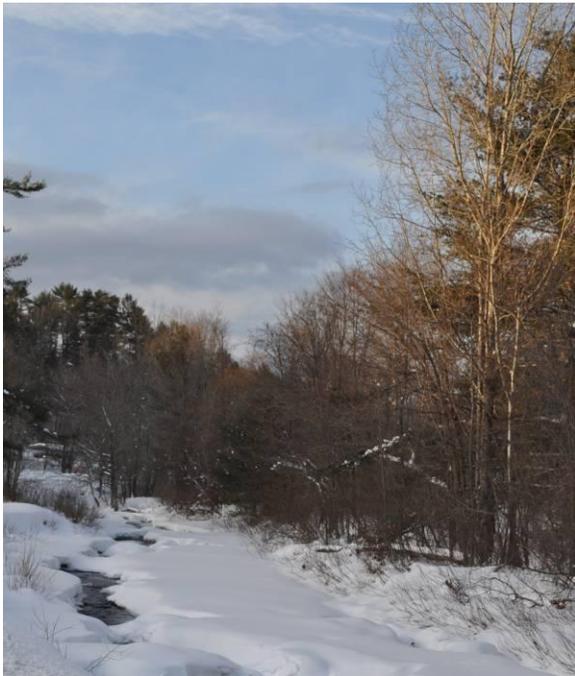




Connecticut River in late spring



Jacobs Brook in winter

Natural Resources Inventory - Town of Orford, NH

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1.0 Introduction

Orford is a rural town of just over 1,200 residents in the Connecticut River Valley of western New Hampshire. The town is roughly 48 square miles, with 46.4 square miles of land and 1.3 square miles of inland water. Orford connects to nearby towns by NH Route 10 which runs north-south on the western edge of the town and Route 25A which runs east-west through the center of the town. The topography of Orford rises dramatically from the Connecticut River (~400 ft elevation) to the hills and mountains to the east; the highest elevation is 2,909 feet above sea level at the summit of Mount Cube.

Farming and forestry are important industries in Orford, utilizing the rich soils of the Connecticut River floodplains and terraces in the western part of town and the extensive forestlands to the east. The natural resources of the town also promote a high quality of life through the country setting abundant with wildlife, scenic vistas, and recreational opportunities.

In the development of the most recent update to the Town of Orford's Master Plan, a series of community meetings were held in May 2000 to receive public input. The summarized response to the question "What is special about Orford?" shows the importance of natural resources and open space to town residents:

"The small town, rural setting of Orford, with its open, uncluttered feeling, is of major importance. People appreciate the sense of history as expressed in the many older homes and historic structures. Trails, wildlife and the openness of private land for public use are considered important attributes of the town. Closeness to cultural opportunities, skiing, good highways and other conveniences were important to some participants. The diversity of people in town, their values of hard work, taking care of each other, honesty and pride and small town Yankee values are important to maintain." (Excerpt from Exhibit II of the 2001 Master Plan)

The Orford Conservation Commission has prepared this Natural Resources Inventory to serve as an index of natural resources and important natural areas for the town of Orford. The purpose of the Conservation Commission, as defined by New Hampshire State Law (RSA 36-A), is to work toward "the proper utilization and protection of the natural resources and for the protection of watershed resources of said city or town." In order to do this successfully, the Conservation Commission needs to know what types of resources exist and where they are located within town. A Natural Resources Inventory is the recognized method for identifying and keeping track of natural resources in a municipality.

A Natural Resources Inventory can be used as:

- A baseline of information from which changes in the town can be assessed
- A tool for public outreach to inform citizens about the town's resources
- A source of information to support voluntary land protection and resource conservation
- A source of information to support land use decision-making

- A source of information to support sound decisions about town and state projects, such as siting new community facilities or planning for roadway improvements.

The status and significance of natural resources and their protections do change over time, and this inventory should not be construed as a “final product.” The inventory includes a summary of what exists at the current time and recommends actions for the future; this document should be revisited periodically to update the inventory with newly available data, protections, and priorities for natural resources conservation. It may be most helpful to update the Natural Resources Inventory on a regular cycle in sync with Master Plan updates, so that the statistics and recommendations contained within the Natural Resources Inventory can be used to inform the development of the Master Plan.

2.0 The Natural Resources of Orford

The Orford Conservation Commission identified seven important natural resources for inclusion in this inventory: surface waters, wetlands, floodplains, groundwater, agricultural lands, forest lands, and wildlife habitat.

This Natural Resource Inventory also documents scenic views and vistas, outdoor recreation opportunities, cultural and historic areas, air quality, noise level and dark skies. These resources are included because town residents place important cultural value on the natural, quiet and unpolluted landscape that provides scenery, recreation and links to culture and history.

Sections 5-13 of this report describe each type of natural resource in detail, including:

- an explanation of the resource and its importance to Orford or the broader region,
- existing or potential threats to the resource,
- any current protections, and
- any potential future protections or management strategies.

3.0 Inventory Methods and Data Sources

The Orford Conservation Commission developed this Natural Resources Inventory, with technical assistance from the Upper Valley Lake Sunapee Regional Planning Commission, in 2010/2011. Members of the Orford Conservation Commission researched town records and interviewed local farmers to obtain information on land use, forestry and agricultural activities. The Orford Conservation Commission members also provided their local knowledge of Orford and its specific natural resource locations and characteristics.

Identifying the location of natural resources over the landscape is a crucial piece of information for any planning effort. UVLSRPC created a series of maps, where natural resources were digitally mapped using ArcGIS 9.3.1. UVLSRPC also combined the data in a co-occurrence

analysis (a study on where resources overlap or occur in the same location) to identify areas of high resource value. The co-occurrence analysis is described in detail in Section 14.

Information on the natural resources in Orford was derived from statewide data sources, town tax maps and local sources. Corrections to the statewide data were made by Emily Bryant of Stonehouse Mountain Mapping and of the Orford Conservation Commission. This information is represented descriptively in the text of the report and also visually on maps, which are included as appendices to this report. Information for the following natural resources and base geographic features was compiled:

- Political boundaries
- Public roadways
- Surface water features – rivers, streams, lakes, and ponds
- Topography
- Soils – capabilities for agricultural production and forest management
- National Wetlands Inventory
- Aquifers
- Floodplains
- Watershed boundaries
- Highly ranked wildlife habitat from the NH Wildlife Action Plan
- Unfragmented forest blocks from the NH Wildlife Action Plan
- Undeveloped public land and conserved land protected from development
- Tax parcels enrolled in current use
- Hiking trails
- Public boat launches
- Historic mill sites and historic areas.

Detailed information about the natural resources data, including source, scale, and attributes, are described in Appendix A: Data Source Documentation.

4.0 Land in Conservation and Current Use in Orford

Public and privately-held conservation lands protect a wide variety of natural resources on 2,945 acres of the land in Orford, about ten percent of the town’s land area (Tables 1-2). The existing conservation lands in Orford protect important working landscapes for forestry and agriculture, provide recreational access to trails and water bodies, protect water quality, provide wildlife habitat and protect scenic vistas.

Conservation lands are found primarily on the western and eastern edges of town. On the mountainous eastern side of Orford, conservation easements protect land near Upper Baker Pond, and the National Park Service owns the Appalachian Trail corridor. On the western side, private and public landowners have placed easements on land near the Connecticut River and Route 10: the Wilson and Bunten easements near Grimes Hill Road, the Eck easements stretching east toward Cottonstone Mountain as well as the Richmond Conservation Land owned by Orford and conservation land owned by Rivendell School District. In the south-central section of Orford, Stonehouse Mountain summit is protected by conservation easement.

Conservation easements on privately owned land (and in some cases, town-owned land) in Orford have been steadily increasing the acreage of protected land. According to Conservation Commission records compiled by Sarah Schwaegler, nine conservation easements were completed in the 1980’s, nine in the 1990’s and seven in the 2000’s. Several of these easements have been placed over time on different lots owned by the same family; the commitment of these families to the preservation of open space and natural resources is truly outstanding. These conserved lands provide permanent protection for the natural resources of Orford for the benefit of present and future generations.

Table 1: Public Undeveloped Lands

<i>Name of Tract</i>	<i>Acres</i>	<i>Owner/Manager</i>
Community Field	9.0	Town of Orford
Connecticut River Boat Landing & Recreation Area	9.0	Town of Orford
Town Shed Rd Gravel Pit	7.8	Town of Orford
Indian Pond Beach	1.1	Town of Orford
Lower Baker Pond - Boat Access	0.3	Town of Orford
Upper Baker Pond - Town Beach	4.0	Town of Orford
Sunday Mtn Development Land	0.5	Town of Orford
Flat Rock	0.7	Town of Orford
Former Brookside Store Land	0.2	Town of Orford
Town Offices	8.0	Town of Orford
Rivendell School Land	32.0	Rivendell Interstate School District
Reeds Wildlife Management Area	72.0	New Hampshire Fish and Game Dept.
Appalachian Trail Tracts	1,381.0	National Park Service
<i>Total Acres of Public Undeveloped Land: 1,525.6</i>		

Table 2: Conservation Easements in Orford

<i>Name of Tract</i>	<i>Acres</i>	<i>Easement Holder(s)</i>
Brownson	42.0	Upper Valley Land Trust
Bunten	160.3	State of New Hampshire
Bunten	23.2	State of New Hampshire
Cook	12.0	Society for the Protection of New Hampshire Forests
Cook	5.5	Society for the Protection of New Hampshire Forests
Eck Riverfront	11.4	Upper Valley Land Trust
Eck (1a-1d)	213.7	Upper Valley Land Trust
Eck Woodlands	31.0	Upper Valley Land Trust (town-owned)
Eck (3)	83.2	Upper Valley Land Trust
Green, A.	3.6	Upper Valley Land Trust
Hewitt & Lewis	7.7	Society for the Protection of New Hampshire Forests
Lamb	22.8	Society for the Protection of New Hampshire Forests
Richmond Conservation Land	11.1	Upper Valley Land Trust (town-owned)
Rivendell	13.0	Upper Valley Land Trust
Schwaegler, B & S	49.1	Society for the Protection of New Hampshire Forests
Schwaegler, B & S	27.5	Society for the Protection of New Hampshire Forests
Schwaegler, B & S	118.7	Society for the Protection of New Hampshire Forests
Schwaegler, B & S	123.2	Natural Resources Conservation Service
Schwaegler, S., Richardson	35.1	Town of Orford; Society for the Protection of NH Forests
Thorndike	107.0	Society for the Protection of New Hampshire Forests
Thorndike	116.0	Society for the Protection of New Hampshire Forests
Wilson, A	16.0	State of New Hampshire
Wilson, G	72.4	State of New Hampshire
Wilson, G	13.7	State of New Hampshire
Zaldestani	100.3	Town of Orford
<i>Total Acres under Conservation Easement: 1,419.5</i>		

Please note – Not all conservation lands are open for public recreation. Please consult with the easement holder or land-owning agency for information on public access.

