THE IMPORTANCE OF MICRO-SCALE AVALANCHE FORECASTING IN MOUNT WASHINGTON'S TUCKERMAN AND HUNTINGTON RAVINES

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ABSTRACT: For over fifty years U.S. Forest Service Snow Rangers have patrolled Mount Washington and issued avalanche advisories. The focus of these activities has occurred in Tuckerman Ravine, a popular East Coast steep skiing destination and Huntington Ravine, renowned for alpine ice climbing. These two alpine cirques are within a day's drive of 75-80 million people wanting to cut their teeth in the East's most significant avalanche terrain. The Mount Washington Avalanche Center is tasked with educating these users through forecasting for avalanches, icefall, crevasse problems and communicating these in an advisory. Upwards of 4000 people can be expected to make the 7 mile round trip pilgrimage on a sunny spring Saturday. High visitation in this concentrated use environment paired with Mount Washington's spatial variability has made micro-forecasting critical for successfully conveying stability issues to the public.

Avalanche forecasting occurs on a micro-scale through the issuance of ratings for 16 independent areas. Stability may vary by one to three ratings within this relatively small area due to the intense spatial variability caused by Mount Washington's extreme wind, high tensile strength hard slab, and the associated bridging over weak layers. Winds between 160 and 225 kph occur on a regular basis through the winter and provide the dominant forecasting variable. This micro-scale focus gives more detailed point specific information to visitors so they may better mitigate risk in a heavy use environment.

KEYWORDS: Micro-Scale, Avalanche, Forecasting, Mount Washington, Tuckerman, Huntington.

1. INTRODUCTION

For the past 50 years US Forest Service Snow Rangers have patrolled the snow covered terrain of Mount Washington on the White Mountain National Forest. The program has worn many faces over the years and has changed to best suit new times and new ways of thinking. The current Snow Ranger staff of 4 makes up the Mount Washington Avalanche Center (MWAC) which focuses on a daily avalanche forecast, search and rescue, and avalanche education. Avalanche forecasts are made 7 days a week for 16 independent areas on a very small land base. The forecasted slopes and gullies make up approximately 450 acres with an entire management area of +/-2000 acres. The White Mountain National Forest has the unique responsibility within the National Forest System as lead agency responsible for search and rescue on the eastern side of Mount Washington from December until June of each year. This puts the Snow Rangers in the position of incident command, technical rescuer, and medical response for all accidents and missing persons. Avalanche education takes all the traditional forms from the actual advisory, impromptu talks in the field, scheduled evening talks, TV and Radio programs, and involvement in about 30 avalanche classes each year. The Avalanche Center manages 20 volunteers on the Mount Washington Volunteer Ski Patrol (MWVSP) and maintains program facilities, equipment and backcountry trails in the Cutler River Drainage. We are a traditional Snow Ranger program built on lessons of the past and embracing modern technologies when applicable. Our efforts focus on field contacts with the visiting public and having face-to-face conversations about their intended plans and mountain conditions. Micro-scale forecasts and personally customized advice for visitors in the field have proven themselves as the critical tandem components and pillars of our safety program. These program fundamentals have developed over time and have gone through an evolution for over 50 winters.

Winter recreation on Mount Washington has a long and illustrated history, much of which took place in Tuckerman and Huntington Ravines along its eastern flank. Skiing and mountaineering popularity grew in the 1920's as opportunities on

