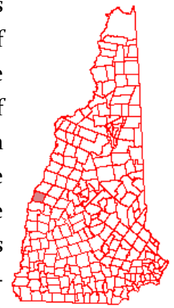
Chapter I: General Description of Lebanon's Natural Resources



At 41.2 square miles, Lebanon is about average in size for the state of New Hampshire. Located along the western edge of the central part of the state, it shares a border with Hanover to the north, Enfield to the east, Plainfield to the south, and the state of Vermont to the west. Its shape is roughly square with its western edge following the sinuous course of the Connecticut River. The river provides the lowest elevation in the City at 330 feet above sea level; more than 1300 feet below its highest elevation of 1656 feet on Eastman Hill. In general, the topography of Lebanon is fairly steep as it trends from highland ridges on its north, east and southern sides downwards into the central valley of the Mascoma River.

The Mascoma (or Mascommah) River, reportedly a western Abenaki word for the good hunting and fishing grounds it contained, drops over 400 feet as it winds down its length of over seven miles between Mascoma Lake to the east and the Connecticut River on the west. With three principal dams in Lebanon, the Mascoma has long served as the icon of the settlement that grew up along its banks. Casually used by colonists since the 1730's, it wasn't until 1761 that Lebanon saw its first permanent settlers and was officially chartered as a town by Governor Benning Wentworth. Excellent river trade and ample farmland allowed Lebanon to flourish even during the general decline of agriculture in the 1840's and the outmigration of thousands of settlers from the region during the Civil War. Over one hundred years after the earliest colonists chose the flowing waters of the Mascoma to settle next to, the river continued to provide positive economic conditions for the town to survive and expand. Charles Algernon Downs described this period after the Civil War as one of industrial growth,[1] with new residents arriving from Quebec to work in the furniture and woolen mills, and with farmers establishing dairy herds on the rich hillsides above the river.

The highlands of Lebanon helped establish the 'sense of place' within the Mascoma River valley by providing a picturesque backdrop to the rushing waters of nine named brooks that carved the valley sides. Settlers first came to know Crafts, Farnum and Storrs Hill and soon established upland farms on them. By the early 1800's settlements reached into the northern uplands of Mt. Support, Signal Hill, and Mt. Tug. Although somewhat less hospitable, the sides of Eastman and Methodist Hills also saw homesteads by the time Payne's Mill was fully operational in East Lebanon in the 1820's. By the time of the great fire that destroyed this mill in 1840, nearly 80% of the forested highlands of Lebanon were converted to open pasture or cropland.

It was the combination of good growing soils, ample water, and wildlife that allowed the early settlers of Lebanon to make great gains. Blessed with deep alluvial soils along the Connecticut and Mascoma Rivers, as well as the productive loams of the valley sides, farmers were rewarded quickly for their efforts. Dozens of miles of perennial streams provided grist for the farmer's mills, and ample power for sawmills, turneries, and slate mills. Anadromous fish such as Atlantic salmon, shad, and alewife could be caught in all of the brooks, and the colder streams supported brook trout and fallfish. Turkey and deer fed on the plentiful oak and beech mast in the forests, and bear, moose, and rabbit could be taken for game meat. Beaver, mink, and otter pelts were traded early on as a means of exchange, and after these were trapped out by the late 18th century money could be made on the bounties of other furbearers such as wolf, bobcat, and fox. The forests provided ample supplies of spruce for poles and rafters, chestnut and oak for timber frames, and pine for flooring and furniture. In many ways, the earliest of economies in Lebanon came about only as a result of the abundant natural resources that could be had.

