

NATURAL RESOURCE INVENTORY

TOWN OF JAFFREY, NEW HAMPSHIRE

SUMMARY REPORT



PRODUCED IN COOPERATION WITH THE JAFFREY CONSERVATION COMMISSION

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Cover photograph: View of Mount Monadnock and Mountain Brook Reservoir, Jaffrey, NH.

AUTHORS

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ASSUMPTIONS AND LIMITATIONS OF PROJECT

The information contained in this report is based principally on stock geographic information systems (GIS) data publicly available from federal and state agencies. While the reader can expect these data to have a high level of spatial, temporal, and content accuracy, these data are meant for broad-scale planning purposes and have not been field verified in the Town of Jaffrey. This report and the accompanying maps can be considered a “coarse-filter” evaluation of Jaffrey’s resources. Any land management or conservation activities initiated as a result of this planning effort should involve some level of “on the ground” evaluation to confirm the findings of this report at the specific site and also to identify features not mapped here.

DISCLAIMER

Every reasonable effort has been made to maintain a high level of quality in developing this natural resource inventory report and the accompanying large-format maps (“The NRI”). However, the Town of Jaffrey, Christopher Kane, and Peter Ingraham (“The Producers”) make no warranties, expressed or implied, concerning the accuracy, completeness, reliability, or suitability of the data described or displayed in The NRI. The Producers do not assume any liability associated with the use or misuse of this information. The information depicted in The NRI is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or property conveyance purposes. In addition, the resources described and mapped in The NRI are subject to alteration by natural and human influences, and thus this project is a static representation of the natural resources in Jaffrey, one that will benefit from periodic updates.

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I. EXECUTIVE SUMMARY

This study aims to categorize, catalogue, and map the rich natural resources of Jaffrey, NH as a basis for natural resource management and conservation planning. The study was commissioned in 2008 by the Jaffrey Conservation Commission and funded in part through the NH Moose Plate Program. This summary report is accompanied by nine large format maps which illustrate the various resources.

Natural resources were divided into the following four categories:

- Wildlife Habitat
- Water Resources
- Soils
- Scenic Resources

Jaffrey's wildlife benefit greatly from numerous remaining large unfragmented natural areas: the town still has five blocks between 1,001 and 2,500 acres, two blocks between 2,501 and 4,999 acres, and one block over 5,000 acres. Within this matrix of undeveloped lands, numerous important habitat types exist, as mapped in the NH Fish & Game Department's Wildlife Action Plan. There are several areas designated "highest ranked habitat in NH" as well as "highest ranked in biological region". In addition, Jaffrey has 873 acres of grassland habitat, a declining, yet biologically important habitat type in NH.

Jaffrey sits atop the watershed divide between the Connecticut and Merrimack River basins. Despite its high watershed position, the town has large areas of intact stratified drift aquifer, most of which remain intact. In addition, two river sections of the Contoocook River have been designated significant on a statewide basis by the New Hampshire Rivers Management and Protection Program.

Jaffrey was left with significant soil resources in the post-glacial environment. Large amounts of Class IA forest soil (about 41% of the town's area), ideal for producing northern hardwoods like sugar maple, blanket the town. Jaffrey also has significant potential for agricultural production with over 3,000 acres of important agricultural soils ("prime farmland" and "soils of statewide importance" designations).

As the center of the Monadnock region, and renowned for its scenic beauty, Jaffrey will benefit from the conservation of scenic resources and the preservation of its rural character. No one who has visited Jaffrey will be surprised that Mount Monadnock claims the highest scenic values in the scenic analysis model performed for this study. However, numerous other areas are highlighted here, including the ridge running between Gap Mountain and Mount Monadnock, the ridge just east of Cummings Reservoir, and numerous hilltops around the town.

In addition to these resource areas, a co-occurrence analysis was performed to facilitate conservation planning. A co-occurrence analysis incorporates all of the resources mapped as part of this study in a single model, thus simplifying the process of selecting potential conservation priorities. Numerous areas had high scores in the model and deserve further

consideration or study as potential conservation priorities. The top five, in no particular order, are:

- Meade Brook Wetlands
- Monadnock massif
- Gap Mountain unfragmented area
- Jaffrey downtown from Contoocook Lake to Cheshire Pond and to the Mountain Brook Reservoir
- Mountain Brook Swamp unfragmented area

The results of this Natural Resource Inventory will serve both as a foundation and a springboard for future open space and conservation planning.

2. INTRODUCTION

Background and Justification

The Jaffrey Conservation Commission, in its role as advocate for natural resources on behalf of the Town, recognized the need for current natural resource data for the entire town displayed at a scale sufficient for meaningful interpretation for conservation planning. Cognizant of the technical advances in both digital spatial data and the mapping software applications to utilize it, the Town applied for a grant through the NH Moose Plate Program for the production of a series of new maps to display the extent and location of its critical resources. Funding was approved, and in 2008 the Town secured the services of Kane & Ingraham, Conservation Consultants, to produce the map series, along with a summary report that would together constitute a new Natural Resource Inventory of the town, which the present report comprises.

The Natural Resource Inventory

In the past two decades, the Natural Resource Inventory has become a critical tool for the collection, synthesis, display and interpretation of data relating to the natural resources of an area, be it at the property scale, town scale, regional scale or larger. Essentially a compilation of resource information tied to location, it can take many forms, depending on the needs of the sponsor. By displaying the known resources of an area on a variety of maps, the various component resources that exist at a location can be comprehended at once, and decisions that impact resource use are better informed.

Building on Previous Work

Maps in Jaffrey's Master Plan were designed and produced at a size and scale suitable for inclusion in the Master Plan Report but are not ideal for study at a detailed level or for display. Most of these maps also display a discrete data category, which works well with the treatment of these data in the Master Plan, but which do not allow for simultaneous display of multiple resources. The Conservation Commission desired maps that revealed much more detail and that could be practically used in conjunction with tax parcel and zoning district overlays to identify specific properties associated with the different resources displayed on the maps.

The Jaffrey Master Plan Natural Resources Chapter is broad in approach, preparing the justification for a more in-depth exploration of the town's natural resources. With the completion of this Natural Resource Inventory, Jaffrey will be well informed about the breadth, location and quality of its natural resources and will be well poised to take the next step toward planning for the protection of these vital resources.

Mandates for Natural Resource Planning and Protection

New Hampshire law grants to municipalities certain authority and responsibility through their planning boards and conservation commissions to catalogue their local natural resources and take actions toward their protection. The following are excerpts from New Hampshire State Statute that relate to local board purview of natural resources.

NH RSA 674:2:d (Master Plan)

“A natural resources section which identifies and inventories any critical or sensitive areas or resources, not only those in the local community, but also those shared with abutting communities. This section provides a factual basis for any land development regulations that may be enacted to protect natural areas. A key component in preparing this section is to identify any conflicts between other elements of the master plan and natural resources, as well as conflicts with plans of abutting communities. The natural resources section of the master plan should include a local water resources management and protection plan as specified in RSA 4-C:22.”

NH RSA 36-A:2 (Conservation Commissions)

“Such commission shall conduct researches into its local land and water areas and shall seek to coordinate the activities of unofficial bodies organized for similar purposes, and may advertise, prepare, print and distribute books, maps, charts, plans and pamphlets which in its judgment it deems necessary for its work. It shall keep an index of all open space and natural, aesthetic or ecological areas within the city or town, as the case may be, with the plan of obtaining information pertinent to proper utilization of such areas, including lands owned by the state or lands owned by a town or city. It shall keep an index of all marshlands, swamps and all other wet lands in a like manner, and may recommend to the city council or selectmen or to the department of resources and economic development a program for the protection, development or better utilization of all such areas.”

A Natural Resource Inventory of an entire municipality is an important planning tool in New Hampshire for carrying out the duty conferred upon Conservation Commissions by RSA 36-A:2. Originally in the form of hand-drawn paper maps and supplemented with written reports, the powerful technology now available through geographic information systems (GIS) and the growing number of datasets appropriate for its use, has made large-scale Natural Resource Inventories a very sophisticated and comprehensive tool for natural resource planning.

Results of Previous Studies and Surveys from Jaffrey

Reference works, studies, web-based resources, town documents including the Master Plan, Town Ordinances, plans and other documents all contributed to this NRI. Numerous discussions and personal communications with the Conservation Commission and other members of the Jaffrey public and staff informed various parts of the project, and helped greatly with the completion of this project. A complete list of sources can be found in Appendix A. The following are excerpted highlights from the various town documents that pertain to natural resources, providing an established justification for embarking on this natural resource inventory study.

Jaffrey Master Plan (2007 Update)

The recent update to the Master Plan addresses natural and scenic resources in several places. The following are select quoted excerpts from the Master Plan.

Vision Statement:

“The people of Jaffrey have indicated that they want to see Jaffrey remain a small town, with a friendly atmosphere. We envision a Jaffrey that combines controlled growth and development with strong land preservation and environmental protection.”

“Preservation of open space, forests and fields, and wildlife habitats, all of which are integral to our rural character, is of crucial importance. Mount Monadnock, and our ponds, lake, wetland areas, and scenic vistas are trusts to be passed unspoiled to future generations.”

“Jaffrey will encourage the wise use of land and preservation of open space, such as is provided by its present Open Space Development Plan. Jaffrey will focus on concentrating high density housing development or mixed uses in or adjacent to the Town’s hub where town water and sewer are presently available. The town shall also look at housing needs for elderly, retirees, and the less fortunate, and seek to maintain a stock of workforce affordable housing.”

Implementation:

“Develop a plan for open space and agriculture designed to protect Jaffrey’s natural resources, open spaces, and rural character.”

“Create a natural resources section in the new zoning ordinances. Review all ordinances pertaining to these natural constraints and seek expert opinion on how best to protect them.”

“Develop a 3-tiered map, 1st tier Unfragmented Rural Land, 2nd tier Other Rural Lands, including agricultural lands, and 3rd tier Targeted Development Areas. This could be done in conjunction with the JCC and would be a helpful guide for decisions concerning conservation and development.”

“Direct mixed-use development to the downtown hub area (possibly enlarging it to accommodate residential and commercial expansion).”

“Consider a criterion for Open Space Development Plan that any proposals should include consideration of sensitive lands.”

Land Use:

Rural Periphery:

- I. “Clarify and specify the rules governing what constitutes “developable land”.”

2. “The Planning Board is responsible to review the adequacy of ordinances concerning current roadside buffer zones and setbacks around sensitive environmental assets and viewsheds, especially for the protection of surface water, wetlands, floodplains, visual character, and natural forest vegetation.”

“Preserve and protect the natural resources, open space, and rural character of Jaffrey by encouraging OSDP’s (Open Space Development Plans).”

Natural Resources Chapter:

The Natural Resources Chapter of the Master Plan cited three core issues:

The fragility of the Town’s natural resources

The threat to ecosystems from land fragmentation

The implications for both the environment and Jaffrey’s rural character posed by increasing housing and human density in the Rural District.

Natural Resource Maps:

The following series of small-scale maps was produced from stock GIS data.

Recreational Resources (rail trail)

Aquifers

Bedrock

Gravel

Hydric Soil

Topography

Water Resources

Watersheds

Conservation

Sensitive Soils

Sensitive Resources

Wildlife Habitat (as mapped in the NH Fish and Game Department Wildlife Action Plan)

Land Use

Development Constraints

Steep Slopes

Regional Context:

Mount Monadnock and the Contoocook River

(paraphrased): Jaffrey is the site of the majority of Mt. Monadnock and much of the headwaters of the Contoocook River, and as such Jaffrey assumes a responsibility in their protection for the

benefit of other communities in the vicinity of the mountain, and downstream in the river watershed.

The Mountain Zone District Ordinance around Monadnock is intended to protect the rural and scenic beauty of the mountain and associated highlands.

Survey of Residents, Summary of Results (2006)

The results of the 2006 Jaffrey Residents Survey showed a strong response that diminishment of rural landscape was increasing, including loss of (scenic) viewsheds, disappearance of open space, and need for protection of rural and agricultural landscapes. Also, that new construction is not sensitive to context and appropriate design, and vistas of key sites (eg. Monadnock, Meetinghouse) are not being maintained. A series of goals were articulated with the common theme of open space and scenic view protection, and maintenance of rural character through preservation of historic and agricultural resources.

Themes of the 2006 Community Survey showed that, by and large, residents wanted:

1. To maintain the rural character of Jaffrey.
2. To protect the natural resources of the area.
3. Future growth to be well planned and regulated.

Jaffrey Cost for Community Services Study (2005)

The Cost of Community Services Study (COCS) methodology was developed by the American Farmland Trust in the 1980's. The object of such a study is to collect actual data on how much tax revenues are spent by a municipality according to different land uses. Innovative Natural Resource Solutions LLC completed such a study for Jaffrey in 2005. The study breaks land use down into three categories:

Residential – all single and multi-family residences and apartment buildings, including farmhouses, residences attached to other kinds of business, and rental units;

Commercial & Industrial – all privately owned buildings and land associated with business purposes, the manufacture of goods or the provision (with the exception of agriculture and forest industries which are considered part of Open Space land uses), and utility-owned property;

Open Space – all privately owned land that is devoted to agriculture, forestry or open space, as well as wetlands, are considered open space. Open space is defined as land enrolled in or clearly eligible for enrollment in New Hampshire's Current Use program.

The results of the study show that in Jaffrey, using data from 2004, for every \$1.00 in revenue collected by the Town for the particular land use:

\$1.15 was spent in services to residential properties

\$0.49 was spent in services to commercial/industrial properties
\$0.68 was spent in services to open space lands.

Results will vary by community, but according to this study based on actual tax and expense records specific to Jaffrey, residential properties required significantly more tax spending than open space lands. In terms of revenue flow, the study found, residential property in Jaffrey is a net cost to the town, whereas commercial/industrial property and open space are both net benefits in that revenues received exceeded expenditures made. This pattern has also been found to be the case in 16 other New Hampshire towns that have had similar studies.

Other Plans and Studies

Monadnock State Park Master Plan (2003)

This 2003 update of the earlier 1992 Monadnock State Park Management Plan was a collaboration between the NH Department of Resources and Economic Development Division of Parks and Recreation, the Society for the Protection of New Hampshire Forests and the Town of Jaffrey. The plan acknowledged that the ever-increasing popularity and use of Mt. Monadnock by the public has many implications, including recreation, conservation, education and fiscal. Specific recommendations focused on improvements to recreational trails and access points, recreational and maintenance facilities, and natural and cultural resource inventories.

Quabbin to Cardigan Initiative (Q2C)

The broad forested highlands stretching 100 miles from the Quabbin Reservoir Reservation in central Massachusetts to Mt. Cardigan in the southern White Mountains have recently been recognized for their regional importance as one of the largest remaining intact contiguous forests in central New England. Jaffrey is situated on the very spine of the Q2C focus area, which is the subject of a public/private initiative to protect a corridor of interconnected conservation lands along the Monadnock Highlands.

This area forms the division between the watersheds for the Connecticut River and the Merrimack River, making its streams and rivers important source water for both watersheds. According to the Q2C report, recent trends in the region indicate an increased rate of conversion from forest to development as long-time timberland owners sell off their holdings. At the same time, land prices are increasing, tipping the balance economically toward the conversion and subdivision of working forest lands which until recently have not been considered at risk for development.

A consortium of 23 private organizations and public agencies has come together since the project's inception in 2003 to study this area and to develop strategies for its protection. They identified a 3,100 square mile focus area and developed a list of goals. These goals are to complete region-wide natural resource mapping, identify and refine focus areas for targeted and proactive land conservation, accelerate land protection in the focus area, identify and secure private funding sources, identify and secure additional federal, state and local conservation funding, and promote the initiative's regional vision with key stakeholders and the public. The

Q2C partners “share a vision of the permanent protection of the region’s most ecologically significant forest blocks, and key connections between them for wildlife passage and human recreation.”

Introduction to Jaffrey

Jaffrey’s Landscape

From a low elevation of 880 ft. where the Contoocook River flows into Peterborough to the east, to the lofty 3,165 ft. peak of Mt. Monadnock, Jaffrey is a town of great diversity and contrasts of terrain. Productive farmland and settlement areas tend to define the east, while steep wooded slopes convey a wilder character to the west.

Factors influencing land conversion in Jaffrey: Population Growth and In-migration¹

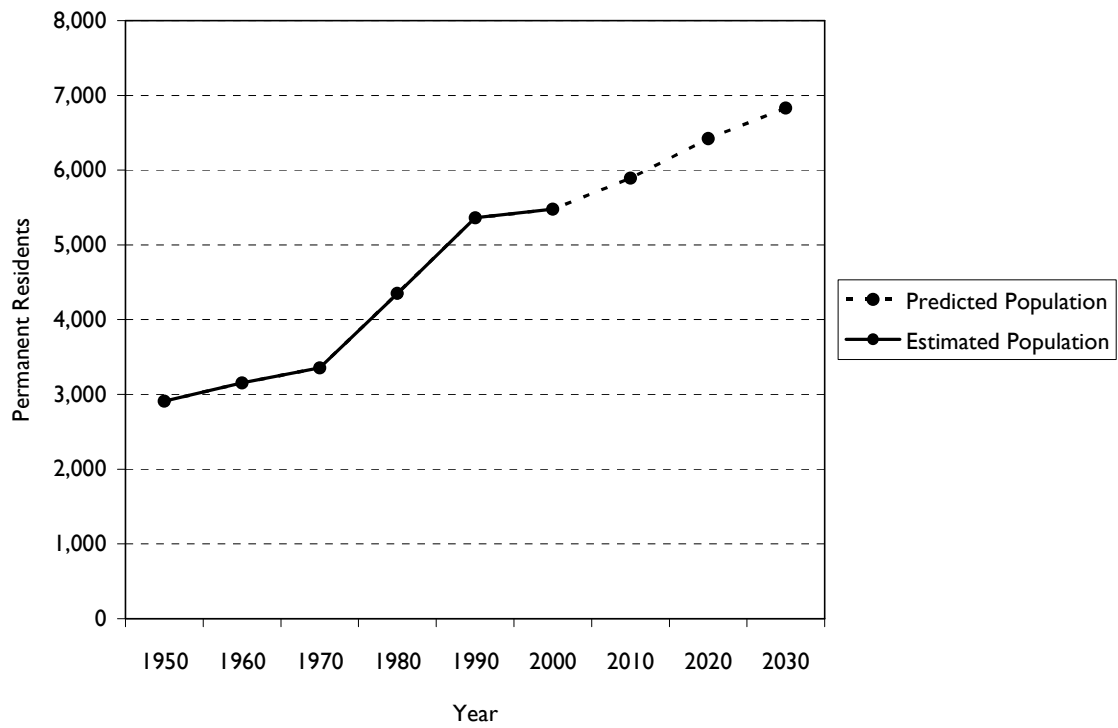
Jaffrey’s population has grown substantially since the mid-twentieth century, nearly doubling from 1950 to 2000 (see Figure 1: *Population of Jaffrey, NH, 1950-2030*). According to *New Hampshire’s Changing Landscape* (Society for the Protection of New Hampshire Forests, 2009), from 2000 to 2007 Jaffrey’s population grew from 5,476 to 5,722, or about 4.5%. While this is not as great as population growth statewide over the same period (about 6.5%), it does have implications for land conversion and other environmental impacts. In New Hampshire, for each single family home built, approximately 1.4 acres of land is developed². To accommodate the population increase over the 2000 to 2007 period, 191 new single family homes were built in Jaffrey, resulting in approximately 267 converted acres.

As Figure 1 indicates, Jaffrey’s population is predicted to grow by approximately 25% by 2030. This growth will be associated with a loss of forest and farmland: Jaffrey is predicted to lose approximately 3.4% (approximately 650 acres) of its forested area between 2001 and 2025.

