

# **Phytosociological Investigations and Mapping of the Alpine Region of Mount Mansfield, Vermont**



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**FINAL REPORT**

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**Abstract:**

A detailed classification of the alpine vegetation along the ridgeline of Mount Mansfield, Vermont was developed. A series of plots were established within the alpine vegetation on the mountain and data such as percent cover and frequency for each identified vascular and nonvascular plant species were collected. Plot physical characteristics such as aspect, slope angle, and slope position (convex or concave) were also recorded. A TWINSpan analysis of the sampling data identified four specific plant communities: krummholz, moist heath, dry heath, and talus slope. All four communities were dominated by *Vaccinium uliginosum* with variations in other co-dominants and sub-dominants in the "canopy" and the diversity of species in the "understory" determining the different communities. Technical problems with ortho-rectifying aerial images of the mountain's ridgeline prevented the production of a quality map depicting the location of these natural communities at this time.

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## **Introduction:**

The linear ridgeline of Mount Mansfield harbors the largest and most biologically rich alpine region in Vermont. The area provides habitat for a large number of state listed species and consists of several recognized (but poorly defined) natural communities. Mount Mansfield is also host to a collection of telecommunication facilities, a major regional downhill ski area, a road to the ridgeline open to the public, and numerous hiking trails and backcountry facilities. These developments deliver thousands of people to the summit ridgeline during all seasons of the year. There are numerous proposals to expand existing facilities currently before permitting authorities that may lead to increase use and resulting impacts. Historically, these impacts have included trampled vegetation, soil loss, species decline and extirpation, habitat loss and fragmentation, ground and surface water contamination, the introduction of nonindigenous invasive species, aesthetic blight, and overcrowding.

This research seeks to develop a more detailed classification and mapping of the alpine vegetation on Mount Mansfield. Quantitative measurements of alpine plant diversity and associations will assist in determining the extent and limit of identified and classified communities. Basic site physical characteristics will also be recorded to further assist in community descriptions and assessments. Mapping of these communities will be accomplished by identifying the varying color signatures expressed by different vegetation on color infrared imagery.

The resulting products should prove useful both to ecologists and other scientists who seek to better understand the patterns of vegetation on the mountain, to conservationists interested in protecting and managing the area, and to regulators and planners responsible for the assessment of proposed development projects.

## **Study Site:**

Mount Mansfield at 1309 meters (4393 feet) is Vermont's highest mountain and harbors the largest expanse of terrain above treeline in the state. The north-south trending linear summit of the mountain forms the main ridgeline of the Green Mountains and is located in the North Central Vermont towns of Underhill, Chittenden County and Stowe and Cambridge, Lamoille County (44 degrees 32 minutes N, 72 degrees 39 minutes W). This linear ridgeline resembles a reclining human facial profile complete with features referred to as the Forehead, Nose, Lips, Chin and Adam's Apple. The Champlain Valley stretches to the west of the mountain with the Stowe Valley and the Worcester Range found to the east. The mountain is within the Mount Mansfield State Forest (38,612 acres) with higher

elevation lands designated as the Mount Mansfield Natural Area (3850 acres). A linear strip of land along the ridgeline is owned and managed by the University of Vermont as the Mount Mansfield Natural Area (400 acres).

The summit ridgeline of approximately two miles in length exposes considerable bedrock of the Underhill formation. This gray-green quartz-muscovite-chlorite schist is folded and wrinkled in appearance and appears somewhat platy and knobby in some areas (Bazilchuk and Strimbeck, 1999). Soils where found are primarily organic, uniformly acidic, and azonal in structure (Howland, 1995). They tend to be shallow to bedrock with occasional deeper deposits and peaty lenses in low wet depressions.

The summit of Mount Mansfield contains Vermont's most extensive and diverse complex of alpine natural communities. These communities are subject to a variety of environmental stresses including severe climatic conditions, poorly productive soils, high rates of abrasion and erosion, and slow rates of recovery from disturbance. Alpine meadows appear extensively along the main ridgeline of the mountain with concentrations found in the Forehead area to the south, in the Chin area to the north, and along two descending ridges (Maple Ridge and Sunset Ridge) running perpendicular and west of the main ridgeline. These meadow communities appear in various sizes (from square meters to hectares) and are often found interspersed with exposed bedrock outcrops and subalpine krummholz. Earlier authors suggested upwards of 100 hectares of alpine habitat on the mountain (Johnson, 1980) with more recent natural community mapping efforts estimating fewer than 30 hectares of alpine meadow along the ridgeline of the mountain (Lew-Smith). Also found along the ridgeline are several alpine peatlands. These small (less than 0.25 hectare each) wetlands occur in shallow depressions in the bedrock where moisture has accumulated and is retained, even during droughty periods.

