuel and insurance" (UVTMA 2007, 5). Clearly, there is demand for public transportation services. This section explores the history of public transportation in the Upper Valley and the present situation – funding, options, alternatives, and areas for improvement.

Our research is qualitative and based on interviews with Advance Transit's Executive Director Van Chesnut, Two Rivers-Ottauquechee Regional Commision's Senior Transportation Planner Chuck Wise, and the Upper Valley Transportation Management Authority's Coordinator Gabe Zoerheide as well as various studies of Upper Valley transportation conducted by towns, nonprofit organizations, and private companies. The research focused on describing the current status of the Upper Valley's public and alternative transportation network and evaluating its efficiency. We focus on a broad array of issues, ranging from the Upper Valley's historical transportation needs to recent initiatives to incorporate transport demand management (TDM) into local planning processes.

Historical Background

Public Transportation became identified as a regional Upper Valley issue in the mid-1970s (Jessen and Wechsler 1976, 1). A 1971 Regional Transportation Study for the Upper Valley Region focused on "completion of interstate routes, not only to improve transportation within the area but increase accessibility to the Upper Valley from metropolitan areas and thereby produce concomitant effects on land use" (Environmental Consulting Group, INC, 1971,

3-1). Notably absent from the 1971 study is investigation into public transport options. Instead the focus was on interstate highways and connecting major roadways.

However, by 1974, the region's inter-town train system and the privately operated Tri-Town bus company went out of business, even though the Upper Connecticut River Valley Region was "one of the fastest developing areas in New Hampshire and Vermont" (Jessen and Wechsler 1976, 1). Jessen and Wechsler attribute the demise of Upper Valley public transportation to

> "primarily, the American love affair with the automobile (itself aided by higher income levels and massive expenditures for highways, making autos safer and quicker) and changes in population/housing patterns, with which public transportation did not or could not keep pace" (Jessen and Wechsler 1976, 1).

Yet, the Upper Valley Lake Sunapee Council (a precursor to the current UVLS Regional Planning Commission) conducted a study beginning in 1975 to reexamine whether public transportation was again needed for the region. The final report (released in 1976) cites several factors as to why a new system might succeed: the rising costs of owning and operating automobiles; increasing public awareness of these costs and nationwide energy shortage; a shift in federal transportation policies from focus on highway construction and maintenance to a more balanced approach which included subsidies for local transit programs; socio-economic and elderly group needs; and changing patterns of housing, employment, and shopping from a "downtown" concentration to more dispersed groups (Jessen and Wechsler 1976, 2-3).

Many of the factors cited in the 1976 study are still relevant to public transportation issues in the Upper Valley region, especially housing and employment demographics and energy costs. Importantly, the study recognized that the public transportation issue had a geographic scope that was regional rather than local: "the problems are being caused regionally, the solutions should be achieved regionally" (Jessen and Wechsler 1976, 21).

Buses

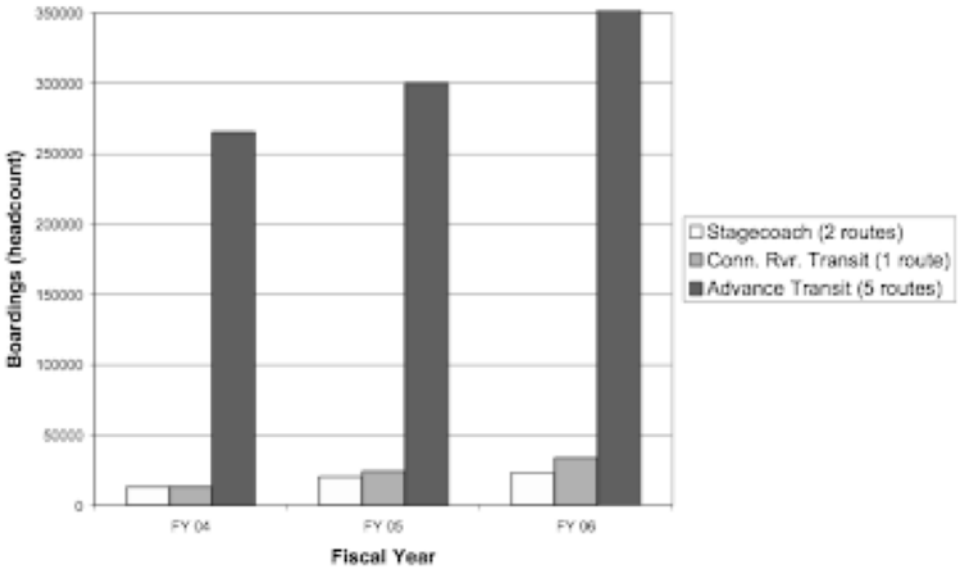
There are currently four fixed-route public bus options for commuters in the Upper Valley10:

- Advance Transit (AT) – fixed five route system which provides scheduled regular service "to the core Lebanon, Hanover, White River Junction area as well as service to Enfield, Canaan, Norwich, Wilder, and Hartford (UVTMA 2005)
- Community Transportation Services (CTS) (depending on the designated definition of Upper Valley, CTS may not be relevant) – fixed route system serves only Newport and Claremont, NH
- Connecticut River Transit (CRT) - one route serving Ascutney, Lebanon, Hartford, Hanover, Springfield, Windsor
- Stagecoach - two fixed routes serving Bradford, Hanover, Hartford, Lebanon, Randolph, Royalton, Sharon, Wells River

All companies operate as non-profits and "depend upon federal and state resources to continue operations" (UVTMA 2007). From fiscal year 2004 to fiscal year 2006, AT, CRT, and Stagecoach have experienced significant increases in ridership.

[10] UVTMA defines Upper Valley as the Lebanon-Hartford Labor Market Area

Figure 5.2: Fixed Route Boardings by Carrier, FY 2005 – FY 2006



Source: UVTMA 2007

Table 5.1: Fixed-Route Transit Bus Boardings, FY 2004- FY 2006

Route Name or Descriptor	Operator	FY '04	FY '05	FY '06	Annual % Change
River Route	Stagecoach	12,973	14,328	11,998(a)	-3.7%
89-er	Stagecoach	-----	5,547	11,523	107.7%
I-91 North	Conn. River Transit (CRT)	13,408(b)	24,297	33,877	29.8%(c)
Blue	Advance Transit (AT)	108,858	124,009	146,657	16.0%
Red (d)	Advance Transit (AT)	62,671	72,445	84,208	15.9%
Orange (d)	Advance Transit (AT)	41,436	44,002	53,596	13.7%
Green (d)	Advance Transit (AT)	24,772	28,211	34,853	18.6%
Brown (d)	Advance Transit (AT)	27,865	31,293	34,222	10.8%

Source: UVTMA 2007

The UVTMA notes that "demand for rural public transportation has been motivated by somewhat different trends and objectives. They include national needs as well as needs common to Upper Valley residents. The following motivations are cited from the UVTMA 2005 *Operational Impact Study of Advance Transit Fixed-Route Bus Network:*

- The needs of an aging rural population that has limited mobility

- Migration of working age people to suburban and rural areas
- Congestion reduction and air quality concerns
- The increasing cost of parking facilities and the opportunity costs of creating them
- Personal financial reasons

In order to try to meet the demand increase, AT, Stagecoach, and CRT have attempted to increase their capacity (UVTMA 2007, 4). However, each company's ability to increase capacity is limited by the amount of available funding.

Obtaining sufficient levels of funding for public transit projects is further complicated by the number of levels involved: federal, state, and local. The federal government provided no capital or operating assistance to transit systems until the 1960s (Baxandall 2008, 36). Additionally, federal funding often requires some percentage of state or local "match" money as a qualification. State funding can also be difficult to procure and states spend relatively different amounts on public transportation. To counteract low levels of state spending, "some state and localities have compensated for a lack of statewide funding by creating local funding mechanisms, such as local-option taxes in counties served by transit agencies or funding from general local revenues. Local governments fund transit primarily through general revenue and sales tax" (Baxandall 2008, 41-42).

In fiscal year 2000, New Hampshire distributed only $200,000 of state grant money for public transportation, ranking it 42nd out of 50 states for state funding of public transportation. Vermont allocated $5,300,000 in public transit expenditure (UVTMA 2007). Furthermore, while other states allocate a "portion of local sales taxes, gasoline taxes, property taxes and surcharges on certain permits or vehicle registrations to pay for public transit," New Hampshire's public transit is limited to the General Fund at the state level as there is no personal income or sales tax.

In Vermont, local municipalities only use property tax revenue to provide local match support for public transportation services (UVTMA 2007, 10). For transit companies in the Upper Valley that serve both Vermont and New Hampshire towns, coordination of funding is further complicated by state boundaries (UVTMA 2007, 4).

