Natural Resource Inventory and Evaluation for Dana Pasture Natural Area in Hanover, New Hampshire

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EXECUTIVE SUMMARY

The Dana Pasture property is located in the town of Hanover, New Hampshire on the ridgeline of Moose Mountain. Moose Mountain is located in eastern Hanover and is an eight mile long ridge running roughly north/south. The property is co-owned by the Town of Hanover and the Robes Family.

The goal of this project is to inventory and evaluate natural resource features throughout the Dana Pasture Natural Area, and to identify sensitive areas. The Town of Hanover Conservation Commission wishes to maintain the scenic, cultural and ecological integrity of the property. The objectives are:

1. Provide an evaluation of the property and prioritize areas from a natural resources perspective while identifying sensitive areas
2. Provide an assessment of cultural and scenic resources found throughout the property.
3. Provide the Town of Hanover with the ability to integrate data generated from this project into existing GIS coverages, related to natural, cultural, and scenic resources.
4. Incorporate data generated from this study with other complementary studies including adjacent and regional connections of Natural Resource Inventories, Master Plan updates, watershed-wide planning, and Town-wide low impacting recreational uses.

Recommendations for Wetlands

1. Maintain buffers around all wetlands. Ideally buffers should be over 100 feet or more, particularly around wetland containing open water and emergent vegetation. For some wetlands (forested, scrub-shrub) a 50-foot buffer should be adequate, especially since the area will not be developed and only affected by timber harvest.
2. A comprehensive wetland delineation of the entire property should be done to better understand connectivity of habitats and extensions of ecological functions.
3. Use some of these wetlands for education, especially where access is relatively easy. The Mill Pond Wetland Complex has easy access to the beaver ponds, and would make an excellent outdoor classroom.
4. There are a few areas that offer excellent scenery and wildlife/wetland viewing. A couple of additional benches in key areas would enhance viewing and enjoyment of Mill Pond.

Recommendations for Perennial Streams

1. Protect all perennial streams by maintaining an adequate buffer around them. We recommend 50+ feet around all perennial streams with more in steep sloped areas.
2. Removal of any temporary crossings used for logging purposes. Examples include, temporary bridges and pole ford crossings.
3. If a crossing is planned for perennial streams, a bridge that runs “top of bank” to “top of bank” is recommended to maintain natural stream flow, fish passage, and insect travel.

Vernal Pool Recommendations

1. Maintain buffers around vernal pools. Ideally buffers should be over 100 feet or more. The US Environmental Protection Agency and NH Department of Environmental Services recommend at least a 50-foot buffer around vernal pools.
2. Education – bring schools in to document some of these pools, particularly those that are easily accessible for groups.
3. Monitor some or all vernal pools, especially if there is a change in use of the forest (eg., timber harvest, new trails, etc.). The vernal pools documented in this report were found in November, 2012, a time when vernal pool species are no longer using them. They should be verified in May/June.

**Recommendations for Mast Producing Trees:**
1. Manage mast producing trees and shrubs for a continuous source of wildlife food and quality seed for regeneration
2. Retain beech trees with bear claw marks on the trunk or clumps of broken branches in the crown.
3. Whenever possible avoid harvesting beech and oak mast stands during the fall (September through November), important foraging time for bears and other wildlife.

**Recommendations for Dense Softwood Stands**
1. Retain dense softwood stands throughout the Dana Pasture property to be used as deer and other wildlife wintering areas. Target for 20% throughout the region for the following reasons:
   - wetland complex protection
   - stream buffers
   - surrounding land contains mostly hardwood or mixedwood stands, and therefore retaining softwood on the property is important
2. Protect cavity trees, which are important for nesting or denning of many bird and mammal species
3. Softwood is good cover for walking the hiking trails for human use

**Recommendations to Conserve Scenic Resources**
1. Maintain fields on western part of the property with panoramic views towards the Connecticut River Valley and Vermont.
2. Maintain hiking trail around Mill Pond. A couple of additional benches along the pond will enhance enjoyment for visitors.
3. Determine the impacts of development on the Moose Mountain Ridgeline in general and how the view towards the ridge would be affected.

**Recommendations to Protect Cultural Resources**
1. In the event of future timber harvests in the area of cultural resources, flag the area to show loggers which areas to avoid.
2. Fell trees away from stone walls, the mill pond dam site or other sites to protect them.
3. Use existing stone-wall openings when possible. Limit the number of new openings and cut only the minimum width necessary. Leave openings for future use if necessary. Otherwise restore the wall when work is completed.
4. Contact the NH Division of Historical Resources for additional advice about documenting and protecting cultural and historic resources, particularly the mill dam site. http://www.nh.gov/nhdhr/. The agency is located at 19 Pillsbury Street, Concord, NH 03301-3570. Phone: 603-271-3483
Soil Protection Recommendations
1. Detailed soil mapping should be completed before any type of activity occurs on the property. The soils mapped by NRCS are sensitive to activities such as timber harvest, community development, and use by motorized vehicles. The three main issues on the Dana Pasture property are:
   a. Poorly drained (hydric) soil conditions
   b. Steep slopes (over 15%)
   c. Shallow soil depth

Recommendations for Permanent Openings
1. Maintain permanent opening areas whenever possible. They are valuable wildlife habitat and offer excellent recreational and scenic opportunities.
2. Identify areas where small clearings could be created to enhance additional views. Examples include areas upslope from Mill Pond to the east, where a small clearing could offer a view of the pond from above, and also create a small wildlife opening.

Priority Areas
The top four priority areas based on field inventory and mapping analysis for this study are listed below.

1. The Mill Pond wetland complex with dense softwood buffers, stands out as the number 1 priority in value of natural resources within the Dana Pasture property, and is equally important to the larger landscape from Moose Mountain Ridge to Mink Brook.
2. The permanent openings in the southwestern part of the property. The combination of viewsheds, recreational opportunities, and edge habitat diversity gave these openings high value during field inventory and mapping analyses.
3. Vernal pools and wetlands in the southwest and southeast parts of the property combined with hydric soils and adjacent forested land.
4. Dense softwood stands that are ecologically valuable, exist as a small portion of the property. They are important wintering areas for large and small mammals and birds, and are particularly important where they are adjacent to the permanent openings.