Mount Mansfield has an extensive system of trails with many reaching the summit ridgeline including the Long Trail which traverses it. Along with these trails, a gravel road (Toll Road) and ski lift (Gondola) ascend the mountain, providing access for tens of thousands of ridgeline visitors per year. The mountain also accommodates a down hill ski area on its eastern flank and a four major telecommunication facilities clustered somewhat along the southern portion of the ridgeline. These developments have historically disturbed the alpine communities resulting in direct loss of overall plant cover and the fragmentation of some areas into smaller patches. These impacts are most noticeable along existing trails and in the vicinity of existing towers, buildings, parking lots, and other telecommunications infrastructure. Areas of unweathered (and lichen free) bedrock and exposed gravel can be observed near these developments indicating areas of former plant cover. The edges of existing vegetated patches also exhibit disturbance with a decrease in

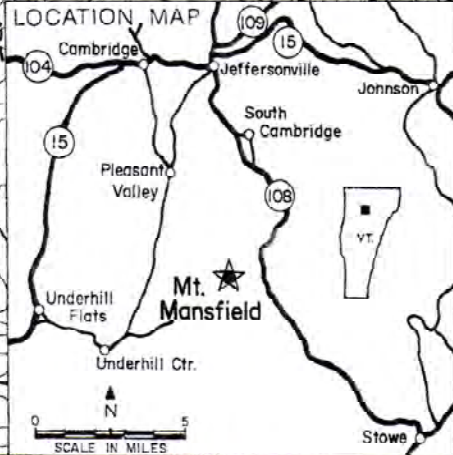
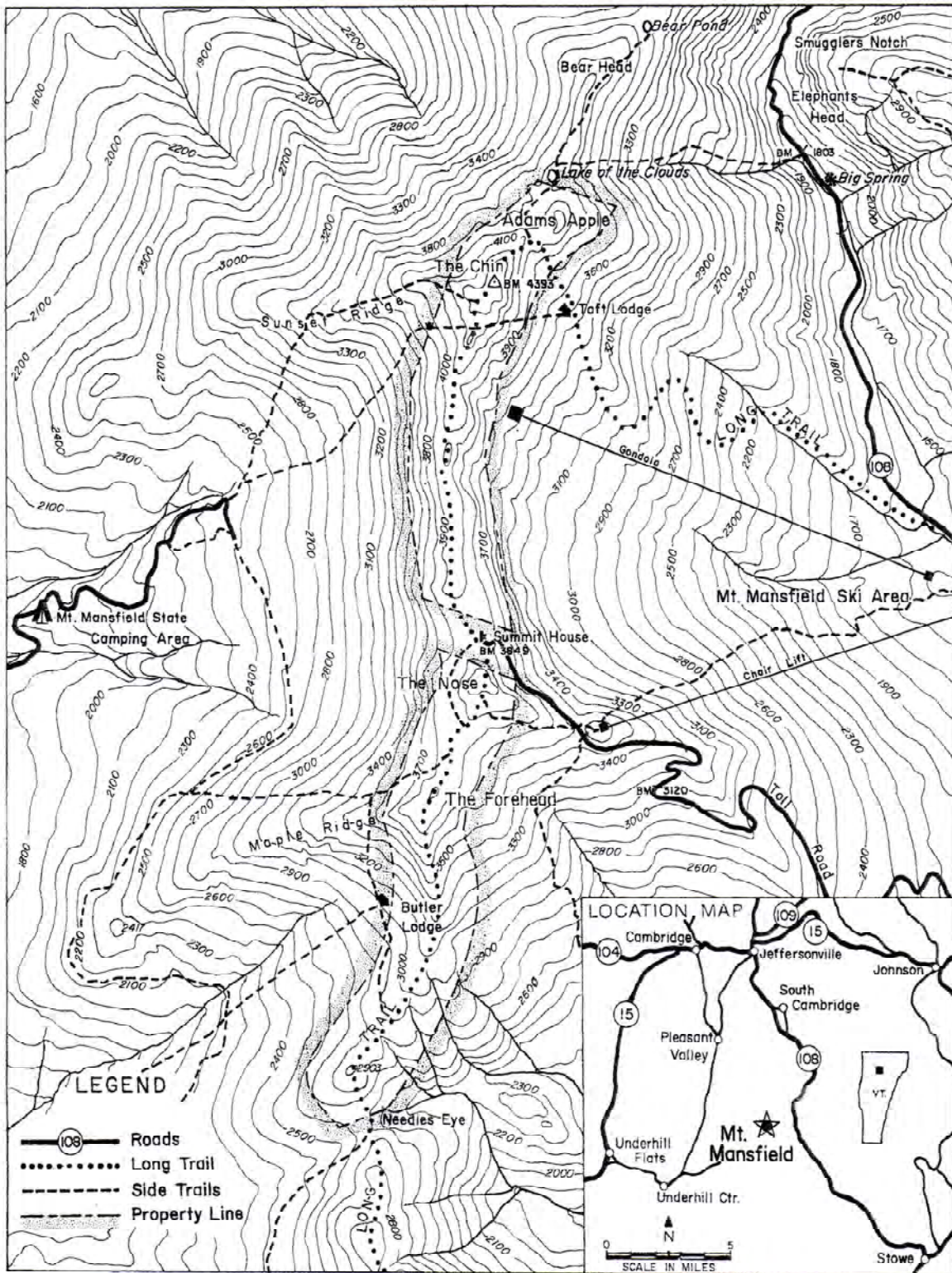
species diversity and plant cover as compared to areas away from these edges. Areas in the vicinity of the Forehead, the concentration of towers and buildings near the top of the Nose, the Toll Road summit parking lot, and at trail junctions along the Long Trail all appear noticeably disturbed. Areas away from existing trails (particularly the West Chin region) or where trails appear well-marked and easy to follow appear less disturbed. There is also some evidence indicating that air pollution, acid deposition, and climate change may be contributing to changes in species diversity and plant cover in the alpine area (Eller, 2002).