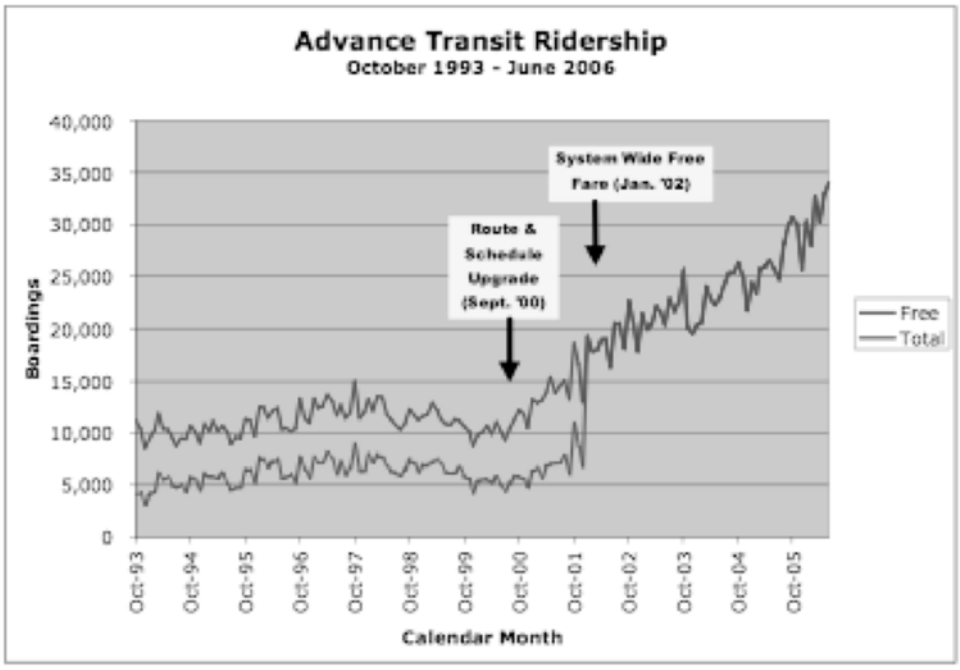
A Closer Look at Advance Transit

Advance Transit (AT) is a 501(c)(3) New Hampshire corporation that runs three services: fixed route transit service, Rideshare, and shuttle service (UVTMA 2005, 4). Notably, all of Advance Transit's services are free. AT eliminated transit fares in three phases:

- September 2000 – AT eliminated fares in Vermont
- September 2001 – Dartmouth College sponsored the "Show ID – Ride Free" program in which college students and employees could ride free anywhere in the system after showing their Dartmouth ID
- January 2002 – all fares eliminated in entire transit system

The elimination of fares, restructuring, and route and schedule upgrades, has contributed to ridership increases. Importantly, the growth in ridership "took place against a backdrop of a 10.6% growth in the combined population of the six served towns between 1990 and 2000 and a 21% growth in employment in the Hartford/Lebanon Labor Market Area" (UVTMA 2005, 13).

Figure 5.3: Advance Transit Ridership History



Source: UVTMA 2005

From our conversation with Van Chesnut, Executive Director of Advance Transit, we understand that securing funding is the most complicated component of AT operations and the limiting factor to expanding services (Chesnut 2008). Therefore, understanding Advance Transit's funding process at the federal, state, and local level is essential to a discussion of how AT's services can be expanded in the Upper Valley.

Advance Transit has always operated as a nonprofit company. The company never saw the advantages that becoming a for-profit business would provide. This was in part because New Hampshire and Vermont would have had to pass legislation that enabled AT to become a transit authority. A transit authority has taxing ability and it is highly unlikely that New Hampshire or Vermont legislature would have approved legislation to make AT a transit authority with taxing rights. Because AT is a nonprofit company and does not charge fares, the company relies on

federal and state funding, local municipality money, and private donations for operating and capital costs (Chesnut 2008).

Advance Transit has two types of costs: operating and capital expenses. Of all states, New Hampshire allocates some $200,000 in operating funding for all public transportation companies state-wide. Advance Transit receives some $25-29,000 of this money annually from the state of New Hampshire. The operating money provided by New Hampshire does not cover the cost of one full time driver (Chesnut 2008). Insufficient financial assistance from states makes it necessary for AT to generate local funds from the municipalities served and the institutions that benefit from AT's services in the Upper Valley such as Dartmouth College and DHMC to (Chesnut 2008).

At the federal level, the Federal Transit Administration "Section 5311" program, which is the program that allocates funding for the operating costs of public transit programs in non-metropolitan rural areas (as defined by the US Census Bureau), determines the money each state receives by a formula. In simplified terms, the formula accounts for each state's percentage of rural population as a percentage of total rural populations in the nation. Each state then takes applications to distribute the Section 5311 money among the transport companies. However, the public transit companies that receive federal funding from Section 5311 must fund a portion of the federal money from local sources, this is referred to as "local match" (Chesnut 2008).

This local money comes from local town governments, contributions from major employers, and 501(c)3 fundraising. Each town that is served by AT on the fixed route system contributes an amount which is taken from property tax money of each municipality's budget (Chesnut 2008). However, there is no established formula, nationally or in the Upper Valley, to determine what each local government must contribute to AT. Instead, AT tries to divide the

total required local match money among municipalities by each municipality's passenger boardings as a percentage of total service area (Chesnut 2008). The table below gives an idea of how the number of boardings is divided among the six municipalities AT serves.

