2. Natural Resources

Overview—*Sandwich is blessed with an Abundance of Natural Resources*

Sandwich's natural resources are a critical consideration in establishing a proper approach for land-use planning and management. Understanding natural resource values provides a rational basis for determining which areas of the town are more appropriate for protection of open space and which areas are more suitable for development. Natural resources such as slope, forest resources, wildlife and water resources add to Sandwich's character, provide recreational and economic opportunities and contribute to the quality of life for Sandwich residents. These natural resources also provide both opportunities and limitations for growth. Steep slopes and wetlands, for example, are less suitable for development, while flatter, better drained areas are more suitable.

A Few Facts about our Resources

Sandwich contains:

- 52,130 acres of forest and brush land ,approximately 86% of the total land area
- 438 acres of Prime Farmland Soils and another 511 acres of Farmland Soils of Statewide Importance
- Over 96 miles of rivers and streams
- Part of three major watersheds—the Ossipee (Saco) River, Pemigawasset River, Winnipesaukee River
- One major surface water body—Squam Lake—with an area of 1,305 acres and a shoreline of over 87,000 feet within Sandwich
- 4,749 acres of hydric soils and 840 acres of Prime Wetlands
- Over 4,300 acres of sand and gravel deposits and 1000 acres of these have good water yielding capacity
- 36,322 or 60.8% of the town in Tier 1 high quality wildlife habitat (Highest Relative Rank by Ecological Condition in NH)
- 17,243 acres of protected lands in the White Mountain National Forest (WMNF), 2,430 acres of protected lands in community ownership and another 3,240 in private ownership

Topography and Elevation—*Elevation Ranges from 537 to 3,933 Feet*

Sandwich lies at the nexus of three distinct eco-regions in New England: the Vermont-New Hampshire Upland Section to the west, the White Mountain Section to the north, and the Southern New England Coastal Hills & Plains Section to the south and east[1]. The hilly terrain ranges in elevation from about 537 feet near the Red Hill River in the southern section of town to approximately 3,993 feet at the top of Sandwich Dome in the White Mountain National Forest

[1] From: *New Hampshire's Living Legacy, The Biodiversity of the Granite State*, N.H Fish & Game Department (1996).

along the town's northern border—an approximately 3,456 foot change. **See Map 2, Topography and Groundwater Resources.**

There are numerous significant peaks within Sandwich, including: Sandwich Dome, Black Mountain, Flat Mountain, Young Mountain, Mount Israel , Dinsmore Mountain, Mount Squam and Doublehead Mountain. These peaks provide much of Sandwich's scenic quality.

Sandwich's terrain ranges from lowlands to mountainous terrain, from almost flat marshland in the eastern portions of North Sandwich, to gently sloping areas near the center of town, to the mountainous areas of the White Mountain National Forest. Much of the land in Sandwich, particularly those areas within the WMNF, is comprised of steep slopes above 900 feet. Once slopes exceed 15%, activities such as forestry and development become more difficult and costly and may require appropriate land management practices to minimize environmental impacts. The **Slope Map, Map 3** shows the extent of slopes between 15 and 25% and greater than 25%.

Surface Geology—*Most of Sandwich is covered in Glacial Till with Sand & Gravel in Lowland Areas*

The majority of Sandwich is overlain with glacial till, a relatively thin mantle of soil over the bedrock, and is made up of a mixture of boulders, stones, cobbles, sand, silt and clay. Some of the lower lying areas are made up of stratified drift materials that were deposited by the melt waters of the last period of glaciations. These deposits provide a good source of sand and gravel and in some cases potential groundwater supplies. These stratified drift features are shown on the **Topography and Groundwater Resources Map,** indicated by the aquifer areas. The largest concentration of these deposits is along the Cold and Bearcamp Rivers, straddling NH Route 113 in eastern Sandwich.

Sand and Gravel Resources

Sand and gravel are valued resources for general construction, as well as road construction and maintenance. The Natural Resources Conservation Service (NRCS) has interpreted the Carroll County Soil Survey for the potential use of sand and gravel soils as construction materials. **See Map 4, Sand and Gravel Resources**. In Sandwich there are 3,186 acres of sand and gravel soils. There are several active or recently abandoned pits that have taken advantage of these resources for construction materials.

Areas containing sand and gravel are important groundwater recharge areas for stratified drift aquifers. There are over 2,000 acres where both stratified drift aquifer and sand/gravel resources exist together. Proper management of sand and gravel operations is critical for protection of the water quality in the aquifers and associated streams and rivers. At present, Sandwich has an Excavation Ordinance dated November 1, 1989 that regulates sand and gravel extraction.

Forest Resources and Unfragmented Lands—*Sandwich has Large Tracts of Unfragmented Forest and Open Lands*

One of Sandwich's most significant natural resources is its forests. Sandwich has over 52,000 acres of forest and brush land, or approximately 86% of Sandwich's total land area as shown on **Map 5**, **Land Cover**. Aside from the White Mountain National Forest, there are still approximately 35,000 acres or about 58% within municipal jurisdiction.

Sandwich's forests provide multiple benefits to the community and region including:

- Source of economic opportunity for lumber and wood products
- Source of fuel wood for private owners and for commercial sale
- Value for holding soil in place to minimize erosion and sedimentation into adjacent streams
- Valuable wildlife habitat
- Opportunity for outdoor recreation
- Natural beauty and scenic views for residents and visitors.

Almost all of Sandwich's forests are second growth coniferous and deciduous woodlands. These forest resources represent a response to a relatively wet climate that produces about 48 inches of rainfall annually with warm summers and cold winters. Variation in soil and slope also results in a variation in forest cover. Where soils are somewhat wet there may be a preponderance of hardwoods such as red maple and yellow birch. A mixed forest, including white pine and red oak, will more likely occur in drier/gravelly soils, whereas spruce/fir forests are often at higher elevations in thinner soils. Given the town's variation in soils types and elevation, there is a wide variety of forest types and tree species, from white pine-red pine shorelines, to oak-pine dry woods to hemlock-beech-oak-pine mixed woods to spruce-fir montane forests.

Forest Types

The Land Cover Map indicates the distribution of forest types, as well as the number of acres for each tree species. The largest forest block is Mixed Forest, which includes both hardwoods and softwoods and comprises approximately 14,500 acres. Mixed forest is primarily at elevations between 600 and 1200 feet in the east and southeastern portions of the town. Other large blocks by species group include:

- Beech/Oak 10, 480 acres; at lower elevations—600-900 feet near Squam Lake
- Northern hardwoods 10, 235 acres at higher elevations—900-1800 feet
- Paper Birch/Aspen 5,565 acres at higher elevations—900-1800 feet

Important Forest Soil Groups

In recent years the Natural Resource Conservation Service (NRCS) in New Hampshire has been developing the concept of forest soil productivity and management limitations. Soils mapped by the NRCS for each county soil survey have been grouped into six forest-related categories, termed "Important Forest Soils Groups," based on the inter-relationship of soil characteristics including texture and moisture or wetness; inherent limitations of the soil for forest management e.g. steep slopes, shallowness, boulders, rock outcrops; and typical forest successional trends on certain soil types. Higher quality forest soil groups include Group 1A (11,478 acres), Group 1B (16,651 acres), and Group 1C (2,118 acres). Lower quality forest soils that are steep, shallow, or wet include Group 2A soils (6,023 acres) and Group 2B soils (3,346 acres). Non-productive forest soils (Group NC or "not classified") include 8,443 acres of muck and peat, gravel pits, open water, or other areas that do not support forests. Specific data on important forest soils are included on **Map 6, Forest Soils.**

Unfragmented Lands

Another indicator of the significance of Sandwich's forest resources is the amount of unfragmented land. Unfragmented lands are land blocks—usually forest lands—that are not interrupted or fragmented by road or railroad corridors. Using a variable width buffer from known public roadways, Sandwich has approximately 57,889 acres of unfragmented lands. The use of the variable width is based on the rationale that a less travelled or narrower roadway presents less of a barrier to wildlife and has less impact on forest resources. The following buffer widths were used for this analysis:

- State roads 150 feet
- Class V, paved 75 feet
- Class V, gravel 50 feet
- Class VI 0 feet

Forest blocks of 500 or more acres tend to have high value for ensuring healthy wildlife habitat, as well as providing a significant opportunity for sustained forest management. **See Map 7, Unfragmented Lands.** Sandwich is fortunate to have significant blocks that exceed 5000 or more acres. Specifically, Sandwich has 7,006 acres of unfragmented lands in 500 to 1,000 acre blocks; 11,293 acres in 1,000 to 5,000 acre blocks, and 37,360 acres that occur in blocks greater than 5,000 acre blocks (representing much of the White Mountain National Forest).