The value of these areas throughout the Dana Pasture property is evident because of their ecological diversity, combined with cultural and scenic resources, low-impact recreational use, and education possibilities. The ecological value of this property goes beyond the boundaries to the larger Moose Mountain region, where tracts of unfragmented land contribute to additional habitat for a diversity of wildlife, plant species, and habitat types.
INTRODUCTION AND OBJECTIVES

The Dana Pasture property is listed as 130 acres and is located in the town of Hanover, New Hampshire, on the top of Moose Mountain. Moose Mountain is in eastern Hanover and is an eight mile long ridge running roughly north/south with two named summits. North Peak is the highest peak in Hanover at 2,313 feet above mean sea level. South Peak is 2,293 feet. The entire ridgeline of the Moose Mountain region lies within a 25,000 acre block of minimally fragmented forest land that extends to bordering towns of Canaan, Lyme, Enfield, and Dorchester. The Dana Pasture property is approximately 8,700 feet south of Moose Mountain’s South Peak. Moose Mountain Lodge Road is in the northwest corner of the property, and provides vehicular access. There is further access via recreational trials which are part of an extensive trail network, including 13.9 miles of the Appalachian Trail in Hanover. Part of the trail system on the property is a Class VI road known as Pasture Road (discontinued since 1932).

A main attraction for the Dana Pasture property is Mill Pond. It was historically dammed, by people, but the dam is now maintained by an active beaver population. The perennial stream which leaves Mill Pond is a major tributary to Mink Brook, Hanover’s only 4th order stream that flows through the southern part of Hanover. Mink Brook enters the Connecticut River in southwestern part of Town.

Much of the property contains steep slopes with a large amount of exposed rock. There are sluiceways along the stream south of Moose Mountain Lodge Road and a rock/mortar dam known as Mill Pond Dam north of the Road. The slope of the stream provided power and energy for mills in the past. There is also an impressive series of beaver dams just north of the Moose Mountain Lodge Road and the water height of Mill Pond itself is enhanced by beaver activities.

The Town of Hanover Conservation Commission sent out a Request for Proposals to identify and prioritize areas from a natural resource, cultural resource and scenic perspective. Watershed to Wildlife, Inc. (WTW) was hired in October 2012 to assess its natural resources and identify high value areas within the property.

Goals and Objectives

The goal of this project is to inventory and evaluate natural resource features throughout the Dana Pasture Natural Area, and to identify sensitive areas. The Town of Hanover Conservation Commission wishes to maintain the scenic, cultural and ecological integrity of the property.

1. Provide an evaluation of the property and prioritize areas from a natural resources perspective while identifying sensitive areas.
2. Provide an assessment of cultural and scenic resources found throughout the property.
3. Provide the Town of Hanover with the ability to integrate data generated from this project into existing GIS coverages, related to natural, cultural, and scenic resources.
4. Incorporate data generated from this study with other complementary studies including adjacent and regional connections of Natural Resource Inventories, Master Plan updates, watershed-wide planning, and Town-wide low impacting recreational uses.
METHODOLOGY

Compile Existing Data into GIS

Digital data was gathered from GRANIT, Natural Resource Conservation Service (NRCS), and the Town of Hanover Data collected includes the following:

- Aerial photography
- Topographic map
- Hydrology (rivers, streams, lakes and ponds)
- National Wetlands Inventory wetlands
- Soils data (NRCS)
- New Hampshire Natural Heritage Bureau data
- Previous wetland delineations
- Trail map data
- Botanical Survey report by Alice Schori, 2001
- Wetlands delineated in portion of property by Jim McClammer, CWS #3, Connecticut Valley Environmental Services, Inc.
- Property survey information supplied by Christopher E. Rollins, Rollins Land Survey.

Existing available maps were then integrated using ArcMap-ArcView software. Using the 2009, 2003, 1998 and 1992 aerial photos topographic maps, and soils maps, features were digitized and overlaid onto a base map. These include:

- Dense softwood stands
- Mixedwood stands
- Hardwood stands
- Unique or noteworthy community types including potentially significant wildlife habitat
- Vernal pools
- Wildlife trails and travel corridors
- Recreational trails
- Cultural Resources
- Scenic Resources (scenic views from the property)

Steep slopes were determined using the NRCS soil maps. Data was displayed in ArcMAP and queried so only those soils map units with 15% slope and greater were displayed. Similarly, poorly and very poorly drained soils were displayed using NRCS soil maps. Data was queried so those soil map units classified as poorly and/or very poorly drained were displayed. Habitat types were digitized by WTW using a combination of aerial photographs, topographic maps, and GPS points with associated photographs and notes. They were displayed as polygons. Newly identified wetlands were incorporated into the GIS mapping. GPS points were taken at all documented vernal pools and brought into the mapping.

All maps are displayed at the end of this report with the features described above. All information gathered, compiled, and mapped for this report is in digital format, owned by the Town of Hanover.
Field Work
Two days of fieldwork were conducted throughout the Dana Pasture Property on November 5 and 12, 2012. Doug McIlroy and James Kennedy joined WTW and gave an orientation of boundaries and trails. Field work included inventories and assessments of several different habitat types (dense softwood stands, wetlands, mast-producing trees, rock outcrops, perennial streams), wildlife sign (direct or indirect observations), vernal pools, rock outcrops cultural resources, and scenic views. GPS point data, field notes, and photographs were taken at these points of interest. GPS locations were taken using a Garmin GPSmap 76CSx, WAAS enabled (not survey accurate), photography using a digital camera, and field books for notes and documentation.

Compilation of Project Data and Public Presentation
WTW produced a series of GIS maps displaying various natural resource features and a written report including a ranking priority of the natural resources contained within this property. A map displaying cultural resources and scenic views is also included. At the completion of the fieldwork and GIS analyses, Watershed to Wildlife, Inc. will present results from this study to the Hanover Conservation Commission and the public. The goal is to show what was accomplished during field work and analysis, and show some of the higher ranked areas on the Dana Pasture Nature Preserve. There will be time for discussion during this presentation.