Table 5.2: Boarding and Service in the Six Municipalities with AT Service

Municipality	Number of Routes	Boardings by Residents	Boardings within Municipality	Boardings by Destination	Percentage of Bus Stops	Percent of Fixed Route Miles
Lebanon	4	44.20%	52.90%	59.90%	40.80%	45.90%
Hanover	4	18.80%	27.00%	32.00%	17.10%	22.10%
Hartford	2	17.70%	13.40%	5.10%	30.30%	15.10%
Enfield	1	8.20%	1.50%	0.40%	3.30%	2.80%
Canaan	1	7.30%	2.60%	1.80%	1.30%	5.10%
Norwich	2	3.80%	2.70%	0.80%	7.20%	9.00%

Source: UVTMA 2005

As expected, the six municipalities do not have equal boarding numbers, nor are the percentage of fixed route bus miles and bus stops equivalent. Because of these discrepancies, there is potential for municipalities to disagree on what their financial contributions to AT should be and how the money allocated should be shared among the total municipalities AT serves. Furthermore, AT has to go through different processes to get on each municipality's annual budget. For example, in order to be included on Hartford, VT's proposed budget, 5% of registered voters must sign a petition in favor of putting AT on the budget. The intricacies of securing funding at the local, state, and national levels in two states and six municipalities cost time and money.

Since AT became completely free in 2002, the company has had to increase their fundraising efforts, no longer relying on federal, state, and local government money to provide funds. The switch to free fares and the subsequent need for fundraising is a large reason for the increase in AT staff size (Chesnut 2008). AT does take advantage of their 501(c)3 status, which legally makes them a charitable organization that allows institutions and individuals to make tax-

deductible donations. They are currently trying to build up a donor base and are planning a capital campaign to hopefully raise a few hundred thousand dollars (Chesnut 2008).

Rideshare and Park and Ride

Upper Valley Rideshare (UVR) is nonprofit service run by Advanced Transit and funded by the Vermont Agency of Transportation and the New Hampshire Department of Transportation that coordinates the sharing of commuter rides. The service, accessible from its website – uppervalleyrideshare.org – "maintains a database of commuters who are interested in carpooling. Commuters who enroll receive a 'match list' of others who have similar commuting patterns. Members then contact each other directly to set up a carpool" (Upper Valley Rideshare 2008). According to UVR, there are seven reasons that commuters choose to share rides:

- To reduce the miles they put on their cars;
- To save daily commuting costs by sharing expenses;
- To reach jobs that would otherwise be unavailable to them (Many families don't have a separate car available for each working member.);
- To contribute to cleaner air;
- To help reduce unnecessary traffic congestion; and
- To be good neighbors, sharing space in their cars with community members who live nearby and who need a ride to work (Upper Valley Rideshare 2008).

A major concern that prevents many commuters from utilizing rideshare programs is the fear that they will be at work during a family emergency or be left behind by their carpool and not be able to reach their families. UVR combats this fear by providing up to $50 for the rental of a car or a taxi fare in the event of a personal or family emergency, unexpected overtime, or for an unexpected miscommunication between driver and rider. Thousands of residents of the Upper Valley have participated in the rideshare program, and Van Chesnut noted that "its popularity is due to word-of-mouth advertising and in-house incentives from employers…but that it is still difficult to combat the culture of car-based transportation" (Chesnut 2008).

The Upper Valley is also the home to a Park and Ride system that supports the use of public transportation options like buses and ridesharing. Park and Ride facilities are public transportation stations that are located at important junctions and commuter areas. They "enable motorists to drive from their homes, park, and the carpool or use public transit to arrive at their destination while reducing traffic congestion and pollution" (Hartford Planning Commission 2007, 205). Commuters and others travel to the Park and Ride lot where they transfer to bus or carpool for the remainder of the ride. Parkhurst (2005) lists six benefits to Park and Ride systems.

- Park and Ride facilities have an enabling effect on economic development and environmental enhancement in urban areas.
- Park and Ride systems remove cars from urban areas, relieving congestion and air pollution and creating safer areas for pedestrians and cyclists.
- Because the facilities are located on the outskirts of urban areas, there is more room for parking spaces. Land in the urban center can be used for better purposes than parking garages.
- Park and Ride facilities reduce the number of cars in urban areas without reducing access to the area from the outside.
- Many motorists have reported favorable opinions of Park and Ride systems. Using public transit to commute to urban areas has been noted to be stress free and often quicker than standard commuting.
- Park and Ride systems increase accessibility to downtown areas and thus relieve pressure on suburban sprawl and out of town commuting (Parkhurst 2005, 17).