Agricultural Lands and Farmland Soils —*Sandwich primarily has Farmland Soils of Local Interest*

The **Agricultural Soils Map (Map 9)** for Sandwich indicates a total of 24,623 acres of soils that are classified as good to excellent agricultural soils. (The WMNF has not yet been mapped for soil types, although this process has begun and is scheduled for completion in 2013. Consequently, this total only includes areas within the town and outside the WMNF.) As shown

on the map, a majority - 96% or 23,674 acres – is classified as farmland soil of local importance, with smaller, scattered pockets of soils identified as being of statewide importance (511 acres) and prime agricultural soils (438 acres). The total acreage of good to excellent agricultural soils comprises 57% of the town or 40% of the total including White Mountain National Forest. Given the steep and rocky nature of most of the White Mountain National Forest, it is likely only a small amount of good agricultural soil land will be added to the total once it is mapped.

Water Resources—*Abundance of Surface and Groundwater Resources*

Surface Waters

Major river and stream systems divide Sandwich into three major watersheds. The Ossipee (also referred to as the Saco) River Watershed is the predominate watershed covering the central and eastern portion of the town, with the Pemigewasset River Watershed encompassing the western portion, and the Winnipesaukee River Watershed the south-central areas. Within these three larger watersheds there are eight (8) subwatersheds, as shown on **Map 10, Surface Water Resources.** The Upper Bearcamp River and Cold River watersheds are contained almost entirely within the town of Sandwich, and portions of the Mad River, Beebe River, Squam Lake Drainage, Red Hill River (Moultonborough Inlet), Lower Bearcamp River, and Swift River watersheds are contained within Sandwich.

Large Water Bodies

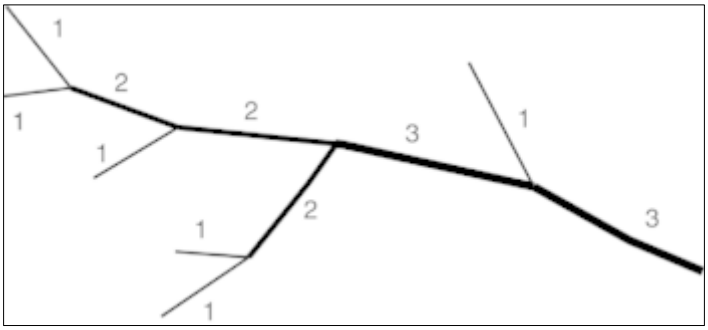
Open surface water provides important habitat for a variety of wildlife species, as well as recreational opportunities for residents. The town has a total of 2,366 acres of open surface water. The largest body of water is Squam Lake. The lake's northeastern portion lies within the town's borders. The 6,791- acre natural lake has over 60 miles of shore frontage; of this Sandwich has 1,305 acres or almost 20% of the lake and almost 17 miles (87,970 feet) of shoreline. The town also contains at least 17 ponds, the largest being Bearcamp Pond. Others include Red Hill, Kusumpe, Intervale, Dinsmore, Barville, Guinea, Little Pond, and Upper, Middle and Lower Hall Ponds.

Many of the shorelands of these large bodies of water are within the Shoreland District of the Zoning Ordinance. This zoning district extends 600 feet from these waterbodies and regulates the use and activities within this area. For example, prohibited uses include automobile junkyards and solid waste facilities.

Streams and Rivers

Streams and rivers are often categorized in hierarchical fashion with first order streams serving as the headwater streams in a watershed. When two first order streams join the stream becomes a second order stream and so on. See the figure below. The **Surface Water Resources Map** indicates that of the 96.3 miles of streams and rivers in Sandwich--32.1 miles are first order, 32.0

miles are second order, 24.3 miles are third order and 7.9 miles are fourth order streams. The first order streams include Atwood Brook, portions of the Bearcamp River, portions of the Beebe River, Burrows Brook, Captain Neal Brook, Cook Brook, East Branch of the Whiteface River, Eastman Brook, Ford Brook, Heath Brook, Mill Brook, Meadow Brook, Montgomery Brook, Pond Brook, Skinner Brook, Smith Brook Stanton Brook, Tilton Brook, Thompson Brook, Weed Brook and White Brook. These headwater streams are particularly sensitive to development impacts since the low flows in these streams cannot assimilate pollutant impacts.



US Army Corps of Engineers, after Strahler Stream Order

Although the Shoreland District regulates activity around large waterbodies, it does not regulate activities along streams and rivers. The Wetland Protection Ordinance provides some regulatory standards for septic systems and dwellings near streams ("water bodies"), but does not address other land use activities. The state Comprehensive Shoreland Protection Act does regulate 4th and some 3rd order streams, but not lower order streams, such as White Brook in the Cold River subwatershed or Stanton Brook in the Red Hill subwatershed.

Floodplains

Sandwich has approximately 5,767 acres of floodplains that have flooded once every 100 years These areas provide valuable flood storage during significant rainstorm events. Development in or adjacent to these areas must be minimized in order to preserve this flood storage value. Such development simply forces flood waters to other low lying areas that may not have been subject to such flooding in the past.

The Town of Sandwich regulates activity in floodplains through the Floodplain Management Provisions of the Zoning Ordinance. These provisions require new construction or substantial improvement to be at or above the 100-year flood level. It does not regulate the type of use which would be determined only by the underlying zone, such as Rural Residential.

Groundwater

The Topography and Groundwater Resources Map indicates several areas of potential groundwater extraction within stratified drift aquifers. These areas are located along the eastern boundary of Sandwich and are associated with segments of the Whiteface, Cold, Red Hill and Bearcamp Rivers. The deposits are rated by their transmissivity or ability to yield groundwater. Sandwich's deposits are rated primarily over 1,000 square feet per day, with one area associated with Cold River along Route 113 up to 8,000 square feet per day. In total, there are over 4,000 acres of this resource, with over 800 acres potentially yielding more than 2000

square feet per day. These areas may need additional protection to maintain water quality and potential for future municipal water source consideration. Much of the area east of the Cold River to the Tamworth border has been developed for sand and gravel extraction as shown on **Map 1**.

While the town's Excavation Regulations control excavation into groundwater for extraction activities in sand and gravel areas, there is currently no Aquifer Protection Ordinance with specific standards for groundwater protection.

Water Quality

Squam Lake Watershed

The health of surface waters may be determined through a consistently applied monitoring program. Squam Lake has been regularly monitored by the Lay Lakes Monitoring Program at UNH for the past 31 years.[2] This program has over 20 monitoring locations, seven (7) of which are wholly or partially within the Sandwich municipal boundary on the lake. These include:

- Rattlesnake Cove,
- Inner Squaw Cove,
- Sandwich Bay
- Kent Island
- Loon Reef, and
- Deephaven Reef.