¹ Unless otherwise noted, data in this section are based on NH Office of Energy and Planning estimates and predictions as compiled in *New Hampshire’s Changing Landscape* (unpublished data), Society for the Protection of NH Forests, 2009

² *New Hampshire’s Changing Landscape*, Society for the Protection of NH Forests, 2005

Figure I: Population of Jaffrey, NH, 1950-2030



General Explanation of Maps

Nine large-format maps were created as part of this project for the Conservation Commission's use:

- Aerial Photo Base Map
- Wildlife and Ecology
- Unfragmented Lands
- Water Resources
- Soils
- Scenic Areas
- Co-occurrence Model
- Tax Parcel and Zoning Overlay (transparency)
- Conservation Focus Areas

A reduction of each large-format map is included in Appendix C of this report. All maps for this project were produced at a scale of 1:18,000 and cover the full extent of the Town of Jaffrey. With the exception of the Parcel Overlay, all maps also include a 2,500 ft. buffer extending into adjoining towns to provide context for the natural and cultural features, protected lands, unfragmented blocks and conservation planning. The map format is 36" x 36", with the exception of the Co-occurrence Analysis map, which is 36" x 40".

All maps associated with this project were produced with GIS technology and data. "GIS", short for *geographic information system*, is a powerful tool designed to utilize computer hardware, specialized software, and digital geographic data for the capture, management, analysis and display of many forms of information that is geographically referenced. Virtually any kind of data that is associated with a geographical location or area can be used to gain perspectives of the data in a new way. The particular GIS software environment used for this project is ArcGIS 9.2, created by Environmental Systems Research Institute, or ESRI.

Three forms of data are utilized by GIS. *Map data* supply spatial information associated with objects; *Attribute data* in table form supply numerical and descriptive information associated with objects; *Image data* allow simultaneous viewing of static photographic and map images such as aerial photography with the other forms of data.

Most data used in this project are stock public data compiled from a variety of sources and made available through NH GRANIT, the statewide clearinghouse for an array of GIS geospatial data and services. Original sources of data include the NH Fish & Game Department, the NH Department of Transportation, the US Geological Survey, the NH Department of Environmental Services, and USDA's Natural Resource Conservation Service, to name a few.

In some instances custom datasets were created by the authors from local information, including new roads and scenic viewpoints, in a process known as digitizing. All data used in GIS must be in digital form; custom data are created at the computer in a format that is compatible with the system, in the form of points, lines or polygons. These spatial data are

then associated with text and numerical data as needed and available. New data thus created can be utilized by subsequent users of GIS for planning and other purposes.

The details relative to the sources, units, formats, creators, parameters and other aspects of the data are encapsulated in metadata documents included with the data. Metadata for the GIS files used in this project, including the sources of the data, are presented in Appendix B.

NH GRANIT

The New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) is a cooperative project whose purpose is to create, maintain, and make available a statewide geographic data base serving the information needs of state, regional, and local decision-makers. A collaborative effort between the University of New Hampshire and the NH Office of Energy and Planning, the core GRANIT System is housed at the UNH Institute for the Study of Earth, Oceans, and Space in Durham. It includes a geographic database, hardware and software to build, manage, and access the database, and a staff of experts knowledgeable in geographic information systems, image processing, and computer analysis. In addition to database development and maintenance, the GRANIT staff offers a range of application development, training, and related technical services to GIS users in the state and the region.

The GRANIT approach to a statewide GIS depends upon the cooperative efforts of a host of agencies, collaborating on various elements of database design and construction as well as application development. The collaboration occurs formally through the NH GIS Advisory Committee and informally through daily interactions between the growing body of GIS users in the state and the region.

GRANIT was the primary source for geographic data for this project.

Map Components: Base Layers

All maps in this Natural Resource Inventory, with the exception of the Tax Parcel and Zoning overlay, include the following common “base layers”:

Town and County Boundaries as provided by GRANIT are based on 1:24,000 USGS topographic maps. Towns and USGS do not always agree as to the exact location of town boundaries. Tax maps that include a portion of the Jaffrey town boundary do not always coincide with the USGS town boundary, as sources vary. On all maps, the USGS town boundary has been displayed and is used for town-wide calculations, but in cases where conservation lands are shown along town boundaries, the tax map lines are generally followed. Town and county names are displayed on all maps.

Roads data are provided by GRANIT and are produced and maintained by NH DOT. Data include state highways, town roads, private roads, and un-maintained roads including Class 6 roads and jeep trails. In a few cases the DOT classification was erroneous or incomplete, and roads were added, removed, and/or reclassified to improve accuracy. Road name labels are displayed on all maps.

Surface Waters (lakes, ponds, rivers, and streams) based on United States Geological Survey (USGS) data and **Wetlands** based on National Wetlands Inventory (NWI) data (produced by the US Fish and Wildlife Service) are provided by GRANIT. Streams are displayed as either perennial or intermittent, and all wetlands are displayed the same regardless of type. Where lakes, ponds, or streams have a place name associated with them, this is also displayed on all maps.

Conservation and Public Lands as provided by GRANIT (2009 release) are labeled by name. Additional parcels were added to this layer as this information became available from partner organizations, including The Nature Conservancy, the Society for the Protection of NH Forests, the Monadnock Conservancy, and the Jaffrey Conservation Commission. Lands included in this data layer include privately-owned tracts with legally binding restrictions for conservation use (such as conservation easements or deed restrictions), lands owned by federal, state, and local agencies, and conservation properties held in fee by private organizations such as the Society for the Protection of New Hampshire Forests. Town-owned properties are also displayed with conservation lands. However, these publicly-held lands do not necessarily qualify as true conservation lands unless legally restricted in some fashion.

3. WILDLIFE HABITAT

Habitat for wildlife provides food, shelter, water and space for animal species to survive and thrive. Every species has unique habitat requirements and preferences. Virtually all portions of the landscape provide some form of wildlife habitat from time to time, yet some habitat areas are disproportionately important either to a particular species or to a diversity of species. Unfortunately, many of these important habitat types are relatively uncommon to begin with, and some are disappearing due to conversion or alteration by humans. As the patch-scale habitat accounts below illustrate, uncommon wildlife species often depend on unusual habitat, making conservation of these habitats especially important. The Wildlife Action Plan described below makes connections between these species and the communities they are associated with. It also has mapped areas where they are predicted to occur.

Landscape Context and Unfragmented Lands

Unfragmented Lands

Large undeveloped areas are recognized for their significance as intact biological habitat and for general open space values. These undeveloped areas are without maintained or regularly used roads. They contain natural land cover types such as forest, wetlands and surface waters, and can also contain (though far less frequently) agricultural lands and other unimproved human-disturbed areas such as gravel pits.

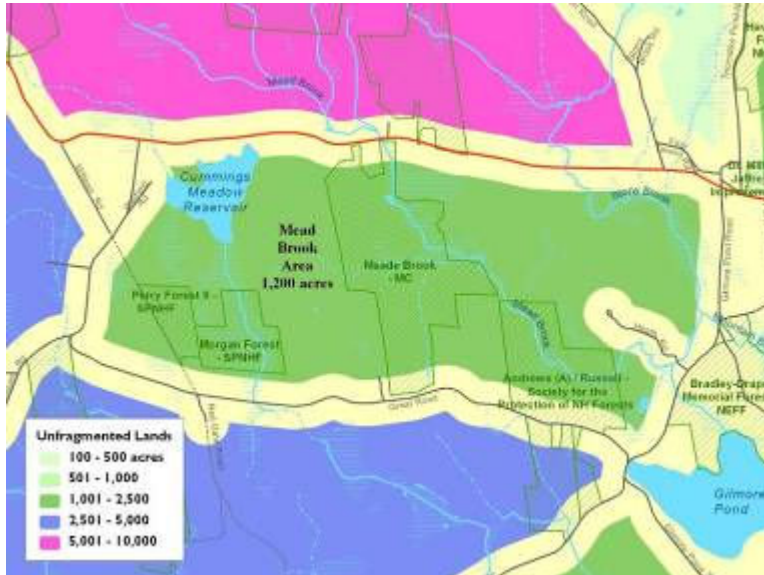
Fragmentation primarily from road use has a well-documented influence on wildlife, both by direct death or injury from vehicles, and by more environmental effects such as noise, terrain alteration and light disturbance. Certain migrant songbird species and several species of larger mammals including black bear and bobcat are known to avoid areas with significant fragmentation, while conversely being attracted to large unfragmented areas.

Consideration of the fragmentation that can result from unplanned development and guiding such development to areas that will have less fragmenting impact can result in the conservation of these important areas.

Unfragmented areas are delineated using roads data. A 500-foot buffer along regularly traveled (i.e. ecologically fragmenting) roads was created for this analysis, to account for a typical existing or future house lot and its structures, and a disturbance area along maintained roads. This buffer was then removed from the landscape, resulting in areas unfragmented by roads and their associated development or development potential.

Figure 2 shows the Mead Brook Unfragmented Area and its surrounding road buffers.

Figure 2: Mead Brook Unfragmented Area.



Note: Buffers applied to regularly traveled roads (light yellow areas).

Class 6 and some Class 5 town roads (those considered by the Conservation Commission to be non-fragmenting), private driveways and trails were not included as fragmenting features for this analysis (note Milliken Road in the Mead Brook Unfragmented Area). As natural features of the landscape, water bodies and streams were also not considered fragmenting elements for the purposes of this analysis. The developed area of the Jaffrey Airport was manually removed from the analysis in recognition that, although not mapped as road, it is already altered and developed for commercial uses.

Blocks of unfragmented lands do not stop at political boundaries, and thus the analysis considered blocks that occur in Jaffrey that in several cases also extend into neighboring towns. For this analysis, unfragmented blocks were calculated on the basis of total size regardless of political boundaries (see Figure 3. *Regional Unfragmented Lands*). Acreages in these other towns are included in the calculation and ranking.

Significant Unfragmented Lands in Jaffrey

A minimum threshold of 100 acres, and upper thresholds of 500 ac., 1,000 ac., 2,500 ac., 5,000 ac. and 10,000 ac. were established in classifying the blocks. All blocks were assigned names for ease of reference, based on a place name within each block. Please refer to Map 2: *Unfragmented Lands* and Table 1: *Unfragmented Lands in Jaffrey* for names of each block.

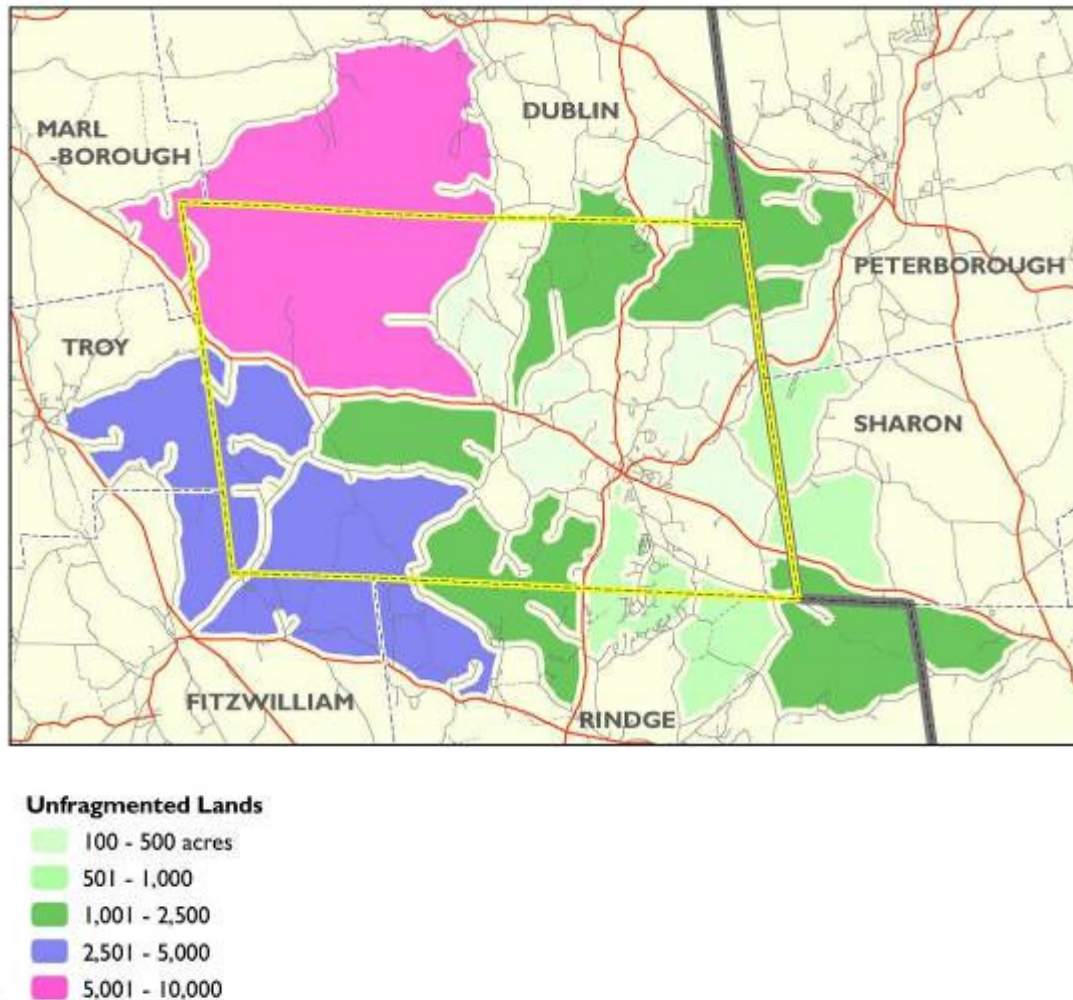
The analysis identified all or a portion of: 11 blocks of 100 to 500 acres, four blocks of 501 to 1,000 acres, five blocks of 1,001 to 2,500 acres, two blocks of 2,501 to 4,999 acres, and one block over 5,000 acres (see Table 1 for actual acreages within the Jaffrey boundary). It is especially noteworthy that the only block over 5,000 acres contains the area surrounding Mount Monadnock ("Mount Monadnock Area") and its extensive block of protected lands.

Table 1: Unfragmented Lands in Jaffrey

Unfragmented Area Name	Size Class Acres	Total Acres	Acres in Jaffrey	Protected Acres	% Protected
Tyler Brook	100 - 500	115	115	19	43.4%
Prospect Street	100 - 500	169	169	0	0.0%
Cutter Cemetery	100 - 500	170	170	64	6.1%
Cheshire Pond	100 - 500	186	186	120	25.9%
Mountain Brook Swamp	100 - 500	323	323	0	0.0%
Jaffrey Airport	100 - 500	347	347	197	10.1%
Stony Brook	100 - 500	386	386	0	0.0%
Town Farm Brook West	100 - 500	398	398	9	2.7%
Town Farm Brook East	100 - 500	437	111	54	35.3%
Parker Road & Route 137	100 - 500	447	40	367	30.6%
Jaffrey Village	100 - 500	473	473	0	0.0%
Contoocook Lake	501 - 1,000	886	461	0	0.0%
Gridley River South	501 - 1,000	950	78	328	26.1%
Gridley River North	501 - 1,000	972	265	0	0.0%
Grassy Pond	501 - 1,000	987	44	0	0.0%
Mead Brook	1,001 - 2,500	1,199	1,199	0	0.0%
Woodbury Hill	1,001 - 2,500	1,574	1,409	50	12.9%
Mountain Brook Reservoir	1,001 - 2,500	1,961	1,052	0	0.0%
Parker Pond	1,001 - 2,500	2,309	897	619	44.0%
Annett State Forest	1,001 - 2,500	2,484	78	0	0.0%
Gap Mountain	2,501 - 5,000	3,379	1,258	208	21.3%
Jock Page Hill	2,501 - 5,000	4,086	1,948	3,872	74.9%
Mount Monadnock	5,000 - 10,000	9,690	5,172	47	19.2%
Total Acres		33,928	16,580	5,954	36.0%

Note: See Map 2. Unfragmented Lands

Figure 3: Regional Unfragmented Lands



Status of Land Protection in Unfragmented Areas

The comprehensive natural resource protection that land conservation provides makes it a good measure of the status of the protection of resources generally in an unfragmented area. As Table 2: *Unfragmented Lands and Protection Status* illustrates, some of the unfragmented areas in Jaffrey are well protected, while others are not protected at all. Ten of the 23 unfragmented areas mapped are without conservation or public lands. The Monadnock Mountain Area has an exceptional level of protection, with proportionately more moderate levels existing in the Mead Brook, Gap Mountain and Contoocook Lake Areas. Recent protection of conservation lands in the northeast part of town have enhanced protection in the Woodbury Hill and Parker Pond unfragmented areas.

Immediately southwest of the large Mount Monadnock Area and separated by a single road is the ~4,000 acre Gap Mountain Area. Likewise, immediately southeast of the Gap Mountain block is another ~4,000 acre area, the Jock Page Hill Area. This would point toward the value

of conserving the areas where these blocks conjoin, to mutually enhance the values of these combined large areas and to fashion protected connections.

Table 2: Unfragmented Lands and Protection Status

Unfragmented Area Name	Total Acres (Jaffrey)	Protected Acres	% Protected
Parker Road & Route 137	40	0	0.0%
Grassy Pond	44	19	43.4%
Gridley River South	77	0	0.0%
Annett State Forest	78	0	0.0%
Town Farm Brook East	111	0	0.0%
Tyler Brook	115	0	0.0%
Cheshire Pond	153	54	35.3%
Prospect Street	169	0	0.0%
Cutter Cemetery	170	0	0.0%
Jaffrey Airport	247	47	19.2%
Gridley River North	265	0	0.0%
Mountain Brook Swamp	323	9	2.7%
Stony Brook	386	50	12.9%
Town Farm Brook West	398	0	0.0%
Contoocook Lake	461	120	25.9%
Jaffrey Village	473	0	0.0%
Parker Pond	977	208	21.3%
Mountain Brook Reservoir	1053	64	6.1%
Mead Brook	1,199	367	30.6%
Gap Mountain	1,259	328	26.1%
Woodbury Hill	1,409	619	44.0%
Jock Page Hill	1948	197	10.1%
Mount Monadnock	5,172	3,872	74.9%
Total	16,526	5,954	36.0%

NH Wildlife Action Plan

In the most comprehensive and sophisticated study yet undertaken in New Hampshire for wildlife habitat mapping and conservation planning, the New Hampshire Fish & Game Department unveiled its Wildlife Action Plan (WAP) in late 2006. Recently updated and subject to continuous refinement, it is an important tool for towns and organizations to use in planning the conservation of high quality and/or imperiled wildlife habitat, rare plant habitat and

exemplary natural communities and systems. Data from the Wildlife Action Plan have become available for this project and are featured prominently.

The WAP project worked with habitat groupings at three scales: broad-scale (matrix forests and sub-watershed groupings), patch-scale (priority habitats such as grasslands and peatlands) and site-scale (documented occurrences of rare and uncommon species and natural communities). Mapped data are available for viewing and use only at the broad- and patch-scale levels.

WAP Patch-Scale Priority Wildlife Habitat Areas

The recent Wildlife Action Plan used predictive modeling to estimate where examples of significant habitat groupings would occur in New Hampshire. According to their findings, the immediate Jaffrey area has examples of five *Small Scale Priority Habitat Types*: Marsh Complex (Wet Meadow/Shrub Wetland), Peatland, Grassland (25+ ac), Rocky Ridge – Talus Slopes, and Floodplain Forest. Four of these habitats (excluding Floodplain Forests) are well-represented in Jaffrey and are considered by this study to be especially critical habitats for wildlife as well as being, in many cases, relatively uncommon in the state. Field surveys are recommended by the WAP to verify the accuracy of the predictive model mapping on the ground.

Table 3: Conservation Status of WAP Habitats in Jaffrey

Matrix forest (broad scale)	Total Acres	Unprotected		Protected	
		Acres	%	Acres	%
<i>Appalachian oak-pine</i>	7	7	100%	-	0%
<i>Hemlock-hardwood-pine</i>	16,789	12,676	76%	4,113	24%
<i>Northern hardwood</i>	1,437	415	29%	1,021	71%
<i>Spruce-fir</i>	2,052	950	46%	1,103	54%
Habitats (patch scale)					
<i>Grasslands</i>	865	852	99%	13	1%
<i>Marsh</i>	1,139	997	88%	142	12%
<i>Peatlands</i>	124	117	94%	7	6%
<i>Ridge-talus</i>	761	-	0%	761	100%

WAP Large Grasslands in Jaffrey

Large grasslands are typically created and maintained by humans, but they also provide critical habitat for a variety of wildlife species. Grasslands have become uncommon in New Hampshire as forests gradually reclaim what were once extensive agricultural areas during the 18th, 19th, and early 20th centuries, and as fire suppression prevented most wildfires.

