

APPENDIX F – Natural Communities Information

The topography, soils, vegetation, and wildlife associations of each natural community in the CHMU are described below. The scientific names of plants and some uncommon animals are given the first time a species is mentioned in each description below.

1. Alpine Meadow

The open summit of Camel's Hump is an extreme environment, where high winds, cold temperatures, frequent fog, intense sun, and a short growing season all shape the vegetation. Overall, the climate is reminiscent of the arctic tundra found at much higher latitude. As a result, many of the plant species found in this community at Camel's Hump are very rare in Vermont and New England. Fourteen species of rare or very rare vascular plants, and one very rare liverwort, are known to occur around the summit of Camel's Hump. Three of the rare species are dominant: Bigelow's Sedge (*Carex bigelowii*), Bog Billberry (*Vaccinium uliginosum*) and Three-forked Rush (*Juncus trifidus*). Also abundant in this community (but not rare in Vermont) are Labrador Tea (*Ledum groenlandicum*), and Common Hairgrass (*Deschampsia flexuosa*). Other species occasionally found include Bunchberry (*Cornus canadensis*), Starflower (*Trientalis borealis*), Acuminate Aster (*Aster acuminatus*), Cinnamon Fern (*Osmunda cinnamomea*), and Woodlily (*Clintonia borealis*), along with a few very short and twisted Balsam Firs (*Abies balsamea*). In many places vascular plants are only found growing in protected crevices in the bedrock; exposed bedrock and moss-covered rock are common here. What little soil can be found is thin and mostly peaty, with a pH measured at 4.0-4.2.

The exposed mountaintop is a challenging habitat for animals, but northern juncos and evidence of snowshoe hare were observed around the summit. Ravens fly near the summit but may make only limited use of the Alpine Meadow community. The rare rock shrew has been found at high elevations on Camel's Hump, but not specifically in this community. Deer mice, red-backed voles, and meadow voles have also been found on the summit. Finally, there may be uncommon invertebrates associated with the alpine zone, though these have not been thoroughly studied. Several insect species endemic to the alpine zone have been found on Mount Washington in New Hampshire, while in Vermont there is a beetle that is restricted to a small area of the alpine zone on Mount Mansfield (Johnson 1998).

Although the plants found in this community are well-adapted to the harsh mountaintop climate, they are easily damaged by hiker trampling. It is likely that the extent of vegetation in this community has been affected by many decades of visitors to the mountain. Ongoing monitoring and management, as well as continued public outreach and education, are all necessary to maintain the viability of these plant populations. The Green Mountain Club's Summit Caretaker program is likely largely responsible for the continued presence of the alpine tundra vegetation on the summit.

The 5-acre occurrence of Alpine Meadow in the CHMU is C-ranked, and considered to be an example of statewide significance.

2. Beaver Wetland

These wetlands are constantly changing in response to the presence or absence of beavers. As a result, they are not mapped as a natural community type; instead they are separately identified to indicate their dynamic nature. Thirteen beaver wetland patches have been mapped in the CHMU, and several of these are part of the large beaver wetland complexes found in the Phen Basin and along the northeast ridge of Camel's Hump. Because of their dynamic nature, the beaver wetlands mapped in this report are not assessed for statewide significance in the same way that specific natural community types are. Nevertheless, these wetlands are highly important for their ecological functions and habitat values.

Vegetation in these patches can be quite diverse, and the processes of flooding and draining that characterize beaver wetlands influences vegetative composition. Soils vary from deep, saturated organics to drier alluvial soils. Areas recently drained are dominated by herbaceous growth, including species such as tussock sedge (*Carex stricta*), stipitate sedge (*Carex stipata*), retrorse sedge (*Carex retrorsa*), *Carex leptalea*, *Carex interior*, three-way sedge (*Dulichium arundinaceum*), interrupted fern (*Osmunda claytoniana*), bluejoint (*Calamagrostis canadensis*), hairy panic grass (*Panicum lanuginosum*), soft rush (*Juncus effusus*), and grass-leaved goldenrod (*Solidago graminifolia*). Alluvial deposits near the margins of beaver ponds and the streams that feed them can be dominated by Speckled Alder (*Alnus incana*). Other species noted in beaver wetlands include Meadow-sweet (*Spiraea alba*), Hobblebush (*Viburnum lantanoides*), Evergreen Woodfern (*Dryopteris intermedia*), Ostrich Fern (*Matteuccia struthiopteris*), Sensitive Fern (*Onoclea sensibilis*), Long-hair Sedge (*Carex crinita*), and White Hellebore (*Veratrum viride*). At higher elevations the shrubby areas can include Mountain Maple (*Acer spicatum*), Yellow Birch (*Betula alleghaniensis*), Evergreen Woodfern (*Dryopteris intermedia*), and White Snakeroot (*Eupatorium rugosum*). Beaver wetlands can be local "hotspots" for wildlife diversity in forested landscapes, and can host many animal species including birds, bats, small mammals, moose, amphibians, and many species of invertebrates.

Some portions of the Phen Basin wetland complex were mapped as Sedge Meadow and Alder Swamp in an earlier ecological assessment. Aerial photos show that these patches have changed over the past decade, and can be expected to continue to change, and thus are better mapped as Beaver Wetlands rather than any particular natural community type.