## **Methods:**

In order to more fully develop a community classification system for the alpine vegetation on Mount Mansfield, a series of plots were established along the ridgeline of the mountain. Vegetation was sampled in each plot and several site physical characteristics were recorded to further aid in classification.

Field work for this study was undertaken from June until August, 2000. Areas to be sampled were identified through field reconnaissance and the review of arial photographs. A total of 16 10x10 meter plots were subjectively established along the ridgeline above treeline in areas of distinct and somewhat homogenous alpine vegetation cover (Figure 1). This was done (as opposed to randomly selecting the plots) to capture as much of the diverse alpine vegetation cover as possible and to avoid establishing plots in areas devoid of vegetation or in areas of extensive tree cover, both of which are often found interspersed with the alpine vegetation. Within each plot, 10 randomly selected 1x1 meter subplots were sampled. Within each subplot, percent cover and frequency were recorded for each vascular and nonvascular plant species that could be recognized and identified using the Braun-Blanquet cover class scale. In addition, percent cover of bedrock and loose stone were recorded. For each plot, aspect, slope angle, and slope position (convex or concave) were recorded. Site elevation and the coordinates of the northwest corner of each plot were recorded using a Trimble ProXR GPS unit. This was done to allow for more accurate mapping of the plots and for future reference for followup studies.

From subplot sampling data, percent plant cover and frequency were calculated for each of the 16 plots. The data was analyzed using Two-way Indicator Species Analysis (TWINSPAN). TWINSPAN is a polythetic divisive hierarchical classification technique (Gauch, 1982). It begins with all samples grouped together in a single cluster and successively divides the samples into a hierarchy of smaller and smaller clusters based on the strongest floristic differences. The clusters are



# Mt. Mansfield Natural Area

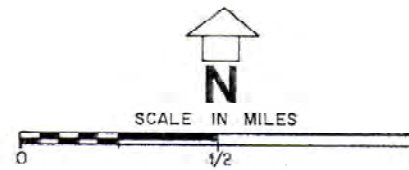


Figure 1

divided until a specified number of separations has been completed. It is up to the interpreter to determine where the splits lose ecological meaning.

## Results:

The TWINSPLAN analysis of the sampling data identified four specific plant community types on Mount Mansfield (Figure 2). The communities were labeled as: krummholz, moist heath, dry heath, and talus slope. Three of the plots sampled were characterized as krummholz, four as moist heath, four as dry heath, and five as talus slope (Table 1). Environmental variables such as aspect, slope angle, slope position, and elevation demonstrated some correlation with specific plant communities. For instance, all four plots identified as dry heath were classified as convex. The three plots identified as Krummholz were classified as concave.

All four community types were dominated by *Vaccinium uliginosum* with variations in other co-dominants and sub-dominants in the "canopy" and the diversity of species in the "understory" determining the different communities (Table 2). A total of 27 vascular plants were recorded with the diversity of mosses and lichens grouped as total mosses, total fruticose lichens, and total crustose and foliose lichens.

Data sheets for all 16 plots complete with information on plot description, location, environmental variables as well as listed plant species with percent cover and frequency can be found in the appendix.

## Discussion:

As stated above and illustrated in the data sheets in the appendix, all plots sampled were overwhelmingly dominated by *Vaccinium uliginosum*. As a result of this dominance, the differences in community floristic composition are reflected by the species associated with *V. uliginosum*. Of particular note is the variation in average percent cover of *Abies balsamea* and the mosses and lichens (Figure 3). Howland (1995) observed that one of the predominant alpine associations on Mount Mansfield was that of *V. uliginosum* and the lichen *Cetraria islandica*. Although many cryptogams are difficult to positively identify in the field, *C. islandica* was easily identifiable and was found in close association with *V. uliginosum* in the moist heath community.

Specific characteristics of each of the four community types with representative vegetation and environmental factors are as follows:

**Krummholz:** This community is characterized by a dense cover of *Abies*



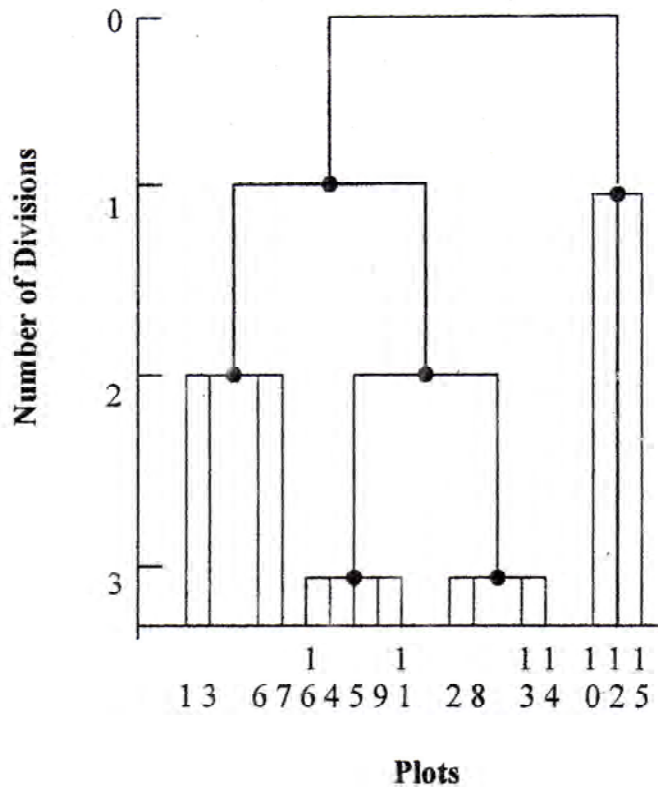


Figure 2. Dendrogram of two-way indicator species analysis (TWINSPAN) of Mount Mansfield, VT study plots.