Current use tax assessment is a program designed to encourage preservation of open space by taxing undeveloped land at its “current use” rather than its “highest and best use.” RSA 79-A authorizes this program first established in 1973, which allows for a reduced assessment for parcels of:

- field, farm, forest, and wetland of 10 acres or more.
- natural preserves or recreation land of any size.
- farmland of any size generating annual revenues in excess of \$2,500.

As of 2009, 25,035.53 acres are enrolled in current use, or 84% of the town’s land area, according the Department of Revenue Administration’s annual current use report. These lands

are held by 195 different owners, and constitute 396 parcels. In the last five years (2005-2009), the acreage of land in current use has increased by 906.71 acres.

Taxation rates are based on the use of the land, which is broken into five categories: forest, forest with stewardship, farmland, wetland, and unproductive land (Table 3). Forest land with documented stewardship has a lower assessment, to reflect the cost of active stewardship of the land; documentation of a Certified Tree Farm, a Forest Stewardship plan from a licensed forester, or a summary of a Forest Stewardship plan developed privately are sufficient to enroll a parcel in current use as forest land with documented stewardship.

Table 3: Current Use in Orford, by type, as of 2009

<i>Current Use Type</i>	<i>Acreage</i>	<i>% of CU Land</i>
Forest	7,834	31.3%
Forest with stewardship	14,415	57.6%
Farmland	1,655	6.6%
Wetland	46	0.2%
Unproductive	1,085	4.3%
Total in Current Use	25,035	100%

The Land Use Change Tax (LUCT) is a penalty for withdrawing land from current use. Because it is possible to withdraw land from current use and develop it, current use is not considered a long-term conservation method. In Orford, the withdrawal of land from current use in the last five years has been relatively small in that it represented only 0.4% of the land in current use:

- 89.19 acres were removed from current use in the years 2005-2009;
- The acreage removed each year ranged from 5 acres to 33.99 acres.

In Orford, 100% of the Land Use Change Tax is placed into to the Town Conservation Fund. The Conservation Commission is authorized to use these funds to undertake conservation projects, including land acquisition or purchase of conservation easements, following a public hearing. The Conservation Fund is an important mechanism for assisting landowners who want to conserve their land.

4.0 Surface Waters

Surface waters are rivers, streams, lakes and ponds. Many surface waters are associated with wetlands. The rivers, streams, lakes and ponds in Orford provide a fundamental resource required by all life: water. While there are no public water supplies drawing water from Orford’s surface waters, these features are hydrologically connected to groundwater. Surface waters also provide significant wildlife habitat, renewable energy sources, recreation opportunities, and scenic views. Ponds and lakes impounded by dams may also be used for fire protection, flood control, or agricultural irrigation.

Roughly 83% of the Town of Orford is within the Connecticut River watershed; the remaining 17% around Upper and Lower Baker Ponds drains to the Pemigewasset River to the east. The

Connecticut River flows along the western border of Orford. There are two large wetlands on the eastern shore of the Connecticut River in Orford. One is at the confluence of Jacobs Brook and the second forms Reeds Marsh.

The primary stream draining to the Connecticut River in Orford is Jacobs Brook. It drains 15,600 acres. The north and south branches of Jacobs Brook originate in the southeast corner of town and join together west of the Appalachian Trail corridor, where they form the main stem of Jacobs Brook. It then flows towards the former settlement of Quinttown, where Mousley Brook flows into it. From that point Jacobs Brook flows westward along Quinttown Road, then along Route 25A west through Orfordville. Just east of Creamery Rd. at Tillotson Falls, Jacobs Brook turns to the northwest, along the east side of Townshed Road and meanders toward the Connecticut River.

Archertown Brook drains the central section of Orford and is a major tributary of the lower section of Jacobs Brook. The upper reaches of Archertown Brook flow through significant wetland areas and the lower reaches flow along Archertown Road. Archertown Brook enters Jacobs Brook below Tillotson Falls near Highbridge Road.

Indian Pond Brook, the outlet stream of Indian Pond, drains the northwestern section of town, and then flows into Piermont before entering the Connecticut River. At the outlet of Indian Pond, Indian Pond Brook flows through an extensive wetland complex on either side of Indian Pond Road. The Indian Pond Brook watershed drains the western slopes of Indian Pond Mountain and Pine Hill and the northern slopes of Cottonstone Mountain. Bean Brook is a northern tributary to Indian Pond Brook, located primarily in Piermont. The Bean Brook watershed drains the west side of Piermont Mountain and the brook rises in the south-central section of Piermont near Piermont Heights Road. Bean Brook flows through a large wetland complex in Clay Hollow before turning southward into Orford. In Orford, Bean Brook Road follows the stream, which meanders into Piermont and drains into Indian Pond Brook just east of NH Route 10.

In the southwestern section of town, Mud Turtle Pond drains southward into Lyme as part of the Clay Brook watershed that drains to the Connecticut River. Sawyer Brook drains the northern slopes of Kenyon Hill in Lyme and flows northward near Strawberry Hill Rd and then bends to flow westward near Route 25A. Sawyer Brook flows into Reeds Marsh on the Connecticut River.

Upper and Lower Baker Ponds lie in the northeastern corner of Orford, and are connected by Pond Brook. Between the two ponds, Brackett Brook joins Pond Brook, draining the northeastern side of Mount Cube. These mountain ponds and streams lie at the headwaters of the Pemigewasset watershed, which flows through the southern White Mountains and into the Merrimack River.

Existing and potential threats to the resource

Invasive species present in the Connecticut River threaten its water quality, native plant and animal communities, and recreational opportunities of the river itself as well as waterbodies nearby. Boaters and fishermen can and have unwittingly spread a number of unwanted plant species in and around New Hampshire. The Connecticut River Joint Commission's 2007

Connecticut River Aquatic Invasive Plants Outreach and Survey Project’s Final Report identified five invasive species in the river in Orford:

- Purple Loosestrife,
- Yellow Flag Iris,
- Eurasian Milfoil,
- Phragmites, and
- True Forget-me-not.

Invasive species are established in both the river’s main channel and the wetland areas at the mouth of Jacobs Brook. While not yet present in Orford, Didymo (a.k.a. “rock snot”) is a major concern in the Connecticut River; Didymo is an invasive algae species that grows in dense mats on river beds.

Land development may pose threats to water quality, whether the land is immediately on a shoreline or far from a stream or pond. Shoreline development and removal of native vegetation can contribute to increased sedimentation from bank erosion, runoff of lawn or agricultural chemicals or road salt, and increased water temperature. These may lead to degradation of water quality and the capacity to support fish and other aquatic organisms.

Current management and protection

The Connecticut River Joint Commissions (CRJC) acts as a voice for the Connecticut River in New Hampshire and Vermont. The CRJC is organized into five local river subcommittees, represented by volunteers appointed by each town; Orford is part of the Upper Valley River Subcommittee. In 2009, the CRJC published an update to the 2007 Water Resources Management Plan for each river subcommittee. The plan addresses water quality, river flow, water withdrawals and uses, land uses and riverbank erosion. The CRJC has also coordinated water quality testing, sediment pollution studies, river education and outreach, riparian restoration projects and a wide variety of other river protection projects all along the Connecticut River.

The Comprehensive Shoreland Protection Act is a state law regulating land use within 250-ft of public waters in the State of New Hampshire. Public waters are defined as lakes and ponds greater than 10 acres in size and rivers and streams of the fourth order or higher. In Orford, the Comprehensive Shoreland Protection Act applies to four ponds (Table 4) and the Connecticut River.

Table 4: Public Waters in the Town of Orford

<i>Waterbody Name</i>	<i>Acres</i>	<i>Elevation</i>
Indian Pond	142.0	1,111 ft
Lower Baker Pond	94.6	895 ft
Mason Pond	14.5	1,315 ft
Upper Baker Pond	185.5	901 ft

In recognition of the important conservation value of undeveloped shoreline, several landowners have placed conservation easements on roughly 20 percent of the Connecticut River shoreline in Orford, or 1.5 miles of Orford’s eight miles of shoreline (Table 5). The State of New Hampshire also manages a quarter-mile of shoreline as part of Reeds Marsh Wildlife Management Area. The Bunten easement and Wilson easements abut each other, protecting one full mile of continuous undeveloped shoreline.

Table 5: Conservation Land on the Connecticut River

<i>Conservation Land Name</i>	<i>River Frontage (miles)</i>
Bunten	0.33
Eck Riverfront (town-owned)	0.17
Lamb	0.20
Reeds WMA (state-owned)	0.26
Richmond (town-owned)	0.11
Wilson, A	0.19
Wilson, G	0.54
<i>River Frontage Protected from Development: 1.8 miles</i>	

The four ponds in Orford are largely undeveloped, with the exception of Upper Baker Pond, where two summer youth camps and several lakefront homes have been built on or near the shoreline. There is also Camp Pemigewasset on Lower Baker Pond in the town of Wentworth.

Jacobs Brook, Archertown Brook, Indian Pond and the Upper and Lower Baker Ponds have been routinely tested for contaminants during the last half-dozen years by the Orford Conservation Commission.

Each month, from June through September, volunteers take water quality samples at three locations on Jacob’s Brook and one location on Archertown Brook. Three of the measures (temperature, dissolved oxygen, pH) are indicators of the ability of the waterway to sustain fish and other aquatic species. Over the years, these measures show that important attributes vary consistently from season to season in local waterways, providing good habitat for fish and other aquatic creatures. Volunteers also test for the level of E. coli bacteria in the brooks, which has detected a seasonal cycle in Jacob’s Brook. Throughout the summer, large animal activity in the large bogs that constitute the headwaters of Jacob’s Brook gradually increases the presence of bacteria. Heavy rainfall flushes the bogs into the brook, yielding spikes in E. coli colony counts. Sampling has also detected a couple of unusual events which have been attributed to possible illegal dumping of black-water from campers leaving the area.