The utility of Park and Ride systems is not limited to large urban or metropolitan regions. The Upper Valley is home to many small, crowded urban centers. Towns like Norwich, Hanover, and Woodstock all are small in size yet face traffic congestion problems (Resource Systems Group 2008, 36). Currently, Resource Systems Group (a major local employer) is planning a satellite Park and Ride location for Woodstock that:

> "would clearly benefit many citizens and visitors to the town. It has the potential to reduce congestion, increase the number of visitors to town, improve the quality of life for students and seniors, and relieve parking limitations. In addition, shuttle service could help contribute to the Woodstock brand through innovative design and marketing. As a shuttle could reduce congestion

> and vehicle trips, it has the potential to reduce greenhouse gas emissions, which would protect and promote the local environment" (Resource Systems Group 2008, 36).

Because "park and ride facilities currently served by transit are heavily used by commuters…and many lots are over capacity, pointing to unmet demand for facilities" (Upper Valley Lake Sunapee Regional Planning Commission 2003), additional development is needed:

- Construction of a Park and Ride facility in the vicinity of Norwich to serve commuters crossing the Ledyard Bridge, and the construction of facilities in other underserved areas;
- Construction of one or more Park and Ride facilities along the Vermont US Route 4 Corridor between Rutland and White River Junction;
- Expansion of the Exit 9 Park and Ride lot in Hartland to include shelter, bicycle racks, and landscaping; and
- Formation of partnerships between Rideshare, Park and Ride, and other public transportation providers such as Advanced Transit (Upper Valley Lake Sunapee Regional Planning Commission 2003).

Park and Ride facilities are a key part of a public transportation plan because they are facilities that encourage the use of buses and ridesharing. Rather than needing "multiple stops to gather a dispersed residential population, public transit can utilize a single park and ride to shuttle commuters to their employment destinations" (Hartford Planning Commission 2005, 205). Without central parking hubs for transportation, bus services like Advanced Transit would serve far fewer riders (Parkhurst 1995, 16).

Alternatives – Cycling and Walking

Bicycling and walking are the two cleanest options for alternative transportation. Both are human powered and emit no greenhouse gases excepting through their manufacture (in the case of bicycles). Besides the obvious economic benefits that this relatively small investment affords in the face of rising fuel prices, insurance, and maintenance costs for a personal automobile, bicycling or walking to work is a great source of exercise and a way to enjoy the natural environment that Upper Valley residents value so much. Even bicycling or walking a few

times a week can save a lot of money for the commuter and minimize environmental damage, as well as lowering parking demand and congestion problems along commuting routes.

In many European countries, governments have imposed larger taxes on gasoline while funding mass transit to reflect more accurately the total cost of automobile transport. This action has resulted in fewer cars on the road and more people using transit, walking, or biking to get around. The Netherlands and Denmark in particular have reached a high percentage of total trips made by bicycle, proving that the single occupant vehicle trend in industrialized countries (and colder climates) can be reversed (Noland and Kunreuther 1995). The Vermont Agency of Transportation's "Vermont Pedestrian and Bicycle Policy Plan" (2008) cites the benefits of bike and pedestrian commuting as "enhancing the human scale and livability of communities; enhancing the economic vitality; improvement of the health of Vermonters; improvement of air quality; and the enhancement of commuter choices" (5).

Bicycling and walking are important elements in any sustainable transportation system and are also a useful component of TDM strategies (see below). The installation of showers, free bike maintenance, and subsidies can all have a great effect in promoting bicycling and walking to commuters (Meyer 1999). However, lack of access to safe biking and walking trails, an unreasonable distance to travel to work, and bad weather can pose large obstacles to using these alternative modes of transportation. These problems are particularly pronounced in the semi-rural setting of the Upper Valley. Although some may live within a few miles of the workplace, many live much further away. For these longer trips, bicycles can still provide an initial source of transportation to get to a bus stop, for all AT buses have bike racks. Advance Transit also provides an Emergency Ride Home service that provides a free ride home up to $30 up to six

times a year for registered users of transit, walking, or bicycling commutes. This reduces the risk of a biker or walker being stranded in an emergency.

Chuck Wise, a Senior Transportation Planner for the Two Rivers-Ottauquechee Regional Commission, notes that there are six obstacles preventing the growth of a bike-pedestrian system in the Upper Valley:

- The difficulty in recognizing that alternative commuting must start with the individual and on a small scale;
- The still relatively small cost of fuel and the overall availability of parking (with the exception of certain urban zones);
- The harsh and often unpredictable climate of New England;
- A lack of regional planning;
- Road maintenance that focuses on making roads drivable for cars, not bikes; and
- Lack of awareness of the feasibility of bike commuting by employers (Interview with Chuck Wise 2008).