The expansion of the town's population in the 19th century went from about 1579 residents to 4965 residents.[2] This tripling of the town's residents was accompanied by a shift in population centers from the shores of the Connecticut River to "Lebanon City" in East Lebanon, and then back into Lebanon Center during the height of mill operations along the Mascoma River. The concentration on mill trade aided in the demise of hilltop agriculture and allowed for the gradual return of forests to the highlands. Wildlife species such as deer, bear, and beaver slowly returned in the early 20th century, but it wasn't until the 1950's and 1960's that species associated with older woodlands began to return. With help of scattered reintroductions in the state, fisher, turkey, and brook trout re-established themselves in the backlands of the town. The discontinuance of the use of DDT in the 1960's also aided in the return of aerial predators such as hawks and owls, and the continued lack of high-density development of the highlands in the 1970's and 1980's allowed for the return of moose. Today, nearly all of the pre-existent wildlife species are present in Lebanon, with the exception of eastern timber wolf, mountain lion, wolverine, and woodland caribou. Wolf and mountain lion are making a very slow comeback particularly in the northern parts of the state, and wolverine and woodland caribou are considered extirpated from the region.

The 2009 population of Lebanon is approximately 13,638 based on NH Office of Energy & Planning estimates,[3] or roughly 330 persons per square mile or one person for every two acres. In 2008, there were approximately 4500 parcels that averaged 5.9 acres each. City and state owned lands equaled 180 parcels or roughly 3000 acres. Therefore, privately owned parcels numbered approximately 4320, with an average size for each landowner of about 5.4 acres. Since unfragmented lands - i.e. those without roads, houses, or agriculture, exceeded 15,000 acres in 2008, the average amount of developed land per lot was a little less than two acres. In 2008, the number of housing units (6550) confirms this estimate.[4]

> *"In the City of Lebanon we are consuming land and habitat resources at a steadily increasing rate…"*
>
> From *Lebanon's Landscape*, City Planning Office, September 2008, p. 6.

Current land use patterns suggest that the natural resource base of Lebanon is shrinking. Commercial and residential subdivisions are converting forestland at an alarming rate of approximately 100 acres per year in Lebanon.[5] Pressure on the remaining undeveloped land has brought with it increased sedimentation in rivers and streams, higher nutrient inputs to lakes and ponds, and fragmented wildlife habitat. Fish consumption advisories have previously been posted for

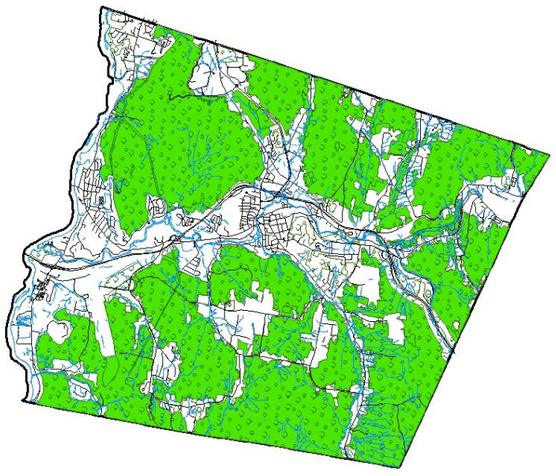
[1] Excerpts from the *History of Lebanon 1761 – 1887* by Charles Algernon Downs can be found at http://www.archive.org/details/historyoflebanonoodown

[2] From the History of Lebanon summary, http://www.lebanonnhhistory.org/lebanon-history

[3] U.S. Census Bureau data for the year 2000 was 12,568 residents.

[4] From *Lebanon's Landscape*, City Planning Office, September 2008, p. 6.

[5] Based on statistics on land conversion 1999-2005 supplied by the Lebanon Planning Office.



Lebanon's unfragmented lands are shaded in green in the above illustration. Approximately 15, 171 acres of land in Lebanon (57%) do not have maintained roads, open land agriculture, or industrial, commercial or residential development. This area was delimited on the basis of the 2007 photogrammetric map of Lebanon as well as field confirmation of contiguous habitat across powerlines, dirt roads and byways, and in the buffer areas of developed land.

the Connecticut River, and Mascoma Lake is currently on the New Hampshire Department if Environmental Services (NHDES) "Impaired Waters" list[6] for non-point source pollution.

Clearly the City of Lebanon needs to pay close attention to those natural resources that are being compromised by growth, and to plan wisely for securing and protecting water quality, water quantity, wildlife habitat, and biodiversity in the years to come. The purpose of the Phase II NRI was to help with this process.