Large grasslands are especially important for wildlife diversity, with several species occurring only in the very largest of grasslands areas. To reflect this, the WAP mapped grassland areas that have at least 10 hectares (24.7 acres) of continuous area that are dominated by grasses, forbs, and sedges, and with little shrub or tree cover (generally less than 10%). These areas are generally active or recently abandoned farm fields. Grasslands can include agricultural fields, airports, landfills, meadows, or heathlands. Northern harrier, upland sandpiper, purple martin, eastern meadowlark, grasshopper sparrow, horned lark, vesper sparrow, northern leopard frog and wood turtle are all uncommon species that depend on grassland habitat in New Hampshire.

Ten large grasslands were identified by the WAP in Jaffrey, totaling 873 acres. These grasslands range in size from 32 acres to 281 acres; the largest is the extensive grassland that straddles Rte. 137 just north of the center of town. Other significant grasslands remain primarily on the east side of town. One prominent exception is the highly visible grassland on the north side of Rte. 124 west of Cummings Meadow Reservoir, which in addition to valuable wildlife habitat offers a sweeping view of nearby Mt. Monadnock to the north.

Statewide, grasslands are relatively under-protected, with about 8% in land conservation. About 13 acres of the grassland on Ingalls Road is the only large grassland in Jaffrey included in conservation or public lands. Jaffrey still retains relatively large open grassland areas, but as Table 3 above indicates, almost none are securely protected from conversion and development as of yet.

WAP Peatlands in Jaffrey

Peatlands are a category of wetland that accumulate slowly decomposing vegetative matter as peat. Peaty wetlands form due to limited or no groundwater input and thus have poor nutrient content and acidic water. “Quaking” bogs are one particularly familiar yet uncommon type of peatland. This habitat category contains many dozens of natural wetland communities, a number of which are rare in New Hampshire. Rare plant species are often associated with peatlands. Associated uncommon wildlife species of note include ringed boghaunter dragonfly, palm warbler, spruce grouse, mink frog, ribbon snake and northern bog lemming.

Peatlands are predicted by the WAP in numerous locations in Jaffrey. They total about 124 acres and range from less than one acre to 29 acres in size, with the great majority existing as small and isolated occurrences. The largest by far is a 29-acre continuous peatland in a wetland complex north of Scott Pond. The WAP mapped other notable peatlands in Jaffrey: the west side of Hodge Pond (10 acres), a peatland northwest of Parker Pond (8 acres), two peatlands on the border of Garfield Lake (8 acres) and a complex of two peatlands in an isolated wetland north of Contoocook Lake (12 acres). Field verification of these peatlands would confirm their condition and may yield new findings of rare species or natural communities. Like large grasslands, peatlands in Jaffrey are under-protected by land conservation, with only 6% of the peatland by area restricted for conservation use (See Table 3).

WAP Marsh and Shrub Wetlands in Jaffrey

This large habitat group includes dozens of natural wetland community types. These open wetlands are dominated by herbaceous vegetation or short (less than 3 meters) woody vegetation (i.e. shrubs) and include three broad habitat types: wet meadows, emergent marshes, and scrub-shrub wetlands. Significant wildlife species associated with these areas include ringed bog-haunter dragonfly, American black duck, American bittern, American woodcock, northern harrier, osprey, pied-billed grebe, common moorhen, great blue heron, least bittern, rusty blackbird, sedge wren, Blanding's turtle, spotted turtle, eastern red bat, silver haired bat and New England cottontail. Often thought to be safe from development due to State wetlands laws, these habitats are susceptible to impacts from the surrounding uplands as well as from surface source waters.

Examples of marsh and shrub wetlands are actually fairly common in Jaffrey, with 1,139 mapped acres. Relatively large examples occur widely in town, and in some cases they are adjacent to examples of peatland habitat, in which case they are especially valuable for the combined wildlife habitat diversity that they provide. These combinations occur at Garfield Pond, Hodge Pond, the wetland north of Scott Pond, a wetland south of Great Road, and a wetland at the end of Plantation Drive. While the locations of marsh and shrub wetlands in Jaffrey are protected by land conservation to a modest degree (about 12% overall), none of the peatland / marshland association areas are protected currently.

Rocky Ridge – Talus Slope Areas in Jaffrey

This habitat group includes two distinct types. Rocky ridge and summit outcrops are characterized by thin soils and dry, nutrient-poor settings. Talus slopes are steep and rocky and range from open to barren to woodland. Situated primarily at the upper elevations of the higher mountains, and at the base of steep cliffs, bedrock and loose bedrock fragments compose the primary substrate. Twenty-five natural plant communities are known to occur statewide in areas mapped as rocky ridge – talus slope. Melissa arctic butterfly, black racer, timber rattlesnake, common nighthawk, peregrine falcon, black bear and bobcat are important wildlife species known to associate with this habitat in New Hampshire.

The peak and much of the upper slope of Mount Monadnock are mapped as the Rocky Ridge – Talus Slope Priority Habitat Type, which is characterized there by exposed bedrock areas and boulder fields. Totaling 996 acres, the majority of this substantial example of a priority habitat type is located in Jaffrey (about 760 acres), but extends somewhat northerly into Dublin. This is the largest example of its kind in this part of New Hampshire.

Fifty-seven percent of this Priority Habitat type is protected statewide by conservation / public lands, primarily due to the large representation in the White Mountain National Forest. Locally, 100% of the Rocky Ridge – Talus Slope Priority Habitat Type - the upper elevations of Mt. Monadnock - are protected.

Floodplain Forests in the Jaffrey Area

Associated with larger streams and rivers and prone to periodic flooding, floodplain forest areas contain a wide variety of natural communities that provide important habitat for uncommon species. Red-shouldered hawk, veery, cerulean warbler, American redstart, chestnut-sided warbler, Baltimore oriole, beaver, mink, river otter, wood turtle, Blandings turtle and spotted turtle all depend on such habitat. Many floodplain forest areas have been cleared and converted to agriculture, as these easily worked and rock-free fine alluvial soils tend to be highly suitable for this use. Primarily for this reason, intact examples of this habitat are much less common than they once were.

Floodplain forests were mapped by the WAP just downstream of the Jaffrey boundary in Sharon along the Contoocook River. They are included here because floodplains are dynamic, fluctuate in size and location, and could potentially occur in Jaffrey just upstream of the Sharon occurrence. Also, the condition of surrounding and upstream habitats is important for the continuing ecological functioning of floodplain forests.

WAP Matrix Forest Types Model

There are numerous classification systems of forest type (the associations of tree species that vary across the landscape). Each was developed with specific goals in mind by various entities such as the US Forest Service, the Natural Resource Conservation Service, and The Nature Conservancy. Working with The Nature Conservancy and the NH Natural Heritage Bureau, NH Fish & Game mapped areas predicted to support any of five large, inclusive matrix forest groupings as part of the WAP. All of the recognized forest species assemblages are included in one of these broad matrix forest types, and each is represented to some extent in Jaffrey. This data model estimates climax forest type, i.e. the broad forest type which would eventually occur given total recovery from human disturbance based on abiotic site factors (such as slope, aspect, elevation, latitude, or soil type). Included in each matrix forest type are smaller-scale natural communities that commonly occur within them, including various specific wetland communities.

Appalachian Oak-Pine Matrix Forest

Occurring in a southerly distribution relative to others, this matrix forest type reaches its northern extent in southeastern, southwestern and far western New Hampshire in association with warmer and drier conditions and often in fire-influenced landscapes. Major canopy species include the “southern” oaks such as white and black oaks as well as red oak and white pine. This matrix forest type is considered at risk, largely because it tends to occur in populated areas with impacts from infrastructure, development and intensive land use. Uncommon wildlife species known to associate with this matrix forest type include black racer, Fowler’s toad, Eastern hognose snake, timber rattlesnake, smooth green snake, American woodcock, bald eagle, wild turkey, whip-poor-will, wood thrush, eastern pipistrelle and eastern red bat. In Jaffrey, this matrix forest type is represented by a very small patch (about 7 acres) on the Sharon border north of Rte. 202.

Hemlock-Hardwood-Pine Matrix Forest

These forests are often considered a transitional zone between northern hardwood - conifer forests and Appalachian oak - pine forests. Major canopy species may include hemlock, red oak, and red maple. These forests are likely to succeed to hemlock and beech over the long term. Species of concern in New Hampshire associated with this habitat type include: spotted turtle, timber rattlesnake, wood turtle, northern goshawk, veery, Coopers hawk, cerulean warbler, eastern pipistrelle, eastern red bat, northern myotis, silver haired bat, New England cottontail and bobcat.

By far the dominant matrix forest type in Jaffrey and in this part of New Hampshire in general, it is quintessentially familiar to all who live in and visit the state. Mapped in over 75% of Jaffrey, this forest type grouping is especially suitable for popular game species including moose, white-tailed deer, wild turkey and black bear.

High-elevation Spruce-Fir Matrix Forest

These forests cover the exposed woodlands of New Hampshire's high summits and ridgelines and are comprised primarily of balsam fir, red spruce, and paper and heartleaf birch. Species of concern in New Hampshire associated with this habitat type (almost exclusively in more northern parts of the state) include: spruce grouse, bay-breasted warbler, Bicknell's thrush, American marten, Canadian lynx, and northern bog lemming.

In Jaffrey, this matrix forest type coincides to a large extent with the Rocky Ridge – Talus Slope on Mt. Monadnock. This is one of the very few locations of this matrix forest type south of the White Mountains and is the only one in Cheshire County.

Lowland Spruce-Fir Matrix Forest

These valley forests span an ecological gradient from swampy black spruce bogs to well-drained red spruce forests. Species of concern in New Hampshire associated with this habitat type include: spruce grouse, Northern goshawk, three-toed woodpecker, bay-breasted warbler, purple finch, rusty blackbird, hoary bat, Canadian lynx, American marten, and northern bog lemming.

In Jaffrey, this forest type occurs in many relatively small and scattered locations across the town. The most prominent example is located directly down-slope of and surrounding the High-elevation Spruce-Fir area on Mt. Monadnock. A few notable stands of this forest type are protected by land conservation areas, including the Perry Forest Reservation (SPNHF), Monadnock Memorial Forest (NEFF) and the aforementioned Monadnock Reservation (SPNHF).

Northern Hardwood-Conifer Matrix Forest

These mid-elevation forests generally include an even mix of sugar maple, yellow birch, and beech. They can also include and frequently mix with red spruce and balsam fir (especially at

higher elevations). Species of concern in New Hampshire associated with this habitat type include: ruffed grouse, American woodcock, wood thrush, veery, Canada warbler, cerulean warbler, eastern pipistrelle, eastern red bat, hoary bat, northern long-eared bat, silver-haired bat, and gray wolf.

Large swaths of this matrix forest type occur in Jaffrey at mid-elevation on flanks of the Mt. Monadnock / Gap Mt. upland land mass in the northwest part of town. Due to the presence of extensive conservation lands in this area, the majority (71%) of this forest type is included in conservation areas.

Ranking of Wildlife Habitat by Condition

With the goal of setting priorities for conservation of important wildlife habitat in New Hampshire, the Wildlife Action Plan identified areas of the state with unusually pristine, influential, diverse or extensive examples of “exemplary” habitat. These areas were, in turn, ranked by condition on both sub-state regional and statewide levels, resulting in a tier of priority areas for conservation. Figure 4: *WAP Wildlife Habitat by Condition Ranking*, below, illustrates the excerpt from this rank mapping that shows what priority areas occur in the Jaffrey study area.

Referring in particular to the purple and green color-coded areas shown in Figure 4, the two category areas highest ranked by condition, it becomes clear that some of these areas are located in Jaffrey. Several small areas that coincide with the Marsh and Shrub Wetland Priority Habitat areas just south of the center of town along the Contoocook River corridor are ranked as Highest Ranked Habitat in New Hampshire (appear in purple on the map). Larger areas displayed in green indicate Highest Ranked Habitat in Biological Region (of New Hampshire). A very large polygon of this rank is mapped on Mt. Monadnock, and numerous smaller areas are scattered across the town. Areas displayed as orange are Supporting Landscapes that provide important habitat of local importance. All three categories are considered unusually significant on a statewide basis for wildlife.

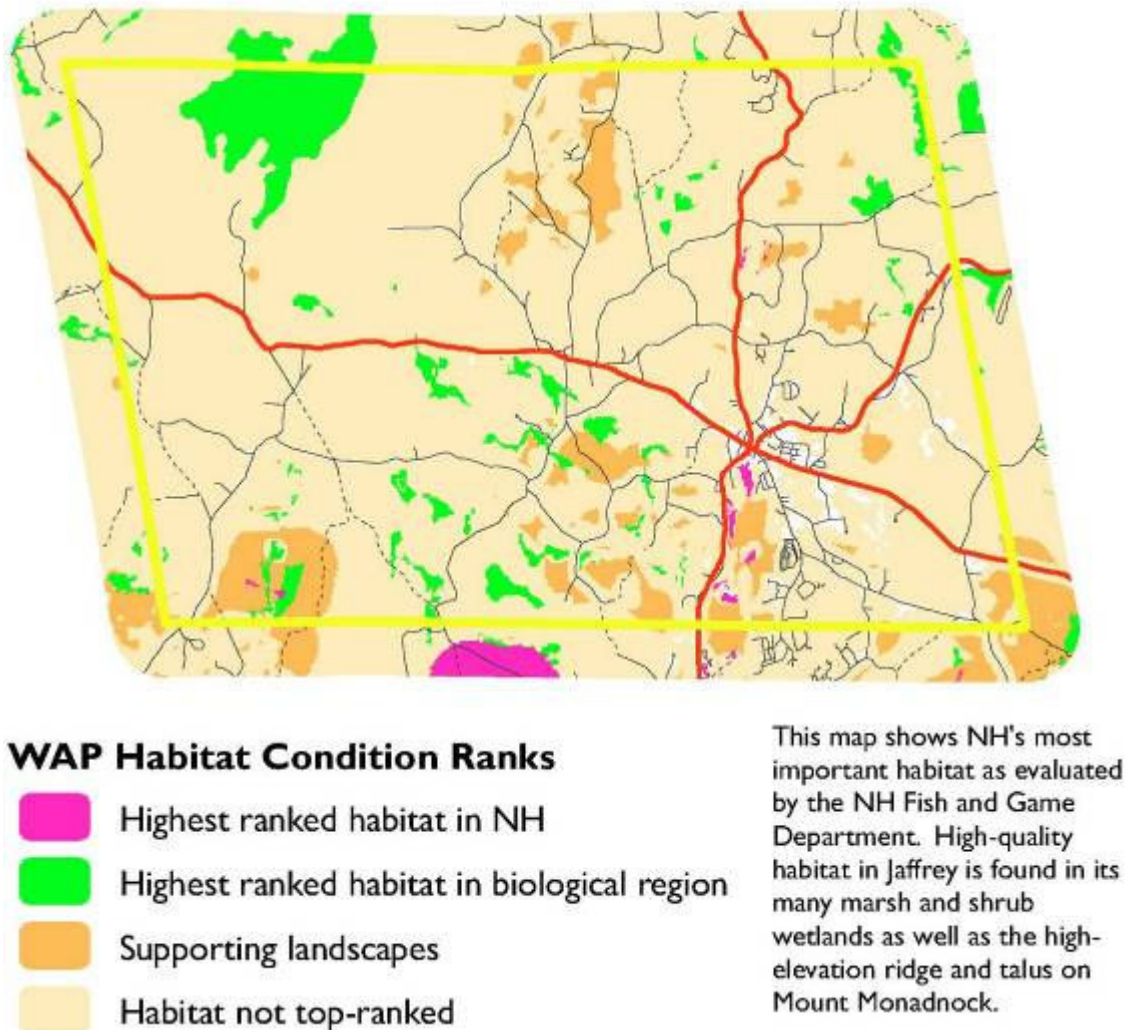
Table 4: Conservation Status of Priority Habitat Areas in Jaffrey, NH

	Total Acres	Unprotected		Protected	
		Acres	%	Acres	%
<i>Highest ranked habitat in NH</i>	58	53	92%	5	8%
<i>Highest ranked habitat in biological region</i>	1,452	595	41%	857	59%
<i>Supporting landscape</i>	1,750	1,364	78%	387	22%
<i>Not top ranked</i>	21,073	15,641	74%	5,432	26%

Several of the high-scoring wildlife areas are already conserved. The conservation areas Bradley-Draper Memorial Forest (NEFF), Children’s Woods / Carey Park (Town of Jaffrey), the Pierce easement (SPNHF), Mountain Brook Reservoir (MC), Blaine Forest (SPNHF), Jaffrey Well Field (Town of Jaffrey) and the Monadnock “Super” Reservation all contain portions of at

least some of each category of high-ranking habitat areas as mapped by the WAP. However, significant areas remain unprotected, most notably the wetlands north of Scott Pond, several areas in the northeast corner of town, much of the remaining unprotected shoreland around Thorndike Pond, and several areas in the vicinity of Gilmore Pond, among others. Refer to Figure 4 for the locations of these areas.

Figure 4: WAP Wildlife Habitat by Condition Ranking



Rare and Uncommon Species and Natural Communities

Rare and uncommon plant and animal species have been documented in the Town of Jaffrey in the past, and these data are maintained by the New Hampshire Natural Heritage Bureau of DRED, in cooperation with the New Hampshire Fish & Game's Non-Game and Endangered Wildlife Program. Generalized information on the presence of these species and communities is available from the Natural Heritage Bureau. According to the Bureau's "Rare Plants, Rare

Animals and Exemplary Natural Communities in New Hampshire Towns”, the following species and natural communities/systems are now or were at one time documented to exist in the town of Jaffrey. Specific spatial information on these rare species and communities is not available for this study due to data release policies of the NH DRED. See the following list and accompanying notes for explanations of rarity codes.

Rare Plant and Animal Species and Natural Communities Documented in Jaffrey

Natural Communities - Terrestrial

** Rich mesic forest

Plants

Fringed Gentian (<i>Gentianopsis crinita</i>)	T	Historical
Goodenough's Sedge (<i>Carex nigra</i>)	T	Historical (recently relocated)
Green Adder's Mouth (<i>Malaxis unifolia</i>)	T	Historical
Mountain Firmoss (<i>Huperzia appalachiana</i>)	T	
Piled-up Sedge (<i>Carex cumulata</i>)	E	Historical
Smooth Sandwort (<i>Minuartia glabra</i>)	E	Historical
Squirrel Corn (<i>Dicentra canadensis</i>)	T	Historical
Summer Sedge (<i>Carex aestivalis</i>)	E	Historical

Vertebrates - Reptiles

** Blanding's Turtle (*Emydoidea blandingii*)

** Wood Turtle (*Glyptemys insculpta*)

Invertebrates - Insects

Graceful Clearwing (<i>Hemaris gracilis</i>)	Historical
Phyllira Tiger Moth (<i>Grammia phyllira</i>)	Historical

Listed: E = Endangered; T = Threatened; W = Special concern (watch list); M = Monitored;
Historical = Documented more than 20 years before publication of source report

Flags: **** = Highest importance
*** = Extremely high importance
** = Very high importance
* = High importance

These flags are based on a combination of (1) how rare the species or community is and (2) how large or healthy a particular example is. Please contact the Natural Heritage Bureau at (603) 271-2214 to learn more about approaches to setting priorities.

Source: New Hampshire Natural Heritage Bureau. 2006

Riparian Zones

Riparian zones are areas adjacent to surface waters that provide a transition to upland areas and wetland context for these waters. Where they are undisturbed, these zones are important for the water quality services they provide by the filtration of off-site erosion materials and nutrients, shade from excessive solar in-stream heating, flood water storage, contributions of beneficial organic (especially woody) debris, and -- most germane to this chapter -- wildlife habitat. The ecological systems that are incorporated within riparian zones make them worthy of consideration for conservation.