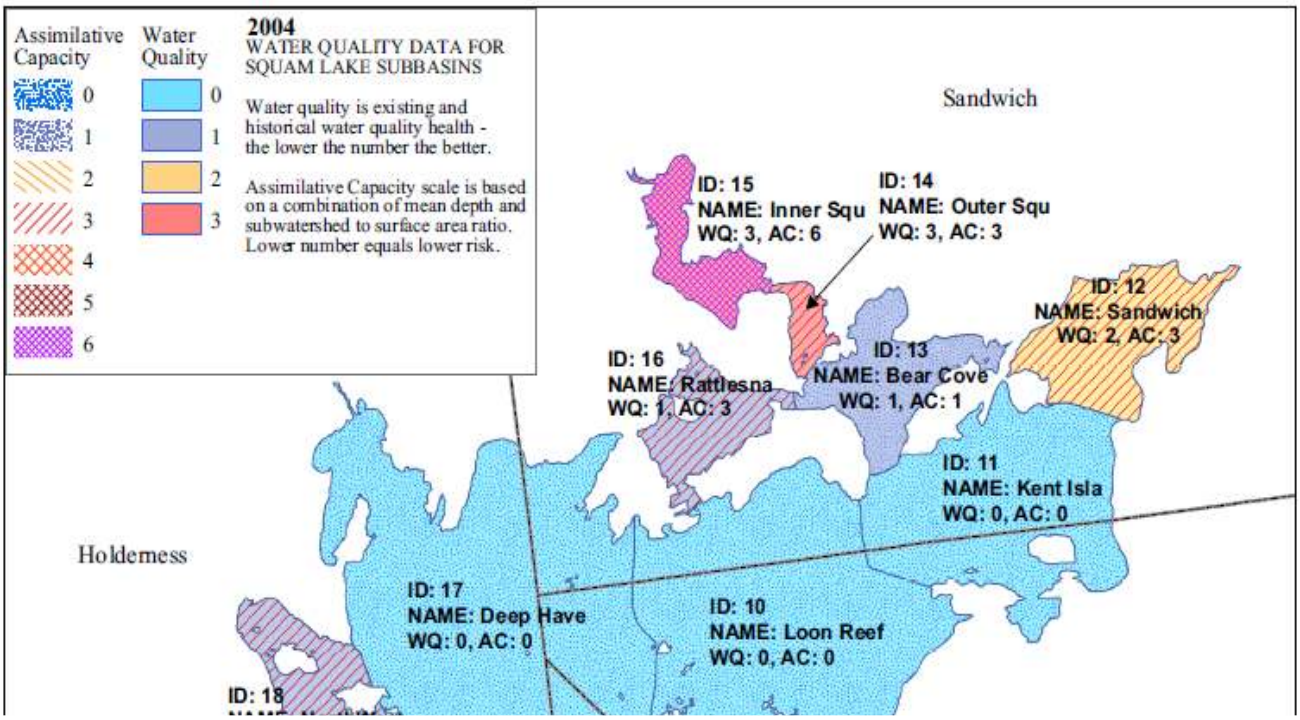
Both open water and tributary data has been tested for transparency, chlorophyll α, total nitrogen, total phosphorus, dissolved oxygen, biologic oxygen demand (BOD), and conductivity (specific conductance). In general, the overall water quality of the lake is good to excellent, although there are seasonal variations that may affect this condition, especially during periods of high precipitation, leading to sediment and nutrient runoff and a greater loss of transparency. In addition, restricted areas have been more vulnerable to pollutants from stormwater runoff, including sediment, phosphorous and nitrogen.

Figure 2-1 shows the location of these areas. The figure also includes summarized water quality and assimilative capacity data for each site. Overall, the Water Quality ranges from 0 to 3, where the lower the number the better the water quality—that is low levels of nitrogen, phosphorous and sediment in the water. Similarly, assimilative capacity (or the ability to dilute the impact of pollutants) ranges from 0 to 6, where the lower the number the more assimilative capacity and, therefore, the lower the risk of pollution.

[2] *Squam Lake, Water Quality Data Summary, 2000-2007; Schloss, Jeffrey; NH Water Resources Center in association with the Squam Lake Association, 2009*

As can be observed, the sites located in coves tend to have lower water quality and have less capacity to assimilate pollutants. Conversely, the open water sites have better water quality and more ability to assimilate pollutants.

Figure 2-1. Water Quality Data, Squam Lake Sub-Basins



Source: Squam Lake, Water Quality Data Summary, 2000-2007; Schloss, Jeffrey; NH Water Resources Center in association with the Squam Lake Association, 2009

Ossipee Watershed

One of Sandwich's largest ponds, the 167 acre Bearcamp Pond, has been monitored for many years through the Volunteer Lake Assessment Program (VLAP), using standard measures of water quality health such as chlorophyll-a, transparency and phosphorus. Bearcamp Pond has historically had relatively stable, good water quality health.

In addition, for the past seven (7) years the Green Mountain Conservation Group and the NH Department of Environmental Services (NH DES) have been conducting water quality sampling in various rivers and brooks of the Ossipee Watershed. Volunteers have conducted sampling at 35 sites, 2 of which are in Sandwich—on the Cold River and on Pond Brook. . Results from the past seven (7) years indicate that the watershed's surface water quality is high. In 2005-2006, a survey for variable milfoil was conducted in all open water bodies in Sandwich. The negative result also testified to the positive water quality of the ponds and lakes that can be found in Sandwich.

Pemigewassett Watershed

The Lakes Region Planning Commission conducted a study in 2008 of the Pemigewasset River Watershed, which included the Beebe River sub-watershed, part of which is located in the western portion of the town.[3] The study included a co-occurrence analysis that interpreted "significant resource features", including lands and waters that were most important for identifying living resources (flora and fauna). Five key features were evaluated through the co-occurrence analysis: (1) high quality stream watersheds; (2) large and high quality wetland systems; (3) riparian zones on freshwater rivers, streams, lakes and ponds; (4) unfragmented forest ecosystems; and (5) exemplary natural communities and significant wildlife habitat. The Beebe subwatershed was identified as having the greatest amount of significant habitat in the Pemigewasset River Watershed. The majority of the Beebe River subwatershed contained moderate or high quality waters, with the Beebe River corridor having the highest quality waters.

> ……this (study) illustrates that not all areas in conservation are necessarily of high water quality, and highlights the need for continued diligence when planning for conservation purposes.
> *Pemigewasset Watershed: Resource Co-Occurrence Mapping and Analysis. Final Report, June 2008. Lakes Region Planning Commission.*

The Squam Lake drainage area, located to the south of the Beebe River subwatershed and including the southwestern portion of the town, was identified as an important source for water supply, and providing flood storage capacity.

The NH Forest Society is conducting a regional natural resource co-occurrence study for the communities bordering on Squam Lake. Originally scheduled to be completed by the end of 2009, it will be published later in 2010. This study is intended to identify those areas with the highest value for long-term protection. Preliminary results indicate that the most highly valued areas in Sandwich will be associated with its streams, brooks, and wetland resource areas, as well as the Squam Range.

Wetland Resources—*Over 6,500 acres of Hydric Soils*

Sandwich is estimated to have over 6,500 acres of hydric soils of which 4700 acres lie outside the WMNF (see Surface Waters Resources Map). These soils have poor drainage characteristics, yet often lie in areas where floodwaters are retained, valuable wildlife habitat can be found, and where surface waters percolate into the substratum and feed underground aquifers.

In terms of jurisdictional wetlands, the exact number of acres in Sandwich has yet to be determined. Wetlands exist where surface and/or groundwater can be found at the soil surface for a long enough period of time for both hydric soil conditions to develop and wetland plants

[3] *Pemigewasset Watershed: Resource Co-Occurrence Mapping and Analysis. Final Report, June 2008. Lakes Region Planning Commission* http://www.lakesrpc.org/pemi_water.asp

(hydrophytes) to grow. Although streams and rivers are "surface waters" in the eyes of the state, they often develop wetland conditions by having bordering vegetated areas with hydric soils and a prevalence of hydrophytes. Intermittent streams are also considered part of the wetland system by the state of New Hampshire, as well as all lands below the high tide line, although it's been a little while since Sandwich has experienced any tides.

Wetlands provide valuable functions to society. The ability to store floodwaters has been mentioned above, as has the ability to store flood waters and the recharge groundwater into the underlying aquifer. Thus, they improve water quality by filtering out unwanted chemicals and suspended solids in our flowing streams and ponds. Most importantly, they serve as a refuge for wildlife, and offer habitats, and food sources for mammals, birds, fish, amphibians, and reptiles. In terms of social value, wetlands often add a scenic backdrop to forest land or open waterways

In Sandwich, eight wetlands were designated by town vote in 1984 as "prime." According to RSA 482: A-15, prime wetlands are those that by virtue of their "unspoiled and fragile nature" can be voted on by the town to be specially registered with the state, and thereby receive extra protection under state law. The eight prime wetlands are as follows:

1) Bearcamp Pond and the marshes upstream of the pond
2) Bearcamp River below the pond
3) Red Hill Pond and bogs
4) Red Hill River south of Route 109
5) Atwood Brook
6) Meadow Brook
7) Squam Lake marshes on Squaw Cove near Metcalf Road
8) Miles, Bragg, and Taylor Ponds

These wetlands were initially identified by a wetland research project in 1983 and are identified by number on the **Surface Water Resources Map**. A revised map of their location has yet to be created. In the interim, the Conservation Commission has reviewed and commented on timber harvesting and other development activities requiring permits in and near prime wetlands to the Planning Board and Board of Selectmen in order to maintain the high degree of protection the town sought in 1984. The town regulates use of wetlands through the Wetland Protection overlay district of the Zoning Ordinance.