3. Boreal Acidic Cliff

Two examples of a Boreal Acidic Cliff have been mapped within the CHMU, and both are considered examples of statewide significance. One is the large cliff on the south face of the Camel's Hump summit; the other is a cliff above the "Beaver Meadow" saddle southeast of the summit. Both cliffs are exposures of the underlying schist bedrock, and are generally sparsely vegetated. Little ecological data was collected on species present, however several rare and uncommon species have been observed on these cliffs. Ten rare or very rare species are reported for the south face of the Camel's Hump summit: Bigelow's Sedge (*Carex bigelowii*), Fragrant Fern (*Dryopteris fragrans*), Mountain Firmoss (*Huperzia*

appalachiana), Three-forked Rush (*Juncus trifidus*), A liverwort (*Mylia taylorii*), Boott's Rattlesnake Root (*Nabalus boottii*), Bearberry Willow (*Salix uva-ursi*), Rand's Mountain Goldenrod (*Solidago simplex* spp. *randii* var. *monticola*), Bog Billberry (*Vaccinium uliginosum*), and Smooth Woodsia (*Woodsia glabella*). Of these the Boot's Rattlesnake Root and Bearberry Willow are legally listed as "endangered" by Vermont statute. Additionally, the uncommon Steller's Cliffbrake (*Cryptogramma stelleri*) was located at the cliff above Beaver Meadows. This species can sometimes be indicative of mineral enrichment, and suggests that the rock may have thin calcareous veins, or that groundwater seepage through cracks in the cliff may be a source of minerals. These cliffs might provide habitat for nesting ravens, but overall few animals can use this community.

4. Boreal Outcrop

These high-elevation outcrops are found scattered throughout the CHMU. Many are relatively small and isolated, but the northeast ridge of Camel's Hump has a very extensive complex of Boreal Outcrops that may be one of the largest in the state. This community is found where there are exposures of the underlying schist bedrock, generally on moderately sloping rock. In the large outcrop complexes there can be a mix of flat shelves, steep slopes, sheer faces, and even overhangs. The varied topography does not seem to influence species composition, but it does affect the overall vegetative cover. The "canopy" on these outcrops is typically a 20-30% cover of very short (3-8' tall) Red Spruce (*Picea rubens*). Heart-leaved Paper Birch (*Betula papyrifera* var. *cordifolia*), Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*), American Mountain Ash (*Sorbus americana*), Striped Maple (*Acer pensylvanicum*), and Mountain Maple (*Acer spicatum*) can also be present. Low shrubs include Mountain Holly (*Ilex mucronata*), Velvet-leaf Blueberry (*Vaccinium myrtilloides*), Lower Lowbush Blueberry (*Vaccinium angustifolium*), and an *Amelanchier* species. Herbs are sparse, and include Bracken Fern (*Pteridium aquilinum*), Hay-scented Fern (*Dennstaedtia punctilobula*), Common Hairgrass (*Deschampsia flexuosa*), and Bristly Sarsaparilla (*Aralia hispida*). Mosses and lichens are abundant. Wildlife species that might use these outcrops include birds such as common raven and northern junco, and small mammals, including possibly the rare rock shrew which has been found at high elevations on Camel's Hump. Five occurrences of this community have been mapped in the CHMU (though they may be others that were too small to detect during inventories); the largest covers 55 acres and is an A-ranked example of statewide significance.

5. Boreal Talus Woodland

A small (1-acre) patch of Boreal Talus Woodland is found below a large complex of rock outcrops that are northeast of the Camel's Hump summit. Below a small 15'-tall cliff, large boulders ranging from 2-4' on the longest side are resting on a 40-45 degree east-facing slope. It is likely that these are boulders of the local schist bedrock that were broken off and deposited by the plucking action and southeast advance of the continental glacier. With little space for soil development, only a few plant species find room to establish. There is open canopy (65-70% cover) of Yellow Birch (*Betula alleghaniensis*), and a tall shrub layer with Striped Maple (*Acer pensylvanicum*) and Mountain Maple (*Acer spicatum*). Only two

herbs were noted in this patch: Rock Polypody (*Polypodium virginianum*) and Evergreen Woodfern (*Dryopteris intermedia*). Though small in acreage, this talus community provides habitat in the crevices between boulders that may be used by some small mammals. A rare species, rock shrew, which uses mossy talus as habitat has been found nearby in the Gleason Brook drainage.

Because of its small size, this occurrence is C-ranked and not considered an example of statewide significance. However, this patch is certainly locally important as part of the large association of cliffs, outcrops, talus and forest on the ridge.

6. Hemlock-Balsam Fir-Black Ash Seepage Swamp

A patch of this community type was mapped on Robbins Mountain WMA, along the trail that enters behind the neighboring shooting range. Though the mapping was based on field observations, no ecological data was collected in this patch. These swamps can be found on both mineral and organic soils, though in both cases groundwater flow provides some mineral enrichment. Expected species would include Hemlock (*Tsuga canadensis*), Balsam Fir (*Abies balsamea*), and Black Ash (*Fraxinus nigra*) in the canopy, Winterberry Holly (*Ilex verticillata*) in the shrub layer, and Cinnamon Fern (*Osmunda cinnamomea*) in the herb layer. This occurrence is preliminarily C-ranked based on knowledge of size and landscape context. Additional data is needed for this occurrence to confirm if it is properly typed and to confidently assign a quality rank.

7. Hemlock-Northern Hardwood Forest

Found on shallow-to-bedrock till soils and sandy glacio-fluvial soils, this community is found scattered around the lower elevations of the CHMU. In most patches, Hemlock (*Tsuga canadensis*) shares the canopy with the typical northern hardwood species Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*), and American Beech (*Fagus grandifolia*). Red Maple (*Acer rubrum*) and Big-toothed Aspen (*Populus grandidentata*) are present in some younger patches of this type. The canopy is usually closed (70-90% closure) and averages 60' tall. Understory species include a shadbush (*Amelanchier* sp.) and Hobblebush (*Viburnum lantanoides*); herbs can be sparse. Evergreen Woodfern (*Dryopteris intermedia*) and Wild Sarsaparilla (*Aralia nudicaulis*) were two species noted. One patch of Hemlock-Northern Hardwood Forest (near Robbins Mountain) had evidence of mineral enrichment. Basswood (*Tilia americana*), Wild Leeks (*Allium tricoccum*), Broad-leaved Sedge (*Carex platyphylla*), Sharp-lobed Hepatica (*Hepatica acutiloba*), Squirrel-corn (*Dicentra canadensis*) and Rattlesnake Fern (*Botrychium virginianum*) were all noted in this patch. Wildlife in this community is likely similar to Northern Hardwood Forest, though patches of dense hemlock may provide winter cover for species like white-tailed deer and ruffed grouse. Overall five occurrences of Hemlock-Northern Hardwood Forest have been identified in the CHMU, and all are considered to be examples of statewide-significance.