Wise noted 3% of Hartford residents bike or walk to work, a percentage that is generally accurate for urban areas in the Upper Valley. Promoting bike and pedestrian commuting in the Upper Valley are organizations like Upper Valley Rideshare, which in addition to coordinating carpooling, also sponsors Upper Valley Bike to Work Day, an annual event held each May in which over 400 commuters participate (Upper Valley Bike to Work Day 2008). In an introduction to bike and pedestrian friendly planning, Reid Ewing lists a number of necessities for promoting alternative transportation:

- Medium to high density urban areas that allow for alternative commuters to feel comfortable without the protection of a car;
- Frequent intersections, which make walkers and bikers feel more comfortable and empowered;
- Continuous sidewalks wide enough for couples;
- Safe crossings with comfortable and safe places to wait;
- Appropriate buffering from traffic; and
- Traffic calming along access routes (Ewing, 1-13).

Although biking is definitely a sensible and feasible option for commuting for many in the Upper Valley, it would take the construction of bike trails and lanes, a large increase in awareness, and significant economic benefits to make it widespread. Noland and Kunreuther (1995) state that the best ways to promote bicycle commuting are to provide safe and convenient bicycle lanes in the short-term, and to reduce the convenience of automobile commuting in the long-run. Incentives or disincentives are the bottom line in changing our automobile culture (Meyer 1999), and planning in the Upper Valley should incorporate this awareness in making the transportation system more efficient in the future. The construction of bike trails and bike lanes between Upper Valley population centers could be an economical alternative to expansion of the current road system, and should be considered in future planning proposals for its role in reducing congestion, pollution and ecological footprints, parking needs, the price of travel, and much more. Although, as the case study of Lebanon's recent attempt to establish bike lanes in its downtown area demonstrates (see Chapter Two), implementation of alternative transportation has to be done in a carefully thought out way. Wise summed up the plight of alternative transportation by commenting that alternative transit planners "look at victories not in terms of thousands of people convinced to bike to work but rather in terms of individual victories, because winning the fight for bike friendly areas is a hard task" (Wise 2008).

Transportation Demand Management

Recently in the Upper Valley, employers and governments have begun to address the demand side of transportation issues, creating policies that promote public and alternative transportation. These policies, known as Transportation Demand Management (TDM), are traffic reduction methods that work to decrease the number of cars on the road by providing financial incentives for commuters to use public or alternative transportation. In its simplest form, TDM is

"any action or set of actions aimed at influencing people's travel behavior in such a way that alternative mobility options are presented and/or congestion is reduced" (Meyer 1999, 576). Because the factor that influences commuter choices the most strongly is cost, TDM policies make it more affordable for a traveler to find alternatives to driving a car. For instance, many employers have found that by offering a small stipend to employees who forego a parking space, the employer is not forced to create new parking options. Klavon notes that the construction of a new parking space costs between $1,500 and $17,400, while a transit pass for an employee for a full year costs around $260 (Klavon 2005, 2). Because of its reliance on alternatives to private commuting, TDM requires a strong public transportation system in a micropolitan region like the Upper Valley. Without a bus network, a commitment to safe areas for bike and pedestrian commuting, and rideshare and park and ride programs, TDM will never be successful.

TDM policies were first used by urban governments in the 1970s as a way to "satisfy increasing travel demand without building more capacity" (Meyer 1999, 575). Recently, businesses have been recruiting these governmental policies for use in the private sector. TDM policies are popular with businesses because they:

- Increase public and employee health by reducing air pollution;
- Improve regional mobility and thus economic health;
- Enhance customer access;
- Reduce congestion and lower parking demand;
- Create opportunities for space sharing and creative planning; and
- Improve productivity (Meyer 1999, 578).

A model for TDM programs is found in Portland, Oregon, where planners have instituted a comprehensive TDM program with the help of businesses and government that promote:

- Ridesharing by the creation of preferred parking for carpools and government and employer subsidies for those participating;
- Public transportation by the provision of subsidies to transit users and shuttles from work centers to transportation hubs;

- Bike and pedestrian commuting by offering subsidies to alternative commuters and by installing lockers and showers for cyclists at work centers; and
- Elimination of trips by establishing telecommuter programs and allowing flextime for employees who share rides and providing services such as banking and food near business districts (Meyer 1999, 595).

Though Portland is a large city, the TDM policies used there are still applicable to the Upper Valley, where the region's major employers are taking a similar approach. Dartmouth College employs TDM methods by requiring costly parking permits for its employees and paying employees $180 per year to give up their parking permit (Dartmouth College 2001). By adding a financial incentive to a commute, a company can drastically reduce its traffic footprint. TDM is just one of many ways that governments, employers, and other institutions can promote public transportation (Meyer 1999, 580); other options include rideshares, carpools, and park and ride complexes. The TDM plans of many companies include subsidized rides home in emergency situations. Dartmouth College "will pay for a ride home, no questions asked, for those participating in [TDM]" (Dartmouth College Office of Planning, Design, and Construction 2001). In the future, Upper Valley employers like Dartmouth College need to increase their focus on comprehensive TDM as seen in Portland. Employers in the Upper Valley are committing to "enhanced TDM programs" (Dartmouth College Office of Planning, Design, and Construction 2001) in recognition of TDM's potential as a demand-side traffic reduction tool, and Dartmouth should "take the lead in creating and maintaining a sustainable community" (Klavon 2005, 5).