Each year, one of the three largest ponds in town is tested for the usual water quality indicators and for the presence of the heavy metal, mercury. Upper and Lower Baker Ponds have long been sites of boys and girls summer camps. When these waters were tested, both E. coli bacteria and mercury were below detectable levels in all sample locations in all of the ponds.

Recommendations for resource protection

- The Conservation Commission should consider participating in the Volunteer Lake Assessment Program (VLAP) on Upper Baker Pond. VLAP is a water-quality monitoring program coordinated by the NH Department of Environmental Services; in 2010, 153 lakes and ponds were participating in the program. VLAP volunteers test the waters each summer in many lakes in neighboring towns, including Lakes Armington, Katherine and Tarleton in Piermont, Post Pond and Reservoir Pond in Lyme, and Canaan Street Lake and Goose Pond in Canaan. It is common for lakefront homeowners and homeowner’s associations to become active volunteers in the water quality testing.
- The Conservation Commission should continue to support land conservation efforts that protect surface waters and shorelines, building on previous private and public conservation efforts that have protected shorelines along the Connecticut River and Indian Pond Brook.
- The Conservation Commission should educate and work with willing landowners who want to restore riverbanks and shorelines. The Connecticut River Joint Commissions has published an excellent series of worksheets describing the value of riparian buffers and the USDA has technical resources available to assist farmers.
- The Planning Board should encourage the use of Low Impact Development techniques and stormwater infiltration systems to protect water quality.
- The Conservation Commission should work to educate landowners on the threat of invasive species and options for management. The Conservation Commission should work to control invasive species on town-owned or town-managed properties.

5.0 Wetlands

Wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetland areas include, but are not limited to, swamps, marshes and bogs.

In New Hampshire, a certified wetland scientist identifies the location of a wetland through field delineation, taking the vegetation, hydrology and soil types into account. It has been unfeasible to complete a nation-wide field delineation of wetlands, and so the US Fish and Wildlife Service mapped wetlands based on aerial photography, resulting in The National Wetlands Inventory, or NWI. Also, the Natural Resources Conservation Service has identified and mapped soils with poor drainage, which is one of the three wetland indicators, in their county soil surveys. The NWI tends to underestimate the acreage of wetlands, as smaller wetlands were not captured using this methodology, and using the soils data from the County Soil Survey tends to overestimate wetlands coverage, as the soil survey generalizes soil characteristics (Table 6). Both of these sources of information have been used to paint a general picture of the major wetlands in Orford. There are certainly many smaller wetlands that could only be mapped on a site-specific basis by a certified wetland scientist.

Table 6: Estimates of Wetlands Acreage

<i>Data Source of Wetlands Mapping</i>	<i>Acres</i>
National Wetland Inventory, US Fish and Wildlife Service	691
Soils with Poor or Very Poor Drainage, Grafton County Soil Survey	1,758

Wetlands in Orford are most often associated with headwater streams and ponds. Extensive wetlands are found along the North and South Branches of Jacobs Brook, the Mud Turtle Pond stream corridor, the upper reaches of Archertown Brook, and around Indian Pond, Upper Baker Pond and Lower Baker Pond.

There are two large wetland areas along the Connecticut River in Orford, at the mouth of Jacobs Brook and at Reeds Marsh.

There is a wide variety of the types of wetlands. They may be forested, grassy, or covered in shrubs, and may be connected to a stream, lake, groundwater spring, or they may be separate and fed only by rainwater. This variety in the types of wetlands results in a diversity of wetland functions. Some wetlands are more important for flood control or nutrient retention, while others may be better for wildlife. The NWI classified each wetland into a category based on its dominant type of vegetation (Table 7).

Table 7: NWI Wetland Types in Orford

<i>Wetland Type</i>	<i>Acreage</i>
Emergent (e.g., cattail, reeds)	116
Forested	228
Scrub-shrub	241
Other	106
<i>Total Acres</i>	<i>691</i>

Wetlands provide a great number of natural services, including groundwater recharge, erosion control and shoreline anchoring, flood control and floodwater storage, sediment and nutrient trapping, and wildlife habitat for aquatic, semi-aquatic and terrestrial animals. Some wetlands also offer education and recreation opportunities.

A vernal pool is a special type of small wetland that is generally not included in the National Wetlands Inventory. This is an intermittently flooded small pond that is filled with water in the spring and early summer, but dries up completely during the rest of the year. Vernal pools provide critical breeding habitat for many amphibians, as the intermittent nature of these ponds do not support aquatic predators, like fish. Amphibians breeding in vernal pools in New Hampshire include marbled salamanders, wood frogs, spotted salamanders, and Jefferson or blue-spotted salamanders. These species depend on vernal pools, which make this wetland type a highly important resource.

Existing and potential threats to the resource

Wetlands suffer many of the same threats as surface waters. Encroachment into a wetland eliminates some of the function of the wetland, and land clearing and development can degrade wetland function as well. Additional stormwater runoff can pollute and overwhelm the flood storage capacity of wetland areas, changing the water quality and flow in a watershed. Land clearing around wetlands can have especially harsh consequences for the quality of the wildlife habitat, particularly for migratory amphibians and other animals that require both wetland and upland habitat.

Beavers play an important role in the formation and development of many wetlands in New Hampshire. Often referred to as “ecosystem engineers”, beavers can enlarge existing wetlands and create new ones along stream corridors and ponds by building dams and flooding upland areas. This activity creates excellent habitat for moose, turtles, warm-water fishes, a variety of birds, and dragonflies and damselflies, but sometimes leads to undesired consequences for adjacent landowners, including flooded roads, driveways, yards, fields and basements.

Current management and protection

NHDES Wetlands Bureau administers a permitting program for any dredge, fill or construction in wetlands and surface waters, pursuant to RSA 482-A. In addition, the NHDES Subsurface Bureau requires that new septic systems be set back from poorly and very poorly drained soils. The Orford Conservation Commission receives copies of state wetlands permits for its review.

Reeds Marsh is partially protected by a State Wildlife Management Area. Conservation easements also protect wetland areas above Upper Baker Pond, along Indian Pond Brook, and on the Connecticut River near Grimes Hill Road.

Recommendations for resource protection

- The Conservation Commission should continue to support land conservation efforts that protect wetlands, in particular vernal pools, which provide outstanding wildlife habitat.
- The Conservation Commission should present educational workshops on vernal pool ecology, identification and stewardship to raise awareness of these particularly important wetlands.
- The Conservation Commission should provide information to landowners on methods to address beaver-caused flooding, such as baffles and “beaver deceivers.”

6.0 Floodplains

Floodplains describe the area of land adjacent to a river or stream that may flood. The Federal Emergency Management Agency has mapped floodplain and flood-prone areas with their Flood Insurance Rate Maps, defining Special Flood Hazard Areas as those areas that would be inundated by a 1-percent annual chance flood, also referred to as the base flood or 100-year flood.

In Orford, floodplains have been mapped along the Connecticut River, Jacobs Brook, Archertown Brook and Pond Brook. The Connecticut River floodplain lies primarily west of Route 10, and the floodplains for the brooks are relatively narrow. The total acreage within the Special Flood Hazard Areas is 2,141 acres, which includes the area of the Connecticut River, Indian Pond, Upper Baker Pond and Lower Baker Pond at ordinary high water.

Floods are the most common and most costly natural disaster, and leaving floodplains as open space helps to slow and absorb floodwaters. Floodplains also provide unique wildlife habitats and a transition between the river ecosystem and upland ecosystem. The Connecticut River floodplain is known for having some of the richest agricultural soils in the world.

Existing and potential threats to the resource

Development in the floodplain increases stormwater runoff and, at the same time, reduces the absorption capacity of the floodplain, increasing the severity of floods. Development also increases the risk of environmental contamination during a flood event, if the flooding affects septic systems and carries away home heating fuel or other household chemicals.

Undersized or failing culverts pose another threat to flood-prone areas. Insufficient culverts can easily be blocked by debris and overwhelmed by floodwaters, which can exacerbate flooding, lead to road and culvert washouts, create additional bank streambed erosion and also serve as barriers for fish migration.

Current management and protection

The Town of Orford does maintain a floodplain development ordinance and participates in the National Flood Insurance Program, which allows homeowners to purchase flood insurance. The Town of Orford also has an up-to-date Hazard Mitigation Plan, which assesses the risk of several natural hazards, including flooding, and identifies mitigation strategies to reduce the impact of natural hazards.

Recommendations for resource protection

The following recommendations have been excerpted from the CRJC Water Resources Management Plan for the Upper Valley River Subcommittee, published in 2009:

- The Planning Board should encourage developers and landowners to establish and/or maintain buffers of native vegetation along rivers and streams for privacy, pollution control and habitat.
- The Conservation Commission should work with public agencies and private landowners to retain current natural flood storage, such as in wetlands and floodplains.
- The Town of Orford should undertake a survey of culverts and bridges to identify those that are undersized, also noting if they block fish passage, and seek grants for replacing them where necessary. The Nature Conservancy and Trout Unlimited are two organizations that have been active in fish passage/culvert studies in other areas of New Hampshire.

7.0 Groundwater Resources

Groundwater provides drinking water for all Orford residents, supplies water for irrigation and commercial uses, and also recharges ponds and streams, sustaining aquatic ecosystems in times of low water or drought. In New Hampshire, groundwater supplies are classified into two major groups: sand and gravel aquifers and within fractures or cracks in bedrock.

Sand and gravel aquifers have the greatest potential for development for community wells, but are limited in their extent to only 10% of the State of New Hampshire. In Orford, 12% of the town’s land and waterbodies are underlain by sand and gravel aquifers. These aquifers are located generally along the Connecticut River, lower Jacobs Brook in the vicinity of Townshed Road and Jacobs Brook in Orfordville, as well as around the Upper and Lower Baker Ponds.

Wells in fractured bedrock generally provides lower yields than sand and gravel aquifers, however, the yield is usually sufficient for residential use. In New Hampshire, 85% of water extracted by private domestic wells comes from fractured bedrock wells.