Riparian areas are hotspots for wildlife. They provide foraging and nesting opportunities, and are critical movement corridors for species dependent on streams and their environs. They are preferred habitat for the following species among many others: Northern two-lined salamander, Fowlers toad, Blandings turtle, ribbon snake, wood duck, red-shouldered hawk, Eastern screech owl, barred owl, red-bellied woodpecker, pileated woodpecker, veery, cerulean warbler, river otter, mink, and all species of bat in New Hampshire.

To capture the ecological value of riparian zones, they are mapped here as 300-foot buffers along both sides of all perennial streams and along the shore of lakes and ponds. They can be seen on the Wildlife Habitat map as meandering brown strips bordering all significant water features in the town.

4. WATER RESOURCES

Watershed Context

Municipal, county and state boundaries in and of themselves are irrelevant or non-existent from the standpoint of plants, animals, and the physical landscape and elements that interact and co-exist with humans. However, delineations of the landscape that are based on real physical characteristics do have meaning and utility, and can reflect the differences that are observable at various scales. One such delineation is watersheds.

All terrestrial portions of the earth are a part of a watershed. Watersheds exist at an almost infinite range of scales, from the tiniest tributary stream that does not show on any map to major continent-draining rivers. Terms are applied to the different scales of a drainage unit, which are, in effect, nested. Thus the Jaffrey downtown is in the Town Farm Brook sub-watershed, which is located in the upper Contoocook River watershed, which in turn is located in the Contoocook River sub-basin, which in turn is located within the regional Merrimack River basin.

In some instances the dividing lines between major drainage basins form real biological boundaries for the organisms and natural systems that occur there. In other instances, watershed boundaries are more useful to indicate subtler distinctions, such as likely concentrations and routes of migrating wildlife or nutrient cycles reflective of forest condition. Regardless of their application, watersheds are a convenient and physically definable way to parse the landscape into smaller units. The question becomes one of scale and applicability to a particular purpose.

On the Cusp of Two Major River Basins

Situated on the highlands that include Mt. Monadnock and Gap Mountain, Jaffrey straddles the dividing line between the Connecticut River Basin and the Merrimack River Basin. The dividing line between these two regional watershed basins follows a roughly north-south path along the height of land on the Mt. Monadnock ridge, across Rte. 124, and then southeast along the highest points to Peacock Hill and into Rindge (See Map 4: *Water Resources*) By virtue of its topographical location, Jaffrey is truly connected hydrologically not only with the rest of southern New Hampshire, but also with the states of Vermont, Connecticut and Massachusetts. Refer to Table 5 for the portions of sub-watersheds that occur in Jaffrey.

Hydrologic Unit Code Drainages

The U.S. Geological Survey has developed a scaled delineation approach that has coded all drainages in the United States. This numbering scheme is called the Hydrologic Unit Code (HUC). This hierarchical approach to classification of drainage units uses a set of digits that represents a certain level in the system. The more digits used to refer to a drainage, the finer the delineation within the system. Under this cataloguing system a six-digit code is a basin (for instance the Connecticut River Basin), eight digits represent a sub-basin, 10 digits represents a “watershed” and 12 digits is a sub-watershed. Although the term watershed can be used to

describe any drainage at any scale, in the HUC system only a 10-digit hydrologic unit is called a “watershed”.

On the Water Resources map for this project (Map 4), HUC 12, or 12-digit sub-watershed level boundaries are displayed as bold dotted blue lines. For convenience and easy recognition the watersheds are also referred to by a name associated with a significant waterbody within the watershed. The HUC12 sub-watershed divisions are labeled on the accompanying map on both sides of the divides with the name of the watershed drainage. The lines shown delineate the various sub-divisions of watersheds by indicating divisions between adjacent watersheds. Thus, the boundaries always follow the highest points of the terrain that separate adjacent drainages. To interpret the watersheds on this overlay, it is best to view it with the underlying streams and surface waters showing on another map, and with topographic contours.

Table 5: HUC12 Sub-Watersheds in Jaffrey, NH

Sub-Watershed (HUC12)	Watershed (HUC10)	River Basin	Ac. in Jaffrey
The Branch	The Branch	Connecticut	173
Peterborough Tributaries	Upper Contoocook River	Merrimack	194
Torbell Brook	Upper Millers River	Connecticut	763
Stanley Brook	Upper Contoocook River	Merrimack	1,959
Priest Brook	Upper Millers River	Connecticut	2,302
South Branch Ashuelot River	Middle Ashuelot River	Connecticut	2,738
Town Farm Brook	Upper Contoocook River	Merrimack	17,579

Lakes and Ponds

Lakes and ponds provide many benefits to the public, as well as to their natural constituents. Public benefits include recreational activities such as fishing, swimming and boating. Lakes and ponds also provide habitat for aquatic plant and animal species which depend on them solely for survival, but also for many other species of animals that rely on this resource for at least a portion of their life cycle.

Lakes and Ponds in Jaffrey

Contoocook Lake (380 ac., 151 ac. in Jaffrey) and Thorndike Pond (265 ac., 243 ac. in Jaffrey) are the two largest water bodies in town, together accounting for over half of the total 987 acres of surface water in Jaffrey. Other relatively large water bodies include Gilmore Pond (115 ac.), Mountain Brook Reservoir or Red Mill Pond (110 ac.) and Frost Pond (103 ac., 58 ac. in Jaffrey). A total of 13 “Great Ponds” occur in Jaffrey; this designation is conferred by the State of New Hampshire to bodies of water that are generally maintained at an area of 10 acres or more. Certain land use restrictions apply to Great Ponds and their adjacent uplands, including forestry laws and the Comprehensive Shoreland Protection Act. See Table 6 below for a full listing of surface waters.

Table 6: Lakes and Ponds in Jaffrey, NH (Great Ponds)

Name of Water Body	Size in Acres
Black Reservoir	30
Cheshire Pond	57
Contoocook Lake	380
Cummings Meadow	42
Frost Pond (Dike)	103
Gilmore Pond	115
Gilson Pond	16
Hodge Pond	12
Island Pond	39
Mountain Brook Reservoir (Red Mill Pond)	110
Parker Pond	20
Thorndike Pond	265
Wildlife Pond (Ainsworth Pond)	16

Source: DES Consolidated List of Waterbodies Subject to RSA 483-B,
The Comprehensive Shoreland Protection Act – Revision Date 7/1/08.

Recreational Access

Public access is available on several lakes and ponds in Jaffrey: Contoocook Lake (two access points), Frost Pond, Thorndike Pond and Gilmore Pond. Depending on the nature of individual access points, these include swimming, fishing and boating access.

Rivers and Streams

Values of Rivers and Streams

Streams and rivers provide wildlife habitat in the form of direct support for aquatic species and also as corridors of travel to a variety of species. They also provide recreational opportunities for fishing, swimming and boating. Water quality of flowing waters is largely dependent on the condition of the surrounding landscape, as well as the condition of ground and surface water inputs. As water sources for lakes and ponds, it is important that streams and rivers be preserved in their natural state to the greatest extent possible. Forestry, agricultural, commercial and residential activities all have the potential to degrade water quality.

Rivers and Streams in Jaffrey

Based on the existing GIS data, Jaffrey has approximately 36.8 miles of perennial streams and 37.5 miles of intermittent streams, the vast majority of them unnamed. Many of the reaches of these streams are in undeveloped, relatively pristine condition. While most of the stretches of streams in Jaffrey are single tributaries to larger streams or water bodies, several are of a higher order.

Stream order is determined by the number and significance of tributaries contributing to a stream. Thus, a 1st order stream has no tributaries. A 2nd order stream is made when two 1st order streams combine. A 3rd order stream is made up of 2 or more 2nd order streams, and so on. There are no streams larger than 4th order in Jaffrey. Certain regulations apply to areas adjacent to 4th or higher order streams, including forestry laws and the Comprehensive Shoreland Protection Act.

4th Order Streams in Jaffrey

Contoocook River – Mainstem, from the outlet of Poole Pond in Rindge to the confluence with the Merrimack River at the Boscawen/Concord municipal boundary.

North Branch - From the outlet of Rye Pond in Stoddard to the confluence of the Contoocook River in Hillsborough.

Mountain Brook - Juncture of Stony Brook and Mead Brook

Source: New Hampshire Department of Environmental Services. Revised 7/1/2008. DES Consolidated List of Waterbodies Subject to RSA 483-B, The Comprehensive Shoreland Protection Act – Revision Date 7/1/08.

Status of Protection of Surface Waters in Jaffrey

Comprehensive Shoreland Protection Act

The Comprehensive Shoreland Protection Act (CSPA) specifies distances from certain significant bodies of water in which some activities are limited or prohibited. A State Shoreland Permit is required for some activities within the shoreland protection area. The purpose of the act is to protect public waters through the interception of surface runoff, wastewater flow, subsurface flow, and groundwater flow through the minimization of the effects of nutrients, sediment, organic matter, pesticides, and other pollutants, and through the moderation of water temperature. All 4th order and higher streams, designated rivers, and lakes and ponds are subject to the CSPA. See Table 6, above, for a list of water bodies in Jaffrey that are subject to the CSPA. It should be noted that CSPA enforcement is variable and should not be relied upon solely as a mechanism for shoreland protection.

Wetlands Laws of the State of New Hampshire

The State of New Hampshire Wetlands Bureau has jurisdiction over all wetlands, defined as "an area that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include, but are not limited to, swamps, marshes, bogs and similar areas." This includes swamps, marshes, bogs, wet meadow, lakes, ponds, streams and any other area that meets the three parameters for being a wetland under the U.S. Army Corps of Engineers Wetlands Manual of 1987, and includes intermittent streams with flow sufficient to create a defined channel. Activities that affect jurisdictional

wetlands require a permit from the New Hampshire Wetlands Bureau. A wetlands delineation performed by a certified Wetland Scientist is generally required to determine the extent of wetlands proposed to be impacted; and depending on the size of proposed impact, different regulations apply. Forestry activities are subject to special regulations for temporary impacts from stream crossings, for instance. Conservation Commissions in New Hampshire are responsible for and entitled to review permits for activities within their borders.

Source: NH Department of Environmental Services Fact Sheet WB-4 1997; Identifying Department of Environmental Services' Wetlands Jurisdictional Areas

The New Hampshire Rivers Management and Protection Program

The New Hampshire Rivers Management and Protection Program (RMPP) was established in 1988 following enactment of the Rivers Management and Protection Act by the New Hampshire legislature. With the purpose of protecting the most significant rivers of the state, to date the program has designated 15 river sections for protection, including the Contoocook River in Jaffrey, which was designated in 1991.

The Rivers Management Protection Program (RMPP) classifies rivers according to a matrix of conditions, impacts and proximity to developed areas. For each river classification, state law establishes specific protection measures related to dams and hydroelectric energy facilities, proposed channel alterations, protected instream flows, interbasin water transfers, siting of solid and hazardous waste facilities, water quality, and recreational use of the river. Local river corridor management plans make recommendations regarding the use and conservation of shoreline and adjacent lands associated with the river corridor.

RMPP Designated Sections of the Contoocook River in Jaffrey

The four RMPP river classifications, from most pristine to least pristine, are: Natural, Rural, Rural/Community and Community. The following river segments in Jaffrey have been designated as significant within their respective class:

Contoocook River: Outlet of Poole Pond in Rindge to Old Sharon Road Bridge in Jaffrey.
(Community River Class)

Contoocook River: Old Sharon Road Bridge in Jaffrey to Noone Falls Dam in Peterborough.
(Rural River Class)

The program relies on local advisory committees to develop, adopt and implement river corridor management plans for the protection of resource values specific to each river and river corridor. The Contoocook and North Branch Rivers Advisory Committee adopted a new management plan for this purpose in 1994. The plan provides a comprehensive overview of the river corridor and watershed of the Contoocook River, and includes specific recommended actions for local and regional stakeholders to help protect the river.

Wetlands Conservation District Ordinance

Last amended in 1993, this overlay district was established by the Town of Jaffrey in 1979 for safety, health, aesthetic, and ecological purposes. It lists specific permitted uses within the district, including forestry, agriculture, water impoundments, wells and trails, it restricts the location of underground sewage disposal units, and it sets residential lot standards, while defining non-conforming uses and special exceptions.

Floodplain Development Ordinance

This town ordinance applies to all areas mapped as special flood hazard areas in Jaffrey by the Federal Emergency Management Agency (FEMA). These areas are displayed on Map 4 (Appendix C). Construction within these zones requires a special permit that includes certification that water and septic improvements will comply with the ordinance and whether basements and structures are designed to be flood-proof. Other uses such as recreational vehicle storage and manufactured home anchoring are also specifically restricted and described.

Shoreland Overlay District

This ordinance establishes standards for subdivision, use and development of shorelands that are adjacent to public waters, for the mutual benefit of these waters and their associated upland shores. These water bodies are listed in the ordinance and also appear in Table 6, above. The ordinance establishes permitted uses and minimum lot requirements. Setbacks and buffer zones for certain uses, such as septic systems, are also specified. Erosion and sedimentation are addressed, and special standards for the use of waterfront lots used commonly by non-shore owners are outlined.

Regulations Governing Earth Excavations

This extensive ordinance was established in 2008 to allow for reasonable excavation while minimizing safety hazards, maintaining public health and welfare, and protecting natural and scenic resources. A detailed and site-specific excavation plan and reclamation plan are required. Exempt activities and prohibited activities are defined in addition to activities that are subject to this ordinance.

Ground Water

Aquifers

Aquifers are exceptional underground repositories of drinking water. Virtually all portions of the landscape are capable of transmitting and storing some volume of water, but so-called “high-yield” or stratified drift aquifers are composed of coarse-grained sands and gravels and are especially reliable, high-capacity source areas for drinking water. As such, they should be targets for protection to preserve their potential as high-volume drinking water sources. Land use in high-quality aquifer areas can adversely affect groundwater, as pollutants may taint them to the point of making them unsuitable as drinking water sources.

Aquifer data are generated by the NH Department of Environmental Services through sampling of ground water wells. Aquifers are ranked in terms of transmissivity, or the rate at which water percolates through the substrate. In this case, the data represent a prediction of the minimum volume of water that a given aquifer area will allow to be transmitted through itself per day, expressed in cubic feet of water. Potentially favorable gravel well areas are high-transmissivity locales largely unaffected by potential pollution sources. Map 4 displays the aquifers in Jaffrey. The Stratified Drift Aquifers layer is displayed on the map as variable shades of pink to purple according to transmissivity; $\leq 1,000$, $\leq 2,000$, $\leq 4,000$ or $\leq 8,000$ ft² / day.

Table 7: High Yield Aquifers in Jaffrey

Transmissivity of Groundwater in ft² / day	Acres
$\leq 1,000$	3,407
$\leq 2,000$	793
$\leq 4,000$	164
$\leq 8,000$	54
Total:	4,418

Source: GIS analysis, Kane & Ingraham, 2008

There are several high-yield aquifer areas in Jaffrey, primarily in the eastern portion of town. A significant aquifer area, totaling 1,960 acres, occurs in the east and southeast portion of the town and extends into the neighboring towns of Sharon, Peterborough and Rindge. Other notable aquifers are located around Parker Pond, in two areas straddling the eastern town boundary, and south of Rte. 124 near the center of the town. Aquifers are ranked according to how much water they are predicted to be able to supply to a well in a given time period, expressed in terms of square feet per day – their transmissivity rate. Aquifers with the highest transmissivity are relatively uncommon but do occur in several areas in Jaffrey. Table 7 shows the acreage of each transmissivity class in Jaffrey.

Potentially Favorable Gravel Well Areas (PFGWA)

PFGWA's are aquifer areas that are predicted based on landscape position, substrate and other physical characteristics to be potentially favorable areas for the withdrawal of drinking water. To map PFGWA's, potential and known contamination sources are excluded from mapped aquifers through GIS analysis. Thus, remaining aquifer areas are estimated to be free from potential contamination and therefore suitable for the siting of wells. For this project, only the PFGWA's that are predicted to produce 150 gallons / minute or more were mapped. These areas are displayed on Map 4 as dark blue diagonal hatches.

A total of 1,664 acres of PFGWA's were identified in the town of Jaffrey. Jaffrey is relatively well endowed with these high-quality potential well areas. However, when the specific ratings of drinking water capacity for all areas are compared, it becomes clear that PFGWA's that occur on the highest producing aquifers are actually quite limited and that several of these have already been developed.

High-yield areas are located under the Darcie Drive housing development and under the South Shore Drive development. Another is partially under the Jaffrey Airport runway. Fitzgerald Drive appears to have been developed over what was once the largest such groundwater source in town. The GRANIT data were produced before these areas were developed. Future updates to these data by GRANIT may potentially remove these areas from the PFGWA layer coverage due to a change in land use. The largest remaining PFGWA is located on the Jaffrey / Sharon boundary in a large undeveloped area that extends into Sharon, where a water company is currently withdrawing drinking water. The undeveloped land surrounding this water source would appear to be an ideal place to plan for land protection specifically to protect this important drinking water resource.

Existing Public Drinking Water Supplies

Current public water supplies are displayed on Map 4 as blue asterisks. These are surrounded by wellhead protection areas (WHPA's), shown as orange buffers. WHPA's, mapped by the NH Department of Environmental Services, are meant to protect areas with influence on drinking water quality. WHPA's are delineated based on NH DES source water protection priorities: radii for wells are based on intake volume; surface water intakes are based on partial watershed delineations. Development in WHPA's is restricted.

There are currently two public water supplies that are subject to State -regulated ¼ mile wellhead protection areas. These are centered at the two Town well field properties southeast of the downtown area, and are surrounded by overlapping wellhead protection areas. Wellhead protection buffer areas also extend into Jaffrey from wellheads in the neighboring towns of Sharon and Troy.

Known Groundwater Hazards and Point Pollution Sources

The NH Department of Environmental Services maintains a database of documented known or potential hazards to groundwater and point pollution sources. These are displayed on Map 4 as either a circle with cross, or an orange polygon, depending on the nature of the hazard and the degree of information available about its size and extent. Virtually all of these sites in Jaffrey are associated with underground or above-ground storage tanks. Many have been closed and are no longer in use. A few of these sites have undergone remediation. Detailed current information about groundwater hazard areas is available at the NHDES OneStop website: <http://www2.des.state.nh.us/OneStop/>

Status of Protection of Drinking Water Resources

The Cheshire Pond Conservation Area contains portions of a high-yield aquifer and a potentially favorable gravel well area. Significant portions of the aquifer near the center of town are included in three conservation lands: the Meade Brook Easement (Monadnock Conservancy), the Andrews / Russell Easement (Society for the Protection of New Hampshire Forests) and the Bradley-Draper Memorial Forest (New England Forestry Foundation). Several other conservation lands contain aquifers, including Querfurth & McCagg (Monadnock

Conservancy), the Kaiser Easement (Society for the Protection of New Hampshire Forests), and four town lands: two Well Fields, Children's Woods and Carey Park, Virginia Pond Trust, and Gray Goose Farm. In all, 400 acres of Jaffrey's high-yield aquifer lands are protected by land conservation. However, most easement terms do not allow for ground water withdrawal or the construction of well facilities within the easement area.

It may be prudent for the Town to protect a distribution of PFGWA's / aquifers across town to allow for better water access options for the future. Also, when appropriate, the Town should include reserved rights in future conservation easement deeds to allow for water extraction in these areas.

FEMA 100-Year Floodplain

Areas prone to flooding are mapped by the Federal Emergency Management Agency (FEMA) in co-operation with NH GRANIT. Mapped areas include the 100-year floodplain, *i.e.* any area with a 1% probability of flooding in any given year. In Jaffrey there are mapped flood-prone areas in the following locations: the entire Contoocook River corridor; Mead Brook / Mountain Brook south of Rte. 124; Stony Brook and the west lobe of Mountain Brook Reservoir; low areas associated with Contoocook Lake and its tributaries near the Rindge town line; and low areas on the north side of Scott Pond. The Jaffrey Floodplain Development Ordinance restricts certain uses in these flood-prone areas.