CONCLUSIONS AND RECOMMENDATIONS

Although the Upper Valley is already remarkable in the fact that it is a rural area with a free transit system, many barriers still exist to the creation of a truly efficient and sustainable

transit network that could replace a large portion of single occupant vehicle trips. Ridership on bus networks is high, but the service still only reaches a small percentage of the population. Inconvenience is often cited as a disincentive to ride the bus instead of driving a private vehicle. Modes and networks of transit as well as route plans are poorly coordinated to the point that they increase travel time and convenience significantly enough to discourage the use of public transit. Coordination is also made difficult by the fact that the region is split by the border of NH and VT. The creation of one centralized planning agency with the financial leverage to enact policies for the entire region is essential.

As public transit in the Upper Valley relies on funding at multiple levels and coordination between the state, federal, and local level, regional planning and cooperation between municipalities in the region is essential to a more efficient and inclusive public transportation system. Future research should focus on how regional planning in the Upper Valley can better incorporate and account for the funding aspects of public transportation projects. Future research might also benefit from looking towards examples from other regions of the country dealing with rural public transportation issues. For example, in Eagle County, CO (Figure 5.4) planners are already implementing a comprehensive and efficient transit vision looking more than 20 years ahead. Planning for transit and alternative modes has been decentralized and haphazard. In the years ahead, a more progressive and centralized approach to transportation The planning perspective thus far has been mostly aimed at meeting demand by private vehicles instead of getting them off the road. Employer and town based TDM programs can help in centralizing public transportation. Better planning of zoning and land development can reduce the number of cars on the road and increase the effectiveness of public transportation. Development of

infrastructure to support cycling and walking should become a priority for planners. None of these is the solution in itself; rather coordination of these ideas is the key.

Case Study: Eagle County 2030 Transit Vision

Eagle County, Colorado has laid out a comprehensive transit vision for 2030 as part of meeting its sustainability and accessibility goals. With a large population increase projected, the county has planned for future demands. According to the ecotransit website, their goals are to maintain a 4% share of trips made in the county to be public transit, along with smart land use and the promotion of alternative transportation modes such as walking and biking. Similar to the Upper Valley, Eagle County is a collection of smaller rural towns with dispersed residential areas creating similar challenges in distance and access. Eagle County's success in centralizing its transportation planning and strategies in a singular, long-term transit vision is a model for other micropolitan areas such as the Upper Valley.

Their plan includes the construction of a "fixed guideway" or regional spine, which in their case would be a light rail system. The central spine running up and down the valley would be served by feeder routes with buses running through each area near the train station. Although a light rail system might be out of the current budget of counties in the Upper Valley, the close coordination of the routes in Eagle County with appropriate modes to fit travelers' needs creates an efficient system. A person living in a very isolated area could bike or walk to a nearby bus route that feeds into the spine, taking them to their destination further afield. The map below shows the Eagle County proposed network of incorporating buses, rails and trails. IMCs are stations where multiple modes of transit converge at areas with concentrated populations including air travel.