While most residents of Orford rely on private wells for their drinking water, the Orford Village District serves 51 connections and approximately 128 residents in the village area of Orford on Archertown Road, Routes 10 and 25A, and Bridge Street. The Rivendell campus of the Rivendell Interstate School District, located just east of Route 10, has its own water supply. In addition, there are five other active public water systems registered with NHDES, as of September 2010 (Table 8). A public water system is defined as “a system that provides water via piping or other constructed conveyances for human consumption to at least 15 service connections or serves an average of at least 25 people for at least 60 days each year.”

Table 8: Active Public Water Wells in Orford

<i>Public Water Supply Name</i>	<i># Served</i>	<i>Well Type</i>
Orford Village District	128	2 Bedrock Wells
Rivendell Interstate School	282	Bedrock Well
The Pastures Campground	145	Point Well
Camp Merriwood	170	Bedrock Well
Camp Moosilauke	200	Bedrock Well
Indian Woods	50	Bedrock Well
Peyton Place	45	Gravel Well

Existing and potential threats to the resource

The most pressing threat to groundwater in Orford is the contamination of groundwater through manmade pollution. It should be noted that some groundwater contaminants are natural in origin, such as radon and uranium. The New Hampshire Water Resources Primer, published in 2008 by New Hampshire Department of Environmental Services, identifies three main causes of groundwater contamination:

- leaking underground storage tanks,
- heating oil tank leaks or spills, and
- hazardous waste releases.

Road salt and fertilizers have also degraded groundwater quality in certain locations within New Hampshire.

As the population of New Hampshire grows, concerns are being raised about the quantity of groundwater, as well as the quality. More development leads to more areas of impervious surface, which reduces the recharge of water to the bedrock or sand and gravel aquifers. At the same time, more development leads to increased demand for groundwater.

Current management and protection

Public water systems in Orford (Table 8) are required by the State to test their water and ensure it meets standards for safe drinking water. The State also requires well drillers to report the locations, depths and yields of new wells, which provides an important source of data to study groundwater availability.

The Town of Orford currently participates in the Household Hazardous Waste Collections organized by the Upper Valley Lake Sunapee Regional Planning Commission. 2010 was the first year that unwanted medicines were accepted, in addition to household chemicals. This program reduces the improper disposal of toxic substances and the threat of groundwater contamination.

Several farms in Orford practice sustainable farming methods that strive to protect safe drinking water. Landowners who have sought Tree Farm certification demonstrate their commitment to sustainable forestry and commitment to protecting natural resources, particularly surface waters.

Recommendations for resource protection

- The Planning Board should consider developing a Water Resource Protection Plan per RSA 4-C:22. This plan requires an inventory of a community's water resources and an analysis of the demands and threats to those resources. Once adopted, a water plan becomes an element of the Town Master Plan and may be implemented through the adoption and enforcement of municipal ordinances. This recommendation reflects a similar strategy identified in the 2001 Master Plan, Section 7.4.
- The Planning Board should also encourage the use of Low Impact Development techniques and stormwater infiltration systems to protect water quality.
- The Town of Orford should continue to encourage residents to participate in household hazardous waste collections and unwanted medicine collections.
- The Conservation Commission should consider drinking water protection when evaluating land conservation projects. Grant funding may be available to protect areas around the community's water supplies.

8.0 Agricultural Resources

Agriculture in Orford is an important component of the local economy and the character of the town. Farms provide produce, milk, meat, maple syrup and other products, provide employment inside the community, and also provide a number of indirect benefits to residents. Farms maintain open space that is often enjoyed for recreational purposes, serves as important wildlife habitat, and protects scenic views. In addition, farmland makes few demands on community services while contributing property taxes to the town’s budget.

Commercial farms are defined by the USDA as a farm operation that grosses \$1,000 or more in farm sales per year. In the past, dairy farms were the dominant type of agriculture, but over the past few decades, farmers have diversified their production. In addition to these farms, some landowners lease their land for agricultural use by other farmers, and many residents raise vegetables, fruits, chickens and/or livestock, keep beehives for honey or engage in maple sugaring on a smaller scale.

Table 9 shows the diversity of farming in Orford in 2010, developed from the 2010 Valley Food and Farm Guide, interviews with local farmers and the local knowledge of the Orford Conservation Commission.

Table 9: Commercial Farms in Orford

<i>Farm Name</i>	<i>Location</i>	<i>Product(s)</i>
Wm H. Baker and Sons, Cube Mtn. Products, Schoolhouse Gardens – Kathy Baker and family	Baker Road	Fresh and Dried Flowers Wreaths and Decorations Raspberries
Mt. Cube Sugarhouse, Mt. Cube Farm - Peter Thomson	Route 25A	Maple Syrup and Maple Products Corn Gifts
Taylor Farm - Larry Taylor	Indian Pond Road	Hay Milk Wood Shavings Production
Echo Hill Farm - Craig and Sarah Putnam	Grimes Hill Road	Vegetables Blueberries Cut flowers Eggs Maple Syrup Evergreen Garlands
O’Brien Family Christmas Trees	Tree Farm Rd (off Route 10)	Choose-and-Cut Christmas Trees
River Valley Farm – George and Sherre Tullar	Route 10, Route 25A and Strawberry Hill Road	Flowers and Vegetables Corn Hay Pasture Greenhouse and Farmstand Compost, Manure, Topsoil, Mulch

Natural Resources Inventory – Town of Orford, New Hampshire

<i>Farm Name</i>	<i>Location</i>	<i>Product(s)</i>
Tullando Farm – George Sr., Rendell and Nate Tullar	Route 10	Milk
Nichols Tree Farm – William Nichols	Indian Pond Road	Maple Syrup Christmas Trees Forest Products
Arthur Dennis	On CT River	Sweet Corn
Steve Stocking, Birch Meadow Farm, Fairlee	Leased Land On CT River	
Gladstone Farm, Fairlee/Bradford	Leased Land On CT River	
Robie Farm, Piermont	Leased Land On CT River	
Cottonstone Farm	On CT River	Cut Flowers
Bunten Farm	Route 10	Milk, Dairy Products Beef, Pork, Eggs Vegetables Farmstand, Restaurant Honey
Strawberry Hill Farm	Strawberry Hill Road	Beef Cows
George Schwarz and family	Route 25 A	Beef Cows
Brigadoon Herb Farm – Kelley Monahan	Grimes Hill Road	Organic Vegetable Seedlings Culinary and Medicinal Herbs Habitat Perennials
Pease & Carter’s Scenic Valley Maple Products – Toni and Gerald Pease	East Cemetery Road	Christmas Trees Forest Products Maple Syrup and Maple Candy Wreaths and Garlands
Sunday Mountain Maple Farm – Paul Sr. and Betty Messer	Route 25A and Quinttown	Maple syrup and Maple products

Another important resource for agriculture is the type of soil. In the Grafton County Soil Survey, there are three classes of agricultural soils, so chosen by their relative value for raising crops or livestock:

- Prime Nationally Ranked Farmland, covering 1,523 acres in Orford (5% of the land area)
- Farmland of statewide importance, covering 735 acres (2% of the land area), and
- Farmland of local importance, covering 4,310 acres (15% of the land area).

These classes represent the capability of the soil for agricultural production, and not the current use of the land. Prime farmland soils, or the best soils for the production of food, feed, fiber, forage, and oilseed crops, have been designated for the purpose of carrying out the provisions of The Farmland Protection Policy Act of 1981. This Act was established to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. Farmland of statewide and local importance is determined by a state and county committee, respectively, and represent soil types that do not qualify as “prime” but are still important to state and local agriculture.

Existing and potential threats to the resource

The economics of commercial farming can pose serious challenges for farmers to continue farming and transfer the operation to the next generation. Total farmland in New Hampshire has declined dramatically in the past half-century, from 903,000 acres farmed in 1964 to 472,000 acres farmed in 2007, according to the US Census of Agriculture (rounded to the nearest 1,000 acres). In the past two decades, the rapid decline has slowed and total farmland acreage has begun to increase, from a low of 386,000 acres farmed in 1992 to 472,000 acres in 2007.

Much agricultural land is flat with good drainage and highly suitable for residential development, which poses a real threat to the finite resource of agricultural soils. Residential development renders agricultural soils unusable for farming, effectively eliminating this resource. Orford's highest ranked soils are located mainly along the Connecticut River, which is also land very much in demand for development.

Current management and protection

Farm diversification or specialization has enabled many farms in Orford to remain open. Several farmers lease land from other landowners in Orford, which allows the land to stay in productive use without the expense of owning all the land put on any single farmer.

Organic certified and other natural practices of low-herbicide/pesticide farming and pasture-raising of meat products increases their value in the marketplace. Local foods and value-added products are becoming increasingly popular, and local farmers' markets and publications like Valley Food and Farm help connect farmers directly with consumers.

In 2009, 1,655 acres were enrolled in Current Use as farmland in Orford, or 6.6% of the town's land area, which provides a decrease in tax assessment on the property and a financial incentive to maintain the land in agricultural production. This figure does not include the woodlots or sugarbushes that many farms also own and operate, and parcels owned by small landowners who have not enrolled their land in Current Use.

In 1989, three contiguous Orford farms along Route 10 and the Connecticut River generously placed permanent conservation easements on their farms under the State of New Hampshire Land Conservation Investment Program. Evelyn and Forrest Bunten placed over 183 acres under easement of which over 40 acres are prime agricultural soils of national importance. George and Mildred Wilson placed nearly 88 acres under easement of which over 60 acres are prime agricultural soils of national importance. Alfred and Alma Wilson placed over 17 acres under easement of which all 17 acres are prime agricultural soils of national importance. The town-owned Richmond Conservation Land consisting of 11 acres of prime agricultural soil has been placed under conservation easement held by Upper Valley Land Trust. Other conserved farmland includes a lot owned by the Rivendell Interstate School District just north of the junction of Route 25A and Route 10, the lot just north of this owned by Ann Green, and Ted Eck owns some conserved farmland along the river north of town. Opportunities for financial assistance in future land conservation projects of farmland do exist - the US Department of Agriculture's Farm and Ranchland Protection Program and New Hampshire's Land and Community Heritage Program (LCHIP) are two grant programs that specifically look to place agricultural land in conservation.

Recommendations for resource protection

- The Town should support the continuation of Current Use taxation.
- The Conservation Commission should work with landowners and local land trusts to identify farmland and areas of prime agricultural soils that should be protected.
- The Town should consider establishing a Local Agricultural Commission to advise town boards on agricultural issues and advocate for farming.