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the mountain became better known within New England's ski communities. The Olympic trials held in 1935, the "Inferno", and other downhill races solidified the Mountain's reputation as a ski destination with snow coverage unrivaled in the Northeast (Leich 1999). The first warming hut was built and staffed by the US Forest Service in the late 1930's in response to the level of use the area was receiving. A decade later the MWVSP was formalized and began working on the mountain as Forest Service volunteers due to the number of skiers and associated accidents. It wasn't until after the end of WWII in the winter of 1951-52 that Leavitt Bowie, the first Snow Ranger on the White Mountain National Forest, with some part-time employees, began patrolling Tuckerman Ravine. Several years later Leavitt and District Ranger Rick Goodrich went to the USFS Alta Avalanche School laying the groundwork for Mount Washington's control program in 1958 and for the first avalanche bulletin in 1959. Avalanche control experimentation continued for a decade using a number of military ordinances as well as an early Avalauncher in 1966. Due to its limited success control work was greatly curtailed and most avalanche focus was put into the bulletin and visitor education. The initial avalanche stability determination was heavily weighted on the numerical value output of the "10 contributing factors". Until the mid 1970's, daily postings stated whether or not avalanche activity was "likely", and if the numerical value surpassed 50 (out of 100) the Ravines were closed. The closure program continued until 1979 when the Snow Rangers abandoned this management strategy and began posting advisories using a Low through Extreme rating and established a more intensive educational approach with visitors. This shift to a "post and advise" program began the main framework and roots for our current operation. Overall popularity of the area increased through these years culminating with the busiest spring Saturday ever seen in Tuckerman's backcountry bowl with just over 5000 people (WMNF-Archives).

Over the next twenty years midwinter use intensified while spring use decreased. This resulted in more climbers and skiers during the most prolific avalanche months between December and March. From 1995 to 2002 seven people died as direct result of avalanches compared to six avalanche deaths in the previous 146 years (WMNF-Archives). In addition to these incidents the Snow Rangers were seeing a marked increase in avalanche related injuries and numerous close calls. Winter recreation numbers on the mountain grew tremendously with the advent of vastly improved ski equipment, ice climbing gear and winter clothing, as well as the expansion of outdoor programs and guiding services. It became clear that human and avalanche interactions would continue to increase. These factors coupled with improved public access to weather and avalanche information on the internet accentuated the importance of our micro-scale forecasting program. This new paradigm focused our attention on what was working, and more importantly, which methods needed improvement to capitalize on the unique advantages micro-scale forecasting provides, particularly in a geographically small, concentrated-use area with high visitation. This focused attention and shift in visitor characteristics guided how the Avalanche Center would use micro-scale forecasting to further reduce avalanche accidents and better educate the public on a daily basis.

2. ENVIRONMENTAL FACTORS

The majority of Mount Washington's snow stability or lack there of, is due to several dominant factors in addition to a traditional recipe of snow, temperature and wind. The bridging strength of thick, dense, high tensile strength slabs over lower weak layers; extreme wind and the resulting high spatial variability of snow deposition; and rain or mixed precipitation followed by arctic temperatures are several parameters that bring a degree of uniqueness to Northeast avalanche forecasting.

The vast majority of natural activity in our region occurs during an avalanche producing weather event. Indirect or delayed natural releases are extremely rare to the point that the mountain could be considered a "poster child" for direct avalanche regimes. The majority of avalanche cycles are caused by the direct loading of 8-12% density new snow during a storm from the SW to NW; a Nor'easter bringing heavier density snow from the coast; or upslope energy bringing in low density snow on light winds and cold temperatures followed by an increase in wind velocities. Low water-equivalent events demonstrate the true impact of Mount Washington winds and the amount of snow that they can transport. During mid winter conditions when smaller terrain features above treeline have filled in with snow and bed surfaces are of significant size, 5-7.5 cm of snow with high W winds can produce an avalanche cycle with a Considerable or even a High rating given the right conditions. This elevated instability scenario occurs regularly from an initial generally stable Low rating. This fact demands respect for each centimeter of accumulation.