Table 1. Community, aspect, slope, slope position, and elevation for each plot sampled on Mount Mansfield, VT.

PLOT	COMMUNITY	ASPECT	SLOPE	SLOPE POSITION	Elevation (meters)
10	krummholz	322°	23°	concave	1276
12	krummholz	340°	20°	concave	1290
15	krummholz	323°	12°	concave	1144
1	moist heath	265°	10°	convex	1170
3	moist heath	280°	3°	concave	1174
6	moist heath	160°	27°	concave	1294
7	moist heath	205°	10°	concave	1269
2	dry heath	285°	23°	convex	1155
8	dry heath	312°	0°	convex	1297
13	dry heath	190°	5°	convex	1205
14	dry heath	322°	28°	convex	1195
4	tallus slope	48°	22°	convex	1298
5	tallus slope	12°	13°	concave	1300
9	tallus slope	270°	19°	concave	1274
11	tallus slope	310°	25°	convex	1290
16	tallus slope	0°	30°	concave	114

Table 2. Average cover (%), standard deviation, and frequency (%) of species in four alpine plant communities on Mount Mansfield, VT.  
 ♦ = dominant species.

Species	Krummholz (n=3)			Moist Heath (n=4)			Dry Heath (n=4)			Tallus (n=5)		
	Mean	SD	Freq.	Mean	SD	Freq.	Mean	SD	Freq.	Mean	SD	Freq.
<i>Vaccinium uliginosum</i>	♦37.75	2.78	87	♦54.38	19.2	100	♦25.69	6.41	80	♦55.95	1.5	98
<i>Abies balsamea</i>	♦27.76	16.52	73	6.44	6.91	33	6.19	8.18	15	1.7	3.7	16
<i>Betula papyrifera</i> var. <i>cordifolia</i>	23.67	16.28	67	0.07	0.13	20	0.01	0.01	5	0.35	0.08	6
<i>Carex bigelowii</i>	0.09	0.16	13	2.19	2.39	45	12.78	9.38	88	5.5	5.5	64
<i>Ledum groenlandica</i>	5.25	3.44	33	6.19	7.31	48	0.38	0.75	10	2.75	2.8	28
<i>Lycopodium annotinum</i>	12.43	3.29	93	0	0	0	0	0	0	0.15	0.03	10
<i>Vaccinium angustifolium</i>	1.08	1.88	13	8.38	8.14	60	0.82	1.62	10	0.01	0.01	6
<i>Vaccinium vitis-idaea</i>	0.35	0.60	30	4.94	3.54	65	2.07	2.49	40	0.0	0.0	0
<i>Chamaedaphne calyculata</i>	0.08	0.14	3	4.75	3.23	45	0	0	0	0.65	1.5	6
<i>Minuartia groenlandica</i>	0	0	0	0.13	0.26	10	4.33	1.81	75	0.95	0.09	24
<i>Diapensia lapponica</i>	0	0	0	0	0	0	2.13	4.26	15	0	0	0
<i>Junus trifidus</i>	0	0	0	0	0	0	1.88	2.95	33	0.16	0.2	12
<i>Cornus canadensis</i>	1.92	3.31	33	0	0	0	0	0	0	0.0	0.0	0
<i>Picea rubens</i>	1.84	2.02	13	0.06	0.13	3	0	0	0	0.0	0.0	0
<i>Carex capillaris</i>	0	0	0	0.94	1.89	18	0	0	0	0.0	0.0	0
<i>Empetrum nigrum</i>	0	0	0	0.81	1.46	8	0	0	0	0.0	0.0	0
<i>Vaccinium oxycoccus</i>	0	0	0	0.57	0.83	13	0	0	0	0.0	0.0	0
<i>Vaccinium myrtilloides</i>	0.05	0.87	13	0	0	0	0	0	0	0.0	0.0	0
<i>Trientalis borealis</i>	0	0	0	0.44	0.89	13	0	0	0	0.0	0.0	0
<i>Maianthemum canadense</i>	0	0	0	0.31	0.63	18	0	0	0	0.0	0.0	0
<i>Huperzia selago</i>	0	0	0	0	0	0	0.14	0.24	18	0.06	0.1	10
<i>Coptis trifolia</i>	0	0	0	0.13	0.26	10	0	0	0	0.0	0.0	0
<i>Eriophorum vaginatum</i> var. <i>spissum</i>	0	0	0	0.13	0.15	10	0	0	0	0.0	0.0	0
<i>Agrostis mertensii</i>	0	0	0	0	0	0	0.07	0.14	8	0.0	0.0	0
<i>Thelypteris phegopteris</i>	0.08	0.14	3	0	0	0	0	0	0	0.0	0.0	0
<i>Deschampsia flexuosa</i>	0	0	0	0	0	3	0	0	0	0.0	0.0	0
<i>Solidago macrophylla</i>	0	0	0	0	0	3	0	0	0	0.0	0.0	0
Non-vascular												
Total moss	26.87	11.74	100	19.45	12.6	73	21.33	20.8	90	29.57	20	94
Total fruticose lichen	16.4	4.31	93	♦25.47	13.1	98	12.93	9.33	98	♦36.63	18	100
Total crustose & foliose lichen	9.9	5.15	100	1.52	2.23	50	♦22.33	17.4	93	5.56	3.7	92