9.0 Forest Resources

Forests provide timber products and can also be managed to produce non-timber forest products, such as wreaths, Christmas trees and maple syrup. In addition, forests filter pollutants from the air, protect water quality, and support a variety of wildlife and native plant species. Many but not all forestlands are open for public recreation, including snowmobiling, hunting and hiking. The forested landscape of Orford plays an important role in defining the rural nature of the town.

Today the Town of Orford is dominated by a forested landscape, as the hill-farms were abandoned 150 years ago, their open fields have largely reverted to forest. As of 2009, 75% of Orford’s land area (22,249 acres) was enrolled in current use as forestland, either managed or unmanaged. There are 26 Tree Farms in Orford, consisting of 10,900 acres. In addition to land enrolled in current use, the backlots of many residential or publicly-owned parcels are wooded.

The Grafton County soil survey classifies soil types by their capability to support sufficient tree growth for commercial forestry operations. which are broken into 5 classes: IA, IB, IC, IIA, and IIB. The dominant tree species on these soil types varies depending on the successional stage of the forest or stand. Orford is exceptionally rich in these forest soils, covering 99% of the land (Table 10).

Table 10: Important Forest Soils Groups in Orford

<i>Forest Soil Group</i>	<i>Acreage</i>	<i>Percent of Town</i>
IA	8,345	28%
IB	7,697	26%
IC	758	3%
IIA	9,839	33%
IIB	2,637	9%
Non- Forest Soils	439	1%
<i>All Land in Orford</i>	<i>29,715</i>	<i>100%</i>

Group I soils are the best soils for forest management and are the most favorable for growth. Group IA soils are the best soils for hardwood production because they are relatively deep, fertile, and well-drained. Group IB soils are slightly less fertile and sandier than Group IA soils; tree growth is not quite as vigorous. Group IC soils are composed of outwash sands and gravels, and are ideally suited to softwood production.

Group II soils have significant limitations with regards to either tree growth or management because of more severe physical features. Group IIA soils are similar in productivity to Group IA and IB soils, but have physical features that make management more difficult, such as steep slopes, erosion-prone soils, rocky outcrops, surface boulders or extreme rockiness. Group IIB soils are poorly drained and therefore generally have lower productivity and significant management limitations.

Existing and potential threats to the resource

Similar to agriculture, the economics of forestry pose challenges to landowners reliant on timber harvest income to maintain ownership of their land. Conversion of forest land to development serves to eliminate the economic resource for timber harvesting and also degrades the quality of the surrounding forest to provide wildlife habitat and other ecosystem benefits.

Another threat to forest resources is the over-harvesting of forest products. Proper forest management allows sustainable regeneration of forests and avoids soil erosion and compaction.

Invasive species can undermine the natural forest community and the wildlife that depends on it as well as hamper native tree regeneration. In Orford, Norway Maple, Japanese Barberry, Japanese Knotweed and Russian Olive have established populations. Non-native diseases and nuisance insects, such as the Hemlock Woolly Adelgid, Asian Long-Horned Beetle, and Emerald Ash Borer could pose a threat in the future to the specific tree species they attack as well as the overall health and composition of forests.

Current management and protection

The Current Use program provides an incentive for landowners to practice long-term forest management and stewardship. A landowner can receive a lower tax assessment on forestland, provided that the land is a Certified Tree Farm or has a forest stewardship plan. Privately-owned forests that are enrolled in this Forest with Stewardship category cover 14,415 acres in Orford, or almost 50% of the town's land area, according to 2009 Current Use records.

Stream crossings and wetlands impacts during timber harvesting operations are regulated by the State of New Hampshire through the Department of Environmental Services. In addition, the Department of Resources and Economic Development has developed Best Management Practices for erosion control on timber harvesting operations and the University of New Hampshire's Cooperative Extension foresters provide technical assistance and information to forestland owners. The Orford Conservation Commission receives copies of state wetlands permits.

New Hampshire state law makes it possible to track timber harvests over time. Timber is considered real estate and is assessed a tax at the time of harvest. Prior to a timber harvest, a landowner must file Intent to Cut to the Town, as required by RSA 79:10. In the past two years (2008-2009), just over 850 acres were harvested on 37 parcels. In the past five years, timber tax revenues in Orford have remained fairly stable between \$14,000 and \$22,000.

Recommendations for resource protection

- The Town should support the continuation of Current Use taxation.
- The Conservation Commission should work with landowners and local land trusts to identify forestland that should be protected.
- The Conservation Commission should educate residents and visitors about the importance of using local firewood to avoid transporting insects or diseases.
- The Conservation Commission should work to educate landowners on the threat of invasive species and options for management. The Conservation Commission should work to control invasive species on town-owned or town-managed properties and be on the lookout for new invasive species coming into Orford.

10.0 Wildlife and Native Plant Resources

The undeveloped nature of Orford provides abundant habitat for wildlife. The Connecticut River and its associated wetlands, such as Reeds Marsh and the outlet of Jacobs Brook, provide important aquatic habitat as well as a stopover point for migratory waterfowl. Agricultural fields and pastures can provide bird nesting sites, habitat for small mammals and food supplies for turkey, white-tailed deer, black bear, snakes and birds of prey. The edge habitats between open fields and woodlands serve another group of wildlife species, including white-tailed deer. Deep forest provides shelter and space for large mammals including bobcat, white-tailed deer, moose and black bear as well as a number of owls, songbirds and smaller mammals. Wetlands support a unique assemblage of wildlife, including beaver, moose, songbirds, waterfowl and a variety of amphibians.

Local resident Bry Beeson has documented 33 species of dragonflies and damselflies in the Mud Turtle Pond area of Orford (see Appendix B for a complete list). The collection of data in Orford is part of an ongoing, five-year study by the New Hampshire Audubon. Dragonflies and damselflies are in the insect order Odonata, and represent a most interesting group of widely seen “bugs.” There are about 165 Odonata species in the State of New Hampshire, and they serve as indicators of a clean, toxic-free environment. Clean water in ponds, lakes, vernal pools, and brooks is extremely important for all of us. Sampling will continue in 2011 with the hopes of finding more species in Orford.

Jeff MacQueen and Bill McKee both provided lists of birds seen in Orford (Appendix B). Jeff MacQueen’s lists contains nearly 200 bird species identified here over the past twenty years, indicating that Orford’s landscape provides an unusually rich habitat for birds in comparison to many other New Hampshire towns. This is likely due to the town’s diversity, ranging from the Connecticut River as a very significant migration corridor, to the higher altitudes of Mt. Cube and other uplands, and including forests, open fields, extensive wetlands at Reed’s Marsh and elsewhere, and relatively large ponds. Records from long-term residents also help to document the recovery or decline of bird populations. Bill McKee reports that he spotted a Bald Eagle on Indian Pond in 1953 and did not see another until 2000 on the Connecticut River. New

Hampshire Audubon reports that nine bald eagle pairs nested on the Connecticut River in 2010, four in New Hampshire and five in Vermont, up from a single nesting pair in 2000. In the spring of 2011, a Bald Eagle nest was identified on the edge of Reed’s Marsh.

New Hampshire Fish and Game Department coordinates a volunteer Reptile and Amphibian Reporting Program (RAARP) to report sightings of reptiles and amphibians around the state. Through this program and other state records, there are documented occurrences in Orford of two turtles, three snakes, six salamanders, and eight frog/toad species. Jeff MacQueen has also compiled a listing of reptiles, including in Appendix B.

Table 11: Reptiles and amphibians documented in Orford

<i>Turtles</i>	<i>Salamanders and Newts</i>	<i>Frogs and Toads</i>
Snapping turtle	Dusky salamander (H)	Bullfrog (H)
Wood turtle	Eastern red-spotted newt	Green frog
	Redback salamander	Northern leopard frog
<i>Snakes</i>	Spotted salamander	Pickerel frog
Common garter snake	Spring salamander (H)	Wood frog
Smooth green snake (H)	Two-lined salamander (H)	Gray tree frog
Redbelly snake		Spring peeper
* H – last recorded sighting prior to 1988		American toad

Several Orford residents have kept lists of animals seen on their property or other locations around town; their lists are included in Appendix B. David Coker and Helen Nagy report 32 mammal species seen on the Settlement Farm in Orfordville in the past twenty years, including two species of bat and bobcat tracks. Bill McKee reports 25 mammal species, including a lynx on Eastman’s Ledges on Mount Cube in 1950 and 1965.

The New Hampshire Natural Heritage Bureau maintains a database of occurrences of rare, threatened, and endangered species. Seven animal species on this list have been documented in Orford (Table 12). Of particular significance is the marsh wren; there is only one documented report of this bird in the entire state.

Table 12: Rare, threatened or endangered animal species in Orford

<i>Species</i>	<i>Status</i>
Bald eagle	Monitored (US), Threatened (NH)
Common loon	Threatened (NH)
Marsh wren	Rare, Monitored (NH)
Pied-billed grebe	Threatened (NH)
Wood turtle	Species of Concern (NH)
Northern leopard frog	Species of Concern (NH)
Dwarf wedge mussel	Endangered (US & NH)

The diversity of plant species in Orford sustain the natural communities of different forest types, floodplain areas, wetlands and meadows. These natural communities sustain the habitat of the

wildlife described in the paragraphs above, and contain a wide array of individual plant species, each a valuable component of the community. Sarah Schwaegler has been documenting the botanical richness of Orford over many years and has compiled an impressive listing of ferns, wildflowers, vines, shrubs and trees, both native and non-native, that she has seen in Orford. She reports that most species are adapted to grow well in the acidic soils of New Hampshire. Her findings are summarized and listed in Appendix C.

The Natural Heritage Bureau also catalogues rare, threatened and endangered plant species in its database. In Orford, there have been four documented species included in the Bureau’s database; they are all listed as endangered under the New Hampshire Native Plant Protection Act of 1987 (NH RSA 217-A). Sarah Schwaegler has also identified several other species of rare plants in Orford (listed in Appendix C).

Table 13: Rare, threatened or endangered plant species in Orford

<i>Species</i>	<i>Status</i>
Climbing Fern	Endangered (NH)
Purple Clematis	Endangered (NH)
Reversed Bladderwort	Endangered (NH)
Sago Pondweed	Endangered (NH)
Wapato	Endangered (NH)

The Natural Heritage Bureau has not exhaustively surveyed the state, so it is possible that more rare species do occur within Orford. If town residents have information about rare species occurrences, they should contact the Natural Heritage Bureau. Their website is <http://www.nhdf.org/about-forests-and-lands/bureaus/natural-heritage-bureau/>.