Results

Wetlands
Wetlands are an essential habitat type for the majority of plant and animal species in New Hampshire. As a whole, wetlands are extremely diverse depending on the hydrology, soils, topography, and climate of an area. In addition to the rivers, lakes, and ponds, there are four general types of Palustrine wetlands: marsh, swamp, bog, and fen, with additional sub-types within each of these categories. Edge habitats within and around wetlands are used by a great deal of wildlife species. It is estimated that riparian areas and wetlands are used by over 90% of the region’s wildlife species, and provide preferred habitat for over 40% of local species.

Throughout the property, just over 10 acres of wetlands were documented. This equals 9% of the property. The wetland types varied greatly and included the following:

- Palustrine Forested Wetlands
- Palustrine Scrub Shrub Wetlands
- Palustrine Emergent Wetlands
- Open water
- Riverine Upper Perennial Streams
- Riverine Intermittent Streams (high water runoff and snow melt)
- Vernal Pools

1 Palustrine wetlands are a group of vegetated wetlands traditionally called marshes, swamps, bogs, fens. They also include the small, shallow, permanent or intermittent water bodies often called ponds.
**Mill Pond Wetland Complex**

The Mill Pond wetland complex is perhaps the center piece or jewel of natural resources in the Dana Pasture property. It contains a matrix of wetlands, uplands, and plant community types. During two days of field work in November, we found the largest diversity of wildlife sign in and around Mill Pond. Mill Pond was created by a dam built of stones and mortar. The dam helped make approximately 10.3 acres of open water, and many wetland areas within the immediate shoreline buffers. It has been, and continues to be, influenced by beaver activities with beaver lodges of varying vintage.

![Mill Pond](image)

Mill Pond is great beaver and wildlife habitat. The lodge in the photo is one of several of varying age and condition.

An interesting occurrence within this property is the cyclic movement and associated open water created by beaver (*Castor canadensis*). By utilizing aerial photography and USGS topographic maps from the past, it is possible to track beaver population cycles over 10, 50 or even 100 years. Beaver are unique animals in that they possess the ability to alter the environment around them by constructing dams and digging channels. Associated with this beaver activity, some areas that were once upland forest with upland soils become wetland species and hydric soils. Based on aerial photography and fieldwork on the Dana Pasture property, there are areas of expanded wetlands due to beaver activities, present and past.

![Left photo](image)

The left photo shows recent beaver chewing and cutting of a mature black cherry tree on the property. Beaver activities on the Mill Pond dam hide the fact that the core of the dam is constructed of rocks and mortar.
While beavers are considered to be pests by some, scientists have proven that beavers are a “Keystone” species in North America. That is, they play a crucial role in biodiversity. Many plant and animal species rely either partly or entirely on beaver ponds, many of them threatened or endangered. Several species of ducks including mallards (*Anas platyrhynchos*), mergansers-Common (*Mergus merganser*) and Hooded (*Lophodytes cucullatus*) were observed during fieldwork. Tracks of white-tailed deer (*Odocoileus virginianus*), moose (*Alces alces*), great blue heron (*Ardea herodias*), and eastern coyote (*Canus latrans*) were also documented during field work.

**Forested Wetlands**

In addition to Mill Pond Wetland Complex, perennial streams, and vernal pools, there are forested wetlands within the Dana Pasture property. In some cases they are seeps that form downslope perennial stream headwaters. One example of this is the wetland in the vicinity of the vernal pools documented near the Moose Mountain ridgeline in the Mascoma River subwatershed portion of the property. The area contains mature hardwood forest with several cavity trees, creating excellent habitat for many wildlife species. Though not necessarily dependent on wetlands, one species that depends on mature hardwood trees and cavities in the pileated woodpecker (*Dryocopus pileatus*) which was heard and seen several times during the fieldwork. Dominant tree species found in this wetland area were sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) with scattered red spruce (*Picea rubens*). Dominant herbaceous species documented were wool grass (*Scirpus cyperinus*), and tussock sedge (*Carex stricta*).
Other forested wetlands documented were located mostly along the west edge of the property. This wetland begins at the beaver ponds just downstream from Mill Pond and runs along the western part of the Dana Pasture property. The forested wetland continues into the openings which are mowed annually to retain views and permanent opening wildlife habitat. These wetlands are primarily dominated by sensitive ferns (*Onoclea sensibilis*) in the herbaceous layer and have a high-water table. The matrix of forested wetlands, wet meadows, and adjacent upland areas will attract a diversity of wildlife species.

**Recommendations for Wetlands**

1. Maintain buffers around all wetlands. Ideally buffers should be over 100 feet or more, particularly around wetland containing open water and emergent vegetation. For some wetlands (forested, scrub-shrub) a 50-foot buffer should be adequate, especially since the area will not be developed and only affected by timber harvest.
2. A comprehensive wetland delineation of the entire property should be done to better understand connectivity of habitats and extensions of ecological functions.
3. Use some of these wetlands for education, especially where access is relatively easy. The Mill Pond Wetland Complex has easy access to the beaver ponds, and would make an excellent outdoor classroom.
4. There are a few areas that offer excellent scenery and wildlife/wetland viewing. A couple of additional benches in key areas would enhance viewing and enjoyment of Mill Pond.

**Perennial Streams**

In more recent times the beaver have expanded their habitat by damming below the Mill Pond dam in a series of dams near Moose Mountain Lodge Road. One of the ponds contains a newly built beaver lodge, with a cache of saplings as a food source under the ice. This upper perennial stream flows northwest to Mink Brook and is an important headwater tributary. It is highly likely that this stream provides wild trout habitat due to its cobbly/rocky bottom, well shaded buffers, and high oxygenated water.