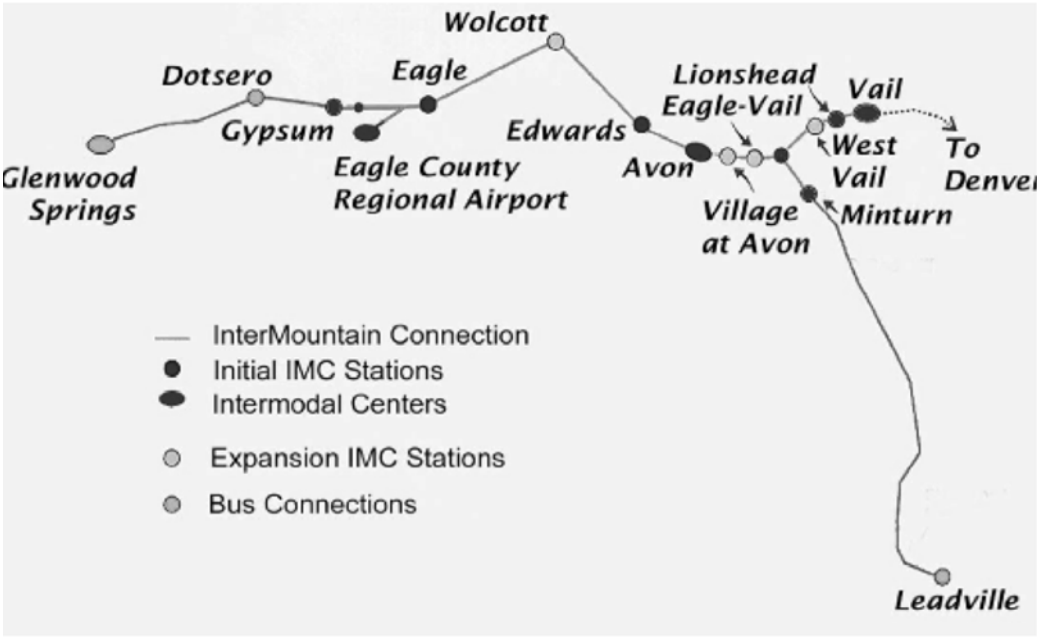


Figure 5.4: Eagle County example

CHAPTER SIX

Conclusions—Towards Sustainability in Regional Planning and Transportation

This report has attempted to offer a comprehensive and broad view of sustainability in transportation and planning in the Upper Valley. Unfortunately our research was limited to only ten weeks and our perspective as researchers was limited to that of temporary residents and Dartmouth students. With these limitations in mind there is much potential for further research in pertaining to these issues which can only become more pertinent to the region in the further due to current trends of rising fuel costs, environmental degradation, and demographic changes. Planners should take note of our findings and recommendations as well as the need for further research and attention in these areas.

The Upper Valley has well-developed layers of planning structure, but the interaction between layers and dispersal of even resources and ideas across certain layers needs some change in order to make the structure work most efficiently. One important weakness of the current situation is the transparency within different planning entities with regard to their current plans and projects. Working together between levels of government is very important for development planning because each level has different experience and a different big picture in mind. Another area of weakness is the lack of interaction both between individual towns and between town officials and community members. The Upper Valley planning community also needs to continue to address the issue of community involvement. With a very broad range of socioeconomic classes and commuting distances represented throughout the Upper Valley it is not realistic to expect all community members to attend town meetings and planning commission events in order to keep themselves updated on planning issues and express their opinions. To this end efforts should be made to reach out more to the general public such as utilizing listserves;

radio and newspapers announcements before and following planning meetings; postings in multiple languages when necessary; and making sure that postings are placed more comprehensively and in highly visible and well trafficked locations.

With regard to the socioeconomic aspects of sustainable transportation, this report found regional disparities of household income and population density to be highly relevant demographic factors. Steadily rising housing costs, as reflected in a similarly high-priced real estate market, together with the problem of fuel expenses complicate the issues associated with commuters in the critical labor-market area at the Upper Valley's core. The transportation usage trends exhibited by these inhabitants underscore the importance of an efficient public transport system, the impact of which was revealed by our insightful analysis of associated economic costs and benefits. This element of our study assigned quantitative values to the positive effects such sustainable practices can have, and a continued focus on the populations hypothetically undertaking such practices can help realize their potential.

Further studies are needed to better understand the impacts of transportation on the environment, and more specifically there is a need for research to understand the ranging effects of road salt on aquatic ecosystems. However, impacts on aquatic ecosystems as a result of road salt could be minimized by taking biological hotspots into account when salting. Additionally, upgrades in salt storage buildings and salting trucks could minimize negative environmental impacts. Overall, additional planning and funding in some cases are essential to decreasing the effects of road salt on the environment.

Finally, we feel strongly that any further examinations of regional planning and sustainable transportation in the Upper Valley should seriously consider two critical issues. The first is the potential for sustainability indicators (see Chapters One and Two) to measure with

greater precision the progress that Upper Valley communities are making towards sustainability goals in areas like transportation, land use, water resources and so on. In addition, the identification of sustainability indicators (specific measures of a process such as amount of open space, water quality, public transportation ridership and so on) can be carried out in a way that builds a shared vision among the different communities and planning entities currently operating in the Upper Valley region. At the very least, such indicators, if agreed on and measured on a regular basis, allow communities to assess where they are and where they are going in the future in terms of sustainability. The second issue is a little more difficult to conduct research on, but well worth the effort. It concerns the political dynamics of regional planning and decision-making regarding the trade-offs between economic development and environmental sustainability. We feel there is a real need for further studies to identify the relationships among the various actors (non-profit organizations, planning commissions, regional planning commissions, state agencies, business interests, citizens in two states and several municipalities) and how there relationships are characterized in terms of planning for sustainability. We only began to scratch the surface of some of these relationships in our study, but the cases of environmental conflict we examined point out the importance of keeping in mind regional and local politics. These political dynamics affect everything from funding of public transportation to decisions made on key planning issues, and definitely merit further investigation.

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