8. Hemlock Forest

Hemlock Forest is found in steep, shady ravines and on dry, exposed low-elevation ridges. Most of the examples of this community are the Hemlock-Red Spruce Forest variant. These occur as small patches within the surrounding Northern Hardwood Forest and Montane Yellow Birch-Red Spruce Forest, usually on south and southwest-facing rocky ridgelines between 1800 and 2600' elevation. This is a stressful environment for plants and animals—soils are extremely thin, winter weather is severe, and conditions are frequently very dry, due to exposure to direct sun and wind. Thirty to 45' Red Spruce (*Picea rubens*) and Eastern Hemlock (*Tsuga canadensis*) dominate the open (55-80%) canopy, and Red Maple (*Acer rubrum*) and Yellow Birch (*Betula allegheniensis*) are sometimes present. In canopy gaps, dense stands of regenerating spruce and hemlock are found. Scattered shrubs present are Hobblebush (*Viburnum lantanooides*) and Canada Honeysuckle (*Lonicera canadensis*). Herbs present include Intermediate Wood Fern (*Dryopteris intermedia*), Sarsaparilla (*Aralia nudicaulis*), Canada Mayflower (*Maianthemum canadense*), Shining Clubmoss (*Lycopodium lucidulum*), Woodlily (*Clintonia borealis*), and Wild Cucumber (*Medeola virginiana*). Windthrow is common in these patches. Two patches of Hemlock Forest were mapped on the northern edge of the CHMU along River Road, but detailed ecological data was not collected from these patches. They would be expected to have a dense canopy of hemlock, with very sparse shrub and herb layers.

Large patches of Hemlock Forest can serve as excellent deer wintering habitat, but none of the small patches in the CHMU have been identified as such. The largest occurrence of this community in the CHMU totals 81 acres. It and another occurrence are both examples of statewide significance.

9. Lowland Spruce-Fir Forest

Lowland Spruce-Fir Forest is a matrix forming community in some regions of Vermont, but in the CHMU it is found only in small patches around beaver-influenced wetland complexes. Since these wetlands are in small basins, cold air sinks down into them from higher elevations, and favors the establishment of Lowland Spruce-Fir Forest on these shores. Preferential feeding by beavers on hardwood species probably also helps maintain the softwood dominance. This community typically occurs on moderately deep, poorly to moderately well drained stony silt loams. Some of the wettest sites have peaty soil. The low (25-30') canopy is 85 to 98% closed, and is dominated by Red Spruce (*Picea rubens*); Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*) and Eastern Hemlock (*Tsuga canadensis*) are also present. Hobblebush (*Viburnum lantanooides*) and Striped Maple (*Acer pensylvanicum*) have 10% canopy cover in the tall shrub layer. The uncommon species Showy Mountain Ash (*Sorbus decora*) is present in one patch, and may be overlooked in others because of its similarity to the more common American Mountain Ash (*Sorbus americana*). The sparse herb layer includes Sarsaparilla (*Aralia nudicaulis*), Bunchberry (*Cornus canadensis*), Intermediate Woodfern (*Dryopteris intermedia*), Common Wood-Sorrel (*Oxalis acetosella*), Canada Mayflower (*Maianthemum canadense*), Painted Trillium (*Trillium undulatum*), and Pink Ladyslipper (*Cypripedium acaule*). Disturbance events in this community include windthrow of shallowly rooted trees and felling of trees by beavers.

The patches of Lowland Spruce-Fir Forest in the CHMU are grouped into five different occurrences. One of these, found about two miles north of the Camel's Hump summit, is considered to be an example of statewide significance.

10. Mesic Red Oak-Northern Hardwood Forest

Northern Red Oak (*Quercus rubra*) is generally only a minor component in forests of the CHMU, but the species does characterize one 55-acre patch above Honey Hollow Road. Found on a southwest-facing slope, this patch is on shallow, very well drained to excessively well drained, rocky silt-loam soils. Though this area was affected by the large forest fire of 1903, tree ring data in this community indicated that some trees were approximately 200 years old. With the large trees (up to 22" dbh), many scattered snags, and a large amount of coarse woody debris (downed logs), this community may approach old-growth conditions. While relatively small for an example of Mesic Red Oak-Northern Hardwood Forest, this is A-ranked for current condition, and is an example of statewide significance.

Red Oak and Sugar Maple (*Acer saccharum*) form a sparse emergent canopy 65' tall with 10% cover. Underneath is a 55' tall main canopy with Red Oak, Sugar Maple, White Ash (*Fraxinus americana*), Paper Birch (*Betula papyrifera*), and a few Big-toothed Aspen (*Populus grandidentata*). A tertiary canopy includes Sugar Maple, White Ash, American Beech (*Fagus grandifolia*), Hop Hornbeam (*Ostrya virginiana*), and Black Cherry (*Prunus serotina*). Interestingly, no evidence of oak regeneration was noted during inventories; it is likely that this patch will require disturbance if the oak is to persist. Tall shrubs (60% cover) include Beech and Hop Hornbeam, and low shrubs (10% cover) include Red Elderberry (*Sambucus racemosa*), Striped Maple (*Acer pensylvanicum*), Maple-leaved Viburnum (*Viburnum acerifolium*), and a *Ribes* sp. Herb cover is 50% and abundant species include Large Bellwort (*Uvularia grandiflora*), Rough-leaved Ricegrass (*Oryzopsis asperifolia*), Zig-zag Goldenrod (*Solidago flexicaulis*), and Marginal Wood Fern (*Dryopteris marginalis*). Bryophytes are infrequent.