![Note the beaver cache of saplings in the larger upper beaver pond (center of photograph).](image)
Several unnamed perennial and intermittent streams and drainages were documented throughout the Dana Pasture property. Most flow into or out of Mill Pond, and are within the Hydrologic Unit level 12 subwatershed called ‘Mink Brook’. This subwatershed is within a larger Hydrologic Unit level 10 called Connecticut River-Ompontanoosuc River to White River. An interesting area containing some wetlands, vernal pools, and drainages was documented in the northeast of the property flowing west in Hydrologic Unit level 12 ‘Mascoma Lake’, within the larger Hydrologic Unit level 10- Mascoma River subwatershed. In some instances the small perennial streams flowing into Mill Pond wetland complex have also been expanded by beaver activities. Water quality appears to be excellent in these perennial streams with cooler temperatures and vegetated buffers.

![Image of a stream with beaver dam](image1)

One of several perennial streams flowing into Mill Pond where beaver have dammed and dug channels to expand their feeding territory and seek safety with deeper water into a forested area.

![Image of a forested area with snow](image2)

Cool water streams at the headwaters of large watershed areas are very valuable to all natural resources and people downstream.
**Recommendations for Perennial Streams**

1. Protect all perennial streams by maintaining an adequate buffer around them. We recommend 50+ feet around all perennial streams with more in steep sloped areas.
2. Removal of any temporary crossings used for logging purposes. Examples include, temporary bridges and pole ford crossings.
3. If a crossing is planned for perennial streams, a bridge that runs “top of bank” to “top of bank” is recommended to maintain natural stream flow, fish passage, and insect travel.

**Vernal Pools**

Unique, sometimes isolated and important wetland types are vernal pools. Vernal pools provide essential breeding habitat for certain amphibians and invertebrates such as wood frogs (*Rana sylvatica*), yellow spotted salamanders (*Ambystoma maculatum*), jefferson/blue spotted salamanders (*Ambystoma jeffersonianum/laterale*), and fairy shrimp (*Branchinecta lynchii*). These creatures depend on vernal pools as breeding sites, because they are mostly temporary water bodies preventing fish and other aquatic predators from taking up residency. Reptiles such as Blanding’s turtles (*Emydoidea blandingi*) and spotted turtles (*Clemmys guttata*) also rely on vernal pools as important feeding areas in early spring. Vernal pools fill annually from precipitation, runoff, and rising groundwater, typically in the spring and fall. By mid-summer, however, these wetlands are typically dry, making them a dynamic system habitable to specifically adapted plant and wildlife species.

Three potential vernal pools were documented throughout the Dana Pasture property. The largest one documented was approximately 30 feet wide, 60 feet long, and 2 feet deep. Although documented during November field work, it appears to be sufficient for spotted salamanders, wood frogs, and perhaps fairy shrimp.

This vernal pool is very close to one of the hiking trails near the Pasture Road trail. It should be visited in May to early June, during the height of the amphibian breeding season, to confirm the presence of vernal pool obligate species.
This vernal pool is one of a series of 2 and possibly more in a remote forested wetland area on the northeastern part of the property. Drainage from this vernal pool eventually flows into the Mascoma River.

**Vernal Pool Recommendations**

1. Maintain buffers around vernal pools. Ideally buffers should be over 100 feet or more. The US Environmental Protection Agency and NH Department of Environmental Services recommend at least a 50-foot buffer around vernal pools.
2. Education – bring schools in to document some of these pools, particularly those that are easily accessible for groups.
3. Monitor some or all vernal pools, especially if there is a change in use of the forest (eg., timber harvest, new trails, etc.). The vernal pools documented in this report were found in November, 2012, a time when vernal pool species are no longer using them. They should be verified in May/June.

**Forest Types**

**Northern Hardwood Forest**

The majority of the property is dominated by mixed northern hardwoods. Much of the property is steep to very steep, with rough broken ledge terrain with rock outcrops (particularly in the high elevations) and relatively shallow soils. Species are a blend of red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), white birch (*Betula*...
Dana Pasture Natural Area

*papyrifera*), yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), and black cherry (*Prunus serotina*), with scattered aspen (*Populus tremuloides*) and hornbeam (*Ostrya virginiana*) Mature red oak and beech, scattered throughout the property, are an important source of mast². Mature hardwood stands containing mast-producing beech and oak trees are very important for wildlife in the fall when feeding on the nuts is critical for obtaining protein and fats. Black bear, deer, wild turkey, red and grey squirrels, chipmunks, and many other wildlife species rely on nuts in the fall as they store up fats and protein.

Northern hardwood stands on the Dana Pasture Property contained an ample amount of cavity trees.

**Recommendations for Mast Producing Trees:**

1. Manage mast producing trees and shrubs for a continuous source of wildlife food and quality seed for regeneration
2. Retain beech trees with bear claw marks on the trunk or clumps of broken branches in the crown.
3. Whenever possible avoid harvesting beech and oak mast stands during the fall (September through November), important foraging time for bears and other wildlife.

**Mixedwood Stands**

There are mixed stands with a blend of eastern hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), red spruce (*Picea rubens*), and white pine (*Pinus strobus*) ‘salt and peppered’ throughout the northern hardwood stand described above. The mixedwood timber type is a result of the soils, slopes, aspect, and wetlands. In general they are a transition from softwood dominant stands and wetlands in flatter areas, to northern hardwood dominant stands on hillsides. Please refer to the maps at the back of this report for an illustration of forest types throughout the Dana Pasture property.

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² Mast refers to nuts and fruits produced by woody plants. It is usually subdivided into hard mast (nuts) and soft mast (fleshy fruits). Forest tree and shrub mast is an important seasonal food for many forest wildlife species. Examples of mast trees and shrubs include, oaks, beech, ash, apples, hickories, beaked hazelnut, dogwoods, choke cherry, etc.
Many of the hardwood stands and mixedwood stands continue to show the damage to tree crowns and limbs from the Ice Storm of 1998, especially stands at 1,300’+ elevation. Though damaged and greatly reduced in timber value, the abundance of cavities and large fissures in mature hardwood is a benefit to wildlife in many ways. Most tree that suffered 50% crown damage or less have survived but are of lesser timber value, with some trees scattered in the higher elevation of the property standing but dead. A good example of standing dead trees is the occasional red oak that still maintains its silhouette even entirely leafless and in some cases entirely bark-less. These trees become “wildlife hotels” attracting birds and mammals to forage for insects and/or nest in the hollow cavities. In addition, even some of the stunted trees are still producing nuts and berries.