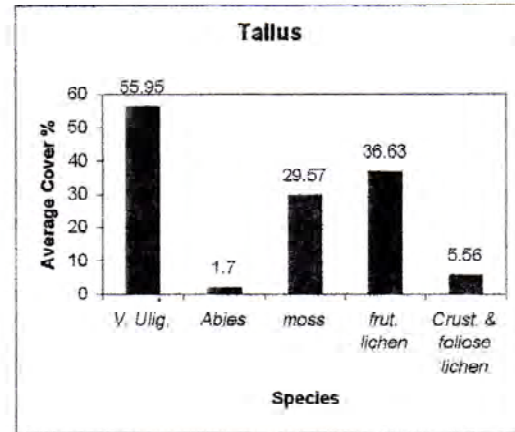
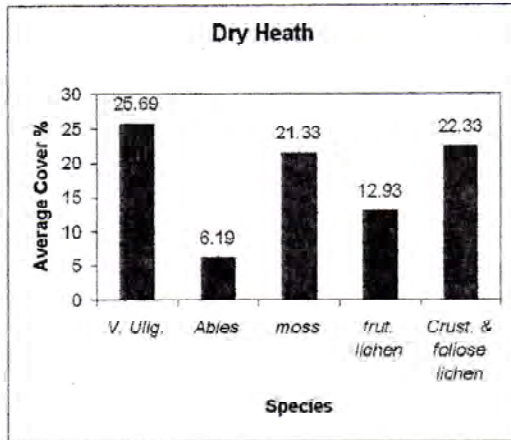
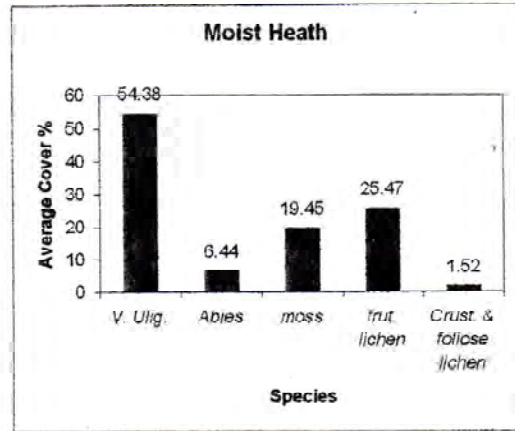
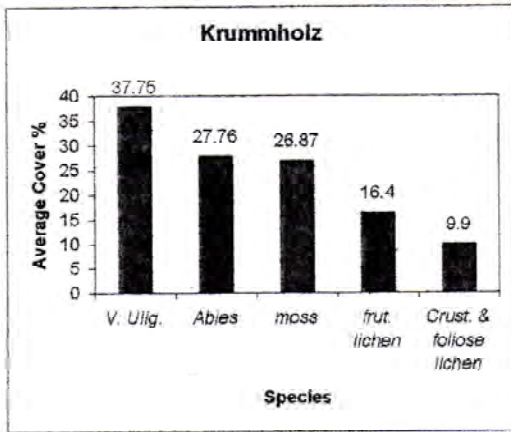


Figure 3. Average percent cover for the dominant species found in each of the four alpine plant communities on Mount Mansfield, VT.

*balsamea* and *Betula papyrifera* var. *cordifolia*. There is a much higher percent cover of *A. balsamea* in this community as compared to the other communities. *Vaccinium uliginosum* is the dominant cover in the understory in association with *Lycopodium annotinum*, *Cornus canadensis*, and assorted mosses found on the moist underside of boulders. The topography is sloping to the northwest and concave providing some shelter from prevailing winds. This community appears as above treeline krummholz islands or scattered krummolz in heath.

**Moist Heath:** Dominated by *Vaccinium uliginosum* with higher occurrences of other heaths such as *Chamaedaphne calyculata*, *Ledum groenlandicum*, *Vaccinium angustifolium*, and *Vaccinium vitis-idaea*, this community is characterized by the *V. uliginosum*/*Cetraria islandica* association described by Howland (1995). Other characteristics of this community include very high plant cover (with occasional krummolz overstory), an abundance of plant species, and hummocky terrain with some standing water in depressions containing mosses.

**Dry Heath:** This community has the lowest percent cover of *Vaccinium uliginosum* and consequently, the lowest coverage of fruticose lichens. Due to the dryness of this community, crustose and foliose lichens were more common with mosses mostly absent. The topography is sloping to level, convex, and mostly facing windward. There is an increase in cover of *Carex bigelowii* and *Juncus trifidus* compared to other communities and a higher percentage of exposed bedrock. An example of this community type harbors a population of *Diapensia lapponica*.

**Tallus Slope:** The tallus slope community is found on northerly slopes with heavy frost action and lots of boulders. It has the highest percent cover of *Vaccinium uliginosum* and fruticose lichens. The mesotopography found here allows for mosses and heaths such as *Chamaedaphne calyculata* to grow in the lee of boulders with more exposed areas exhibiting sparse plant cover and diversity. Disturbed areas due to frost action provide opportunities for colonizing mosses and clumps of *Minuartia groenlandica* to take hold.