The large trees, snags, and coarse woody debris likely make this forest good habitat for a number of wildlife species, including northern flying squirrel, pileated woodpecker, and barred owl. It also probably hosts common species such as turkey, black bear, and white-tailed deer.

11. Montane Spruce-Fir Forest

Just over 4,000 acres of Montane Spruce-Fir Forest have been mapped in the CHMU. These are split into two occurrences separated by Route 17 at the Appalachian Gap. The northern occurrence covers approximately 3,600 acres, though the community probably extends onto private land in places. The southern occurrence includes approximately 400 acres within the CHMU, but is part of a much larger occurrence that extends south to the Lincoln Gap Road on both private land and Green Mountain National Forest land (Sorenson 2010). Both are of very high ecological quality and are considered examples of statewide significance.

Montane Spruce-Fir Forest is found at high elevations where the climate is cold, cloudy, windy and damp. Soils are typically thin. The canopy is composed of Red Spruce (*Picea rubens*), Heart-leaved Paper Birch (*Betula papyrifera* var. *cordifolia*), Balsam Fir (*Abies balsamea*). In most places the canopy is 70-80% closed, and less than 40' tall. American Mountain Ash (*Sorbus americana*) is a common understory tree, and the uncommon Showy Mountain Ash (*Sorbus decora*) is probably an often overlooked component of this forest. Hobblebush (*Viburnum lantanoides*), Mountain Holly (*Ilex mucronata*), and Mountain Maple (*Acer spicatum*) are frequent shrubs. Herbs include Starflower (*Trientalis borealis*), Woodlily (*Clintonia borealis*), Common Wood-Sorrel (*Oxalis acetosella*), Mountain Wood Fern (*Dryopteris campyloptera*), Acuminate Aster (*Aster acuminatus*), Shining Clubmoss (*Lycopodium lucidulum*), and Canada Mayflower (*Maianthemum canadense*). Montane Spruce-Fir Forest can provide habitat for many migratory songbirds, including blackpoll warbler and yellow-rumped warbler. The uncommon Bicknell's thrush nests in this community in the CHMU.

An extensive area around the Camel's Hump summit burned in a 1903 forest fire, including portions of Montane Spruce-Fir Forest. Today, it is still possible to see evidence of this in the stands of Paper Birch (*Betula papyrifera*) that established after the fire, and in some remaining non-native Norway Spruce (*Picea abies*) trees that were planted high on the mountain. More recently, this community was impacted by red spruce decline and acid deposition; however, improved air quality has given this community a chance to recover.

12. Montane Yellow Birch-Red Spruce Forest

This community is found at middle elevations on Camels Hump, typically between 2000 and 3000'. It is typically above Northern Hardwood Forests but below the very cold and exposed ridges that favor Montane Spruce-Fir Forest. Soils are generally shallow silt or sandy loams. The canopy can contain a mix of Yellow Birch (*Betula alleghaniensis*), Heart-leaved Paper Birch (*Betula papyrifera* var. *cordifolia*), Red Spruce (*Picea rubens*) and Balsam Fir (*Abies balsamea*), though often a single species will dominate within a stand. At the most exposed ridgetop sites the canopy can be stunted and sparse (20-25' tall, 50-60% cover), but at more protected sites the trees grow taller. Shrubs noted in this community include Striped Maple (*Acer pensylvanicum*), Mountain Maple (*Acer spicatum*), American Mountain Ash (*Sorbus americana*), and Hobblebush (*Viburnum lantanoides*), and herbs include Goldthread (*Coptis trifolia*), Large-leaved goldenrod (*Solidago macrophylla*), Shining Clubmoss (*Lycopodium lucidulum*), Woodlily (*Clintonia borealis*), Mountain Wood Fern (*Dryopteris campyloptera*), Common Wood-Sorrel (*Oxalis acetosella*), Acuminate Aster (*Aster acuminatus*), and Bladder Sedge (*Carex intumescens*). Moss and lichen cover can be abundant.

Some areas of this community have an abundance of Sugar Maple (*Acer saccharum*) in the canopy, and have been mapped as the Montane Yellow Birch-Sugar Maple-Red Spruce Forest variant. At least some of these sites show evidence of soil enrichment, which may allow the sugar maple to compete in an otherwise unfavorable landscape position. Some species indicating moderate enrichment that are found in this variant include Braun's Holly Fern (*Polystichum braunii*), Drooping woodreed (*Cinna latifolia*), Zig-zag Goldenrod (*Solidago flexicaulis*) and Yellow Jewelweed (*Impatiens pallida*).

Portions of the Montane Yellow Birch-Red Spruce Forest near Robbins Mountain and Camel's Hump summit burned in large forest fires that occurred in 1903 and 1908. These fires are probably in part responsible for many of the stands of paper birch that are still present in this community. After these fires there was extensive tree planting, and some non-native Norway Spruce (*Picea abies*) can still be found in the high-elevation forest.

While the majority of this community is remote and largely undisturbed, a few areas receive intensive use by backcountry skiers. In these places there is extensive illegal cutting of small trees and brush to create open glades for skiing. The cumulative effect of repeated clearing will likely have lasting impacts on forest structure and composition. The impact is especially acute in the Montane Yellow Birch-Red Spruce Forest, where heavy moose browse combined with the tendency for New York Fern (*Thelypteris noveboracensis*) and Hay-scented Fern (*Dennstaedtia punctilobula*) to densely carpet the forest floor, hinders or excludes the establishment of new shrubs or trees.