Wildlife—*A Rich Biodiversity*

One of the most widely recognized features of Sandwich's natural resources is wildlife. Like forest, soil and water resources, the wildlife of the area add to the quality of life that residents value so highly. Wildlife add to the scenic and aesthetic enjoyment of the town, they provide opportunities for hunting and fishing as well as excellent subjects for study, and add to the general economic health by attracting visitors who come here to see and enjoy wildlife.

Figure 2-2. Approximate Number of Vertebrate and Invertebrate Wildlife in Sandwich

Vertebrates	
Amphibians	14
Birds	189
Fish	24
Reptiles	13
Mammals	52
Aquatic Macro-invertebrates	238
Lepidoptera	665
Odonata	74
Other Invertebrates	725

Source: Squam Lakes Science Center, Rick Van de Poll, 2008

As the above figure indicates, there are over 250 vertebrate species in the Squam Region. Although specific counts have not been undertaken except for the occasional natural resource inventory or "bioblitz,"[4] there is an estimated 1600 – 1800 species of invertebrate wildlife that adds richness to the biodiversity of the area. As indicated below, there is a wide variety of wildlife habitats in Sandwich, ranging from the plankton-rich deep water areas of Squam Lake to the hardiest of alpine lichens on the uppermost ledges of Sandwich Dome.

The diversity of habitats within the unfragmented forests of Sandwich means that deer, moose, bear, fisher, bobcat, coyote, fox, mink, otter, and ermine are frequently observed. Owing to the proximity of the White Mountains, the state-threatened pine marten is also a part of the fauna. Federally listed lynx and mountain lion have only been rumored for the area, although ample habitat exists. Lowland forests included the southern hooded warbler during a bioblitz in 2008, yet the summit of Sandwich Dome regularly supports Canada jays and boreal chickadees. Atlantic salmon and rainbow trout make for good angling in Squam Lake, and native brook trout runs occur in many of the coldwater streams.

Areas of Ecological Interest —*Special Areas of Conservation Focus*

Endangered Flora and Fauna

The New Hampshire Natural Heritage Bureau, a bureau in the Division of Forest and Lands, finds, tracks, and facilitates the protection of the state's rare plants and exemplary natural communities. The Bureau also tracks rare animal species in cooperation with the Nongame and Endangered Wildlife Program of the NH Fish and Game Department.

[4] A bioblitz is a fun and educational endeavor that seeks to count every single organism in a defined area during a certain period of time (usually 24 hours). The Squam Lakes Science Center has conducted two bioblitzes in an area that includes part of Sandwich in 2008 and 2010.

In Sandwich, four extant sate endangered plant species and four extant threatened plant species have been identified. Another 10 rare and endangered plant species are considered "historic" since they have not been observed for the past 20 years. In addition, there are current records of three state-threatened animals (pine marten, common loon, and grasshopper sparrow) and at least six "Special Concern" animals in Sandwich. **See Appendix C** for the full list. Among plants, the bulk of the rare species occur in or along large water bodies such as Squam Lake and Red Hill Pond, and in association with calcium-rich bedrock such as syenite and basalt. Rare animals often involve those that have disappeared since the re-growth of forest after the demise of agriculture in the 1800's (e.g. grasshopper sparrow), or since the termination of broad scale DDT and other pesticide use (e.g. bald eagle).

Some of the most visible and easy-to-find areas of ecological interest include exemplary natural communities as defined above. Red Hill Bog is a prime example of this in Sandwich. The late successional hemlock forest near Beede Falls is another. In spite of the widespread timbering and land clearing activities of the colonial era, there are still a few pockets of old growth forest left. The south side of the Squam Range contains red spruce-red oak forests in old growth condition with trees that exceed 300 years in age. Lakeshore black gum swamps at Five Finger Point contain black gum trees over 400 years old. Other pockets of large old trees can be found in the White Mountain National Forest, many of which have not been formally identified or described.

Wildlife Action Plan

The New Hampshire Fish and Game Department completed in 2005 a state-wide Wildlife Action Plan (WAP). The intent of the WAP is to provide a tool to identify the most critical wildlife habitat locations in the state. The WAP conveys habitat information through a comprehensive database and series of GIS maps. The WAP information and habitat analysis is a useful tool in determining where to focus future conservation, restoration and management efforts. The information contained in the WAP may also serve as a benchmark for conservation progress in years to come.

Besides noting the location of eco-regions in the state, the WAP also identifies, on a state-wide basis, eight major watershed groups. Watershed groups are based on geology, topographic features (elevation, gradient and landform), connectivity, and local climate patterns that effect watersheds over long time periods. The Town of Sandwich is bisected by two watershed groups, the Mountain Watershed and the Transition Coastal Watershed.

The Plan then identified sixteen (16) habitat types throughout the state. Of these, nine (9) were identified in the Town of Sandwich. These areas are illustrated on **Map 11, Wildlife Habitat**.

- The Hemlock-hardwood-pine habitat is the largest, with 35,940 acres, representing nearly 60% of the Town's total 60,250 acres. This habitat type is found throughout much of the town except for the higher elevations of the WMNF.

- The second largest habitat type is Northern hardwood-conifer (9,219 acres), which is found primarily in the WMNF, with concentrations in the Squam Range and the area north and west of Route 113A adjacent to the WMNF

- The Lowland spruce-fir forest is approximately 7,003 acres and is generally found between the elevations of 1200 and 2200 feet in the WMNF and associated with the higher elevations of the Squam Range.

- High-elevation spruce-fir forest comprises 1,538 acres and is found at the highest elevations in Sandwich, associated with Flat Mountain and the Sandwich Dome. Almost all (99.7%) is conserved acres—the greatest concentration of conserved land of any habitat type.

Smaller habitat types include Grassland (878 acres), Rocky ridges and talus slopes (1,916 acres), Floodplain forest (587 acres), Wet meadow/shrub wetland (1,940 acres), and Peatland (748 acres).

The WAP information about habitat condition was further analyzed to develop a statewide and regional ranking and identify the highest condition habitat relative to all areas of a given habitat type in the state. The plan established a ranking system in four (4) tiers as follows:

- Tier 1: Habitats of Highest Relative Rank by Ecological Condition in NH
- Tier 2: Habitats of Highest Relative Rank by Ecological Condition in Biological Region
- Tier 3: Supporting Landscapes
- Tier 4: Local Significance

Note: Tier 1 habitats where the biological and landscape ranks are highest and the human impacts lowest. These areas represent the top 10-15% of wildlife habitat in the state and are the ones that are likely to maintain biological integrity over the long term. These areas:
- have fewer risks of degradation or loss than other areas,
- are suitable for maintaining indigenous species and
- minimize the chance of species becoming endangered or extinct.

The Town of Sandwich contains a significant amount of Tier 1 high quality habitat. Of the town's 60,250 total acres, 60.8% or 36,322 acres have been identified as Tier 1 habitat much of which is within the Hemlock-Hardwood-Pine Habitat as shown on **Map 11, Wildlife Habitats Map**. Only 22.6% of the Tier 1 habitat areas in the town have been conserved.

Squam Range-Beebe River

A significant area of ecological value is represented by the Squam Range and Beebe River Corridor within Sandwich. Taken together, there is a high degree of biodiversity including extensive wildlife habitat (191 recorded bird species), well managed forests, blocks of unfragmented land, and a connection between the White Mountain National Forest and Squam

Lakes that makes the conservation of these areas a project of regional, statewide and national significance.