5. SOILS

Values of Soils

The settlement patterns, land use history and ecology of the town of Jaffrey have been determined in large part by the character and placement of its soils. The soils underlying the town today originated as mineral materials transported by water or glacial melt-down at the end of the last Ice Age, approximately 14,000 years ago. Altered over time by moisture, the addition of organic materials and chemical oxidation/reduction, they provide a diverse substrate to today's activities and processes both natural and cultural. Productive soils are a legacy that is essentially non-renewable and, as such, deserve special protection.

Soils are classed by the Natural Resources Conservation Service (NRCS) according to many criteria and for various purposes, including construction, forestry and agriculture. In this study, special attention was paid to important forest soils and significant agricultural soils. As the foundation of much of the historical economy of the town, and as a continuing source of both private and public revenue, commercial activities in large measure depend on these especially productive soils for their success. Soils cannot be practicably replaced or recreated once they are degraded or removed, and thus the conservation of the soils themselves, as well as the land on which they occur, should be an important consideration for the town.

Important Agricultural Soils in Jaffrey

The Farmland Protection Policy Act of 1981 was established to ensure that federal programs are compatible with state and local efforts to limit the conversion of farmland to other uses. The states and counties followed suit shortly thereafter by bestowing their own designations on state and locally important soils. The classes mapped in New Hampshire and available from the GRANIT GIS data system are "prime farmland soils", "soils of statewide importance", and "soils of local importance". This project considered the two most important classifications - prime farmland soils and soils of statewide importance. 3,135 acres of agricultural soils with these two designations are mapped by NRCS in Jaffrey, representing 12.2% of the total area of the town. The designations and the criteria upon which they were developed are outlined below.

Prime Farmland

These superior agricultural soils are deep and arable, with the ability to sustain commonly grown cultivated crops 7 or more years out of 10. These soils are suitable for a variety of agricultural uses and are of the highest quality designation. The USDA Land Use Policy of 1983 that established the prime farmland soils designation describes these highest quality soils as follows:

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land but not urban built-up land or water). It has the soil quality, growing season, and moisture supply needed to produce,

economically, sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. They are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding.

Soils of Statewide Importance

These soils are deemed significant for the production of food, feed, fiber, forage and oilseed crops in New Hampshire. Determination of statewide importance is made by a state committee with representatives of the Department of Agriculture, Markets and Foods; UNH Cooperative Extension; the NH Association of Conservation Commissions; and the NH Office of State Planning (now the Office of Energy and Planning). Originally established in 1983, the criteria for designation were updated in 2000.

Soils that are not otherwise designated prime farmland must meet the following criteria for inclusion in the Statewide Importance ranking:

- Have slopes of less than 15%
- Are not stony, very stony or bouldery
- Are not very poorly, somewhat poorly, or poorly drained
- Are included in soil complexes comprised of less than 30% shallow soils and rock outcrop and slopes that do not exceed 8%
- Are not excessively well-drained soils developed in stratified drift, and generally have low available water-holding capacity

Table 8: Important Agricultural Soils in Jaffrey

Important Agricultural Soils		
Soil Ranking	Acres	% of Town Area
All Areas are Prime Farmland	1,100	4.3
Farmland of Statewide Importance	2,035	7.9
Total Important Agricultural Soils	3,135	12.2

Source: Natural Resources Conservation Service Soil Survey 2001

Protection of Important Agricultural Soils in Jaffrey

A total of 437 acres, or 13.9% of important agricultural soils in Jaffrey, are included in conservation or public lands and are thus under some sort of protection by conservation terms

that would prevent or restrict development. The modest level of protection of these irreplaceable productive soils in Jaffrey highlights the need for proactive conservation efforts to preserve the remaining undeveloped high-quality agricultural soils.

Table 9: Important Agricultural Soils in Conservation or Public Lands

Soil Class	Total Jaffrey Acres	Acres in Conservation	% Conserved
All Areas are Prime Farmland	1,100	91	8.3%
Farmland of Statewide Importance	2,035	346	17.0%
<i>Total of Important Agricultural Soils</i>	<i>3,135</i>	<i>437</i>	<i>13.9%</i>

Values of Forests

Taken together, forest and wetlands are the dominant natural land cover types of New Hampshire. Forests alone account for over 80% of the total land cover of the state³. The character and ecology of the state is, in large measure, determined by that of its forests and wetlands. Soils are intimately associated with forests and wetlands, both determining the structure and composition of the plant communities they support, and being altered themselves over time by the communities on which they depend. The economy of the state is also linked to its forests and wetlands, as growth gradually reduces productive forest cover while at the same time isolating jurisdictional wetlands in an increasingly built environment.

Values of Forest Productivity

The economic benefits of forest lands to the state of New Hampshire are well known. Towns in New Hampshire traditionally derive revenue from the timber tax collected from timber sales, and the harvest, sale and utilization of wood products all contribute to the job base of the state. Keeping forest land in productive use provides an economically viable alternative to more intensive uses such as residential development. Forest land offers additional benefits as well, including preservation of rural character, wildlife habitat, water quality protection, recreational opportunities, hunting and fishing access, and scenic enjoyment, among others.

Soils are the basis of productive forest land, but not all soils are created equal in their capacity to grow forests. Areas with soils that are classed by the NRCS as more productive than others for their suitability to support some of the most economically valuable species, such as white pine and red oak, are especially important to preserve. These so-called Important Forest Soils have designations under which numerous particular soils units are grouped according to common traits such as moisture, depth of soil, and soil texture.

Important Forest Soils in Jaffrey

Some soils are especially suitable for the growth of forests, but the species of trees they excel at growing varies by soil type. A woodlot that grows superior white pine will not necessarily

³ *New Hampshire's Changing Landscape*, Society for the Protection of NH Forests, 2009

be as productive for northern hardwoods, for instance. This has not gone unnoticed by the humans who depend on forests for their livelihood. The particular soils that underlay a woodlot can give them an advantage others for the production of certain high-quality wood products. The majority of soil areas in New Hampshire have been mapped and classified according to their relative productive capacity to grow trees. Six classes of productive qualities were developed by the NRCS for this purpose. Each of the 10 counties in the state has its own particular classification. Cheshire County's six classes are explained below and quantified for Jaffrey in Table 10.

Descriptions of Important Forest Soils Classes

- IA Deeper, loamy textured, moderately well and well-drained soils that support a variety of hardwood species such as beech, sugar and red maple, yellow and white birch, white ash and red oak, with spruces, hemlock and balsam fir also present.
- IB Moderately well and well-drained soils that are sandier in texture, generally less moist and less fertile than IA soils. The tree species found on these soils are similar to those on IA soils, but productivity is not as high.
- IC These soils are moderately well drained to well drained and excessively well drained outwash sands and gravels. These soils favor the growth of softwoods such as white pine, balsam fir, red spruce and hemlock, while some hardwoods such as red maple, aspen and white birch may also be present.
- IIA These soils are the same as those in IA and IB, but certain physical attributes such as steep terrain, bedrock outcrops, surface boulders and erosive textures limit forest management operability.
- IIB High water tables and poorly drained qualities make these soils less suited for forest production. Red maple, hemlock, balsam fir and spruce are typical species. Forest management and harvest are difficult except during frozen conditions.
- NC These soils are not classified due to high variability or low productive capacity.

Note: Only Classes IA, IB and IC were mapped and analyzed for this project.

Table 10: Important Forest Soils and Their Productivity Types: Cheshire County

Soil Class	Acres	% of Jaffrey	Productivity Type
IA	10,665	41.5	Optimal for Northern Hardwoods
IB	1,451	5.6	Optimal for Beech / Hardwoods
IC	1,877	7.3	Optimal for Pine / Spruce / Hemlock
Total	13,992	54.4	

Source: GIS analysis, Kane & Ingraham, 2008

Discussion

Covering 41% of the town, the valuable and productive Class IA soils most suited to high-quality hardwood growth are very well represented and distributed in Jaffrey. Classes IB, somewhat less suitable for hardwood growth, and IC, optimal for the growth of conifers such as pine, are present in significant but lesser amounts. The well-drained conditions typical of IC are often present in areas that are also underlain by sand and gravel soils, which predominate in the southeast portion of the town. The thinner soils of the highlands of Mt. Monadnock and Gap Mountain are not generally as productive as in other areas and display as large white patches on the inset map on Map 5. Areas with these three most productive forest soils are important to protect in order to keep them as viable commercial forestry assets. Table II, below, displays the acreages of productive soils that are included in conservation or public lands – comprising a total of 18.75% of the combined total of these productive soils in Jaffrey. Note that the specific allowed activities and restrictions as they may pertain to forestry vary depending on the nature of the conservation instrument and its terms.

Table II: Productive Forest Soils in Conservation or Public Lands

Soil Class	Total Jaffrey Acres	Acres in Conservation	% Conserved
IA Important Forest Soils	10,665	2,201	20.64
IB Important Forest Soils	1,451	286	18.71
IC Important Forest Soils	1,877	136	7.25
<i>*Total of Important Forest Soils</i>	<i>13,993</i>	<i>2,623</i>	<i>18.75</i>

*Note: Many productive soil areas are classified as both important forest soil and important agricultural soils. Thus the Total Productive Forest Soils figures should not be interpreted as additional and independent of figures for Important Agricultural Soils.

Source: GIS analysis, Kane & Ingraham, 2008

Hydric Soils

Hydric soils were formed under conditions of saturation, flooding, or ponding for a long-enough period during the growing season to develop anaerobic conditions in the upper part. These soils are sufficiently saturated or inundated long enough during the growing season to support the growth and reproduction of vegetation that predominates in hydric conditions (hydrophytic or wetland vegetation).

The (NRCS) Soil Survey Division staff in its 1993 *Soil Survey Manual* identified seven natural drainage classes for soils in the United States: excessively drained, somewhat excessively well drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. The two classes at the wetter end of this spectrum are normally associated with wetlands and hydrophytic vegetation. The *Soil Survey Manual* includes the following generalized descriptions of these soil classes:

Poorly drained. *Water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of internal free water is*

shallow or very shallow and common or persistent. Free water is commonly at or near the surface long enough during the growing season so that most mesophytic crops cannot be grown, unless the soil is artificially drained. The soil, however, is not continuously wet directly below plow-depth. Free water at shallow depth is usually present. This water table is commonly the result of low or very low saturated hydraulic conductivity of nearly continuous rainfall, or of a combination of these.

Very poorly drained. *Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season. The occurrence of internal free water is very shallow and persistent or permanent. Unless the soil is artificially drained, most mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded. If rainfall is high or nearly continuous, slope gradients may be greater.*

Hydric Soils in Jaffrey

Hydric soils are mapped widely in Jaffrey, usually in the same locations as the wetlands that they underlay. Soils classified as hydric by the NRCS account for 3,764 acres, or 14.6% of the total town area. Hydric soil units mapped by the NRCS do not always appear on maps to register with the wetlands mapped by the US Fish and Wildlife Service as part of the National Wetlands Inventory, which used aerial photography almost exclusively to delineate wetlands. Reference to both hydric soils and NWI wetlands will provide a more comprehensive understanding of the location and extent of wetlands in Jaffrey.

Map Display of Soils in Jaffrey

The soils map (Map 5) displays three designations of soils: hydric soils (dark blue hatch) and important agricultural soils (two shades of brown) on the main map, and important forest soils (shades of green and tan) on the inset map to the lower left. It should be noted that precision in soils mapping is limited to units of about 3 to 5 acres or larger and is, for the most part, based on the soil material that existed prior to residential and commercial development. Thus, some areas that are mapped as important productive soils may be altered and degraded today, making them less suitable for productive use. For example, one obvious area that is shown as prime farmland soil on the map occurs in the School Street/ Charlonne Street residential area downtown, clearly converted to other uses since the original soils were mapped.

6. SCENIC RESOURCES

Values of Scenic Features and Views

Jaffrey, like much of the greater Monadnock area, has been recognized and extolled by visitors and residents alike for its exceptional scenic qualities. The region itself is named after its primary scenic feature, the Grand Monadnock. While definitions of such intangible qualities as scenic value and rural character are elusive, most would agree that they are intrinsic to the region and contribute to the sense of place that inspires so many. Scenic resources per se are



Scenic Viewpoint #1, Centennial Park

fundamentally different from the other resources addressed in this report. While clearly dependent on the physical world, they are also difficult or impossible to quantify. The scenic analysis (which sounds like a contradiction in terms) that is presented in this chapter offers one attempt to ascribe measures to the relative scenic value of certain areas of Jaffrey, some of which have no doubt been sources of inspiration since even before the visits of Thoreau and Emerson.

Mount Monadnock

The first European known to climb Mt. Monadnock did so in 1725 while “scouting for Indians”. Native Americans themselves had long revered the mountain, the name of which is based on its Abenaki name. “Monadnock” has since become a type name for mountain landmasses that rise solitary above the surrounding landscape. Simple shelters as well as taverns and inns were erected on the mountain as early as 1826, before the expansive Halfway House was constructed on a prominent south flank of the mountain in 1860. Other inns were to follow, making the general Monadnock area a Mecca for escapees from the urban areas to the south, many of whom eventually became seasonal residents. Jaffrey selectmen paved the way for the many dozens of conservation acquisitions on the mountain that were to follow, by purchasing 200 acres on the summit in the late 1860’s. Subsequent efforts by the State of New Hampshire, the Society for the Protection of New Hampshire Forests, and other organizations have resulted in an extensive block of protected land centered on the mountain which now exceeds 6,780 acres.

Scenic Roads

Thorndike Pond Road from Gilson Road to the Dublin town line, formerly known as Slade Road, is a designated scenic road approved by Town vote. Much of the eastern frontage of its 2.9 mile length is protected by conservation land: Haven State Forest (NH Department of Resources and Economic Development), Blaine Forest (Society for the Protection of New Hampshire Forests) and Stonewall Farm II (Monadnock Conservancy). The only designated scenic road in Jaffrey, Thorndike Pond Road offers sweeping views of Mt. Monadnock as a backdrop to nearby Thorndike Pond.

Scenic Analysis

The preservation of rural character is frequently cited as a goal of open space plans in New Hampshire. While “rural character” as a term is not strictly defined, we often think of the quintessentially New England sights like picket fences, steepled churches, slate gravestones, old farms, and most apropos to this Natural Resource Inventory the aesthetic



View from Scenic Viewpoint #12: Thorndike Pond
(from Thorndike Road)

natural landscape. The latter point is the focus of this chapter: to map and measure Jaffrey’s aesthetic landscape according to scenic viewsheds.

To do this, members of the Jaffrey Conservation Commission selected notable scenic viewpoints and vistas available from public roads and locales (see Table 12). While the selection of scenic vistas is a subjective process, Commission members generally chose points with a landscape view (i.e. beyond the immediate surroundings of the local setting) that included primarily natural features like hills / mountains, lakes / wetlands, or fields / meadows.⁴

These points were mapped along with the extent and direction of the view. Based on this information and the shape of Jaffrey’s topography, we calculated the viewshed for each point (see Figure 5, below, for an example).

⁴ In addition to being inputs to the scenic areas analysis and conservation targets worthy of protection, the selected scenic viewpoints might be considered a representative sample of views in Jaffrey. While there are most likely other places that other observers might deem “scenic”, those places are likely to have views of the same places as mapped here.



View from Scenic Viewpoint #20: Mt. Monadnock and Mountain Brook Reservoir

Each calculated viewshed was incorporated into a scenic areas analysis model which for any given locale indicates the number of viewpoints from which that locale can be seen. For instance, Jock Page Hill can be seen from two points (19 and 25); therefore, in the scenic analysis, it is assigned a value of two (2). Mount Monadnock's summit can be seen from eight points (5, 6, 7, 9, 12, 19, 20, and 21); therefore, it is assigned a value of eight (8).

The scenic areas analysis is shown on Map 6: *Scenic Areas*. The results are displayed here in shades of brown – areas with lighter shades (tan) can be seen from fewer places while darker shades (brown) can be seen from many locations.

It should be immediately obvious to the viewer that Mount Monadnock is the centerpiece of Jaffrey's scenic landscape; as one of New England's principal granite icons, it exerts a curious gravitational pull on viewers and hikers alike in Jaffrey and beyond, so it is no surprise that it rises an order of magnitude above most other scenic locales in Jaffrey.

There are several other noteworthy scenic areas. The ridge running between Gap Mountain and Mount Monadnock (between Route 124 and Old County Road) can be seen from numerous viewpoints south and east of Mount Monadnock. The Metacomet-Monadnock Trail runs along the west side of this ridge, which connects the two large forest blocks on either side of Route 124.

Similar to the above, the ridge running north-south, just east of Cummings Reservoir is a component of several vistas. This ridge falls between the Mead Brook (Monadnock

Conservancy) and Morgan Forest (Society for the Protection of NH Forests) properties. In addition to its scenic aspects, the ridge is a likely upland connector through the Mead Brook unfragmented block.

The unnamed hill west of Thorndike Pond (topped by McCoy Road) is visible from several viewpoints near downtown Jaffrey, adding to the sense of wild hill country leading up to the sweep of Mount Monadnock's flank.

The open fields atop the hill add to the New England aesthetic of this setting.



Looking North from Scenic Viewpoint #23 on Harkness Road

Several other hilltops are visible from numerous points. They include Jock Page Hill, Peabody Hill, the hill southeast of Gilmore Pond, and the hill/ridge south of Haven State Forest.

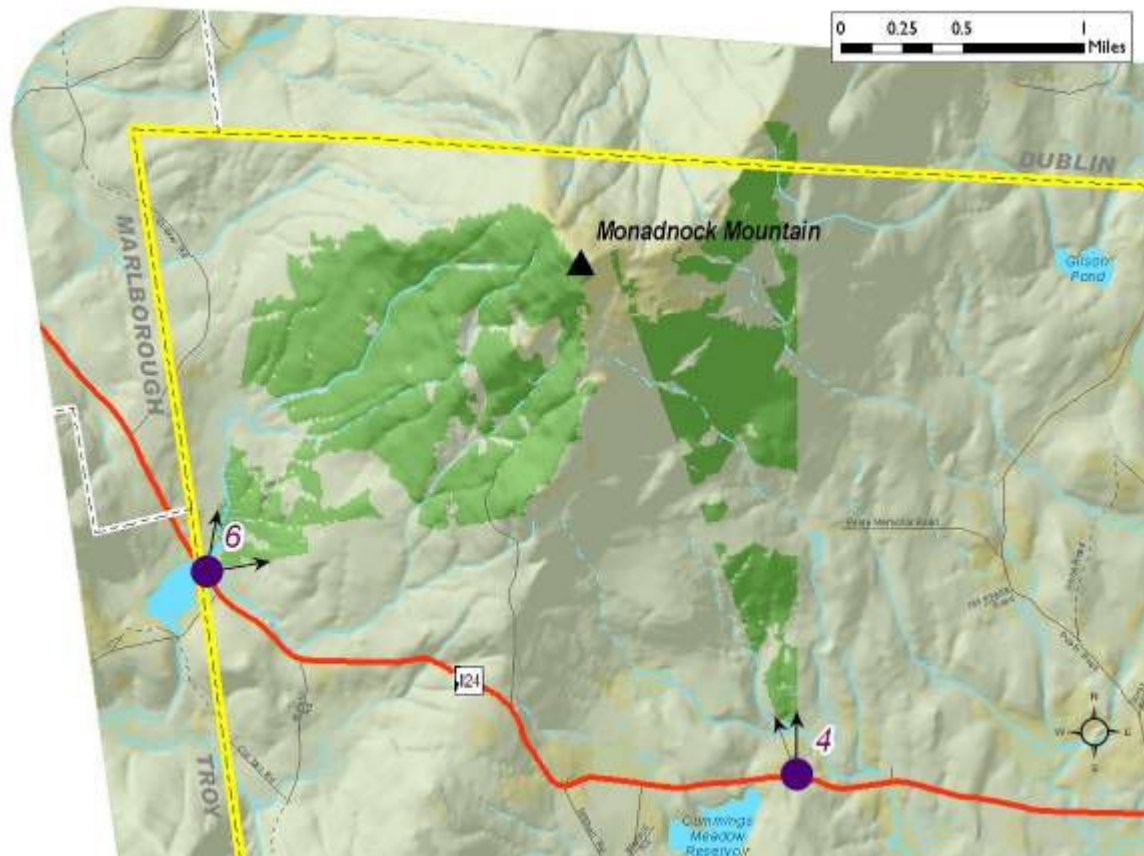


View of Mt. Monadnock from Viewpoint #25 on Witt Hill Road

Table 12: Scenic Viewpoints

Viewpoint #	Location
1	Centennial Park - Old Jaffrey Center; looking toward Mt Monadnock (and "the Swale")
2	Center of Gilmore Pond Road and Rte 124 (looking toward Gap Mt)
3	296 Mountain Road (Route 124)
4	At horse farm just beyond Joe Hoyt's
5	multiple points overlooking Grandview field
6	Route 124 at Troy line
7	Dublin Road in front of Shattuck
8	Dublin Road in front of Bible Conference
9	Gilson Road (just south of intersection with Dublin Road)
10	Near Jct. of Gilson Rd & Thorndike Pond Rd
11	View of Thorndike Pond towards east from Public Beach
12	Thorndike Pond Road at fire pipe on curve
13	View from Melville Academy property (town-owned)
14	View of "Swale" in Jaffrey Center
15	Gilmore Pond outlet under Gilmore Pond Rd
16	Gilmore Pond from fishing beach
17	Gilmore Pond Road at inlet to Mt Brook Reservoir
18	Gilmore Pond Road at inlet to Mt Brook Reservoir
19	View of Mt. Brook Reservoir from Dam / Boat access on Rte 202
20	View of Mt. Monadnock from Monadnock View Drive
21	View from Town Farm Rd near Richmond Hill Farm
22	View northerly from bridge crossing on Town Farm Rd
23	View from Harkness of wetland with field in foreground
24	View of Cheshire Pond from Bean Dam
25	View of Mount Monadnock to west from Witt Hill Road
26	Contoocook Lake from Squantum Rd/Public Beach

Figure 5: Viewsheds from Viewpoint #4 and Viewpoint #6



This map shows two of the mapped viewpoints and their viewsheds (numbers 4 and 6; viewsheds are shown in green). The view from point #6 extends from north-northeast to east-northeast; its viewshed encompasses most of the southwest side of Mount Monadnock. The view from point #4 extends from north-northwest to due north; its viewshed captures a swath of the northeast ridge of Mount Monadnock.