Mixed wood stands tend to be flatter compared to northern hardwood stands, with hydric soils in depressions.

**Dense Softwood Stands**

Dense softwood stands are important deer wintering areas, which cover only about 3% of land base in New Hampshire. For an area to be considered a deer yard two basic elements must be met:

1. Core area identified by concentrations of dense softwoods.
2. Mixed hardwood and softwoods adjacent to, or within the core area will provide accessible forage.

Mixed hardwood and softwoods adjacent to, or within the core area will provide accessible forage. Dense softwood stands within the Dana Pasture property range in size from less than 1 acre to just over 7 acres. Even though deer or moose may not use the smaller softwood stands in the winter, many other smaller mammals and birds rely on them. Their location provides shelter from harsh winter weather by reducing snow accumulation and wind speeds, while allowing access to food supplies and escape from predators.
Dana Pasture Natural Area

- A dense softwood stand at the northern end of this property, bordering Mill Pond is mostly red spruce, balsam fir, eastern hemlock, and scattered white pine and yellow birch. Wildlife trails were documented in several places within this area. This stand of softwoods is yet another favorable component to the Mill Pond wetland complex adding to its diversity and natural resources value.

- A softwood stand was documented at the southern end of the property which is mostly red spruce with scattered eastern hemlock and is adjacent to a much larger softwood stand on the abutting property to the southeast.

- Three smaller softwood stands are located in the southeastern part of the property, one of which is on Moose Mountain ridge and at the divide between the Connecticut River and Mascoma River subwatersheds. Though they are small and appear as remote islands within the hardwood stands, they are on relatively flat land with abundant signs of moose browsing and wildlife trails suggesting heavy use by wildlife. They are primarily red spruce and occasional white pine overstory with balsam fir and red spruce regeneration growing beneath. The soils are thin in these areas with broken ledge blocks throughout.

- There are two additional softwood stands in the southwestern portion of the Dana Pasture property. They are both located either adjacent or close to permanent openings that are mowed annually. This offers nearby cover and bedding locations for wildlife, as well as edge habitat. These stands are mostly red spruce with white pine. The soils are deeper in these stands and contain seeps which contribute to the

This softwood stand on the Moose Mountain ridgeline is on a flat knoll surrounded by hardwood stands and steep slopes in all directions. Although damaged in the 1998 ice storm, the softwood regeneration is lush.
wetlands down-slope. There is an extraordinary amount of wind-throw, mostly red spruce trees in this area. This creates small openings for softwood regeneration.

The ring of softwood stands around Mill Pond provides cover and travel corridors for wildlife.

**Recommendations for Dense Softwood Stands**

1. Retain dense softwood stands throughout the Dana Pasture property to be used as deer and other wildlife wintering areas. Target for 20% throughout the region for the following reasons:
   - wetland complex protection
   - stream buffers
   - surrounding land contains mostly hardwood or mixedwood stands, and therefore retaining softwood on the property is important

2. Protect cavity trees, which are important for nesting or denning of many bird and mammal species

3. Softwood is good cover for walking the hiking trails for human use

**Main Wildlife Travel Corridors**

Generally wildlife trails were observed in most areas throughout the Dana Pasture properties. There were some locations which are frequently traveled with more extensive wildlife trail networks. These are considered to be main wildlife travel corridors. Although areas outside of the property were not assessed during field work, these travel corridors extend beyond property boundaries into the adjacent lands. This is also true of wetland complexes and dense
softwood stands. The main corridors documented are displayed on the attached map. Travel corridors are important for wildlife movement not only within the Dana Pasture property, but also in the entire region of Moose Mountain ridgeline.

As mentioned in the Introduction section, Moose Mountain ecological area is over 25,000 acres. Wildlife will use this entire area and move generally in north/south direction parallel to the ridgeline. Maintaining intact travel corridors are especially important for wildlife that have large home ranges. Fortunately, approximately half of the Moose Mountain ecological region is conserved by tracts owned by the Appalachian Trail (AT), the Town of Hanover, and private landowners. The AT runs along the ridge from South to North Peak, and it continues to head northeast. Trails come off the AT and head south right into the Dana Pasture Natural Area. They continue southward outside of the property, linking the entire ridgeline.

**Scenic Viewshed Resources**

Hanover is known as one of New Hampshire’s premier scenic towns, because of its mountainous topography with open fields. The Moose Mountain ridgeline is aligned roughly north/south in the eastern part of Hanover. The North Peak of Moose Mountain is the highest elevation in Hanover. Hanover has strived and succeeded in maintaining its rural scenic areas.

Looking out over a portion of eastern Hanover out to the Connecticut River valley from the “Baboon Trail” on the Dana Pasture Property.

The following quote is taken directly from Hanover’s Master Plan Chapter 3: Land Use and Community Vision (Town of Hanover, 2003, page 4).
Hanover’s scenic landscape is vital to the town’s identity and economy. It touches the lives of everyone. Directly or indirectly, it provides income, recreation, aesthetic and spiritual opportunities for all. It is the foundation of our quality of life. This study underscores the public’s unequivocal mandate for scenic protection, and provides guidance for a multi-faceted action program by which the town government, institutions, businesses, landowners and the public can find ways to ensure that the landscape that brought and keeps us here, and brings people from all over the world, will be sustained into the future and not be randomly chipped away until only token fragments remain.

There are many scenic view points from the permanent openings located at the southeastern end of the Dana Pasture property. These views encompass miles of landscape visible into Vermont and the Green Mountains.

Not all scenic views are from the Dana Pasture Property looking out over the broad landscape, there are many internal views within the Dana Pasture property that offer a place for wildlife viewing and/or a peaceful place to rest. Mill Pond itself it one example with excellent wildlife viewing opportunities of species such as beaver, mink, river otters, ducks, great blue heron, moose, whitetail deer, raptures, and song birds.