A good example of this biodiversity is the pine marten or American Marten, which inhabits the high elevation Spruce-Fir forest type within the Squam Range and lowlands such as around Kusumpe Pond. It is also a state-listed threatened species. The Squam Range contains a number of late successional to old growth forests that are increasingly rare in New Hampshire. This area also contains the largest streams that flow into Squam Lake. At least two of the brooks contain naturally spawned salmon parr, and all of them contain brook trout for part of the year. A more detailed report on the ecology of this areas is contained in **Appendix A-Squam Range-Beebe River—An Area of High Conservation Value.**

Conservation Lands—*25,900 Acres in Conservation*

There are approximately 25,900 acres of lands in Sandwich that are in conservation, and most are permanently protected from land development. These lands are divided into four levels of ownership, as shown on the **Conservation Lands Map—** federal, state, municipal/county, or private. Conserved land includes land permanently protected by the fee owner or through a conservation easement.

After the WMNF, the next largest category of conservation land is held by several private nonprofit conservation organizations. According to the latest NH GRANIT System records, which tracks conservation lands statewide, Sandwich has 3,240 acres (14% of conservation land) or thirty-six (36) properties.[5] These lands have been protected by private non-profit land trust organizations through the donation or acquisition of fee ownership or conservation easement.

Note: There are additional conservation lands that have not yet been incorporated into the GRANIT system. Over the past several years there have been nearly 3,000 acres of conservation lands added to the town's inventory.

There has been a tremendous amount of conservation activity in Sandwich over the past 30 years. In 1980 there were only 730 acres *(Town of Sandwich Master Plan, 1980*) of land conserved by both public and nonprofit entities, as compared to over 8,700 acres today, an increase of almost 8,000 acres or about an 11-fold increase.

The efforts of the community and several land trusts serving the region have made great strides in permanently protecting critical conservation lands in town. At present, there are three land conservation initiatives involving a number of conservation groups, including the Sandwich Conservation Commission. These include:

[5] Since the NH GRANIT GIS database takes several months to record and post new conservation lands, the above total should be considered approximate to roughly six months prior to May 2010.

- "Squam Wildlife Corridor" that the Squam Lake Conservation Society has been pursuing for the past two years. This effort is to connect the Squam Range with Squam Lake based on research from the *Squam Range Perspective, 2006*. **See Appendix B.**
- "Whites to the Ossipees" initiative by the Squam Lakes Conservation Society, covering the eastern part of Sandwich and including the western part of Tamworth. Supported by the Sandwich Conservation Commission (SCC).
- Protection of unfragmented land near or adjacent to the WMNF, inclusive of the recent conservation action of the Northeast Wilderness Trust, the Lakes Region Conservation Trust, Green Mountain Conservation Group and Society for the Protection of New Hampshire's Forests that have added lands in Whiteface Intervale-Wonalancet Intervale area.

Conservation lands are located throughout the town, with concentrations in several areas (see **Map 12, Conservation Lands Map)**. A string of thirteen (13) conservation properties are located along the boundary of the White Mountain National Forest, adding to that significant block of conservation land. Concentrations of conservation lands have also emerged around Squam Lake (south of Route 113), Red Hill Pond and Red Hill River, Bearcamp River/Atwood Brook corridor, and the Mill Brook area adjacent to NH Route 113A in northeastern Sandwich.

There are a number of conservation entities that hold easements and fee interest in conservation lands including the following:

- Lakes Region Conservation Trust (1,269 acres)
- Society for the Protection of New Hampshire Forests (1,026 acres)
- Northeast Wilderness Trust (569 acres)
- Squam Lake Conservation Society (332 acres)
- New Hampshire Audubon Society (239 acres)
- Green Mountain Conservation Group (160 acres)
- L. Boyd Chapman Wildbird Sanctuary (118 acres)
- New England Forestry Foundation (97 acres)

Other publicly owned land includes a 76 acre property held by the University of New Hampshire on Squam Lake and twenty (20) properties held by the town, totaling 2,430 acres (10% of conservation land). Appendix B details conservation land information.

Note: Not all town properties are in permanent protection, i.e., could be sold for profit.

The Town of Sandwich has a dedicated Conservation Fund that is used mostly for land acquisition purposes. Much of the money for this fund comes from the Land Use Change Tax that is imposed on land owners who develop property that is in Current Use. At present, 25 % of the tax goes toward the Conservation Fund, with 75% going to the General Fund. In 2008 the Land Use Change Tax was $9,285.

Scenic Quality

Figure 2-3. Squam Lake from Squam Lake Road

In the first Master Plan Update public forum in May, 2008 the participants identified several strengths of Sandwich that relate to its scenic quality. These included the natural environment and its beauty as well as the town's cultural identity and historic resources. The 1980 Master Plan included a list of scenic views in Sandwich that contribute to its visual appeal. This 2011 Master Plan Update concludes that, in addition to views, other natural and man-made features contribute to the high scenic value of the Sandwich landscape and should be protected. Examples of such features include:

- Squam Lake viewed from Diamond Ledge Road
- Top of Wentworth Hill on Rte. 109: both the houses and the views looking north, south or west
- Top of the World Road
- Looking west over Squam Lake from Squam Lake Road (See accompanying figure.
- The blend of architecture, historical buildings and public parks in Center Sandwich
- Sandwich Notch Road
- The Cook Farm and Mead Base from Diamond Ledge Road
- Whiteface Intervale Road
- Durgin Bridge over the Cold River
- Beede Falls (See accompanying figure.)
- The Potholes
- Town beaches: Bearcamp Pond and Squam Lake
- Bearcamp River Trail
- Teacup Lake
- Chapman Bird Sanctuary
- Baptist Church cemetery

Figure 2-4. Beede Falls

The natural and cultural landscape of Sandwich provides many residents with a sense of pride and community, making it distinctive from other communities. Highly valued scenic views and vistas can enhance the quality of the community and the desirability for living there. Given the residents' identity with the town's scenic quality, it is important to maintain current policies to protect these resources as well as to consider additional policies and programs to ensure the long-term scenic quality of the town.

The key regulatory policy for protecting the town's scenic quality is the designation of a Skyline Zoning District that limits uses to agriculture, forestry and recreation, but does not allow for any structures. There is also a Steep Slope Protection provision in the Zoning Ordinance that limits activity on slopes greater than 15%.

Issues and Challenges

Sandwich has a diversity of geography, including hilly terrain, a variety of forest types, open agricultural lands, an abundance of water resources and rich wildlife resources that make it a desirable community to live in. The challenge for the town will be how to protect and conserve these resources.

Agriculture and Forest Resources

Although high quality agricultural soils are limited, Sandwich can continue to derive social and economic value from active agricultural activities. Like the town's forest resources, farmlands are also a part of the town's historic fabric and scenic quality. These resource areas should be actively managed and protected for the long-term value to the Sandwich community. Specific challenges, issue and action steps for protection are discussed in the Land Use Chapter.

Surface and Groundwater

Sandwich is blessed with an abundance of high quality surface and groundwater that, like its forest and agricultural resources, provide both environmental and economic value to the community. While the town has a number of water resources protection measures and programs in place, there are areas where further action should be considered. These include:

- Consideration of additional language in the Shoreland District with respect to prohibited use and activities.
- Better protection for lower order streams and brooks which are not directly covered by either state or local regulation.
- Greater protection for the town's aquifer resource areas

Wetland and Water Resources

Sandwich contains over 3,200 acres of wetlands identified under the National Wetland Inventory and over 4,700 acres of hydric soils. In addition, the town has identified eight prime wetlands. There are also almost 100 miles of streams and rivers as well as over 2,300 acres of open water. The town will need to continually manage and protect these resource areas. At present, there are both regulatory and non-regulatory programs protecting these resources. Consideration might be given to the following:

- Coordination of water quality protection efforts including a review / revision of municipal ordinances, protection of ground water resources, and continued monitoring

of water quality, such as the current support of water quality sampling efforts of the Green Mountain Conservation Group.

- Encouraging water monitoring programs in all watersheds and major rivers in town.

- Encouraging best management practices for development and stormwater management through regulatory changes and educational outreach.

- Evaluating town ordinances to minimize fragmentation of agricultural and forest lands, limit steep slope development and cuts; and minimize impacts to streams, lakes and ponds through shoreland regulation.

- Continuation and enhancement of educational programs that are directed at the need to protect and conserve the community's natural resources.

Wildlife

In terms of protecting the wildlife resources of Sandwich, the best overall approach is to protect habitat. With the amount of conservation land in the White Mountain National Forest, clearly the higher elevation northern hardwoods and spruce-fir habitats are well protected. Low-elevation mixed forests are also fairly well-conserved, although riparian lands and shoreland habitats could be better conserved. Providing ample opportunities for all resident and non-resident populations to view, hunt or otherwise appreciate wildlife should become a part of any major development proposal that faces the town.