## Conclusions:

Comparing and contrasting the results of this study with other regional attempts at classifying alpine plant communities (Bliss, 1963; Sperduto and Cogbill, 1999) reveal both similarities and differences. Although we identified fewer community types on Mount Mansfield as compared to the classification work done in the more extensive alpine landscape of the Presidential Range in the White Mountains of New Hampshire, for example, several of our classified communities

do match up considerably well with community types found there. (See Gilpatrick, 2002 and Hazelton, 2001 for further comparisons.)

As plants exhibit distribution patterns at various scales with certain patterns existing at one scale but not necessarily at another, changing the resolution of investigation or plot size and frequency could reveal new and distinct patterns. In retrospect, our plots could have been smaller and more numerous to better capture the differences in plant distribution and association on Mount Mansfield, i.e., at a scale that would be more consistent with the smaller scale variations in the landscape. Smaller plots would have allowed smaller areas to be sampled that may have revealed further divisions when analyzed with TWINSpan.

### **A Note on the Mapping:**

Our intent was to map the alpine natural communities found along the ridgeline of Mount Mansfield. We obtained color infrared aerial photographs of the ridgeline that were taken at an altitude of 2300 meters in August of 2000. The photographs were scanned as transparencies at a resolution of 1200 dpi. The northwest corner of each of our 16 plots was identified using a GPS unit and entered into ArcView where the plots were converted into polygons using a coordinate geometry program. We then attempted to ortho-rectify the scanned images. The exaggerated topography of Mount Mansfield made it difficult to accurately rectify the images. The steeper the topography, the greater the potential for error. In order to ortho-rectify images, they must be digitally overlain on a digital elevation model (DEM). A DEM provides a z-axis that gives the image three-dimensional relief. The scale of the digital elevation model was too large to map this small an area that has such dramatic relief. The DEM was drawn on a scale of 30 meter pixels and this did not accurately enough represent the topography on Mount Mansfield. We also had difficulty identifying a sufficient number of control points. The patches of vegetation on the images did not line up very well with the locations of our plots (as determined by GPS). We could not rectify the images with an acceptable level of error for the scale of map that we were trying to produce.

As a result of these difficulties, we were unable to use the plots as training sites for analysis of the vegetation on the images. While we could draw estimated locations of the plots on the images and produce a map, the map would not coincide with real world coordinates.

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# **APPENDIX**

**Percent Cover and Frequency of all Species Sampled  
in Plots #1-16 on Mount Mansfield, Vermont**

**Maps Depicting Location of Plots Along  
Ridgeline of Mount Mansfield**

Plot #1      Date 6/27/00

**Plot Description:** Heath, scattered krummholz, high cover, lots of vegetation, high moisture.

**Plot Location:** Past Frenchman's Pile, to the west of the trail, before Drift Rock.

Aspect 265°      Slope 10°      Slope position convex slope

<b>Species</b>	<b>Total % Cover</b>	<b>Frequency</b>
<i>Vaccinium Uliginosum</i>	50.75	100
Fruticose lichen	30.76	100
Moss	15.76	90
<i>Vaccinium vitis-idaea</i>	10.00	100
<i>Chamaedaphne calyculata</i>	7.00	80
<i>Ledum groenlandica</i>	6.00	50
<i>Vaccinium angustifolium</i>	4.50	30
<i>Carex capillaris</i>	3.77	70
<i>Abies balsamea</i>	3.25	30
<i>Vaccinium oxycoccus</i>	1.75	20
Crustose & foliose lichen	1.01	50
<i>Empetrum nigrum</i>	0.25	10
<i>Eriophorum vaginatum var. spiss.</i>	0.25	10

Plot #2

Date 6/28/00

**Plot Description:** Steep slope, sedge heath meadow, patchy vegetation following topography, vegetation often broken on downward sides of rock lips. *Polytrichum*, *Carex* and lichen colonizing recently disturbed ground. Heath community is the more established vegetation.

**Plot Location:** Down to the west (south of) Frenchman's Pile and Plot #1. To the west of the trail if facing north.

Aspect 285° Slope 23° Slope position convex

<b>Species</b>	<b>Total % Cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	32.50	90
Fruticose lichen	19.09	100
<i>Abies balsamea</i>	7.50	20
Moss	6.00	80
Crustose & foliose lichen	5.06	70
<i>Minuartia groenlandica</i>	2.76	70
<i>Vaccinium vitis-idaea</i>	2.26	50
<i>Ledum groenlandica</i>	1.50	10
<i>Juncus trifidus</i>	1.01	50
<i>Huperzia selago</i>	0.50	20
<i>Carex bigelowii</i>	0.09	90
<i>Vaccinium angustifolium</i>	0.01	10

Plot #3      Date 6/28/00

**Plot Description:** Hummocks, wet and patchy.

**Plot Location :** Across from the bog past Frenchman's Pile, between the two wooden walkways.

Aspect 280°    Slope 3°    Slope position concave

<b>Species</b>	<b>Total % Cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	34.00	100
Moss	27.76	50
<i>Eriophorum vaginatum</i> var. <i>spis.</i>	27.00	30
<i>Ledum groenlandica</i>	16.51	90
<i>Abies balsamea</i>	16.01	80
Fruticose lichen	14.28	90
<i>Chamaedaphne calyculata</i>	6.51	70
<i>Vaccinium angustifolium</i>	5.50	70
<i>Empetrum nigrum</i>	3.00	20
<i>Vaccinium vitis-idaea</i>	2.26	50
<i>Vaccinium oxycoccos</i>	0.51	30
<i>Carex bigelowii</i>	0.27	30
<i>Betula papyrifera</i> var. <i>cordifolia</i>	0.26	80
Crustose & foliose lichen	0.26	20
<i>Picea rubens</i>	0.25	10

Plot #4      Date 6/29/00

Plot Description: Steep, rocky, heath meadow, broken boulders.