All examples of Montane Yellow Birch-Red Spruce Forest in the CHMU are examples of statewide significant.

13. Northern Hardwood Forest

Northern Hardwood Forest is the matrix-forming natural community at lower elevations (below 2000'), and in the CHMU it covers over 14,000 acres. As a result, this is a variable community, with species and structure determined by landscape position and disturbance history. While some of the Northern Hardwood Forest is fairly young, the CHMU also has some excellent examples of mature forest patches that have seen relatively little human disturbance. Of particular note, these mature patches have complex structure with large trees, tip-up mounds, coarse woody debris, and large-diameter snags. All of these features create important micro-habitats for both plants and wildlife, and are uncommon in Vermont's mostly mid-successional forests.

The most common species in the canopy include Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*), and American Beech (*Fagus grandifolia*), though younger stands often have Paper Birch (*Betula papyrifera*), Red Maple (*Acer rubrum*), and aspens (*Populus* spp.). Areas with slight soil enrichment tend to favor White Ash (*Fraxinus americana*) and Basswood (*Tilia americana*). This canopy averages 60-70' tall and 70-80% closure. Tall shrubs and understory trees often includes canopy regeneration along with Hop Hornbeam (*Ostrya virginiana*), Striped Maple (*Acer pensylvanicum*), Red Elderberry (*Sambucus racemosa*), and shadbushes (*Amelanchier* spp). Low shrubs include Hobblebush (*Viburnum lantanoides*), which can sometimes form a dense, almost impenetrable layer. Herbs (average 50% cover) are diverse, with over 40 different species noted in Northern Hardwood Forest within the CHMU. Some of the most frequently observed species include: Evergreen Woodfern (*Dryopteris intermedia*), Canada Mayflower (*Maianthemum canadense*), Common Miterwort (*Mitella diphylla*), Hay-scented Fern (*Dennstaedtia punctilobula*), New York Fern (*Thelypteris noveboracensis*), and Christmas Fern (*Polystichum acrostichoides*). Areas with moderate enrichment can have Silvery Spleenwort

(*Deparia acrostichoides*) and Blue Cohosh (*Caulophyllum thalictroides*). This community is found primarily on loamy and rocky till soils.

Many wildlife species make use of Northern Hardwood Forest, including mammals such as white-tailed deer, black bear, moose, chipmunk, porcupine, and northern flying squirrel; birds such as hermit thrush, black-throated blue warbler, red-eyed vireo; and reptiles and amphibians such as red-backed salamander, eastern newt, and wood frog.

There are two occurrences of Northern Hardwood Forest in the CHMU, with Route 17 as the separating feature. The northern occurrence encompasses over 13,000 acres and is of very high ecological quality; it is of statewide significance.

14. Northern Hardwood Talus Woodland

Four patches of this community are found in the northern portion of the CHMU. Three of these sites are characterized by an accumulation of large rocks on steep slopes, either as the result of weathering cliffs above or glacial deposits. The boulders average 2-4 cubic feet in size, and are on 40-45 degree slopes. Deep crevices are sometimes formed between rocks. Soil is often absent, but where it does accumulate it can be deep and rich as a consequence of colluvial movement. Tree cover varies from relatively open to near 80% cover, and canopy height can reach 40'. Species include Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*), and Paper Birch (*Betula papyrifera*). Red Spruce (*Picea rubens*) is sometimes present but generally a minor component. Mountain Maple (*Acer spicatum*) and Red Elderberry (*Sambucus racemosa*) are characteristic shrubs. Herb cover can be quite high in places, with Evergreen Woodfern (*Dryopteris intermedia*), Appalachian Polypody (*Polypodium appalachianum*), and Shining Clubmoss (*Lycopodium lucidulum*) as abundant species. Talus can provide important habitat for some species of small mammals, including the rare rock shrew (*Sorex dispar*), for which there are historical records on Camel's Hump.

A fourth patch mapped as this community type is an unusual example of a rocky talus community found on low-angle ground. It has a similar vegetation composition to Northern Hardwood Talus Woodlands, but needs further study to determine if it is properly classified as this type. No examples of this community found in the CHMU are considered to be of statewide significance.

15. Red Maple-Black Ash Seepage Swamp

This wetland community was mapped within Robbins Mountain WMA along Wes White Hill Road. No ecological data was collected at this site. These swamps are often found on organic soils up to 20" in depth, and the ground usually has well-developed hummocks and hollows. Groundwater seepage typically provides a source of mineral enrichment. Species expected in this community include Red Maple (*Acer rubrum*), Black Ash (*Fraxinus nigra*), Winterberry Holly (*Ilex verticillata*), Speckled Alder (*Alnus incana*), Cinnamon Fern (*Osmunda cinnamomea*), and Sensitive Fern (*Onoclea sensibilis*). This

occurrence is preliminarily C-ranked based on knowledge of size and landscape context. Additional data is needed for this occurrence to confirm if it is properly typed and to confidently assign a quality rank.

16. Red Spruce-Cinnamon Fern Swamp

Red Spruce-Cinnamon Fern Swamps are small, seepage influenced wetlands that in the CHMU are typically found in small, bedrock-controlled basins on the high elevation ridges. Sampled sites have moderately deep (20-50") peat with a pH measured between 4.0-4.8. These swamps lack a pronounced hummock and hollow topography, and instead have a mostly flat surface with few pools of standing water. Some examples had mineral soil between peat and bedrock.