Conservation Lands

There are over 25,000 acres of conservation or protected lands in Sandwich, of which over 17,000 acres are in the WMNF. In addition, there are numerous scientifically documented resource areas including critical water resources, forest resources and high quality wildlife habitat that should be protected and properly managed for the benefit of current and future citizens of Sandwich and the region. There are several local/regional initiatives to protect land in Sandwich. Sandwich may wish to support the expansion of existing conservation lands, as well as to ensure long-term management of existing conservation lands.

Action Plan

Vision Goal for Natural and Scenic Resources

Preserve Sandwich's natural environment, scenic beauty, open space, clean water and wildlife through well managed growth and careful planning.

Objective NR 1: Protect our water resources including: surface waters watersheds, shorelines, wetlands, floodplains, and aquifers.

Actions

NR 1.1: Update the Prime Wetland designations and documentation including accurate mapping for each of the identified Prime Wetlands.

NR 1.2: Consider more stringent requirements for activities adjacent to Prime Wetlands such as expanded setbacks.

NR 1.3: Consider separating the shoreland aspects of Wetland Protection and placing them into a separate, but compatible, local Shoreland Protection Overlay District that would focus particularly on lower order streams not covered by the state Comprehensive Shoreland Protection Act, RSA 483-B (CSPA). Such an ordinance could contain sections on permitted and prohibited uses, and standards for activities within a Riparian Zone (e.g., 50 feet from Reference Line).

NR 1.4: Consider adoption of specific, more restrictive shoreland and watershed protection measures within the Beebe River Watershed and portions of the Ossipee River and Winnipesaukee River watersheds.

NR 1.5: Amend the subdivision and site plan review regulations to incorporate stormwater management standards that require best management practices for Low Impact Development and minimize the amount of impervious surfaces for any land use activity that disturbs more than 20,000 sf of land. At a minimum these regulations should incorporate by reference the standards of appropriate New Hampshire statutes.

NR 1.6: Consider amending current Floodplain Management Section of the Zoning Ordinance or adopting a revised Flood Hazard Overlay District. Such an ordinance should be similar to other overlay districts that include permitted uses, prohibited uses and also contain requirements such as:

- Restricting placement of principal building unless no other location on lot of record prior to adoption of ordinance;

- Prohibiting uses that have high potential for causing hazardous condition; and
- Requiring new structures or additions to be 1-3 feet above base flood elevation.

NR 1.7: Ensure compliance with state and town regulations involving water resource protection, particularly with respect to wetlands and shorelands.

NR: 1.8: Consider the development of a town-wide Water Resource Inventory and Management Plan consistent with NH RSA 4-C: 22.

NR: 1.9: Adopt an Aquifer/Groundwater Protection Ordinance to protect the quality of the water in Sandwich's stratified drift aquifers.

Objective NR 2: Preserve Sandwich's surface water resources by meeting state water quality standards.

Actions

NR 2.1: Establish a testing program for septic systems by town personnel within the Shoreland Residential District, to assure proper function with no measurable 'leakage' into nearby town waters.

NR 2-2: Continue monitoring of water quality, such as through the water quality sampling efforts of the Green Mountain Conservation Group on the Cold River and Pond Brook and the Squam Lake Association through the UNH-LLMP on Squam Lake.

NR 2.3: Establish water monitoring programs in all watersheds and major rivers and ponds in town through NHDES VRAP and/or VLAP programs or UNH-LLMP sampling programs to complete the set of significant ponds and bays within Sandwich's boundaries under this program.

Objective NR 3: Protect valuable natural resource features and communities including high value wildlife habitat. *(See related Objective and Actions)*

Actions

NR 3.1: Develop a town-wide open space plan that identifies and maps high value natural resource areas throughout Sandwich and recommends priority areas for protection.

NR 3.2: Amend the Subdivision and Site Plan Review Regulations to require an applicant to undertake the following options at the Planning Board's discretion:

- An environmental impact statement and recommendations for mitigation.
- A wildlife habitat study and recommendations for mitigating impacts

Objective NR 4: Encourage educational and outreach programs related to the protection and long-term stewardship of Sandwich's natural resources.

Action

NR4.1: Coordinate efforts of town and private organizations to inform and educate townspeople regarding land use, conservation and natural resource issues.

Objective SQ.1: Maintain and protect the quality of Sandwich's scenic environment.

Actions

SQ: 1.1: Undertake a Visual Resource Analysis based on a systematic approach to identifying and prioritizing visual resources such as that described in the NH OEP Bulletin #10, *Preservation of Scenic Areas and Viewsheds* or the US Bureau of Land Management's Visual Resource Management program. See link below.

http://www.blm.gov/nstc/VRM/

Such a survey could begin with existing scenic views identified in the current Master Plan.

SQ: 1.2: Amend the Zoning Ordinance such as through additions to the Skyline District or Steep Slope Protection to provide for greater protection of scenic quality from the impact of development.

SQ: 1.3: Adopt provisions within the Subdivision and Site Plan Review Regulations to allow the Planning Board to require location of such utilities as electrical, telephone and cable underground for large multi-lot subdivisions.

Vision Goal for Natural Resource Conservation

Support and encourage protection and management of high value conservation and open space lands that are linked by trails and/or wildlife and natural resource corridors.

Actions

NRC 1.1: Identify areas of high ecological and conservation value to establish conservation/land protection priorities.

Note: For the long-term the Town should acquire a single Geographic Information System (GIS) for use by Town Boards and Departments that will satisfy the needs of the Planning & Zoning Boards, Conservation Commission, Assessor, etc. Such a system will be able to integrate both mapped data with town record data and will allow the town to update its information data base. It will also allow the town to undertake analysis of mapped information for better decision-making, such as suggested in Land Use Action LU 1.1

NRC 1.2: Coordinate current, and create additional, non-motorized trail networks by connecting trails, pathways and sidewalks and Class VI roads.

NRC 1.3: Forecast potential land acquisition/conservation expenditures and consider directing more than the current 25% of Land Use Change Tax (LUCT) to the town Conservation Fund.

Appendix A

Squam Range-Beebe River—An Area of High Conservation Value

In 2006, the Squam Lakes Conservation Society prepared a report—*Squam Range Perspective,* authored by Rick Van de Poll—on the ecological and conservation value of the Squam Range that incorporates Sandwich as well as Holderness and Campton. He also authored a similar report in 2007 that included the Beebe River watershed which is adjacent to the Squam Range and located in both Sandwich and Campton. It is a tributary to the Pemigewassett River. Taken together, there is extensive wildlife habitat, well managed forests, blocks of unfragmented land, and a connection between the White Mountain National Forest and Squam Lakes that makes the conservation of these areas a project of regional, statewide and national significance.

The following is a summary of these reports. While this resource encompasses several towns much of what is documented below is relevant to Sandwich.

Ecological Setting

The Squam Range is a largely a roadless tract of land of over 20,000 acres situated in between the White Mountain National Forests to the north and the Squam Lakes watershed to the south. Seven named, low to middle elevation peaks cap the range from the 1265-foot Cotton Mountain in the southwest to the 2220-foot Doublehead Mountain in Sandwich in the northeast.

The range is largely forested, with a few areas of clear cuts and other openings due to historic settlement along NH Route 113. There are very few wetlands or open water bodies on the range proper, although such resources exist in the nearby lowlands such as at Kusumpe and Intervale Ponds in Sandwich and along the Beebe River. In addition, scattered forested swamps, beaver marshes, or vernal pools can be found along perennial drainage ways and on side slope benches, although very few exceed 10 acres in size. Steep slopes that average between 25 and 40% are bisected by intermittent and upper perennial streams that dot the upper and middle slopes.

Beebe River, on the north side of the Squam Range, is a wild and important tributary of the Pemigewasset River. It rises on the south slopes of Sandwich Dome in the White Mountain National Forest and descends through rocky cataracts and a series of beaver ponds to the Pemigewasset River in Campton. Its upper watershed is ringed by a series of 2,000-foot peaks that are entirely undeveloped.