Mt. Monadnock from Viewpoint #9 on Gilson Road



Scenic View South from Viewpoint #18 on Gilmore Pond Road

7. CONSERVATION PRIORITIES

Existing Conservation and Public Lands

Jaffrey has 49 properties that either are restricted for conservation-related uses (“conservation lands”) or are held in fee by the Town of Jaffrey or other municipalities that may or may not be technically restricted for conservation purposes (“public lands”). According to a GIS calculation, there are 5,518 acres of conservation / public lands in the town. This constitutes 21.5% of the total 25,708 acre area of Jaffrey. The largest contiguous block of protected lands by far is in the northwest corner of the town associated with the Mt. Monadnock massif. This block was protected over many decades primarily to ensure continued recreational access and scenic enjoyment of the icon of the region, Mt. Monadnock. Other lands were protected for specific resource protection purposes such as the Jaffrey Well Fields for drinking water and the Bradley – Draper Memorial Forest for productive forest land. See Table 13: *Conservation and Public Lands* below for information on specific conservation and public lands in Jaffrey.

Table 13: Conservation and Public Lands

Property Name	Type	Protection Entity	Ac. in Jaffrey
Ames Forest	FO	Monadnock Conservancy	60
Andrews (A) / Russell	CE	Society for the Protection of NH Forests	118
Andrews (B) / Russell	CE	Society for the Protection of NH Forests	51
Andrews (C) / Fairbanks	CE	Society for the Protection of NH Forests	11
Andrews (D) / Fairbanks	CE	Society for the Protection of NH Forests	2
Annett State Forest	FO	NH Dept. of Resources & Economic Dev.	2
Blaine Forest	FO	Society for the Protection of NH Forests	167
Bradley-Draper Memorial Forest	FO	New England Forestry Foundation	113
Cheshire Pond Conservation Area	FO	Town of Jaffrey	113
Children’s Woods + Carey Park	FO	Town of Jaffrey	130
Dr. Mills Land	FO	Jaffrey Village Improvement Society	13
Gap Mountain Reservation	FO	Society for the Protection of NH Forests	259
Gay State Forest	FO	NH Dept. of Resources & Economic Dev.	116
Goundry	CE	Society for the Protection of NH Forests	8
Haven State Forest	FO	NH Dept. of Resources & Economic Dev.	93
Jaffrey - Monadnock Lot	FO	Town of Jaffrey	253
Jaffrey Town Forest	FO	Town of Jaffrey	162
Jaffrey Well Field	FO	Town of Jaffrey	12
Jaffrey Well Field	FO	Town of Jaffrey	23
Jewell Forest	FO	Society for the Protection of NH Forests	16
Johnson	CE	Society for the Protection of NH Forests	0

Table 13, continued

Property Name	Type	Protection Entity	Ac. in Jaffrey
Johnson	CE	Society for the Protection of NH Forests	0
Kaiser CE	CE	Society for the Protection of NH Forests	42
Lacy Rd. Lot Town Forest	FO	Town of Jaffrey	11
Lowe	CE	Society for the Protection of NH Forests	4
Meade Brook	CE	Monadnock Conservancy	210
Monadnock Memorial Forest	FO	New England Forestry Foundation	72
Monadnock Reservation	FO	Society for the Protection of NH Forests	2,342
Monadnock State Park	FO	NH Dept. of Resources & Economic Dev.	1,022
Morgan Forest	FO	Society for the Protection of NH Forests	54
Morgan Forest II	FO	Society for the Protection of NH Forests	105
Mountain Brook Reservoir	CE	Monadnock Conservancy	76
Perkins Pond Lots	FO	Town of Troy	2
Perry Forest II	FO	Society for the Protection of NH Forests	29
Pierce	CE	Society for the Protection of NH Forests	51
Querfurth & McCaqq	CE	Monadnock Conservancy	162
Richardson	CE	Society for the Protection of NH Forests	62
Rowlands	CE	Monadnock Conservancy	6
Snelling / Miller	DR	Society for the Protection of NH Forests	13
Stonewall Farm / Stanley Brook	CE	Monadnock Conservancy	3
Stonewall Farm II	CE	Monadnock Conservancy	180
Stonewall Farm III	CE	Monadnock Conservancy	207
Strong, R.	CE	Society for the Protection of NH Forests	14
Thorndike Pond Beach	FO	Town of Jaffrey	9
Troy Mills Wetland	FO	Society for the Protection of NH Forests	3
Troy Water Works Land	FO	Town of Troy	163
Virginia Pond Trust		Town of Jaffrey	58
White Easement	CE	Monadnock Conservancy	76
Whittemore Island Preserve	FO	The Nature Conservancy	6
		Total Protected Acres in Jaffrey	5,518

Source: GRANIT Consland Data 2009, Complex Systems, University of New Hampshire, Durham NH.

Type Codes: CE = Conservation Easement
FO = Fee Ownership
DR = Fee Deed with Conservation Restrictions

Co-occurrence Model and Analysis

Introduction and Rationale for Analysis

Given limited funding, time, and volunteer hours, conservation action must be strategically focused to optimize resource protection. The “Co-occurrence analysis” helps to do that by focusing conservation action on resource-rich locales and by maximizing the number of resources protected per acre. This process represents a data-reduction technique in which all of the mapped resources are combined in a single model, with high value assigned to areas where there is significant coincidence of natural resources.

Explanation of Analysis

Important natural resources were mapped and overlaid such that at any point in Jaffrey the number of coincident resources is known. Areas with the most coincident resources score higher than those areas with fewer coincident resources. Thirty mapped resources were included in the model (see Table 14: *Co-occurrence Model Factors*), thus in theory the model's values could range from 0 to 30. In reality, many of these resources do not occur in the same locales or are mutually exclusive, and the model's actual range is from 0 to 10 (i.e. the largest number of resources that co-occur is 10).

In addition to the main co-occurrence model, sub-models were developed for the four resource categories featured in this study: Scenic, Soils, Water, and Wildlife. (Resources are listed by category in Table 14.) The sub-models are calculated in the same manner as the primary model; however, only resources relevant to the particular category are included.

Limitations

The co-occurrence process is a helpful addition to any Natural Resource Inventory – it is visually appealing and simple to use. However, the reader should bear in mind certain limitations of the co-occurrence analysis. First, the technique is very good at identifying resources which happen to overlap; but it is not good at identifying locales where two resources are adjacent but not overlapping. For instance, using the co-occurrence approach, a parcel with a wetland in a riparian area (a value of 2) would be more important than a wetland complex with a marsh – peatland association (maximum value of 1), whereas in reality, the wetland complex *may* provide more conservation value (exemplary habitat).

Second, the technique is limited in terms of its ability to identify areas where a single very *important* resource exists. It was decided that a weighted approach, where different resources are assigned higher or lower values (more or less importance) dependent on their conservation value, would not be used here so as not to bias the empirical nature of the analysis.

Because of these issues, the reader should bear in mind that the co-occurrence model is neither perfect nor the only tool that should be used to determine future conservation priorities. It is one tool among many that should be applied along with conservation expertise and common sense.

Table 14: Co-occurrence Model Factors

Category	Resource
<i>Scenic</i>	Scenic viewpoints (buffered)
	Scenic Analysis - 1 point
	Scenic Analysis - 2-3 points
	Scenic Analysis - 4-11 points
<i>Soils</i>	Important forest soils - Class IA
	Important forest soils - Class IB
	Important forest soils - Class IC
	Prime farmland soils
	Farmland soils of statewide importance
<i>Water</i>	High-yield Aquifers
	Flood Insurance Rate Zones (100-year floodplains)
	Wetlands and 100' Buffers
	Potentially Favorable Gravel Well Areas
	Public Water Supplies (buffered on Sanitary Radii)
	Wellhead Protection Areas
<i>Wildlife</i>	Riparian zones (300' buffer)
	Unfragmented Lands 100 - 500 acres
	Unfragmented Lands 500 - 1,000 acres
	Unfragmented Lands 1,000 - 2,500 acres
	Unfragmented Lands 2,500 - 5,000 acres
	Unfragmented Lands 5,000 - 10,000 acres
	WAP Matrix Forest: Appalachian oak / pine
	WAP Floodplain forests
	WAP Grasslands
	WAP Matrix Forest: Hemlock / hardwood / pine
	WAP Marshes
	WAP Matrix Forest: Northern hardwood / conifer
	WAP Peatlands
	WAP Ridge / talus
	WAP Matrix Forest: High and low elevation spruce / fir

Note: WAP is the Wildlife Action Plan by NH Fish & Game Dept. 2006

Conclusions of the Analysis

The results of the analysis including the sub-models are shown on Map 7: *Co-occurrence Analysis*. The results show at a glance the areas of town with the highest number of combined important resources. Places with high value (where many resources co-occur; appropriate for conservation) are shown in darker shades, and places with low value (where few resources occur together; not conservation priorities) are shown in lighter shades. Inset maps at the bottom margin of the map, below the main model, show sub-models that display the totals for all four of the resource groups separately. By referring to these sub-models, the viewer can start to determine how different resource groupings contribute to the total model scoring. The results of this analysis, when used in concert with the other resource maps and other considerations, will help reveal areas of the town that may be designated as priorities for conservation.

The following are some of the areas that scored the highest in this analysis.

- **Wetland complexes east and west of Jock Page Hill**
High values in these areas are driven largely by wetlands habitats as mapped in the NH Wildlife Action Plan (marsh and peatland) as well as by riparian habitat.
- **Wetland complexes along Meade Brook** (south of Route 124)
This area has mapped FEMA floodplains, a high transmissivity aquifer, Wildlife Action Plan marsh habitat, and riparian habitat.
- **Eastern portion of the Gap Mountain unfragmented area**
Important forest soils group IA, scenic values, and riparian habitat create high value in this area.
- **Monadnock massif**
Though most of this area is protected, high values abound on the unprotected western (along the Marlborough line) and southern (along Route 124) portions of the unfragmented area driven largely by scenic values, riparian habitat, a wellhead protection area (Troy Water Works), and important forest soils (groups IA and IB).
- **Woodbury Hill unfragmented area near Garfield Pond**
The southeast side of Woodbury Hill has a mix of wetlands (including peatland, marsh, and riparian areas) and upland forest (including important forest soils group IA).
- **Mountain Brook Swamp unfragmented area**
High values here are driven by important forest soils group IA, mapped FEMA floodplains, marsh and riparian habitat.
- **Parker Pond and environs**
Parker Pond is surrounded by wetland complexes (particularly marsh) and riparian habitat, it overlays a high transmissivity aquifer, and has important forest soils group IA on surrounding uplands.

- **Jaffrey downtown from Contoocook Lake to Cheshire Pond**
Co-occurrence values here result primarily from water resource factors: a high transmissivity aquifer, wellhead protection areas, and potentially favorable gravel well areas occur in proximity to mapped FEMA floodplain and wetland complexes.
- **Mountain Brook Reservoir and Environs**
The reservoir has particularly high scenic values, is surrounded by group IA important forest soils, and is part of a large mapped FEMA floodplain.
- **Cutter Cemetery and Prospect Street unfragmented areas**
Both of these areas include small high-value areas driven largely by important forest soils group IA and Wildlife Action Plan habitats (marsh and grasslands).

Please refer to Map 7: *Co-occurrence Analysis* for more detailed results and other high scoring areas.

Conservation Focus Areas

The typical follow-on to an NRI is a conservation or open space plan. In an effort to prepare for that endeavor, the Jaffrey Conservation Commission opted to combine the results of this NRI into a single map which would facilitate the selection of conservation priorities. The map is meant as a springboard for the consideration of geographic areas for further evaluation and conservation action.

To create the map, the lowest scoring resource areas were filtered out, leaving the relatively high-scoring resource areas (approximately the top 5% of values). These portions of the co-occurrence model were displayed over unfragmented areas to identify areas of the landscape which are relatively un-impacted by development and have high conservation values.

The results can be seen on Map 8: *Conservation Focus Areas*. A comparison of the location of these high-quality areas with the location of existing conservation lands suggests where initiatives for new land conservation might be focused. Although this analysis is useful for conservation planning, many other factors should be considered when identifying conservation targets, such as Town resource-protection priorities and the results of on-the-ground evaluations.

8. CONCLUSIONS

The town of Jaffrey is truly blessed with exceptional natural resources – abundant lakes, rivers and streams, productive farm and forest land, high-quality drinking water supplies, diverse wildlife habitat, and spectacular scenic vistas. This study has documented these resources and many more. Thanks to the foresight of earlier generations, much of what makes Jaffrey special has been permanently protected for the benefit of those that follow.

Jaffrey has been identified by outside studies, including the Quabbin to Cardigan Initiative, as being located in the core of a region with significant importance for wildlife, forest resources, and recreation. The Wildlife Action Plan has identified numerous wildlife habitats and areas of state and regional importance in the town.

Here is a sampling of some of the most significant findings of this Natural Resource Inventory:

Highlighted findings:

Wildlife

Significant unfragmented forest blocks still remain in Jaffrey. The recent protection of several parcels in the Woodbury Hill and Parker Pond unfragmented areas in the northeast part of the town has improved the level of protection there, while the Mountain Brook Reservoir and Jock Page Hill unfragmented areas in the southwest remain relatively under-protected.

Several small areas that coincide with the Marsh and Shrub Wetland Priority Habitat areas just south of the center of town along the Contoocook River corridor are ranked as Highest Ranked Habitat in NH. Several larger areas across the town, displayed in green on Map 3, indicate Highest Ranked Habitat in Biological Region.

Despite having 873 acres of grassland habitat, only 10 acres (~1%) is protected. Even though they have some regulatory protection through New Hampshire's wetlands laws, Jaffrey's marsh and peatland habitat are not well protected by conservation lands (12% and 6% respectively).

Water

Two river segments in Jaffrey have been designated as significant on a statewide basis by the New Hampshire Rivers Management and Protection Program:

- Contoocook River: Outlet of Poole Pond in Rindge to Old Sharon Road Bridge in Jaffrey (Community River Class).
- Contoocook River: Old Sharon Road Bridge in Jaffrey to Noone Falls Dam in Peterborough (Rural River Class).

4,418 acres of high-yield aquifer occur in Jaffrey. However, some of the highest productivity aquifers are potentially impacted by development in the following areas:

- Darcie Drive housing development
- South Shore Drive development
- Jaffrey landfill
- Jaffrey Airport runway
- Fitzgerald Drive development

The largest remaining high-yield groundwater source is located on the Jaffrey / Sharon boundary in a large un-developed area that extends into Sharon. Currently providing drinking water, the undeveloped open space over and around this site would appear to be an ideal place to start to work with the Town of Sharon to plan for land protection specifically to protect this important drinking water resource.

Soils

Covering 41% of the area of the town, the valuable and productive Class IA Important Forest Soil group, most suited to high-quality hardwood growth, is very well represented and distributed in Jaffrey.

Only 437 acres, or 13.9% of important agricultural soils in Jaffrey, are protected from development. The modest level of protection of these irreplaceable productive soils in Jaffrey highlights the need for proactive conservation efforts to preserve the remaining undeveloped high-quality agricultural soils.

Scenic

Thorndike Pond Road from Gilson Road to the Dublin town line, formerly known as Slade Road, is the only designated scenic road in Jaffrey. Much of the eastern frontage of the 2.9 mile length of this scenic road is protected by conservation land, but none of the western frontage is currently protected.

The scenic analysis confirmed that Mt Monadnock is the most important scenic resource in the town. The mountain can be seen from numerous locations, but perhaps the most striking is from Rte. 124 southeast of the mountain. This road section is not designated as a scenic road or scenic byway, and there is only one parcel of protected land on the mountain side of the road.

Land Conservation

Jaffrey has 49 properties that are either restricted for conservation-related uses or are public lands. According to a GIS calculation, there are 5,518 acres of conservation or public lands in the town. This constitutes 21.5% of the total 25,708 acre area of Jaffrey. These lands, however, are predominantly in the northwest Mt. Monadnock area. Significant resources elsewhere in the town remain unprotected.

Co-occurrence

The co-occurrence analysis identified several areas as being unusually rich in combined natural resource values: wetland complexes east and west of Jock Page Hill; wetland complexes along Meade Brook (south of Route 124), the eastern portion of the Gap Mountain unfragmented area, the Monadnock massif, the Woodbury Hill unfragmented area near Garfield Pond, the Mountain Brook Swamp unfragmented area, Parker Pond and environs, the Jaffrey hub from Contoocook Lake to Cheshire Pond, Mountain Brook Reservoir and environs, and the Cutter Cemetery and Prospect Street unfragmented areas.

Recommendations

The Town of Jaffrey can now move forward with proactive conservation planning secure in the knowledge that they are building on a strong foundation of knowledge of the town's natural resources. Here are some recommendations for next steps to protect Jaffrey's natural resources:

- Conduct field surveys targeted at documenting rare species and natural communities known or suspected to occur in Jaffrey.
- Conduct field surveys to verify location and quality of priority habitats identified and mapped by the State's Wildlife Action Plan.
- Conduct a review of existing Jaffrey ordinances and regulations to determine where these could be revised, amended or enhanced to make them as consistent as possible with each other and with the findings of this report, and supportive of the stated Town goals for natural resource protection.
- Refer to regional land conservation studies such as the Quabbin to Cardigan Initiative for guidance on what areas in Jaffrey may be regionally important for conservation.
- Map the remaining actively managed agricultural lands in Jaffrey so that these can be considered in future conservation planning.
- Explore designation of the Monadnock section of Rte. 124 as a designated scenic road, and pursue land protection on the north side of this road.
- Pursue development of a conservation plan for Jaffrey that builds on this Natural Resource Inventory and plans for the proactive protection of Jaffrey's critically important natural resources.