The tree canopy is composed of a mix of Red Spruce (*Picea rubens*), Balsam Fir (*Abies balsamea*), Paper Birch (*Betula papyrifera*), Red Maple (*Acer rubrum*), and American Mountain Ash (*Sorbus americana*). Canopy height averages 20-30', and most examples have a relatively closed canopy, though some had as little as 25% tree cover. Coarse woody debris was abundant in some patches. Tall shrubs include Hobblebush (*Viburnum lantanoides*), Mountain Holly (*Ilex mucronata*), and Northern Wild Raisin (*Viburnum cassinoides*). Herb cover varies, and species noted include Cinnamon Fern (*Osmunda cinnamomea*), Three-seeded Sedge (*Carex trisperma*), Mountain Wood Fern (*Dryopteris campyloptera*) and Goldthread (*Coptis trifolia*). *Sphagnum* moss species are abundant. These small swamps may provide habitat for songbirds such as winter wrens, which will nest in roots of tipped up trees. They may also provide suitable habitat for the rare rock shrew (*Sorex dispar*), for which there are historical records on Camel's Hump.

All the examples of Red Spruce-Cinnamon Fern Swamp in the CHMU are small (<5 acres). Because of the high-quality surrounding landscape and good current condition, all are considered examples of statewide significance.

17. Red Spruce-Heath Rocky Ridge Forest

Dry rocky ridges, with little soil and exposure to wind, can favor red spruce (*Picea rubens*) in sites that lack the cold and damp conditions characteristic of Lowland Spruce-Fir Forest and Montane Spruce-Fir Forest. These sites, which are mapped as Red Spruce-Heath Rocky Ridge Forest, are found on mid-elevation ridges above the Winooski Valley. In particular the Bamforth Ridge has a very extensive example of this community type, which is readily visible to vehicle passengers on I-89 westbound, and to Long Trail hikers who traverse through portions of the community. Since the occurrences in the CHMU are relatively large, within an excellent landscape context, and generally in good current condition, they are considered to be of statewide significance. The occurrence on the Bamforth Ridge may be the best example of Red Spruce-Heath Rocky Ridge Forest in the state.

Because this community is primarily characterized by shallow dry bedrock and the presence of red spruce, it is quite variable. Both open canopy woodlands and dense stands of red spruce have been mapped as Red Spruce-Heath Rocky Ridge Forest in the CHMU.

Open sites have a low (10-15' tall) canopy with around 20% cover of Red Spruce (*Picea rubens*) and Balsam Fir (*Abies balsamea*). A 3-8' tall secondary canopy with 70% cover is comprised of Red Spruce (*Picea rubens*), Balsam Fir (*Abies balsamea*), and American Mountain Ash (*Sorbus americana*). Black Spruce (*Picea mariana*) may be also present in places but was not observed during field inventories. Tall shrubs include stunted and prostrate Red Spruce (*Picea rubens*), and a few Paper Birch (*Betula papyrifera*). Low shrubs include Lower Lowbush Blueberry (*Vaccinium angustifolium*) and Creeping Snowberry (*Gaultheria hispidula*). Herbs are very sparse, with Bunchberry (*Cornus canadensis*) and Bracken Fern (*Pteridium aquilinum*). Bare rock is common, and where soil is present it is typically very shallow over the bedrock. In some places, this community intergrades with Temperate Acidic Outcrop and Boreal Outcrop communities.

The closed canopy sites are typified by a taller canopy (up to 30') of Red Spruce (*Picea rubens*), Red Maple (*Acer rubrum*), Paper Birch (*Betula papyrifera*), and Balsam Fir (*Abies balsamea*). Understory trees and tall shrubs include American Mountain Ash (*Sorbus americana*), Striped Maple (*Acer pensylvanicum*), shadbushes (*Amelanchier* spp.) and Lower Lowbush Blueberry (*Vaccinium angustifolium*). Herbs observed include Painted Trillium (*Trillium undulatum*), Bracken Fern (*Pteridium aquilinum*), and Pink Ladyslipper (*Cypripedium acaule*). These sites also had very shallow soils (usually <6") over bedrock.

The abundant American Mountain Ash (*Sorbus americana*) in this community may be an important source of food for black bears and many species of songbirds. Other bird species, such as white-throated sparrow and northern junco, might nest in this high-elevation habitat. Finally, this community may host interesting associations of invertebrates, but these have not been studied.

18. Red Spruce-Northern Hardwood Forest

While Red Spruce-Northern Hardwood Forest can be a matrix-forming community, in the CHMU it is found in smaller patches where local microclimate and soil conditions are slightly cooler and favor the cold-tolerant Red Spruce (*Picea rubens*) and some boreal herb species. It is also possible that historically this community was more widespread on Camel's Hump, but that the history of timber harvests and forest fires has altered the species composition, limiting the role of spruce in the present forests.

The present-day Red Spruce-Northern Hardwood Forest in the CHMU has a canopy that is 60-70' tall and ranges from 50-80% cover, and is composed of Red Spruce (*Picea rubens*), Sugar Maple (*Acer saccharum*), Yellow Birch (*Betula alleghaniensis*), Red Maple (*Acer rubrum*), and American Beech (*Fagus grandifolia*). Some examples have a secondary canopy with a similar species composition. Tall shrubs (averaging 30% cover) include Striped Maple (*Acer pensylvanicum*) and Hobblebush (*Viburnum*

lantanoïdes). Herb cover varies from sparse to abundant; in places ferns can form a dense carpet. Species include New York Fern (*Thelypteris noveboracensis*), Evergreen Woodfern (*Dryopteris intermedia*), Woodlily (*Clintonia borealis*), Wild Cucumber (*Medeola virginiana*), Starflower (*Trientalis borealis*), Wild Sarsaparilla (*Aralia nudicaulis*), and Pink Ladyslipper (*Cypripedium acaule*). Typical for the CHMU, the soil is shallow with one site having 4-6" of organic soil over 8-10" of mineral soil above bedrock. Moose, black bear, and many bird species make use of this forest community. Though it may have dense conifer cover in places, it probably does not serve as suitable deer wintering habitat because of the cold and snowy weather of high elevations.