Ecological Attributes

The Squam Range-Beebe River is in a unique location since it is near the junction of all three ecoregions in New Hampshire--the White Mountain in the northern part of the state, the Vermont-New Hampshire Uplands in the western part of the state, and the Coastal Plain-Sebago Hills in the eastern part of the state. Consequently, this area contains a mix of species that represent a broad range of climate tolerances and habitat types.

A two-year bio-inventory completed for the Squam Lakes Association in 2001-2002 came up with the following:

- over 550 species of vascular plants including black gum (tupelo), white oak, gray dogwood, New Jersey tea, narrow-leaved goldenrod
- 23 species of amphibians and reptiles,
- 27 species of freshwater fish,
- 191 species of birds
- 43 species of mammals, and
- 683 species of fungi.

Within these assemblages, roughly 5% of them are rare in the state, many of which, such as the American marten are at their southernmost limits, while others, such as the bridle shiner and the purple clematis, are at their northernmost limits.

The Pine Marten—A Threatened Species

A good example of this biodiversity is the pine marten or American Marten which inhabits the high elevation Spruce-Fir forest type within the Squam Range as well as some lowlands such as around Kusumpe Pond which is believed to be the southernmost occurrence in the state. This habitat location is unusual, since almost all of the records for the pine marten are for the White Mountains and to the north. Furthermore, the pine marten is considered a threatened species by NH Fish and Game Department is.

It appears that older forests are critical for their survival, especially where their range overlaps with the fisher. Increasing road density and timber harvesting has been shown to have a negative effect on their population. The Squam Range provides an unfragmented mix of conifer and deciduous forest to allow this species to exist at the very edge of its range. It also provides ready access to a core population in the higher elevation White Mountain National Forest to the north and east. Maintaining the structural integrity of the ridgeline spruce-fir forest, as well as an unbroken forested corridor to adjacent lowlands is important for species survival.

A forest inhabitant often associated with the range of pine marten is the Canada lynx. This *federally* threatened mammal also occupies spruce-fir forests and is rumored to exist in the Squam Range area. The statewide *Wildlife Action Plan* (NH Fish & Game, 2005) shows the Squam Range as the southernmost extent of contiguous lynx habitat according to extensive habitat modeling.

Rattlesnake Habitat

Both East and West Rattlesnake derive their name from the eastern timber rattlesnake which was attracted to the dry, south-facing talus slopes and ledges that at one time provided suitable winter habitat. No rattlesnakes currently occur on East or West Rattlesnake. However, there is a high-quality habitat rich in a number of plant and animal species with southern affinities. For example, New Jersey tea and gray dogwood reach their northern limit in the state. There are also sizable old growth white oaks and direct evidence of what appears to be the largest, truly old growth forest on the Squam Range. Over 40 acres of undisturbed woodland exist in pristine condition – complete with trees over 300 years old, old fire-scarred tree boles, desiccated downed logs, and intact, turfy 'lawns' of grasses and forbs. Although not all within Sandwich, , the 2001 study recorded over twenty-four rare plants stations representing 12 species and over 3000 individuals on West Rattlesnake alone

Old Growth Forests

As described above, the Squam Range contains a number of late successional to old growth forests that are increasingly rare in a state characterized by intensive logging and development. Within Sandwich there are several old growth forest areas. The talus area below Mt. Squam contains old growth northern hardwoods that have never been cut or burned. This patch is discontinuous with an old growth yellow birch-red spruce forest on Mt. Doublehead of unknown size. Since relatively few of the upper slopes of the Squam Range have been surveyed, more pockets of old growth likely exist.

Conservation Potential of the Squam Range

At present, the Squam Range remains a remarkably pristine area in an area of seasonal population growth. The Squam Lakes area serves a population base of over 5,000 year-round and over 12,000 summer residents. In spite of recent land use regulatory initiatives, there is still significant potential for second home growth in the watershed.

Viewscapes

Several excellent view sites exist in the Squam Range including the south side of Doublehead. The site has been recently addressed by two critical conservation acquisitions by the Squam lakes Conservation Society. Other views still exist a number of which are identified in the 1980 Master Plan.

Critical Forest Blocks

The Squam Range is one of the critical roadless forested blocks in central New Hampshire. A recent survey of the Mooney Point area yielded field data on a Hemlock-Beech-Oak-Pine Forest of statewide significance with white pines averaging 110 – 130 feet tall and up to 4 feet in diameter. An even older patch of a Hemlock - White Pine Forest exists on conservation land in Bear Cove.

This land area contains the largest streams on Squam Lake, all of which provide clean, low-nutrient, and oxygen-rich waters to Cotton, Livermore, Cairns, Bennett, Squaw and Bear Coves. At least two of the brooks contain naturally spawned salmon parr and all of them contain brook trout for part of the year. White suckers, slimy sculpin, plus a myriad of aquatic invertebrates testify to the high quality of the water, and the abundance and diversity of aquatic plant life in Squaw Cove attests to the regular supply.

Summary

Protection of the Squam Range and Beebe River area in Sandwich as well as the other communities that define this unique area is critical. The quantity and character of its diverse wildlife habitat, its vital role as a water source, the unfragmented nature of its forest growth, a tradition of low-impact recreational uses, the history of private ownership, the connection between Squam Lake to the White Mountain National Forest, and its viewshed value to Squam Lake and Pemigewasset Valley residents combine to make this area a premier conservation resource.

The potential for significant conservation of lands in the Squam Range is tremendous. The area has undergone relatively few landowner changes over the last hundred years, and it has a history of conservation-minded organizations that support sound land use management.

- Squam Lakes Conservation Society has a solid foothold of conserved lands in the Squam Range, and is actively working to protect critical parcels within view of the lake.
- Squam Lakes Association has maintained over 35 miles of trails that are used by over ten thousand people each year. Its affiliation with Plymouth State University, and the top-quality research being supported by PSU's Center for the Environment, makes the Squam Range a superb laboratory for long-term research and graduate education.
- Squam Lakes Natural Science Center has upheld a reputation of excellence in environmental education among primary and secondary schools, and continues to attract and inform visitors about the natural beauty of the area.
- Lakes Region Conservation Trust holds a critical property at its Kusumpe-Intervale Preserve and is actively supporting the conservation of the Burleigh Farm lands.
- Sweet Water Trust has already invested its time and financial support to each of the above organizations and continues to be a leading supporter of forever wild lands in the Squam Range.

Each of these organizations recognizes the value of the natural landscape on the Squam Range and each is playing a critical role in the furtherance of its protection.

APPENDIX B
Sandwich Conservation Lands-January 2011

Name	Tax Map Reference (Range-Lot)	Primary Protection Agency[a]	Primary Protection Type[b]	Acreage[c]
Federal				
White Mountain National Forest	R14-15	USDA	FO	16,934 (69.9% of total)
State				
Five Finger Point	R21-7	UNH	FO	71 (0.3% of total)
Private				
Captain Neal Brook	R5-8	TOS	CE	100
Bates	R6-5	TOS	CE	264
Emerson-O'Neill	R9-4	TOS	CE	12
Crooker	R9-8B	TOS	CE	22
Henry Easement	R9-29, 29A, 30	TOS	CE	218
Emerson[d]	R10-1, 10-4, U1-3, U3-1	TOS	CE	609
Myers Schneider	R11-40	TOS	CE	176
Jackson & Huston/Heritage Woods	R11-37E, F, G, H	TOS	CE	16
Dyer	R12-64	TOS	CE	8
Adriance	R12-78B	TOS	CE	20
Sandwich Town Forest [e]	R14-17	TOS	FO	68
Mutter	R15-1	TOS	CE	433
Cook	R18-2	TOS	CE	273
Sandwich Notch Park Paige	R18-4	TOS	FO	16*
Sandwich Notch Park Keith	R18-5	TOS	FO	30
Colonel Lewis Smith Lot Peaslee	R18-6	TOS	FO	70*
Sandwich Town Forest	R19-11	TOS	FO	80
Total Acreage-Municipal				2,415 (10.0 % of total)
Private				
Whites Forest	R2-2	LRCT	FO	42
Butters	R2-23A, 26	LRCT	FO	23
Gifford Trust	R2-62	LRCT	CE	21
Bearcamp Conservation Area	R2-85	LRCT	FO	126
Blodgett	R3-1	LRCT	CE	58
Alice Bemis Thompson Wildlife Refuge	R3-58, 59, 59A, R2-8A	Audubon	FO	279
Wyman Easement	R3-61A	Audubon	CE	10
Nye	R4-30	SPNHF	CE	505
Mill Brook Expansion	R4-21A	LRCT	FO	17
DW Emerson Preserve	R5-23	SLCS	CE	121
Daniels (A) / Daniels J.	R5-30	SPNHF	CE	86
Daniels (B) / Daniels R.	R5-30B	SPNHF	CE	60
Tewksbury Preserve	R5-31	LRCT	FO	409
Rich Memorial Forest	R5-39	NEFF	FO	90
Wonalancet Nominee Trust	R5-42	GMCG	CE	180
Lincoln / Bates	R6-8	SPNHF	CE	106