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Appendix B: Metadata

Metadata is incorporated with the GIS data included with this NRI project (see project geodatabase: data/data.gdb as well as /metadata). We include here an explanation of the processing steps used to create five custom datasets as additional metadata.

Riparian Areas

To create riparian areas, the following geoprocessing steps were used:

1. All streams (nhhd_flowline feature class) were buffered 300'
2. All surface waters (nhhd_water feature class) were buffered 300'
3. The results from steps 1 and 2 were combined using the union tool
4. The result of step 3 was dissolved to result in a single part final polygon dataset

Unfragmented Lands

To create the unfragmented lands dataset, the following geoprocessing steps were used:

1. Regularly traveled roadways were selected using the following selection set: "SC_LEGEND" = 'Local' OR "SC_LEGEND" = 'State'. NOTE: Private and unmaintained (class VI) roads were assumed to be non-fragmenting and were not used for this analysis. Certain roads were reclassified as part of this analysis to be non-fragmenting based on the judgment of the Jaffrey Conservation Commission.
2. Selected roads were buffered 500 feet
3. Buffer polygons were then erased from the surrounding landmass (Base/clipper feature class)
4. Remaining polygons were converted to single part polygons
5. Polygons smaller than 100 acres were deleted
6. One manual edit was made: The Jaffrey Airport facilities and runway were removed from the "Jaffrey Airport Area" based on aerial photo interpretation.
7. Unfragmented areas were classified by acreage as follows
 - 100 – 500 acres
 - 501 – 1,000
 - 1,001 – 2,500
 - 2,501 – 5,000
 - 5,001 – 10,000
8. Unfragmented areas that had some portion of their area within Jaffrey were named based on the most significant geographic feature within the block based on USGS topographic map features.

Potentially Favorable Gravel Well Areas

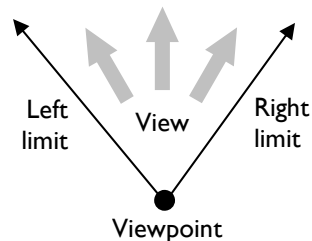
A 150 gallon/minute analysis was used for this Natural Resource Inventory. Stratified drift aquifer data were selected to isolate minimum transmissivity of 2,000 foot²/day. Known and potential contamination sources buffered 1,000 feet (U400des.shp, provided by NH DES) were used to erase aquifer data. Buffered roads and surface waters (hyt4nnn.shp, provided by NH DES) were used to erase aquifer data as well. The resulting feature class (pfgwa) represents

areas unlikely to be contaminated and transmissive enough for a 150 gallon / minute well. For further information, please refer to the DES technical manual, *A Guide to Identifying Potentially Favorable Areas to Protect Future Municipal Wells in Stratified-Drift Aquifers*, NH Department of Environmental Services, Publication NHDES-WD-99-2. Additional information can be found in the NH DES Factsheet, “Using Stratified-Drift Aquifer Maps to Plan for Potential Future Community Wells”, Publication WD-DWGB-22-12 (also contained in project metadata; see “nh_des_pfgwa_dwgb-22-12.pdf”)

Scenic Areas Analysis

The scenic areas analysis model was calculated as follows:

- Jaffrey Conservation Commission members selected 26 scenic viewpoints to review in the field (see in Chapter 6, Scenic Resources)
- They visited each point and recorded an ID#, the location, the azimuth of the leftmost limit of the view (left azimuth) and the azimuth of the rightmost limit of the view (right azimuth), and any other additional notes



- Each viewpoint was marked on a paper map
- Viewpoints were digitized on screen using aerial photography based on the marked location (see Scenic_Points feature class in Data.gdb/Scenic)
- Using ArcGIS Spatial Analyst, viewsheds were calculated for each point (where left and right azimuths corresponded to the optional parameters AZIMUTH1 and AZIMUTH2 respectively)
- The resultant integer viewshed grids included following values
 - 1 = within viewshed
 - 0 = not in viewshed
- The 26 viewshed grids were then summed to arrive at the final scenic areas analysis model
- Values in the final model are equal to the number of overlapping viewsheds at the given grid cell

Co-occurrence Analysis

For a list of resources included in the co-occurrence analysis, see Table 14: Co-occurrence Model Factors. The co-occurrence model was generated according to the following geoprocessing steps:

1. Each input resource was clipped to the study area (see base/study_area feature class)
2. Each input resource was assigned a value field (in the case of this model, the value was one (1) for each factor). Fields were assigned as follows:

Resource	Value Field
Scenic viewpoints (buffered)	SC_PTS
View-Shed - 1 point	SC_VS01
View-Shed - 2-3 points	SC_VS03
View-Shed - 4-11 points	SC_VS11
Important forest soils - Class IA	SO_FIA
Important forest soils - Class IB	SO_FIB
Important forest soils - Class IC	SO_FIC
Prime farmland soils	SO_PF
Farmland soils of statewide importance	SO_SI
High-yield Aquifers	WA_AQ
Flood Insurance Rate Zones (100-year floodplains)	WA_FIRZ
Wetlands and 100' Buffers	WA_NWI
Potentially Favorable Gravel Well Areas	WA_PFGWA
Public Water Supplies (buffered on Sanitary Radii)	WA_PWS
Wellhead Protection Areas	WA_WHPA
Riparian zones (300' buffer)	WI_RIP
Unfragmented Lands 100 - 500 acres	WI_U0500
Unfragmented Lands 500 - 1,000 acres	WI_U1000
Unfragmented Lands 1,000 - 2,500 acres	WI_U2500
Unfragmented Lands 2,500 - 5,000 acres	WI_U5000
Unfragmented Lands 5,000 - 10,000 acres	WI_U9999
WAP Matrix Forest: Appalachian oak / pine	WI_WAPAO
WAP Floodplain forests	WI_WAPFF
WAP Grasslands	WI_WAPGR
WAP Matrix Forest: Hemlock / hardwood / pine	WI_WAPHH
WAP Marshes	WI_WAPMA
WAP Matrix Forest: Northern hardwood / conifer	WI_WAPNH
WAP Peatlands	WI_WAPPE
WAP Ridge / talus	WI_WAPRT
WAP Matrix Forest: High and low elevation spruce / fir	WI_WAPSF

3. All resources were combined with the study area feature class using the union tool
4. The resulting union (see co-occurrence/model feature class) was used as the final model for display and analysis
5. Five fields were added to the model feature class as follows:
 - “MODEL” – model value
 - “SCENIC” – scenic submodel value
 - “SOILS” – soils submodel value

“WATER” – water submodel value

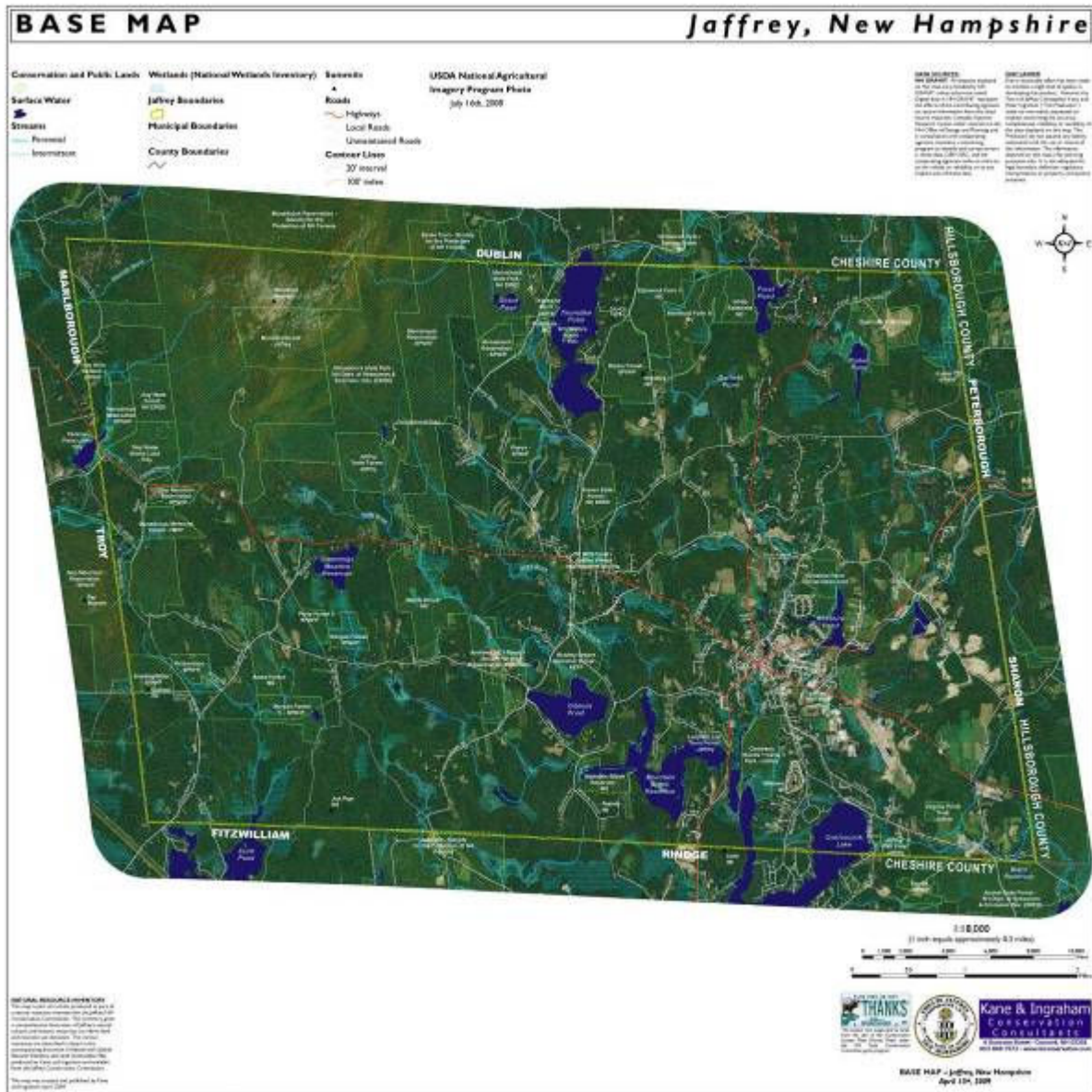
“WILDLIFE” – wildlife submodel value

6. Model fields were calculated as follows:

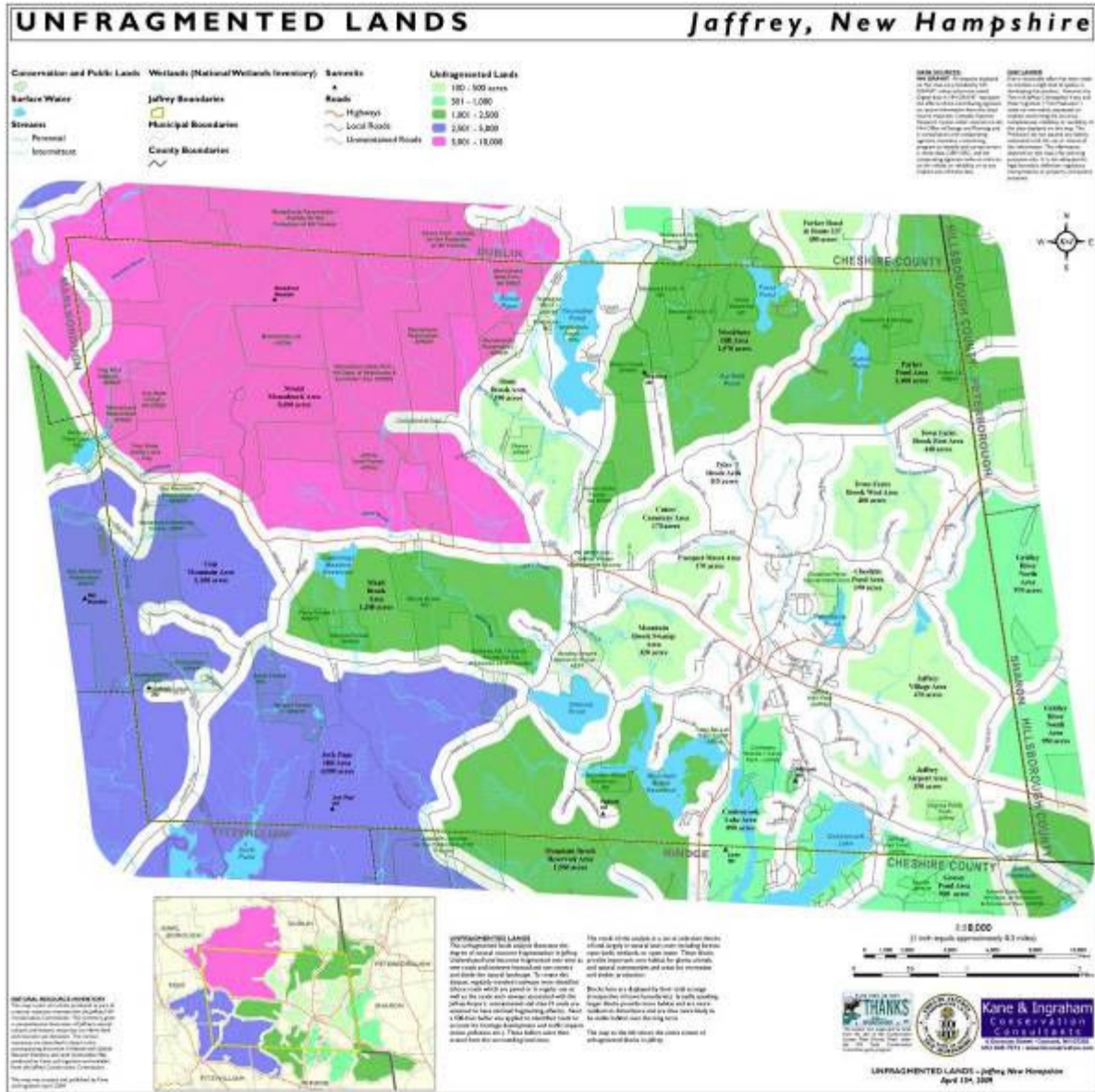
Model / Submodel Field	Calculation
“MODEL” (the sum of all resources)	[SC_PTS] + [SC_VS01] + [SC_VS03] + [SC_VSI1] + [SO_FIA] + [SO_FIB] + [SO_FIC] + [SO_PF] + [SO_SI] + [WA_AQ] + [WA_FIRZ] + [WA_NWI] + [WA_PFGWA] + [WA_PWS] + [WA_WHPA] + [WI_RIP] + [WI_U0500] + [WI_U1000] + [WI_U2500] + [WI_U5000] + [WI_U9999] + [WI_WAPAO] + [WI_WAPFF] + [WI_WAPGR] + [WI_WAPHH] + [WI_WAPMA] + [WI_WAPNH] + [WI_WAPPE] + [WI_WAPRT] + [WI_WAPSF]
“SCENIC” (the sum of all scenic resources)	[SC_VS01] + [SC_VS03] + [SC_VSI1] + [SC_PTS]
“SOILS” (the sum of all soil resources)	[SO_FIA] + [SO_FIB] + [SO_FIC] + [SO_PF] + [SO_SI]
“WATER” (the sum of all water resources)	[WA_AQ] + [WA_FIRZ] + [WA_NWI] + [WA_PFGWA] + [WA_PWS] + [WA_WHPA]
“WILDLIFE” (the sum of all wildlife resources)	[WI_RIP] + [WI_U0500] + [WI_U1000] + [WI_U2500] + [WI_U5000] + [WI_U9999] + [WI_WAPAO] + [WI_WAPFF] + [WI_WAPGR] + [WI_WAPHH] + [WI_WAPMA] + [WI_WAPNH] + [WI_WAPPE] + [WI_WAPRT] + [WI_WAPSF]