Plot Location: North slope, West Chin (beyond sign)

Aspect 48°      Slope 22°      Slope position convex

<i>Species</i>	Total % Cover	Frequency
Fruticose lichen	49.33	100
<i>Vaccinium uliginosum</i>	40.75	100
Moss	10.77	90
Crustose & foliose lichen	7.33	80
<i>Carex bigelowii</i>	3.27	100
<i>Ledum groenlandica</i>	3.01	30
<i>Minuartia groenlandica</i>	1.76	30
<i>Juncus trifidus</i>	0.28	40
<i>Huperzia selago</i>	0.27	30
<i>Abies balsamea</i>	0.01	10

Plot #5      Date 7/5/00

**Plot Description:** Heath, patchy bedrock, some soil.  
Windswept gully, windward gully formations, rock striping (polygons).  
Undulating between bedrock. Very windy site!

**Plot Location:** West Chin along trail (to the west), west of *Diapensia*,  
slightly north of sign

Aspect 12°      Slope 13°      Slope position concave slope

Species	Total % cover	Frequency
<i>Vaccinium uliginosum</i>	75.00	100
Fruticose lichen	59.50	100
Moss	19.00	80
Crustose & foliose lichen	11.00	100
<i>Ledum groenlandica</i>	7.00	40
<i>Carex bigelowii</i>	2.25	40
<i>Juncus trifidus</i>	0.50	20
<i>Vaccinium angustifolium</i>	0.25	10

Plot #6      Date 7/5/00

Plot Description: Snowbank? Moist, some bedrock, southern slope, hummocky.

Plot Location: Southern edge of Chin. Off to the east of the trail, before sign.

Aspect 160°      Slope 27°      Slope position slightly concave

Species	Total % cover	Frequency
<i>Vaccinium uliginosum</i>	80.25	100
Moss	31.00	100
<i>Vaccinium angustifolium</i>	20.50	100
Fruticose lichen	15.27	100
<i>Abies balsamea</i>	6.5	20
<i>Carex bigelowii</i>	4.00	60
<i>Vaccinium vitis-idaea</i>	2.75	70
<i>Ledum groenlandica</i>	2.26	50
<i>Trientalis borealis</i>	1.77	50
<i>Maianthemum canadense</i>	1.25	70
<i>Coptis trifolia</i>	0.52	40
<i>Deschampsia flexouosa</i>	0.01	10
<i>Solidago macrophylla</i>	0.01	10
Crustose & foliose lichen	0.01	50

Plot #7      Date 7/6/00

**Plot Description:** Rolling slope, lots of bedrock, moister areas in lee of bedrock.

**Plot Location:** South, southwest of Profanity Trailhead. East of trail a ways off the trail.

Aspect 205°      Slope 10°      Slope position concave

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	52.50	100
Fruticose lichen	41.56	100
<i>Chamaedaphne calyculata</i>	5.50	30
Crustose & foliose lichen	4.80	80
<i>Vaccinium vitis-idaea</i>	4.75	40
<i>Carex bigelowii</i>	4.50	90
Moss	3.27	50
<i>Vaccinium angustifolium</i>	3.02	40
<i>Minuartia groenlandica</i>	0.52	40



Plot #8      Date 7/19/00

**Plot Description:** Prevailing wind from north, through a gap, windy exposed mound. Lots of frost action, *Diapensia* exposed area. Small to midsized mounds of *Diapensia*. *Carex* and *V. uliginosum* dominant in lee of boulders.

**Plot Location:** *Diapensia* patch, south of trail.

Aspect 312° Slope 0° (no slope) Slope position convex

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	28.00	90
Crustose & foliose lichen	25.78	100
Fruticose lichen	21.36	100
<i>Carex bigelowii</i>	19.75	100
<i>Diapensia lapponica</i>	8.51	60
<i>Minuartia groenlandica</i>	6.02	60
Moss	3.75	80
<i>Vaccinium angustifolium</i>	3.25	30
<i>Vaccinium vitis-idaea</i>	0.50	30
<i>Ledum groenlandica</i>	0.02	20

Plot #9      Date 7/20/00

**Plot Description:** Lots of frost action. Some krummholz,  
*V. uliginosum*, and *Carex* in moist areas between heath and rocks.

**Plot Location:** North of Sunset Ridge Trail (not far from the trailhead)

Aspect 270°      Slope 19°      Slope position concave

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	42.00	100
Moss	22.77	100
Frutiose lichen	19.61	100
<i>Carex bigelowii</i>	13.75	100
Crustose & foliose lichen	2.10	100
<i>Minuartia groenlandica</i>	1.51	70
<i>Vaccinium angustifolium</i>	0.26	20
<i>Ledum groenlandicum</i>	0.25	20
<i>Betula papyrifera</i> var. <i>cordifolia</i>	0.01	10
<i>Huperzia selago</i>	0.01	10

Plot #10      Date 7/20/00

**Plot Description:** Tallus slope, krummholz and heath, lycopod dominance. Krummholz following topography, mostly .5 to 1 meter tall. Moist areas in underside of boulders.