The New Hampshire Fish and Game Department recently updated an analysis of habitat condition, which was published in the New Hampshire Wildlife Action Plan (first published in 2006, updated 2010). Habitat types were mapped and then ranked according to their condition and risk of degradation. Measuring habitat condition entailed a lengthy analysis of various factors that impact wildlife, related to the landscape context, biodiversity, human recreation, development and land use, and air and water quality. For a thorough description of this analysis, please refer to the New Hampshire Wildlife Action Plan available online at the Fish and Game website: http://www.wildlife.state.nh.us/Wildlife/wildlife_plan.htm.

The analysis resulted in four classes:

- Tier 1 - Highest ranked habitat in the state (top 10-15%) – 10,272 acres in Orford;
- Tier 2 - Highest ranked habitat in the biological region – 4,794 acres;
- Tier 3 - Supporting landscapes important to highest ranked habitats – 13,768 acres;
- Habitat not highly ranked – 1,744 acres.

Tier 1 wildlife habitat is of greatest conservation priority because it represents the top 10-15% of habitat in the entire state. Tier 2 wildlife habitat is also of high conservation priority because each part of the state has unique species and habitat types that are important on a regional scale.

Tier 3 wildlife habitat helps maintain the high level of biological integrity of Tier 1 and Tier 2 habitat; an example of Tier 3 habitat is the watershed surrounding a high-quality stream corridor.

Tier 1 habitat in Orford consists of aquatic, wetland and terrestrial habitat. The Connecticut River and its tributaries in Orford (not including those streams that flow southward into Lyme) as well as Indian Pond were highly ranked for their outstanding aquatic habitat and adjacent riparian habitat. Wetland habitats ranked as Tier 1 included three areas of marsh complexes on the south branch and north branches of Jacobs Brook and an unnamed tributary to Jacobs Brook east of Route 25A. In addition, a riparian area south of Reeds Marsh was ranked as Tier 1 because of an occurrence of a rare, threatened or endangered species. Tier 1 terrestrial habitat in Orford is the matrix forest, which describes large blocks of forested land; in Orford, the most common matrix forest type is hemlock-hardwood-pine forest on the western and northern side of Orford and northern-hardwood-conifer forest on the eastern side of town. Other less prevalent matrix forest types include Appalachian oak-pine forest in lower elevations, high-elevation spruce-fire forest on Mount Cube and Smarts Mountain, and lowland spruce-fir forest scattered throughout town. The largest areas of Tier 1 matrix forest habitat in Orford occur in the general vicinity of Mount Cube, Indian Pond, Quinttown, and Upper and Lower Baker Pond.

Tier 2 habitat in Orford is comprised of aquatic and terrestrial habitats. The aquatic habitats are ranked Tier 2 for the Connecticut River tributaries draining southward into Lyme and 15 small ponds scattered throughout town, including Mud Turtle Pond, Archertown Brook and the east side of Rt 10 on the southern edge of town. Terrestrial habitats ranking Tier 2 include numerous areas of grasslands and a few isolated areas of floodplain forest along the Connecticut River. Matrix forest comprises a large area of Tier 2 habitat in multiple areas around Orford.

Descriptions of the Tier 1 and Tier 2 habitats in Orford are included in Table 14. It is important to note that some of the highly-ranked habitats in Orford overlap, e.g. riparian areas and wetlands also located within a matrix forest block.

Table 14: Important wildlife habitat types and areas in Orford

Tier 1 Habitat in Orford		
<i>Habitat Type</i>	<i>Acreage</i>	<i>General Location(s)</i>
Rivers and riparian areas	4,479	Connecticut River and tributaries entering river in Orford
Marsh complexes	140	Jacobs Brook tributaries (south/north branches, unnamed)
Lake and riparian area	242	Indian Pond and its shoreline
River and riparian area	73	Location on Connecticut River south of Reeds Marsh
Matrix Forest	7,149	Central and eastern sections of Orford
Tier 2 Habitat in Orford		
<i>Habitat Type</i>	<i>Acreage</i>	<i>General Location(s)</i>
Rivers and riparian areas	359	Connecticut River tributaries draining to Lyme
Floodplain forest	15	Connecticut River and tributaries in NW and SW corners (3 sites)
Grasslands	740	4 areas near Connecticut River
Grasslands	219	3 areas in central Orford, near 25A and Archertown Rd
Grasslands	39	1 area near Quinttown
Small Ponds	88	15 ponds throughout Orford
Matrix Forest	3,684	Central and eastern sections of Orford

Existing and potential threats to the resource

Habitat loss and degradation are the primary threats to wildlife in New Hampshire. It is not just the loss of forest or other habitat that harms wildlife, but the cumulative effects of landscape fragmentation. Landscape fragmentation describes the process of human development dividing undeveloped lands into increasing small and disconnected pieces, through the clearing of native vegetation and the building of roads, utility lines, buildings and other structures.

Landscape fragmentation has many effects on the quantity and quality of wildlife habitat:

- Decrease in the acreage of undeveloped areas,
- Loss of connectivity between habitats,
- Increased potential for movement of invasive or damaging species into native plant communities, which degrades food resources and nesting sites,
- Increased potential for vehicle-wildlife collisions, and

- Increased potential for undesirable human-wildlife interactions, e.g., nuisance bears and flooding of residential areas by beaver activity.

Vehicle-wildlife collisions are dangerous for both humans and large wildlife but not always fatal; however, mortality may be exceedingly high for reptiles and amphibians crossing roadways in order to reach their spring breeding grounds.

Invasive species can crowd out native plants and diminish the value of wildlife habitat. Sarah Schwaegler reports that Common Buckthorn, non-native Honeysuckles, and Barberries, Purple Loosestrife, and Japanese knotweed are established in Orford, and has also identified Wild Chervil and Garlic Mustard.

Each plant and wildlife species has its own habitat requirements and is susceptible to a unique set of threats. The New Hampshire Wildlife Action Plan contains more information on the threats specific to each wildlife habitat/natural community type and to species of concern.

Current management and protection

As of March 2010, the New Hampshire Fish and Game Department calculated that 9.3% of the Tier 1 habitat, 12.3% of Tier 2 habitat, and 8% of Tier 3 habitat in Orford is conserved land, in either private or public ownership. The Reeds Marsh Wildlife Management Area helps protect an important wetland complex. All conservation lands provide undeveloped spaces for wildlife habitat.

New Hampshire Fish and Game Department, US Fish and Wildlife Service, New Hampshire Audubon, The Nature Conservancy, The Loon Preservation Committee, and numerous other non-profit organizations work to protect wildlife. The Silvio Conte National Wildlife Refuge, established in 1991, works to protect the wildlife and its habitat in the Connecticut River watershed. UNH Cooperative Extension coordinates the Coverts Program, which teaches volunteers to promote wildlife habitat conservation and forest stewardship.

Current use tax assessment helps to maintain forest lands, agricultural lands and wetland areas and serve to protect against the fragmentation of the landscape.

A unique partnership called the Quabbin-to-Cardigan Collaborative is working to conserve large, undeveloped blocks of land between the Quabbin Reservoir in central Massachusetts to the forests around Mount Cardigan. Orford is at the northern end of this initiative's focus area and could benefit from the conservation of regional wildlife corridors and large forested habitats.

Recommendations for resource protection

- The Conservation Commission should work with landowners and land trusts to protect important habitat areas and unfragmented forest habitat.
- The Conservation Commission should manage town-owned properties for wildlife habitat and seek to control invasive species on town-owned properties. Grant funding may be available through the US Department of Agriculture or New Hampshire Fish and Game.

- The Conservation Commission should encourage participation in volunteer wildlife monitoring and stewardship activities, such as the Volunteer Reptile and Amphibian Reporting Program, Coverts program, and bird and insect counts organized by New Hampshire Audubon.
- The Conservation Commission should educate landowners about the importance of protecting and enhancing migratory and resident wildlife habitat, by providing workshops and/or displaying wildlife maps, handouts, and publications in the Town offices and library. New Hampshire Fish and Game has developed a series of informative habitat stewardship brochures for floodplain forests, grasslands and other habitat types.
- The Conservation Commission should educate the public and town highway staff on invasive species so that the control of these plants can be done at the landowner level along with other property maintenance. The New Hampshire Department of Agriculture can provide technical assistance on proper roadside mowing techniques and other invasive species control methods.
- The Conservation Commission should examine culverts to ensure proper drainage and aquatic habitat connectivity, in coordination with the Town Road Agent. The Town should ensure that culverts are properly engineered and installed when replacing them during road work.

11.0 Scenic Resources

From the open fields and historic East and West Common in the Connecticut River Valley to the peak of Mount Cube and Upper and Lower Baker Ponds, Orford provides a wide array of scenic viewpoints and vistas. The scenic value of natural landscapes and open spaces is an important factor in the character and attraction of Orford. Each landowner, resident and visitor to Orford has his own special set of views, whether visible only on private property or accessible to all travelers on the state highway system. For the purposes of this inventory, the Orford Conservation Commission has focused on important scenic features visible from public roadways, public lands such as boat launches and natural areas, the Cross Rivendell Trail, and the Appalachian Trail and associated spur trails.

The 2001 Master Plan identified several outstanding examples of scenic beauty in Orford; the Orford Conservation Commission reviewed this list and added other significant scenic views.

Notable scenic landmarks include:

- Indian Pond, particularly as viewed from the town beach and boat launch;
- Upper Baker Pond, particularly the forested lakeside on the pond's eastern side;
- the beaver bog on Orfordville Road;
- Mount Cube, the Mount Cube ledges, Sunday Mountain and Cottonstone Mountain;
- Tillotson Falls;
- The Town Common and historic homes on the Ridge.

Although Mount Moosilauke does not lie within the Town of Orford, this impressive 4,802-foot mountain can be seen from several viewpoints, including the summit of Mount Cube, Upper Baker Pond, Dame Hill Road and the Dame Hill Road cemetery, and Route 25A. Another outstanding natural feature that may be viewed from Orford is the series of cliffs known as the Palisades across the Connecticut River in Fairlee, Vermont. The Richmond and Eck conservation lands provide excellent views of the Connecticut River.