There is a bench with a view out towards Mill Pond where people can rest and enjoy the view of Mill Pond and the wildlife that inhabit and visit the pond.
Maintained openings on knolls provides spectacular views.

There are also internal views along the perennial streams within the Dana Pasture property along the trail system. In the hot summer months, the shade keeps it cooler and pleasant for hikers. Some of the headwater upper perennial streams are at fairly high elevations around 1,615 feet.

Some places along these perennial streams are scenic resting spots.
In recent years, development and population growth throughout the State and region have caused people to increase their appreciation of the natural scenery New Hampshire has to offer. Hanover’s Dana Pasture property has many scenic opportunities and this should be considered an important natural resource to maintain.

**Recommendations for Protecting Scenic Resources**

1. Maintain fields on western part of the property with panoramic views towards the Connecticut River Valley and Vermont.
2. Maintain hiking trail around Mill Pond. A couple of additional benches along the pond will enhance enjoyment for visitors.
3. Determine the impacts of development on the Moose Mountain Ridgeline in general and how the view towards the ridge would be affected.

**Cultural Resources**

Cultural resources include evidence left by people who once inhabited the land. They include stone walls, cellar holes, sugar shacks, logging camps, old dam sites, cemeteries, Native American ceremonial grounds, and even trash dumps from old farmhouses. During field inventory several cultural resources were documented; many can be a main attraction for the general public and schools.

Mill Pond dam is the most prominent historic resource on the property. It is at the outlet of Mill Pond and the beginning of a tributary to Mink Brook. Although the dam was originally built by people out of rock and mortar, it has been enhanced and maintained by beaver. There is a cellar hole just downstream from the Mill Pond dam adjacent to an active beaver pond.

The cellar hole is all that is left of a homestead near Mill Pond.
These 50+ granite slabs are piled up in what is now a remote forest. They were used as steps, foundations, hitching posts, fence post, and property corner markers.

It is difficult to see the stone and mortar dam beneath the more recent beaver activities and vegetative growth.
Many stonewalls were constructed in the agricultural era that now seem out of place in the re-forested lands. They indicate that this area was once open field.

Some of the stonewalls are ambitiously high. Note the square cleavage of this granite.
Recommendations to Protect Cultural Resources

1. In the event of future timber harvests in the area of cultural resources, flag the area to show loggers which areas to avoid during logging.
2. Fell trees away from stone walls, the mill pond dam site or other sites to protect them.
3. Use existing stone-wall openings when possible. Limit the number of new openings and cut only the minimum width necessary. Leave openings for future use if necessary. Otherwise restore the wall when work is completed.
4. Contact the NH Division of Historical Resources for additional advice about documenting and protecting cultural and historic resources, particularly the mill dam site. http://www.nh.gov/nhdhr/. The agency is located at 19 Pillsbury Street, Concord, NH 03301-3570. Phone: 603-271-3483

Rock Outcrops

Throughout much of the southern and western portions of the property are rock outcrop ridges with broken ledge features. These ridges generally run in a north/south direction parallel to the Moose Mountain Ridgeline and the Connecticut River to the west. This indicates the path of the glacier retreating approximately 12,000 years ago. According to the State of NH Bedrock Geology maps, there are three distinct types of bedrock running roughly north/south with varying identified codes, from west to east; Sfc (calcite-ankerite-muscovite granofels and interbedded gray metapelite), Oalx (Bimodal volcanic rocks), and Oo2-3A (Granodiorite to tonalite).

- Oalx roughly parallels the ridgeline of Moose Mountain
- Sfc mapped band encompasses much of the very steep slopes to the west
- Oo2-3A mapped band encompasses the very steep slopes on the eastern side of the property.
Over time the bedrock composition has an effect on soils and water quality conditions due to weathering and gradual decomposition. Where bedrock contains calcium deposits and calcareous seeps occur, it will increase the soil pH and create unique habitat for rare plant species in NH.

Although the bedrock mapping was done at a large scale, it is available for download from the GRANIT data system. Further details about NH geology are available through the State Geologist – www.des.nh.state.us/geology/ and www.nhgeology.org.

Soils

The nature of soil has a profound effect on plant growth. Whether it is rich with organic material, very poorly drained, or sandy, will affect the type of vegetation adapted to grow in those conditions. Scientists can learn much about the soil type by examining the vegetation. At the same time, examining the soil will predict the type of vegetation that can grow in the area. Because soils affect the vegetation that will grow in an area they also influence the habitat types and therefore the wildlife species that will occur in particular areas. As a result, understanding soil conditions and characteristics can be excellent indicators of critical areas such as wetlands, agricultural lands, forestlands, wildlife habitat and areas with limitations to development. In descriptions of soil types, the Natural Resource Conservation Service (NRCS) evaluates soil types according to their capacity for agriculture, woodland, community development, recreation, and wildlife habitat.

Soil information is critical in making sound land use decisions. By examining soil types and morphology, many predictions can be made regarding forest management, erosion potential, and development possibilities. Certain soils are better suited for certain land uses such as forestland, agriculture or residential development. For example, residential development should be located away from areas with unstable soil conditions such as high water tables, and areas with high erosion potential.

The property contains largely Tunbridge- Lyman- Rock Outcrop complex soils (61B-E) further broken down by slope, A to E with E being the steepest at 25% to 60%. Most of the property is C, D or E, ranging from 8 to 60 percent slope. There is a small polygon of 61B soil along the west side of Mill Pond (approximately 2.7 acres). Other soils consist of Peru fine sandy loam (79C), a moderately well drained soil with a perched water table due to hardpan, and Lyman Moosilauki soils (347B), poorly drained hydric soil. Please refer to the attached map and table below for more information.