Some examples of this community within the CHMU are considered to be of very high ecological quality, and all are of statewide significance.

19. Rich Northern Hardwood Forest

These are forest patches that show signs of mineral enrichment and host a more diverse suite of plants than those found in typical Northern Hardwood Forests. Sources of enrichment include weathering of mineral-rich bedrock, delivery of minerals to plant rooting zones by upwelling of water (e.g., in seepy areas), or downhill movement of soils on steep slopes (colluvial soil movement). Soils vary accordingly, and can be shallow, seepy, or—especially on colluvial slopes—very deep.

Sugar maple (*Acer saccharum*) dominates the canopy in this community, and is usually accompanied by a significant component of white ash (*Fraxinus americana*) and American basswood (*Tilia americana*). Butternut (*Juglans cinerea*) is also present in some locations. The shrub layer is not well-developed in this community, but hobblebush (*Viburnum lantanoides*) and red-berried elder (*Sambucus racemosa*) are occasionally encountered. The diverse herb layer includes blue cohosh (*Caulophyllum thalictroides*), plantain-leaved sedge (*Carex plantaginea*), wild leek (*Allium tricoccum*), rattlesnake fern (*Botrychium virginianum*), Virginia waterleaf (*Hydrophyllum virginianum*), Solomon's seal (*Polygonatum pubescens*), silvery spleenwort (*Athyrium thelypteroides*), wood nettle (*Laportea canadensis*), sweet cicely (*Osmorhiza claytonii*), Braun's holly fern (*Polystichum braunii*), maidenhair fern (*Adiantum pedatum*), jack-in-the-pulpit (*Arisaema triphyllum*), Goldie's Wood Fern (*Dryopteris goldiana*), and Yellow Jewelweed (*Impatiens pallida*). These sites likely host many of the same mammals, and birds found in Northern Hardwood Forests. The mineral-rich soils may also provide habitat for specific invertebrates, such as species of snails.

There are six occurrences of Rich Northern Hardwood Forest in the CHMU, and all but one are of statewide significance.

20. Seep

Seeps are abundant within the CHMU. Fifty-nine different Seep patches, forming more than 20 different occurrences, have been mapped in the unit. Because seeps are nearly impossible to identify remotely, it

is likely that the mapped Seeps represent just a small fraction of those in the CHMU. (As additional Seeps are found during subsequent inventories they will be incorporated into the natural community map.) Many of the seeps found in the CHMU are examples of statewide significance.

These small patch communities are characterized by a continuous discharge of groundwater at the soil surface. The water flow can provide nutrient input, and also help moderate temperatures within the seep. In particular, seeps are often the first places to thaw and grow vegetation in the spring, and wildlife such as deer and black bear will forage on the early vegetation when little other food is available.

Seeps are primarily characterized by hydrology and the dominance of herbaceous vegetation. The species composition of particular patches is variable and reflects nutrient levels and microclimate. Species commonly associated with seeps in the CHMU include: Orange Jewelweed (*Impatiens capensis*), Wood Nettle (*Laportea canadensis*), Golden Saxifrage (*Chrysosplenium americanum*), Jack-in-the-pulpit (*Arisaema triphyllum*), Rough-stemmed Sedge (*Carex scabrata*), Macloskey's Violet (*Viola macloskeyi*), Dwarf Blackberry (*Rubus pubescens*), Turtlehead (*Chelone glabra*), Water Avens (*Geum rivale*), Narrow beach Fern (*Phegopteris connectilis*), Gynandrous Sedge (*Carex gynandra*), Bog-candles (*Platanthera dilatata*), and Slender Mannagrass (*Glyceria melicaria*). Soils are also variable. Some have peat accumulations and *Sphagnum* moss species, others are primarily mineral soil. Higher elevation seeps in particular seem to have more organic soil, likely the result of increased precipitation and cooler temperatures.

21. Silver Maple-Ostrich Fern Riverine Floodplain Forest

Along its northern boundary, Camel's Hump SP borders the Winooski River, and a few portions of the river floodplain are found within the park. Some of the floodplain has been converted to agricultural field, but some areas are Silver Maple-Ostrich Fern Riverine Floodplain Forest. These are generally fairly disturbed patches. Soils are alluvial and generally fine silts and clays, the result of depositions during flooding. Canopy trees include Box Elder (*Acer negundo*), Black Willow (*Salix nigra*), Butternut (*Juglans cinerea*), Basswood (*Tilia americana*), Gray Birch (*Betula populifolia*), Northern Red Oak (*Quercus rubra*), and American Elm (*Ulmus americana*). Alternate-leaved Dogwood (*Cornus alternifolia*), Choke Cherry (*Prunus virginiana*), and a sumac (*Rhus* sp.) are tall shrubs/understory trees present. Vines include Poison Ivy (*Toxicodendron radicans*), Common Woodbine (*Parthenocissus quinquefolia*), and Purple-flowering Raspberry (*Rubus odoratus*). Herbs are diverse, with a number of weedy species. The non-native species Goutweed (*Aegopodium podagraria*) is present and likely poses a threat to native plant species. Other herbs include Ostrich Fern (*Matteuccia struthiopteris*), Moneywort (*Lysimachia nummularia*), Golden Alexanders (*Zizia aurea*), and a wild rye (*Elymus* sp.). The patches of this community in the CHMU form one C-ranked occurrence.