Scenic roadways include:

- Route 10, recognized as part of the Connecticut River Scenic Byway,
- Route 25A, recognized as the Meldrim Thomson Scenic Highway,
- Bridge Street, with views up and down the Connecticut River and west to Fairlee's Palisades,
- Orfordville Road, particularly for the views of large beaver pond wetlands,
- Dame Hill Road, for views of Mt. Moosilauke and Sunday Mountain. Bean Brook Road and Grimes Hill Road, where views are protected by the Bunten easement,
- Indian Pond Road, with views to Indian Pond, wetlands and Mount Cube,
- Cole Farm Road, with views westward to the Connecticut River Valley, and
- Archertown Road, with its extensively wooded roadside and views of Sunday Mountain.

Existing and potential threats to the resource

The beautiful scenery of Orford serves to attract new residents to town and leads to increased development pressure. New development has the potential to degrade the integrity of scenic vistas; for example, Archertown Road has experienced new development along the roadside in the past ten years. Wireless telecommunications towers, utility/transmission lines and commercial wind farms also have the potential to diminish scenic value, particularly on ridgelines.

Current management and protection

The Connecticut River Scenic Byway runs along Route 10 through Orford. This byway is a three-state (New Hampshire, Vermont and Massachusetts) initiative to highlight the historic, cultural, scenic and recreational resources along the Connecticut River. The Scenic Byway program can provide funding for scenic view preservation through land acquisition or easement.

The Orford Conservation Commission has been assisting with a large ongoing conservation project to protect the shoreline of Indian Pond and surrounding forestland. This will help to encourage protection of the scenery, provide wildlife habitat and allow for recreation.

Permanent land protection has helped to protect scenic views, especially along Route 10 and the Appalachian Trail corridor.

The Town of Orford has adopted a telecommunications ordinance, limiting the height of wireless telecommunications towers and requiring camouflaging. Applicants proposing new towers must apply for a Conditional Use Permit through the Planning Board.

Recommendations for resource protection

- The Conservation Commission should consider scenic resources when evaluating land conservation projects, particularly those scenic areas visible from public roadways, public land or recreational trails.
- The Planning Board should encourage developers to preserve scenic resources by establishing forested buffers and encouraging interior roads.
- The 2001 Master Plan includes the following strategy to address siting of wireless telecommunications towers: “The Planning Board should continuously monitor the build-out of telecommunications towers in a manner that will protect the character and beauty of the town while allowing the industry to provide the service that many people now rely on.” Other tower structures, such as those built for wind farm projects and utility/transmission lines pose similar threats to scenic resources and should be monitored and reviewed in a similar manner.

12.0 Outdoor Recreation Resources

Hiking, boating, hunting, horseback riding, skiing, snowshoeing, snowmobiling and birdwatching are just a few of the recreational opportunities in Orford. Outdoor recreation provides an opportunity for town residents to experience nature first-hand and increase appreciation for the natural world, and also promotes an active, healthy lifestyle.

Existing trails or trail networks in Orford include:

- The Appalachian Trail and connecting trails on Mount Cube,
- The Cross Rivendell Trail, a 36-mile trail connecting Flagpole Hill in Vershire, VT, past Rivendell School and over Sunday Mountain to Mount Cube in Orford,
- The Indian Pond Heritage trail,
- The Stonehouse Mountain trail,
- Class VI roads, and
- The snowmobile trail network, maintained by Lyme Pinnacle snowmobile club.

Access to the Connecticut River is provided at the boat launches at the Orford Boat Launch and Reeds Marsh Wildlife Management Area. There are also boat launches on Indian Pond, Upper Baker Pond and Lower Baker Pond. The Town maintains a beach adjacent to the boat launch on Indian Pond.

Commercial campgrounds include Jacobs Brook Campground and The Pastures Campground. There are two summer youth camps, Camp Merriwood and Camp Moosilauke, on Upper Baker Pond.

The Town also owns and manages a community field across Route 25A from the Rivendell School as well as Flat Rock, a small natural area off Quinttown Road.

The Connecticut River Birding Trail lists Mount Cube and Reed's Marsh Wildlife Management Area as two good birdwatching locations. The Richmond Conservation Land offers excellent opportunities for birding as well as insect, plant and mammalian study.

Existing and potential threats to the resource

Hiking trails, boat launches and other recreational resources require good stewardship by both the landowner and the public. In Orford, most of the recreational trails are privately owned and many landowners generously allow public trail access over their lands. Unauthorized uses, such as ATVs, mountain bikes, or horses, can cause damage to trails designed for other purposes, and illegal dumping, vandalism or trespassing may convince landowners to close their land to public access.

Further development in Orford also threatens recreational resources. As the landscape is divided into lots and more land is posted against trespassing, trail connections can be severed and opportunities for hunting or other recreational pursuits become more limited.

Current management and protection

Since the Appalachian Trail was first completed in 1937, the National Park Service has acquired lands along the Appalachian Trail for much of its 2,181-mile length to protect the integrity of the trail in perpetuity. The Dartmouth Outing Club maintains the trail section from Vermont Route 12 to Kinsman Notch, including the section in Orford.

Many of the other trails in Orford pass through private land, and it is imperative to maintain the trust and goodwill of the landowner for these trails to continue. Volunteers also play a crucial role in the maintenance of existing trails and establishment of new trails.

The Cross-Rivendell Trail connects the Towns of Vershire, West Fairlee, Fairlee and Orford and the public schools of the four-town Rivendell Interstate School District via a 36-mile hiking trail. The western terminus is Flagpole Hill in Vershire and travels eastward, crossing the Samuel Morey Bridge across the Connecticut River, and ending at the summit of Mount Cube in Orford. The Cross-Rivendell Trail is maintained as a partnership between the Rivendell Interstate School District and the non-profit Rivendell Trails Association, and with the generosity of sixty landowners who have granted permission for the trail to cross their lands. The Trail is used both as a recreational resource and an outdoor classroom.

The Indian Pond Heritage Trail is a new trail through the north-central part of Orford, generously donated as a trail easement by the Schwaegler family. The Indian Pond Heritage Trail follows a path that was traveled by early settlers as well as Native Americans. It is believed that this path was a main travel route and portage path for early Americans from the lakes region of New

Hampshire to the shores of the Connecticut River. A number of cellar holes and a schoolhouse indicate substantial habitation in the past. The Indian Pond Heritage Trail follows the path of the old Grimes Hill Road. The trail's western terminus is located off of the current Grimes Hill Road. It then travels approximately three miles as it crosses Indian Pond Road and ends roughly one mile past the junction. The old roadbed continues until its eastern terminus at the junction with Route 25A.

Owners of land enrolled in the Current Use program are eligible for a 20% reduction in property assessment if they allow public access to their land. In Orford, this adjustment is widely used; as of 2009, about one-half of all land in Current Use (12,637 acres) was open for recreational access.

Recommendations for resource protection

- The Conservation Commission should consider publishing a map of hiking trails in Orford, including walks along Class VI roads. Information on allowed uses of public trails and rights-of-way should be included.
- The Town and Conservation Commission should continue to protect and manage public recreation areas, including trailheads, boat launches and parking areas.
- The Conservation Commission should work with local trails groups, such as the Upper Valley Trails Alliance and Cross-Rivendell Trail group to develop links between existing trail networks.
- The Planning Board should encourage developers to incorporate trails or recreation access into subdivision designs, especially for land near existing trail networks.
- The 2001 Master Plan includes the following strategy for promoting recreation on Class VI roads: “The Town should retain its rights-of-way over Class VI roads where reasonable and justified and develop policies that maximize non-destructive recreational use.”

13.0 Cultural and Historic Resources

The natural resources of Orford have played a major role in how the Town has developed over history. It is understood that Native Americans frequented this area. The rich soils of the Connecticut River Valley encouraged farming, the cascading brooks provided water power for early mills, and the hillsides provided forest products, mica, granite and soapstone mining, sheep pastures and hill-farms. The larger ponds in town also provided summer recreation at Camp Merriwood and Camp Moosilauke. The 2001 Master Plan provides an excellent summary of the town's history during the past 250 years.

Modern-day cultural resources are also tied to the natural resources of the Town. Recreation is an important component of community culture in Orford, The Community Field is located on a terrace near the Connecticut River. Public boat launches permit access to the Connecticut River, Indian Pond and Upper and Lower Baker Ponds. The Indian Pond Heritage Trail is both a historic pathway and a newly-designated recreational trail.

Cultural and historic sites also help to instill a “sense of place” for local residents and visitors alike, which is a valuable component of any community’s character.

For the purposes of this Inventory, the Orford Conservation Commission identified the following historic and cultural sites:

- Orford Street Historic District (National Register of Historic Places, as of 1977),
- Orfordville historic area,
- East Common and West Common,
- West Cemetery, Dame Hill Cemetery and East Cemetery,
- Samuel Morey Memorial Bridge (National Register of Historic Places, as of 1997),
- Soapstone quarry remains on Cottonstone Mountain,
- Granite quarry remains on Stonehouse Mountain Road,
- “Stone silos” off Quinttown Road,
- Lime kiln off Quinttown Road,
- Camp Moosilauke,
- Indian Pond Heritage Trail,
- The Mall Walk, and
- Stone walls.

In addition, the Orford Conservation Commission identified the following historic farmsteads, which are an important component to the rural aesthetic and character of the Town of Orford:

- Dennis farm,
- Tullando farm,
- River Valley Farm,
- Strawberry Hill Farm,
- Taylor farm,
- Franklin (Nichols) farm,
- Bunten farm, and
- Billy Brown farm remains in Quinttown.

Existing and potential threats to the resource

There are two opposing threats to cultural and historic areas and sites:

- 1) That they are forgotten and their importance is lost to history, and
- 2) That they are overused or exploited to the detriment of the public enjoyment of these resources.

The forest can grow up around old cellarholes, mill sites and stone walls, and over time, these resources can become buried under the forest floor. On the other hand, these same sites can become too popular and visitors can damage fragile artifacts or become illegal trash dumping grounds. Cultural sites, such as picnic areas, parks and ballfields, can be prone to litter, illegal dumping, and vandalism.

Historic farmsteads and the fields that surround them face many specific challenges, outlined in detail in the Agricultural Resources section. Protecting historic farmsteads may be achieved by protecting the natural resources that help to sustain the farm operations.