<table>
<thead>
<tr>
<th>Soil number</th>
<th>Soil name</th>
<th>Drainage</th>
<th>Community Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>61C-8-15%</td>
<td>Tunbridge-Lyman Rock Outcrop Complex</td>
<td>Well drained to somewhat excessively drained</td>
<td>Severe limitations for all types of building site development due to shallow depth of soil to bedrock. Locating sites with deeper soils within this unit is possible, but these areas may be too limited in size to use.</td>
</tr>
<tr>
<td>Soil number</td>
<td>Soil name</td>
<td>Drainage</td>
<td>Community Development</td>
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</tr>
<tr>
<td>61D</td>
<td>Tunbridge-Lyman Rock Outcrop Complex</td>
<td>Well drained to somewhat excessively drained</td>
<td>The moderately steep slopes, frequent rock outcrops, and bedrock at less than 40 inches are severe limitations for all building development. The slope of the area adds to the limitation by increasing the necessity and depth of excavations.</td>
</tr>
<tr>
<td>61E</td>
<td>Tunbridge-Lyman Rock Outcrop Complex</td>
<td>Well drained to somewhat excessively drained</td>
<td>The steep slopes, frequent rock outcrops, and bedrock at less than 40 inches are severe limitations for all building development. The slope of the area adds to the limitation by increasing the necessity and depth of excavations.</td>
</tr>
<tr>
<td>79C</td>
<td>Peru fine sandy loam, very stony</td>
<td>Moderately well drained soil</td>
<td>Poorly drained Pillsbury soil found in depressions. This soil has limitations for most types of building site developments because of wetness associated with the seasonal high water table. Wetness is a severe limitation for dwellings with basements and shallow excavations and moderate for dwellings without basements. Sump pumps may be needed in basements as well as in shallow excavations. Slope may also pose a moderate limitation for building dwellings without basements; cutting and filling areas to level slopes may reduce this concern.</td>
</tr>
<tr>
<td>347B</td>
<td>Lyme and Moosilauke Soils</td>
<td>Poorly Drained</td>
<td>Wetness and frost action on the soil are limitations for most phases of community development. In addition, there are severe limitations during construction because the sides of excavations tend to slough and fill with water. Deep excavations may require special equipment. In many areas the large stones and boulders in the substratum are an additional concern for excavations.</td>
</tr>
</tbody>
</table>
A variety of soils leads to a diversity of habitat for plants and animals.

**Soil Protection Recommendations**

1. Detailed soil mapping should be completed before any type of activity occurs on the property. The soils mapped by NRCS are sensitive to activities such as timber harvest, community development, and use by motorized vehicles. The three main issues on the Dana Pasture property are:
   a. Poorly drained (hydric) soil conditions
   b. Steep slopes (over 15%)
   c. Shallow soil depth

**Permanent Openings**

As the percentage of permanent openings in New Hampshire is decreasing significantly over the past 50 years, the State is encouraging landowners to create or maintain openings as important wildlife habitat. Permanent openings dominated by grasses, forbs, brambles, and fruiting shrubs, provide necessary habitat for about 22% of New England’s wildlife species, and are seasonally important habitat to nearly 70% of species.

The Dana Pasture property contains approximately 2.3 acres or 1.8% permanent openings. The openings are smaller than originally cleared, as trees continue to infringe and annual mowing areas are reduced. The permanent openings are all located in the southwestern part of the property and are adjacent to a variety of habitat types including wetlands, dense softwood stands, northern hardwoods and mixedwood stands. Although a small percentage of the total property, these openings create a diversity of habitat that will attract many wildlife species.
Recommendations for Permanent Openings

1. Maintain permanent opening areas whenever possible. They are valuable wildlife habitat and offer excellent recreational and scenic opportunities.

2. Identify areas where small clearings could be created to enhance additional views. Examples include areas upslope from Mill Pond to the east, where a small clearing could offer a view of the pond from above, and also create a small wildlife opening.

Annual mowing helps keep the area growing grasses and other herbaceous species, while maintaining edge habitat for a diversity wildlife and plant species.

Conservation Land

Many of the abutting lots and much of the land on Moose Mountain are well protected as conserved land. The Town of Hanover has worked hard to maintain a rural setting and the scenic value throughout the Town. There are several documents on record of years spent focusing on future growth, Master Plans, and studies to accomplish these goals. Maintenance of conservation lands in Hanover involves several dedicated groups, committees, and volunteers. Much has been done for recreational low impact uses by and for the public of land within Hanover, including the development of an extensive hiking trail system.

Several large blocks of property are currently in conservation land use, and have successfully provided a large unfragmented connectivity of natural resources. Hanover has approximately 20% of all land in conservation; a good accomplishment for any NH town. Please refer to the attached maps to better understand locations of conservation lands.

There are several ways to conserve land. A conservation easement on private land is a property right that can be bought or sold. It allows property owners to put limitations on their
property when an easement is sold, or for another person to set limitations upon the property owner when an easement is purchased. Encouraging landowners in Town to conserve and connect smaller parcels into one larger, contiguous area of land for conservation can be a great and important place to start when increasing conservation lands. Adding onto already existing conservation lands or working towards connecting nearby parcels is important for wildlife because it will increase the connectivity while decreasing the amount of fragmentation between parcels. Other methods of obtaining and conserving land are ownership by the State, Federal Government, or the Town.

**PRIORITY AREAS**

The Mill Pond wetland complex with the dense softwood buffer, stands out as the #1 priority in value of natural resources within the Dana Pasture property, and is equally important to the larger landscape from Moose Mountain Ridge to Mink Brook. With the varying types of habitat including open water, cold perennial streams for brook trout habitat, dense softwood stands, well buffered shorelines, and wetlands, it has a very high ecological value. The perennial stream leaving Mill Pond is a headwater tributary to Mink Brook. Maintaining good water quality is essential to having good water quality downstream

Recreational use, wildlife viewing opportunities, and educational opportunities, further support Mill Pond wetland complex as a high ranking natural resource. Furthermore, by conserving the ecological functions and values of the Mill Pond and surrounding area, the cultural resources (Mill Pond dam, cellar hole and stonewalls) will also be conserved as valuable cultural resources.

Based on inventories of natural resources, wildlife, and main wildlife travel corridors throughout the Dana Pasture property, three additional areas were determined to contain particularly high value natural resources. These areas stood out because several natural resource features were located adjacent to each other. Moreover, these areas had a relatively higher density of wildlife sign, including networks of wildlife trails and main travel corridors. The three additional areas are listed below.