This report summarizes the "Phase II Natural Resources Inventory" effort of the Lebanon Planning Office. This two-year effort has resulted in a fresh look at those critical natural resources that are being impacted by increasing development and which require careful planning in order to protect their integrity for future generations. The synopsis below is based upon an extensive review of existing literature and map resources, as well as a total of 26 field days during this two year time period. A particular focus was placed on wetlands and wildlife since these two aspects of the natural resource 'fabric' of Lebanon are more difficult to ascertain from remotely produced maps. On-the-ground assessments were completed of wetlands and wildlife habitats and tallies were kept on the species diversity within the City's boundaries. Written permission was obtained for all excursions onto private property and state permits approved for the collection of any and all wildlife species.

Chapter II reviews the Foundations of Lebanon, namely its bedrock and surficial geology, soils, and water resources. Most of this review is map-based and relies heavily on the work of the state and federal government whose documents are cited within. Field verification of certain water resources such as stream centerlines and shorelands aided in the improvement of existing digital data. Aerial photograph interpretation of the 2007 photogrammetric survey of Lebanon helped identify active agricultural areas, many of which were also confirmed on the ground. Within the soils sub-section there is a treatment of steep and erosive soils that brings together new information on Lebanon's "soils of concern." The water resources subsection summarizes the City's surface and groundwater resources, and includes a discussion of possible protection mechanisms to ensure positive water quantity and quality in the future.

Chapter III talks about wetlands and their values. It defines wetlands, describes now to recognize them, and discusses the classification and assessment methodologies that were employed in the field. A revised and expanded wetland map of Lebanon is offered as an 11 x 17" attachment to this report, as well as a similarly sized wetland ranking map. The latter illustrates the 60 wetland complexes that were evaluated for ecological integrity and grouped into 5 classes. The top 15 ranked wetland complexes in Lebanon are described in detail. The final sub-section offers three mechanisms for improving wetland protection in the City, including the use of prime wetland designation, stream designation, and outright conservation of important wetlands.

Chapter IV covers the wildlife resources of Lebanon and includes an in-depth discussion of each major assemblage, namely, mammals, birds, reptiles & amphibians, fish, and invertebrates. An introductory subsection talks about the sampling approaches used as well as the best season(s) for detecting each group of wildlife species. A list of six "target" species (five mammals and one invertebrate) were surveyed intensively since they tend to act as indicators of specific habitat conditions. The findings of this survey are described under the Mammals sub-section of this chapter. Finally, the target species discussion includes a synopsis of their estimated population viability in Lebanon. This will, of course, require further fieldwork in order to test and refine the hypotheses presented.

Chapter V provides a synopsis of some of the most critical natural resource elements in Lebanon. These Significant Ecological Areas or SEA's were identified through a combination of aerial photo interpretation and fieldwork. Of the total of 73 areas that were identified for the City, 11 are described. Each description includes a discussion of the salient natural resource attributes that defined the SEA, including the ecological setting and condition of the habitat present. Sample pictures of the rare and endangered species that made up some of the SEA's are included as well.

Chapter VI offers a summary of the natural resources of Lebanon by considering those areas where a variety of natural resource elements are aggregated. The Co-Occurrence of some 45 different elements not only provides a justification of the SEA's that were described in Chapter V, but also offers a deductive means for making land use decisions that protect certain natural resource qualities. For example, a quick look at the co-occurrence of wetlands and water resources points to the high value of upper watershed areas that extend beyond Lebanon's boundaries. Using a variety of conservation strategies that are commonplace in most towns of the state, several protection mechanisms are suggested. This chapter highlights a few priority conservation sites and ends with a brief discussion about the future land use-natural resource interface in Lebanon.

The Appendices of this report include selected maps, species lists, a descriptive list of significant ecological areas, a field log, and a listing of codes for the wetlands cover type map. References for all citations included in this document are also included at the end of the report.

[6] **Data from U.S. Environmental Protection Agency: http://www.epa.gov/ne/eco/tmdl/impairedh20.html#nh**