Pohl Easement	R8-30	SPNHF	CE	155
Maple Ridge Road Lot Emerson 5	R8-45	LRCT	FO	70*
Upper Road Lot Emerson 4	R8-53	LRCT	FO	53*
Red Hill River Lot Emerson 2	R11-20	LRCT	FO	372
Wentworth Hill Road Lot Emerson 3	R11-49	LRCT	FO	57
Walsh	R13-4, R8-59, 30C	LRCT	CE	116
Sharp Forest	R13-5A, 5B	SPNHF	FO	64
Chapman Wild Bird Sanctuary /Visny Woods	R14-7	LBC	FO	70
Chapman Wild Bird Sanctuary	R14-6, 13	LBC	FO	40
Sandwich Notch Emerson 1	R18-7	LRCT	FO	250
Levi Smith Conservation Area	R19-26	SLCS	FO	124
Metcalf Preserve	R19-36	SLCS	FO	86
Beede Farm/Lost Lake Preserve	R19-58E, 58F, 58G	LRCT	FO	140
Barville Pond Easement	R20-2	SLCS	CE	20
Merriman Forest	R20-27, 38	SPNHF	FO	102
Sabine Point	R20-28F, 28G	SLCS	CE	3
Mayer Family Trust	R20-42	SLCS	CE	41
Sharpland Campstead Easement	R20-47	SLCS	CE	16
Coolidge Beede Forest	R20-51, 51A	SLCS	CE	302
Kusumpe Brook Association	R20-56	SLCS	CE	6
Kesumpe/Intervale Ponds	R20-58C, 58D, 21-29A	LRCT	FO	92
Ponzi Conservation Area	R20-63	SLCS	CE	28
Smith Brook Conservation Area	R21-1A	SLCS	CE	3
East Rattlesnake I	R21-4	SLCS	FO	65
Twig's Island	R21-4A	SLCS	FO	0.1
Lily Cove I	R21-4B	SLCS	CE	14
Lily Cove III	R21-4G	SLCS	FO	15
Lily Cove II	R21-5B	SLCS	CE	3
Pinehurst	R21-6	LRCT	CE	32
Allen Preservation Easement	R21-6B	SLCS	CE	6
Kirk Campstead Easement	R21-6C	SLCS	CE	8
East Rattlesnake II	R21-13A	SLCS	FO	23
Butterworth Natural Area	R21-13B, 13D	LRCT	FO	34
Steward	R21-18A, 21-36	LRCT	FO	6
Isaacs Easement	R21-22	LRCT	FO	213
Suzanne Peerface	R21-37	SLCS	CE	9
Otter Cove	R21-42, 42A	SPNHF	FO/CE	63
Hoag Island	R21-43	SLCS	CE	90
Doublehead Preserve	R22-4	SLCS	FO	58
Eastman Brook	R22-13	SLCS	CE	88
Red Hill River Conservation Area	U3-2	LRCT	FO	14*
Total Acreage-Private				4816 (19.9% of total)
Total Acreage-All conservation Land				**24,404**

Notes:

a. Primary protection type: CE = Conservation Easement; FO = full ownership.

b. Agency: TOS = Town of Sandwich; LRCT = Lakes Region Conservation Trust; Audubon = Audubon Society of NH; SPNHF = Society for the Protection of NH Forests; NEFF = New England Forestry Foundation; GMCG = Green Mountain Conservation Group; LBC = Leonard Boyd Chapman Wildbird Sanctuary and Visny Woods.
c. The reported acreage is that given in the 2010 Town Assessor's database. For a number of properties, the acreage shown in Town records differed (>25%) with that shown in the UNH GRANIT database as of January 9, 2011; those for which this difference could not be resolved are marked with an asterisk (*). Further work is needed to determine the correct conservation acreage and to ensure the accuracy of Town records.
d. Emerson, Town of Sandwich conservation easement. Although the acreage and boundaries of the conservation easement did not change, R10-1 and 10-4 have been subdivided to create several new lots. The details of these subdivisions and these new lots, some created in 2010, are not contained in this table and should be added as the table is updated.
e. Town Forest (R14-17). Town Assessor's records (and recent Town reports) say that this parcel contains 100 acres although a recent survey shows that the actual land area is 68 acres. This latter value (only slightly different that the GRANIT value of 65 acres) is used in this table.

Appendix C
Rare Threatened or Endangered Species and Natural Communities

NH Natural Heritage Bureau

Town Flag	Species or Community Name	Listed? Federal	Listed? State	# reported last 20 Town	# reported last 20 State
Sandwich					
	Natural Communities - Terrestrial				
**	Hemlock - beech - oak - pine forest	--	--	1	11
**	Northern hardwood - spruce - fir forest	--	--	1	12
**	Red oak - pine rocky ridge	--	--	1	14
**	Rich red oak rocky woods	--	--	1	21
	Natural Communities - Palustrine				
**	Black gum - red maple basin swamp	--	--	1	28
**	Medium level fen system	--	--	1	59
***	Poor level fen/bog system	--	--	1	27
	Plants				
**	American Cancerroot (*Conopholis americana*)	--	T	1	24
	Budding Pondweed (*Potamogeton pusillus ssp. gemmiparus*)	--	E	Historical	6
*	Douglas' Knotweed (*Polygonum douglasii*)	--	E	1	11
	Dwarf Bulrush (*Lipocarpha micrantha*)	--	E	Historical	3
**	Fern-leaved False Foxglove (*Aureolaria pedicularia var. intercedens*)	--	T	2	20
**	Grassleaf Goldenrod (*Euthamia caroliniana*)	--	E	1	6
	Green Adder's Mouth (*Malaxis unifolia*)	--	T	Historical	57
**	Missouri Rock Cress (*Arabis missouriensis*)	--	T	1	13
	Mountain Firmoss (*Huperzia appalachiana*)	--	T	Historical	14
	One-sided Rush (*Juncus secundus*)	--	E	Historical	6
	Purple Clematis (*Clematis occidentalis*)	--	T	Historical	25
	Reversed Bladderwort (*Utricularia resupinata*)	--	T	Historical	15
**	Rock Sandwort (*Minuartia michauxii*)	--	E	1	3
***	Three-birds Orchid (*Triphora trianthophora*)	--	T	1	25
	Wiegand's Sedge (*Carex wiegandii*)	--	E	Historical	6
	Wild Senna (*Senna hebecarpa*)	--	E	Historical	10
	Yellow Lady's Slipper (*Cypripedium parviflorum var. makasin*)	--	E	Historical	10
	Vertebrates - Mammals				
**	American Marten (*Martes americana*)	--	T	1	69
	Vertebrates - Birds				
**	Bicknell's Thrush (*Catharus bicknelli*)	--	SC	1	18
**	Common Loon (*Gavia immer*)	--	T	5	254
**	Grasshopper Sparrow (*Ammodramus savannarum*)	--	T	1	12
**	Rusty Blackbird (*Euphagus carolinus*)	--	SC	2	8
**	Vesper Sparrow (*Pooecetes gramineus*)	--	SC	1	12
	Vertebrates - Reptiles				
**	Smooth Green Snake (*Opheodrys vernalis*)	--	SC	1	37
	Vertebrates - Fish				
	Lake Whitefish (*Coregonus clupeaformis*)	--	SC	Historical	8
	Invertebrates - Dragonflies & Damselflies				
**	Ebony Boghaunter (*Williamsonia fletcheri*)	--	SC	1	2

Listed? E = Endangered T = Threatened SC = Special concern M = Monitored

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

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