Appendix C: Maps

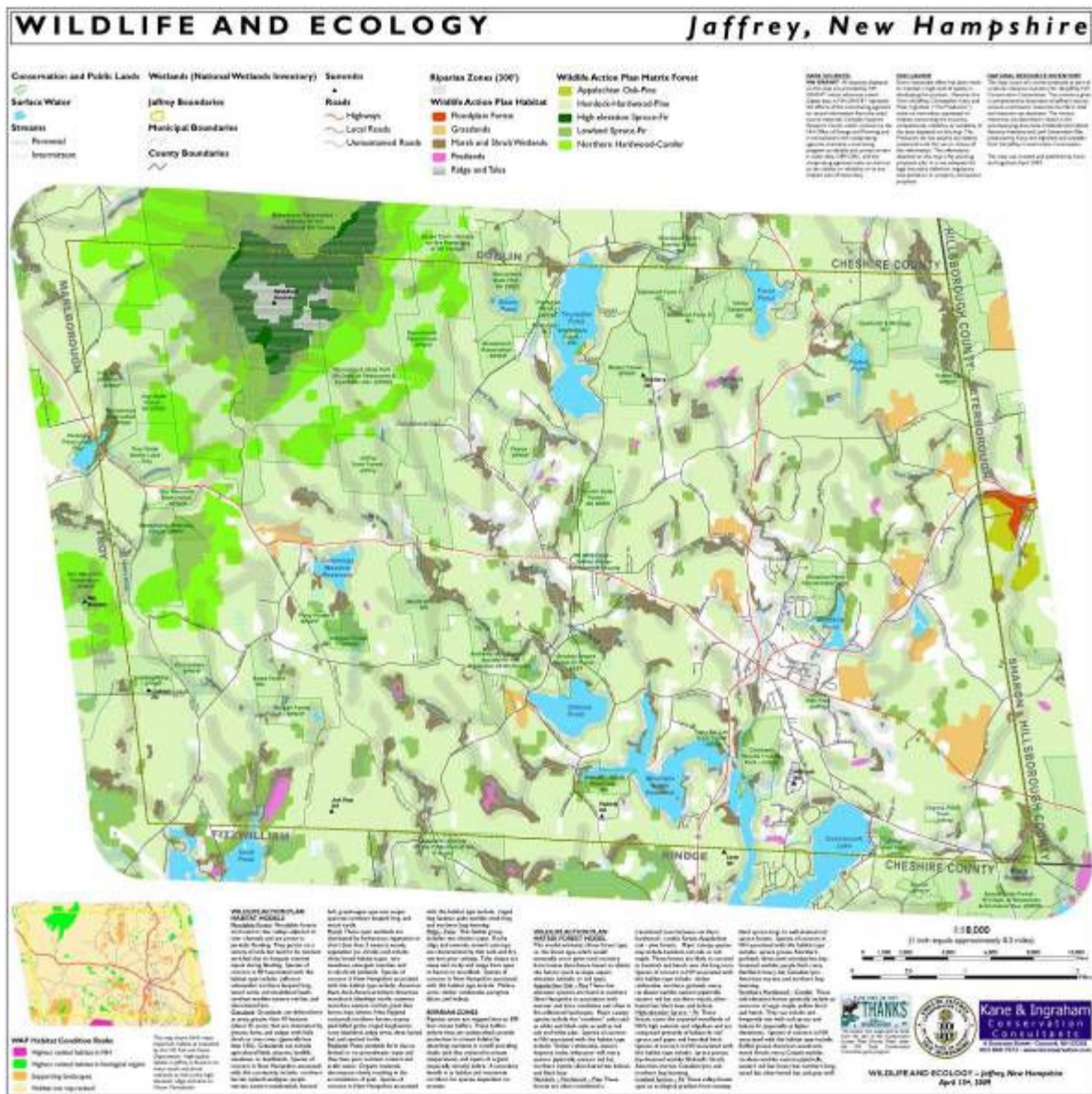
Map I: Aerial Base Map



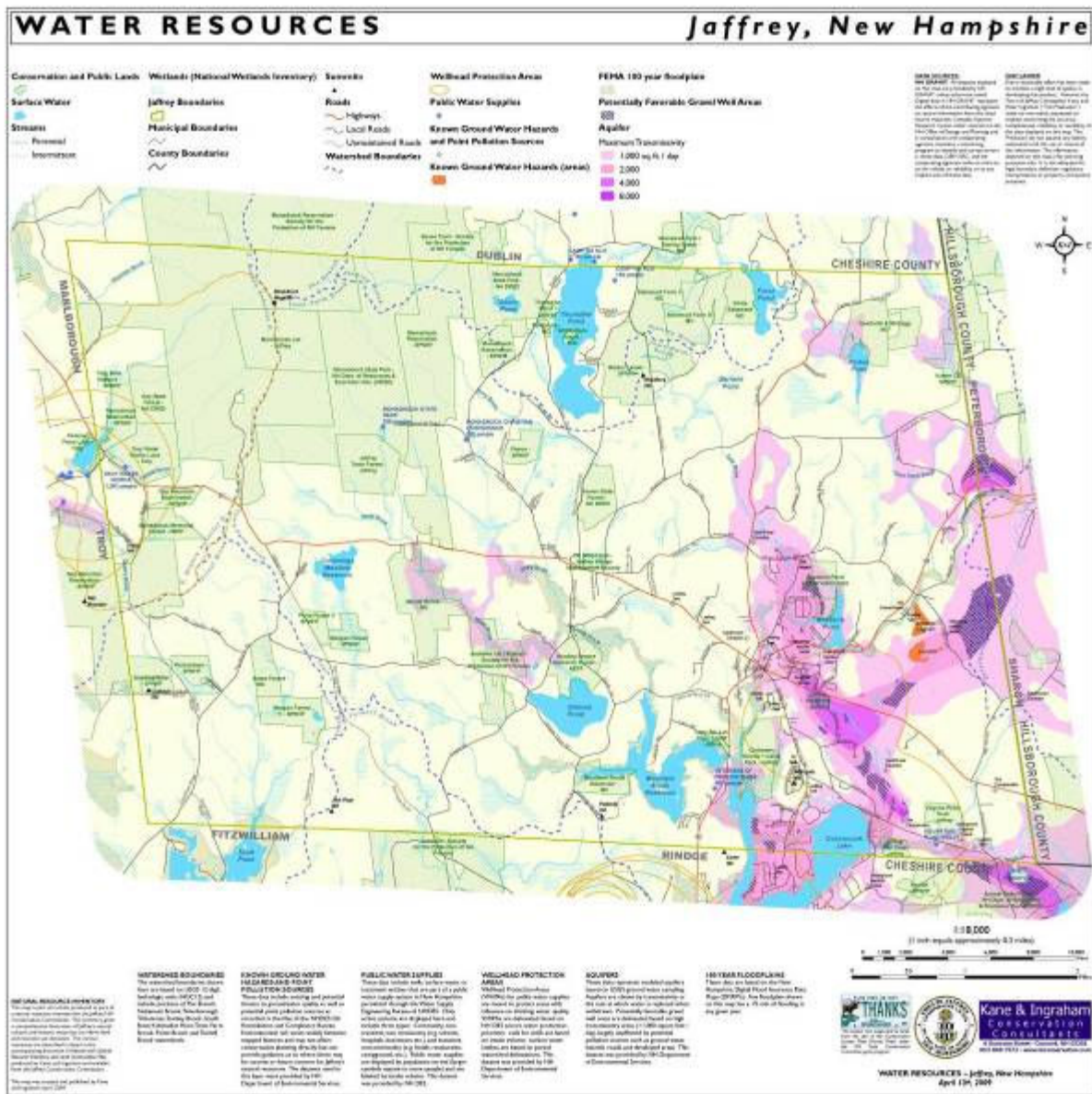
Map 2: Unfragmented Lands

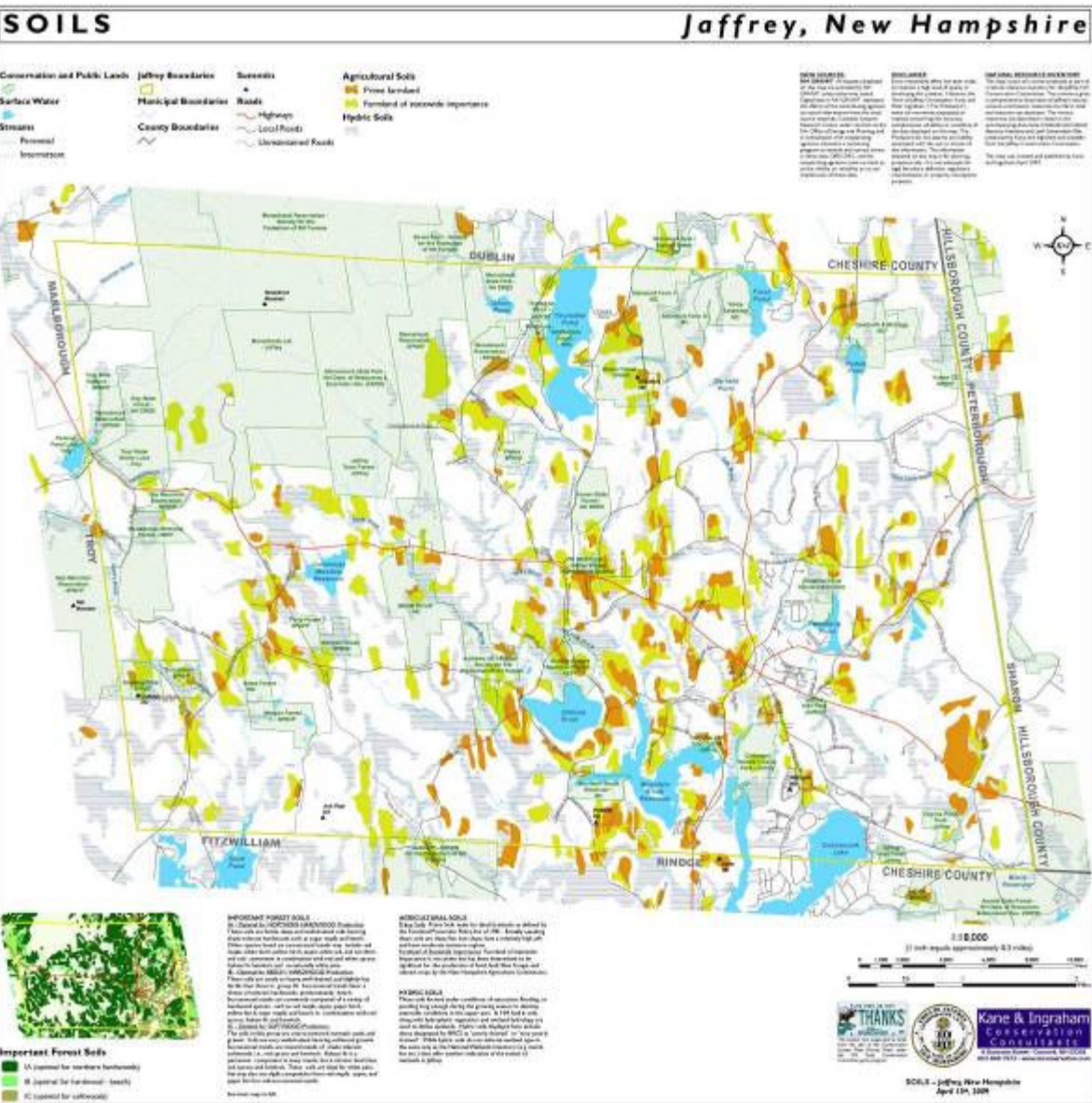


Map 3: Wildlife and Ecology

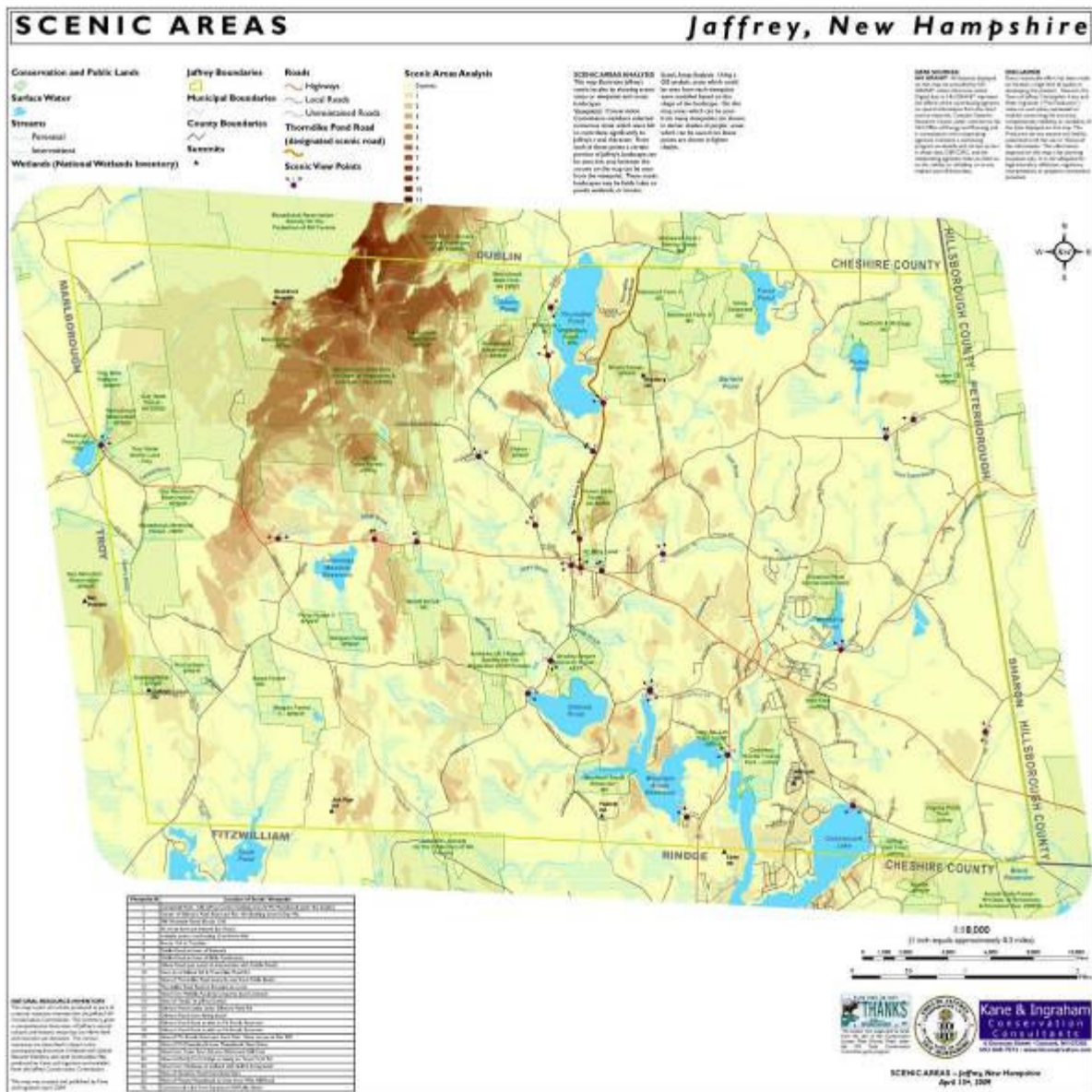


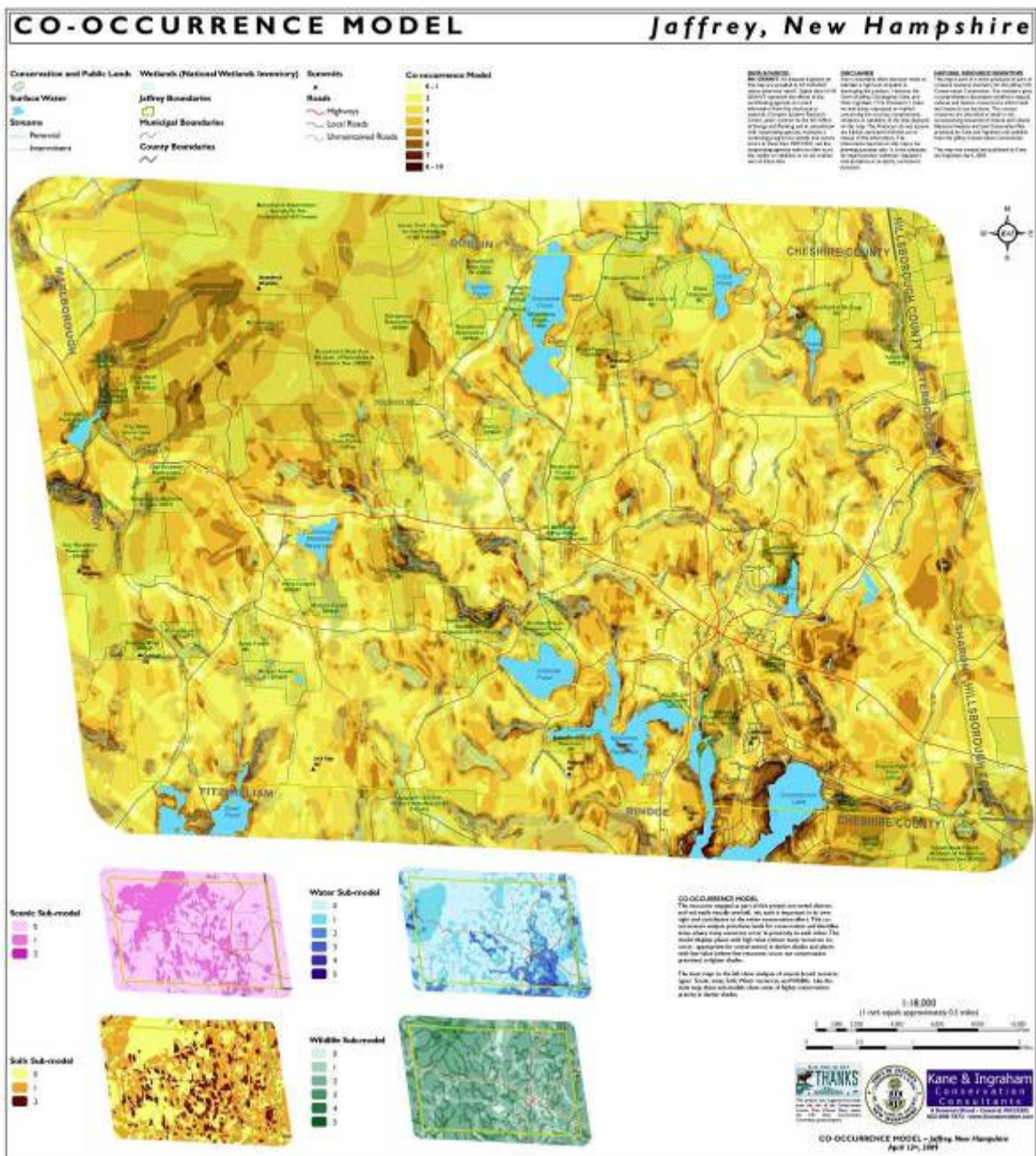
Map 4: Water Resources



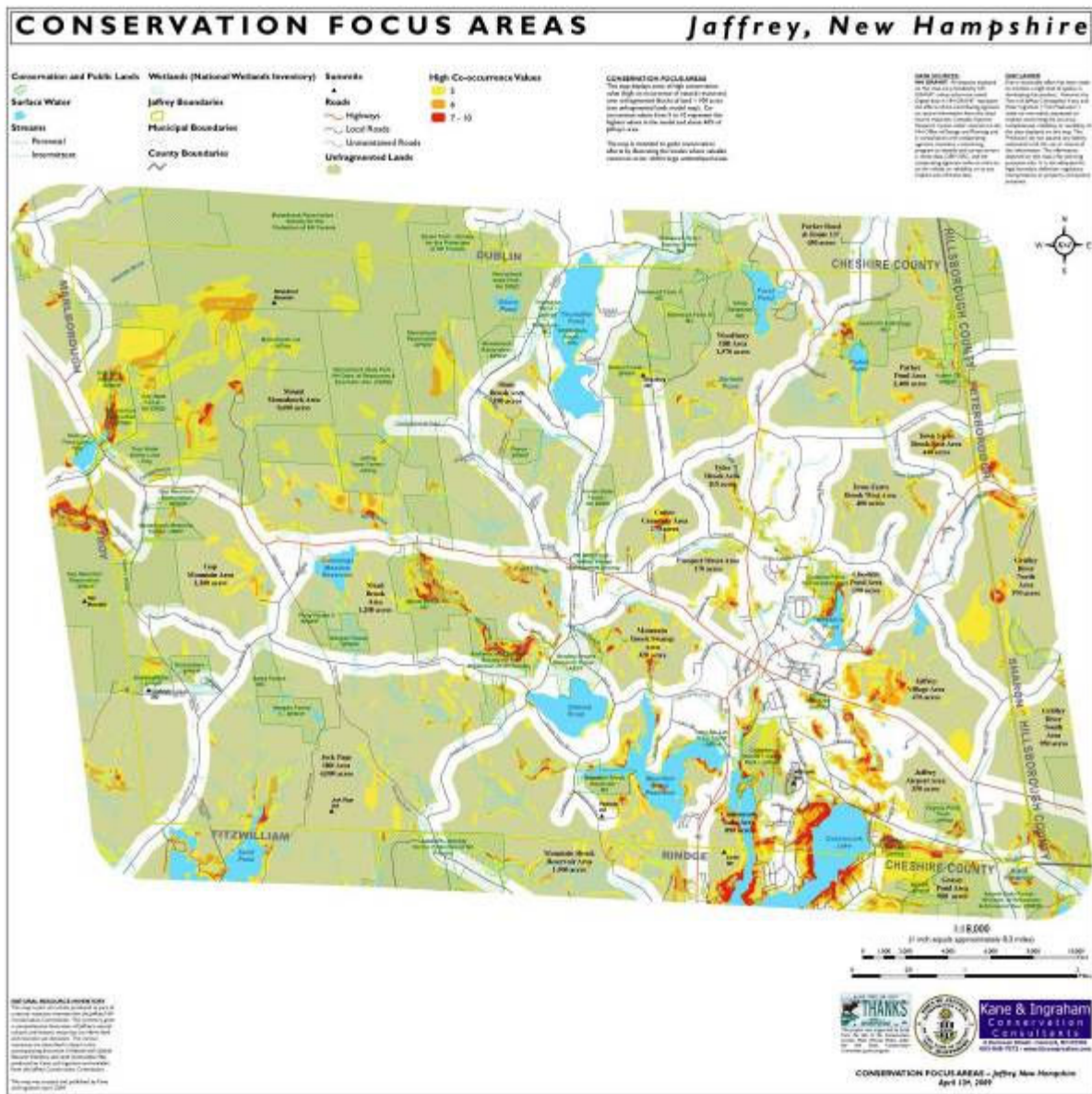


Map 6: Scenic Areas





Map 8: Conservation Focus Areas



TAX PARCELS AND ZONING

Jaffrey, New Hampshire

Jeffrey Boundaries
Municipal Boundaries
County Boundaries

Zoning
General Business
Heavy Commercial
Industrial
Residential
Residential A
Residential B
Rural

TAX PARCELS AND ZONING
Due to scale limitations, not all parcels are shown on this map. Boundaries are shown for the town and county boundaries only. Some parcels may not be shown due to scale limitations. The map is for informational purposes only and should not be used for legal purposes. The map is not a legal document and should not be used for legal purposes. The map is not a legal document and should not be used for legal purposes.

NEIGHBORING TOWNS
DUBLIN
CHESHIRE COUNTY
HILLSBOROUGH COUNTY
PETERBOROUGH
SHAMON
HILLSBOROUGH COUNTY
RINGGEE
CHESHIRE COUNTY
FITZWILLIAM
LORRY
MARTINBOROUGH

LEGEND
Zoning
General Business
Heavy Commercial
Industrial
Residential
Residential A
Residential B
Rural

SCALE
0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
(1 inch equals approximately 0.3 miles)

CONTACT INFORMATION
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Jaffrey, NH 03451
(603) 888-1234

THANKS
TO THE TOWN OF JAFFREY FOR PROVIDING THE DATA FOR THIS MAP.

TAX PARCELS AND ZONING - Jaffrey, New Hampshire
April 15, 2009