22. Subalpine Krummholz

Just below the open summit of Camel's Hump is a dense ring of densely-growing stunted trees. The combined effects of wind, ice, fog and cold temperatures stress even the hardiest of tree species, forcing them grow in tight clumps that are low to the ground. Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*), and Heart-leaved Paper Birch (*Betula papyrifera* var. *cordifolia*) reach 4-8' in height in this community on Camel's Hump. Though not noted during inventories, American Mountain Ash (*Sorbus americana*) and Showy Mountain Ash (*Sorbus decora*) are characteristic of this community type and are both probably present as well. Shrubs (< 3% cover) include Mountain Holly (*Ilex mucronata*), Labrador Tea (*Ledum groenlandicum*), and blueberries (*Vaccinium* spp.), including the rare Bog Billberry (*Vaccinium uliginosum*). Herbs are sparse beneath the dense tree growth, but Goldthread (*Coptis trifolia*), Starflower (*Trientalis borealis*), and Bunchberry (*Cornus canadensis*) were all noted in this community. Moss and lichens cover was relatively abundant, but individual species were not identified during inventories.

Subalpine Krummholz can provide habitat for some birds and small mammals, including the uncommon Bicknell's Thrush, which will nest in this community. Other species likely to be found in this patch of Subalpine Krummholz include blackpoll warbler, white-throated sparrow, and red-backed vole. The rare rock shrew has been found at high elevations on Camel's Hump, and could possibly use this community.

Just less than 14 acres of this community type have been mapped in the CHMU. It is C-ranked and considered an example of statewide significance.

23. Temperate Acidic Cliff

A 15' high Temperate Acidic Cliff was mapped among the large complex of rock outcrops that is on the northern ridge of Camel's Hump, east of Gleason Brook. It is likely that other small cliffs are interspersed with these outcrops (and possibly in other parts of the CHMU) but were not detected during inventories. The mapped cliff is partially overhanging, and is above a Boreal Talus Woodland. Only limited ecological data was collected here; the cliff is an exposure of the underlying schist bedrock and species found around the edges include Red Spruce (*Picea rubens*), Yellow Birch (*Betula alleghaniensis*), American Mountain Ash (*Sorbus americana*), Mountain Wood Fern (*Dryopteris campyloptera*), Lower Lowbush Blueberry (*Vaccinium angustifolium*), and many mosses and lichens. A *Woodsia* sp. was found on the overhanging section of cliff. This occurrence is tentatively C-ranked, but more information is needed to confidently assign an overall quality rank.

24. Temperate Acidic Outcrop

Characterized by a mix of open rock and areas short stunted tree and shrub cover, this community is found where shallow bedrock creates a warm and dry microclimate. Nearly two dozen Temperate Acidic

Outcrops have been mapped in the CHMU, primarily on the northern portion of Camel's Hump State Park, but there are likely additional small outcrops that were not detected during inventories.

Tree cover is sparse (approximately 30-50%) and stunted, with trees only growing 10-15' tall. Species include Red Spruce (*Picea rubens*), Red Maple (*Acer rubrum*), Paper Birch (*Betula papyrifera*), Northern Red Oak (*Quercus rubra*), American Mountain Ash (*Sorbus americana*), shadbushes (*Amelanchier* spp.) and the tall shrub Black Chokecherry (*Aronia melanocarpa*). The only low shrubs observed were blueberries (*Vaccinium* spp.). Herb species in this community include Common Oatgrass (*Danthonia spicata*), Mountain Wood Fern (*Dryopteris campyloptera*), a sedge (*Carex brunescens*), Wild Sarsaparilla (*Aralia nudicaulis*), Bracken Fern (*Pteridium aquilinum*), Hay-scented Fern (*Dennstaedtia punctilobula*), and Fringed Bindweed (*Polygonum cilinode*). In some places the non-native Sheep Sorrel (*Rumex acetosella*) is abundant. Non-vascular plants can be common on these outcrops, with occasional extensive cover of mosses and lichens. The blueberries and mountain ash berries may attract songbirds and other wildlife to these outcrops, and species such as bobcats might be found where outcrops intergrade with cliffs and talus communities.

Six occurrences of this community type have been mapped in the CHMU; most cover less than 5 acres and all but one are considered examples of statewide significance.

25. Temperate Calcareous Cliff

Two occurrences of Temperate Calcareous Cliff are found northwest of the Camel's Hump summit. Though the underlying bedrock is broadly mapped as acidic schist, it seems to contain lens of calcareous rock that contribute to mineral enrichment. The one cliff that was studied in detail is 400' long and varies in height from 10-35'. Species observed on the cliff include Common Miterwort (*Mitella diphylla*), Mountain Maple (*Acer spicatum*), Bulblet Fern (*Cystopteris bulbifera*), Fragile Fern (*Cystopteris fragilis*), Dwarf Blackberry (*Rubus pubescens*), and a *Ribes* species and an *Impatiens* species. The uncommon fern Steller's Cliffbrake (*Cryptogramma stelleri*) is also present on this cliff. Because of their small size, these occurrences are both C-ranked.

26. Vernal Pool

Vernal pools form in small basins that are often dry, but fill with water in the spring (and occasionally in other seasons) due to heavy rain and snowmelt. In the CHMU, these pools vary in size from 20'x30' to 80'x30'; they were usually found with less than 12" of water. Because they lack fish, these pools are excellent breeding habitat for amphibians—frogs and salamanders—that migrate to the pools to reproduce and lay eggs. Unlike other natural communities, which are typically defined and assessed based on vegetation, vernal pools are better characterized by the amphibian and invertebrate species present, such as wood frogs, spotted salamanders, fingernail clams, caddis flies, and fairy shrimp. Vegetation found around the edges of these pools in the CHMU includes Wood Nettle (*Laportea canadensis*), Lady Fern (*Athyrium filix-femina*), Sensitive Fern (*Onoclea sensibilis*), Meadow-sweet

(*Spiraea alba*), Orange Jewelweed (*Impatiens capensis*), Cinnamon Fern (*Osmunda cinnamomea*), and sedges (*Carex* sp.).

Detailed information on amphibian breeding populations is needed to assign quality ranks to Vernal Pools; none could be ranked based on information collected during these inventories. There are six occurrences of this community type in the CHMU, one of which is a cluster of six individual pools.