Current management and protection

Education and preservation go hand in hand in protecting historic resources. The Connecticut River Scenic Byway helps to showcase and interpret the historical importance of the Connecticut River Valley and the towns along the river. The National Register of Historic Places brings special recognition to special places and historic structures, including the Orford Street National Historic District and the Samuel Morey Memorial Bridge. The Orford Historical Society also promotes an appreciation for Orford's history; particularly relevant to natural resources is a booklet on the historic mill sites along Jacobs Brook.

ValleyQuest, an initiative of the regional organization Vital Communities, is an education program designed to collect and share a community's natural and cultural heritage. Each "quest" is a "treasure-hunt made by children and adults working together, leading to a treasure in the community." Local schoolchildren and community members have created several of these "treasure hunts" in Orford that have been published in ValleyQuest books and available online at the Vital Communities website (<http://www.vitalcommunities.org>).

Recommendations for resource protection

- The Conservation Commission should work with the Connecticut River Scenic Byway to protect and manage important natural areas that also serve as historic or cultural sites.
- The Conservation Commission should work with the Orford Historical Society and Rivendell Interstate School District on educational presentations of mutual interest.
- The Planning Board, Conservation Commission and Historical Society should identify potential links between the cultural, historic and natural resources of the Town and incorporate strategies to strengthen these inter-related resources into the Master Plan.
- The Town should promptly address any problems with littering, illegal dumping or vandalism on public property.

14.0 Air Quality, Peace and Quiet, and Dark Skies

As stated in the 2001 Master Plan, residents of Orford place high value on the natural setting in which they live -- "The small town, rural setting of Orford, with its open, uncluttered feeling, is of major importance." As a rural community, Orford generally experiences good air quality, low

noise levels and low levels of light pollution. These contribute to good public health and a serene and natural living environment.

Existing and potential threats to the resource

Air pollution may be caused by regional activities out of the control of local communities, such as smoke and particulates from large forest fires in Canada or nitrous oxides from coal-burning power plants in the Midwest. Air pollution can also be produced locally, through vehicle emissions, local industries, or the open burning of residential trash, which is now illegal in New Hampshire. The open burning of leaves and brush, which is allowed with a local fire permit, produces several air pollutants, including particulates that can spur asthma attacks and carbon monoxide that prevents oxygen from being absorbed into the human body. In 2010, no air quality action days were announced for Grafton County; air quality alerts are typically called for the southern sections of New Hampshire as well as high elevation areas (over 3,000 feet).

Air pollution can also create regional haze, where fine particles suspended in the atmosphere degrades visual clarity and obscures scenic views.

Noise may be defined as a sound that is loud, unpleasant or causes a disturbance. Noise may be caused by local industrial or commercial uses, vehicle traffic, public gatherings, and residential maintenance.

Artificial lights that cast light upward diminish the view of the night sky and may also contribute to problems of glare or “light trespass” onto neighboring property. Bright artificial lights may also disrupt wildlife predation, migration or reproduction.

Current management and protection

The New Hampshire Department of Environmental Services Air Resources Division monitors air quality around the state and issues Air Quality Action Days when the air quality may impair public health. The two pollutants monitored by the Air Resources Division are ground-level ozone (or summertime smog) and fine-particle pollution. These warnings are first targeted at limiting outdoor activity for people with heart or lung disease, older adults and children, although the more serious warning levels recommend that all people restrict outdoor activity.

The Air Resources Division also regulates air pollution emissions through a Statewide Permitting Program, and is involved in reducing air pollution from vehicles. The Division is also responsible for managing regional haze in two wilderness areas in the White Mountain National Forest.

In Orford, the forested landscape buffers sound from the road and adjacent properties for many residents. In other communities, noise ordinances have been adopted at the local level to place restrictions on specific activities that produce excessive amounts of noise.

Recommendations for resource protection

- The Conservation Commission should disseminate information on what residents can do to minimize air, noise, and light pollution. In rural areas, clean air, quiet environs and

dark skies at night are often taken for granted. Some topics of particular interest may be clean-burning woodstoves and outdoor wood boilers, residential trash burning, and dark skies lighting options.

- The Conservation Commission should encourage the use of best practices at Town facilities, such as dark skies lighting and clean-burning diesel engines. It may be possible to work with the local electric utility company on replacing streetlights and/or floodlights.
- The Planning Board should encourage developers to follow the recommendations laid out for dark skies in the Innovative Land Use Guide published by the New Hampshire Department of Environmental Services and the Regional Planning Commissions.

15.0 Natural Resources Co-occurrence

The previous sections of the Natural Resources Inventory have described each type of natural resource individually. To investigate where **multiple** natural resources are found at the **same** location, Upper Valley Lake Sunapee Regional Planning Commission performed a “co-occurrence analysis” in consultation with the Orford Conservation Commission.

A co-occurrence analysis shows where multiple natural resources occur in the same location. A co-occurrence analysis begins with a series of natural resources maps, layers them one on top of the other, and counts the number of natural resources occurring at every location within the town.

Methodology

For Orford’s co-occurrence analysis, the Conservation Commission selected five different natural resources maps, as listed in Table 15.

Table 15: Maps included in the Co-Occurrence Analysis

<i>Natural Resource Map</i>	<i>How this Resource was mapped</i>
Groundwater	Stratified-drift aquifers, from the US Geological Survey
Surface Water	100-year floodplains, from Federal Emergency Management Agency
	Wetlands and 100-ft around wetlands, from National Wetlands Inventory
	Public waters and 250-ft around public waters, from NH Department of Environmental Services
Agriculture	Prime and state agricultural soils, from Grafton County Soil Survey
Wildlife Habitat	Highly-ranked wildlife habitat (Tiers 1 & 2), from NH Fish and Game’s Wildlife Action Plan (2010)
Unfragmented Lands	Blocks of land unbroken by maintained roads or major rivers (over 2,000 acres in size), as calculated from NH Department of Transportation roads and NH Department of Environmental Services rivers data

Each natural resource map was virtually “stacked” on top of the other using the ArcGIS 9.3.1 software package. The maps were then added together to create a final co-occurrence map. The final co-occurrence map shows different areas of town with a “co-occurrence score” between one

and five. Where the features in all five maps overlapped, the final co-occurrence map shows a value of “five.” Where the features in only four of the five maps overlapped, the final map shows a value of “four” and so on, down to where none of the features in the five maps overlap and the final map shows a value of “zero.”

The results of this analysis are used to identify the locations where many natural resources occur in the same spot. This information is one tool can be used to identify some locations in town that may be important for its multiple ecological values as were chosen for the analysis. There are certainly other locations in town that are extremely valuable for one outstanding feature, or for several natural resources that were not included in the analysis.

A value of “five” means that this particular location in Orford has all five resources chosen for the analysis: groundwater, surface water, agriculture, wildlife habitat and unfragmented lands. “Five” does not equal “perfect,” as the analysis only incorporates five natural resources. On a parcel of land with a score of “five”, there may be detrimental features detracting from the conservation value of that location, such as a hazardous waste site or a widespread infestation of invasive species. Similarly, a value of “zero” does not equal “worthless.” A value of “zero” means that this particular location in Orford has none of those five resources chosen for the analysis, but this parcel of land may have other remarkable natural resources that were not included in the analysis. For example, vernal pools, locations of rare plants, or outstanding historic structures were not included in the co-occurrence analysis.

Limitations of the Analysis

As described above, the co-occurrence analysis is one tool that can be used to evaluate the natural resource value of any particular location. There are several important limitations to keep in mind when evaluating the map of the analysis results. The goal of the co-occurrence analysis to look at how five important natural resources interact and overlap, and to keep the analysis simple to interpret.

- 1) The results of the co-occurrence analysis are skewed towards favoring water features and areas around water features, because there were three maps chosen for the analysis that are related to water resources: 1) surface water, 2) ground water and 3) Tier 1 and 2 wildlife habitat, which takes into account important aquatic habitat as well as stream corridors.
- 2) The analysis does not represent the capacity of land for forestry or timber production, or the areas of land currently managed for forestry. The co-occurrence analysis did not include important forest soils groups, as these soils cover 99% of Orford.
- 3) There is significant overlap between the Tier 1 and 2 wildlife habitat and large blocks of unfragmented land. Unfragmented forest blocks were used in the New Hampshire Fish and Game’s development of the Tier 1 and 2 wildlife habitat, as these large features in the landscape are vital to supporting many animal species. The unfragmented forest blocks were included in the co-occurrence analysis for their capacity to support recreation and forestry and to preserve water quality, scenic views and a part of the rural character of the Town.

- 4) Each of the maps selected for the analysis have limitations on their completeness or accuracy. These maps and the resulting co-occurrence analysis were created to show landscape patterns on a large scale and are not suitable for site-specific work. For more details on the map scale and accuracy, please see Appendix A.

Results of the Co-occurrence Analysis

The co-occurrence analysis is a tool for looking for patterns in the landscape where those five natural resources do overlap, which helps provide additional information beyond what each of the natural resources maps provide individually.

In Orford, the co-occurrence analysis highlights several areas of town with three or four features overlapping (shown in orange and yellow on the map). The largest is the Connecticut River shoreline and floodplains, which is ranked highly for the presence of stratified-drift aquifers, agricultural soils, and high-quality wildlife habitat. The area immediately along the Connecticut River receives an extra point for proximity to public waters and/or for 100-year floodplains. The rich agricultural land along the Connecticut River and also the Reeds' Marsh wetland complex are recognized for having high conservation value. The land between Upper and Lower Baker Ponds, particularly the inlet to Lower Baker Pond, also scored highly in the co-occurrence analysis, for its value of aquifers, wetlands and proximity to the ponds, as well as smaller areas of prime agricultural soil and high-quality wildlife habitat. Both ponds abut onto large unfragmented areas of land, which contribute to the forestry, scenic, recreational and wildlife values.

There are also several spots of high scores along streams:

- The headwater wetlands of Archertown Brook,
- Archertown Brook near Town Road 100 north of Archertown Road,
- Jacobs Brook near Quinttown,
- Jacobs Brook near the intersection of Quinttown Road and Route 25A,
- the headwaters of Clough Brook near Orfordville Road, and
- streams flowing southward into Lyme on the east side of Route 10.

These streams ranked highly in the co-occurrence analysis primarily due to the presence of aquifers, floodplains, and wildlife habitat or unfragmented forest. The area near the Lyme town line also has agricultural soils.