#2. The permanent openings in the southwestern part of the property. The combination of viewsheds, recreational opportunities, and edge habitat diversity gave these openings high value during field inventory and mapping analyses.

#3. Vernal pools and wetlands in the southwest and southeast parts of the property combined with hydric soils and adjacent forested land.

#4. Dense softwood stands that are ecologically valuable, exist as a small portion of the property. They are important wintering areas for large and small mammals and birds, and are particularly important where they are adjacent to the permanent openings.

The value of these areas throughout the Dana Pasture property is evident because of their ecological diversity, combined with cultural and scenic resources, low-impact recreational use, and education possibilities. The ecological value of this property goes beyond the boundaries to the larger Moose Mountain region, where tracts of unfragmented land contribute to additional habitat for a diversity of wildlife, plant species, and habitat types.
Summary of Recommendations

Recommendations for Wetlands
1. Maintain buffers around all wetlands. Ideally buffers should be over 100 feet or more, particularly around wetland containing open water and emergent vegetation. For some wetlands (forested, scrub-shrub) a 50-foot buffer should be adequate, especially since the area will not be developed and only affected by timber harvest.
2. A comprehensive wetland delineation of the entire property should be done to better understand connectivity of habitats and extensions of ecological functions.
3. Use some of these wetlands for education, especially where access is relatively easy. The Mill Pond Wetland Complex has easy access to the beaver ponds, and would make an excellent outdoor classroom.
4. There are a few areas that offer excellent scenery and wildlife/wetland viewing. A couple of additional benches in key areas would enhance viewing and enjoyment of Mill Pond.

Recommendations for Perennial Streams
1. Protect all perennial streams by maintaining an adequate buffer around them. We recommend 50+ feet around all perennial streams with more in steep sloped areas.
2. Removal of any temporary crossings used for logging purposes. Examples include temporary bridges and pole ford crossings.
3. If a crossing is planned for perennial streams, a bridge that runs “top of bank” to “top of bank” is recommended to maintain natural stream flow, fish passage, and insect travel.

Vernal Pool Recommendations
1. Maintain buffers around vernal pools. Ideally buffers should be over 100 feet or more. The US Environmental Protection Agency and NH Department of Environmental Services recommend at least a 50-foot buffer around vernal pools.
2. Education – bring schools in to document some of these pools, particularly those that are easily accessible for groups.
3. Monitor some or all vernal pools, especially if there is a change in use of the forest (eg., timber harvest, new trails, etc.). The vernal pools documented in this report were found in November, 2012, a time when vernal pool species are no longer using them. They should be verified in May/June.

Recommendations for Mast Producing Trees:
1. Manage mast producing trees and shrubs for a continuous source of wildlife food and quality seed for regeneration
2. Retain beech trees with bear claw marks on the trunk or clumps of broken branches in the crown.
3. Whenever possible avoid harvesting beech and oak mast stands during the fall (September through November), important foraging time for bears and other wildlife.

Recommendations for Dense Softwood Stands
1. Retain dense softwood stands throughout the Dana Pasture property to be used as deer and other wildlife wintering areas. Target for 20% throughout the region for the following reasons:
• wetland complex protection
• stream buffers
• surrounding land contains mostly hardwood or mixedwood stands, and therefore retaining softwood on the property is important

2. Protect cavity trees, which are important for nesting or denning of many bird and mammal species
3. Softwood is good cover for walking the hiking trails for human use

**Recommendations to Conserve Scenic Resources**
1. Maintain fields on western part of the property with panoramic views towards the Connecticut River Valley and Vermont.
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Conclusion

Though priority value natural resource areas have been investigated and qualified for the Dana Pasture property, it is a snapshot in time. Future studies and inventories will continually add to the database.

Overall, the relatively shallow soils and steep slopes make much of the property fragile and prone to erosion without careful management. Any practices beyond non-motorized use of this property will need to be approached cautiously and planned accordingly in consideration of impacts to the natural, cultural, and scenic resources within the property.

Wetlands and perennial streams are complex ecological systems that extend outward from their defined boundaries well into adjacent buffers. Based on priority areas identified in this study, we highly recommend that none of the components that make up Mill Pond Wetland Complex are disturbed or compromised. The ecological loss would have repercussions that could extend far into the future. Water quality, wildlife habitat, and wild trout habitat are some of the more obvious potential losses. The negative effects from a natural resource perspective could persist beyond Mill Pond to Mink Brook, and even as far as the Connecticut River.
References

NRCS, Natural Resources Conservation Service, attached soil data of Dana Pasture property.

Schori, Alice. Botanical Survey Field Work, an addendum to Natural Communities and Rare Plants of Hanover, NH. Funding assistance provided by the Silvio O. Conte National Fish and Wildlife Refuge. 2000-2001.

Smith, Vicki. Senior Planner, Town of Hanover, digital data, contact person, communications.


Town of Hanover, NH. 2003. Hanover Master Plan. Viewed on the worldwide web on 12-12-2012. www.hanovernh.org/Pages/HanoverNH_BComm/Planning/masterplan/master
Maps

Topographic Map with Property Boundary
Aerial Photo with Property Boundary
NRCS Soils with Descriptions
Natural Resource Features
Regional Map
Dana Pasture Natural Area
USGS Topographic Map with
Property Boundaries
January 2013

Legend
- Wetland Point
- Scenic View Points
- Cultural Resource
- Vernal Pool
- Trail
- Perennial Stream
- Wetland Polygon
- Property Boundary
Dana Pasture and Forest Property
Natural Resource Features
With Priority Areas
January 2013

Map Produced by:
Watershed to Wildlife, Inc.
544 Jefferson Road
Whitefield, NH 03598
www.watershedtowildlife.com

Legend
#1-4 Priority Areas
N Views
C Cultural Resource
V Vernal Pool
W Wetland Point
Trails
Streams
Wetland
Property Boundary
Mill Pond
Permanent Opening
Hardwood Stand
Mixed Wood Stand
Dense Softwood Stand

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