**Plot Location:** West of summit, 200 yards down. (scrambled down on rocks)

Aspect 322°    Slope 23°    Slope position concave

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	37.25	100
Moss	27.52	100
<i>Betula papyrifera var. cordifolia</i>	22.50	90
Fruticose lichen	17.82	100
<i>Abies balsamea</i>	16.77	60
<i>Lycopodium annotinum</i>	16.00	100
Crustose & foliose lichen	15.83	100
<i>Cornus canadensis</i>	5.75	80
<i>Picea rubens</i>	4.00	20
<i>Ledum groenlandicum</i>	1.50	10

Plot #11      Date 7/21/00

**Plot Description:** Tallus, lots of frost action, small boulders with heath/  
krummholz (*Abies* and *Betula*)/ sedge. Trees on downside of boulders.  
Heath on exposed areas.

**Plot Location:** North of summit, west of Long Trail.

Aspect 310°      Slope 25°      Slope position convex

Species	Total % cover	Frequency
<i>Vaccinium uliginosum</i>	55.25	100
Fruticose lichen	35.59	100
Moss	32.29	100
<i>Carex bigelowii</i>	8.25	80
Crustose & foliose lichen	2.54	80
<i>Betula papyrifera</i> var. <i>cordifolia</i>	1.75	20
<i>Lycopodium annotinum</i>	0.77	50
<i>Abies balsamea</i>	0.26	20
<i>Ledum groenlandicum</i>	0.26	20

Plot #12      Date 7/26/00

**Plot Description:** Krummholz and heath. Cover dominance - *V. uliginosum*, *Abies*, *Betula*. Moist areas in lee of boulders. Drier in high areas. Understory in moist areas moss & lichen. Understory in dry areas lichen. Heavy frost action tallus slope.

**Plot Location:** West of Long Trail, north of summit (between summit and Plot #11)

Aspect 340°    Slope 20°    Slope position slightly concave

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	40.75	100
<i>Betula papyrifera</i> var. <i>cordifolia</i>	40.50	80
Moss	38.70	100
Fruticose lichen	19.81	90
<i>Abies balsamea</i>	19.75	70
<i>Lycopodium annotinum</i>	11.77	100
<i>Ledum groenlandicum</i>	8.26	50
Crustose & foliose lichen	7.34	100
<i>Vaccinium angustifolium</i>	3.25	40
<i>Vaccinium myrtilloides</i>	3.00	20
<i>Picea rubens</i>	1.51	20
<i>Carex bigelowii</i>	0.28	40
<i>Thelypteris phegopteris</i>	0.25	10
<i>Cornus canadensis</i>	0.01	10

Plot #13      Date 7/27/00

Plot Description: *V. uliginosum*, *C. bigelowii* dominated. Moist, some bedrock.

Plot Location: On the Nose, approximately 50' north of Public Television tower.

Aspect 190°      Slope 5°      Slope position convex

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
Moss	48.00	100
<i>Vaccinium uliginosum</i>	25.00	80
<i>Carex bigelowii</i>	20.01	100
Crustose & foliose lichen	13.34	100
<i>Vaccinium vitis-idaea</i>	5.51	80
<i>Minuartia groenlandica</i>	2.76	80
Fruticose lichen	0.86	90
<i>Agrostis mertensii</i>	0.27	30
<i>Juncus trifidus</i>	0.25	10
<i>Betula papyrifera var. cordifolia</i>	0.02	20
<i>Huperzia selago</i>	0.02	20

Plot #14      Date 7/27/00

**Plot Description:** Heavy frost action. Heavy lichen cover on boulders. In lee of boulders - polytrichum mats, patchy *Abies* and *V. uliginosum* with dense mats of *C. bigelowii* and *J. Trifidus*, *Minuartia* in disturbed areas.

**Plot Location:** Downslope NW corner of Nose. E, SE of cliff.

**Aspect** 322° **Slope** 28° **Slope position** convex, concave in lee of boulders

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
Crustose & foliose lichen	45.13	100
Moss	27.56	100
<i>Abies balsamea</i>	17.25	40
<i>Vaccinium uliginosum</i>	17.25	60
<i>Carex bigelowii</i>	11.25	60
Fruticose lichen	10.41	100
<i>Juncus trifidus</i>	6.25	70
<i>Minuartia groenlandica</i>	5.76	90
<i>Huperzia selago</i>	0.01	20

Plot #16      Date 8/9/00

**Plot Description:** Moist steep northern slope, scattered krummholz, prone to rockslides. *Minuartia* and *Polytrichum* colonizing bare rock.

**Plot Location:** Forehead - north of Wampahoofus Trail. Further down trail from Plot #15. North of trail.

Aspect 0°      Slope 30°      Slope position slightly concave

<b>Species</b>	<b>Total % cover</b>	<b>Frequency</b>
<i>Vaccinium uliginosum</i>	66.75	90
Moss	63.04	100
Fruticose lichen	19.12	100
<i>Abies balsamea</i>	8.25	50
Crustose & foliose lichen	4.84	100
<i>Chamaedaphne calyculata</i>	3.25	30
<i>Ledum groenlandicum</i>	3.25	30
<i>Minuartia groenlandica</i>	1.50	20
<i>Huperzia selago</i>	0.01	10