Depth hoar facets, surface hoar, pooled graupel, and a variety of buried weaknesses are typically not a concern for long due to the development of intense bridging. This most often occurs in one of two ways. The winter pleasures of New England bring a variety of moisture types including rain or a "wintry mix" on a fairly regular basis. These weather events either generate an avalanche cycle or refreeze the saturated isothermal snowpack from the surface down creating a mass resembling concrete, its thickness determined by the event's percolation intensity. Many of these events render all weaknesses below this layer moot, saving a later rare weather event to melt the entire bridge. A far more common bridge is created by the mountain's most dominant avalanche producing parameter ...wind. Winds over 160kph are common and winds between 220 and 240kph occur each winter. The current worldwide surface wind speed record was recorded on Mount Washington in 1934 with a speed of 372kph. These velocities create extremely dense hard slab (aptly named "steel slab" on Mt. Washington) that are often deposited in large pillows several meters thick in strong lee areas. The outcomes of these two bridging scenarios typically have us focusing our attention during subsequent snow events in the upper meter during field assessments. These assessments are most often focused on the intensity of spatial variability of wind-transported new snow or the wind-eroded snow from the upper mountain. As 160+kph winds move snow into the Ravines, a high degree of scouring occurs on the slick aspects exposed to these velocities. During these high wind events strong lee areas are often the only locations holding on to new slabs that are poorly bonded to the old icy surface. The result can be a Ravine with old bullet-proof concrete on northern aspects and a meter of soft and hard slabs on many others; or more often, an artful composition of intermingled old, hard bed surfaces and new slabs of varying degrees of hardness from pencil/knife to fist. Any one of these examples is usually reasonably straight forward to forecast, particularly with clear visibility. However, when the next snow falls with lighter winds these valuable visual clues become buried and invisible to the day tripper. What was an easy to explain patch-work of old surfaces and new instability is now a hidden mosaic of spatial variability chaos and a sea of sweet spots. At times, finding any commonality between stability assessments concerning the weak layer or its depth can be a challenge. There are many days when 15 different pits within 500m distance of each other have no similarity whatsoever in stability or identifiable weaknesses. This spatial variability is our number one discussion point within the daily advisory on a season-to-season basis and generates the rationale and need for micro forecasts within each Ravine. It is not uncommon to have forecasted ratings in either ravine ranging from Low to the upper end of Considerable or from Moderate to High within 400m of one another. This forces us to dig as many hasty pits as possible to get a handle on the degree of variability across the forecast areas. Full data pits are rare with the exception of tracking a unique deep buried problem.

A caveat to the lack of weak layer growth within the existing snowpack structure discussed above is the problem of near-surface faceting due to extreme temperature gradients. This most often occurs following a warm wet weather cycle above 0 C with a trailing arctic air mass dropping temperatures to -32C within 20 to 24 hours. In these scenarios wet snow at 0C with 8-10% free water content by volume may exist below 30cm, a temperature of -15C at 10cm, and -25 to -32C at the surface depending on the ambient air temperature. The rapid development of an icy crust with pronounced faceting below is the typical outcome. Depending on the permeability of additional ice lenses below the surface crust and the porosity between them, multiple layers of facets above and below lenses may occur albeit, with a more delayed response than the previous example. The extreme gradient may exist for approximately12 hours before ambient air temperatures push deeper into the snowpack, decreasing the gradient and slowing growth. The cold, hard, slick surface with an underlying faceted weakness that develops from this weather event results in poor bonding with future snow. Moisture and high winds associated with the backend of the cold air mass will often deposit new snow in strong lee areas as discussed previously. A patch work of new slab peppered throughout the forecast area immediately after these near surface facet events create an entirely new spatial variability concern. New snow in some areas and scoured surfaces in others provides a vastly different temperature gradient in the upper snowpack affecting the intensity of facet growth near the surface. This variability may have facets pouring out of one snow pit, while they're barely discernible in another pit only 20m away.

An additional complication to these factors is the mountain's terrain. Ski touring options do not exist in lower angled avalanche terrain where visitors might mitigate risk during times of elevated

instability. The steepness of the terrain is such that you are either in the flats unable to pursue your desired sport or you are forced to be in steep avalanche terrain. During periods of high instability this fact is often unacceptable to many visitors who have traveled a great distance to climb or ski a particular gully. The environment is not only keeping them from pursuing their goal, but they have no other options nearby to pursue their sport.

3. SOCIAL AND HUMAN FACTORS

80 million people are within a day's drive from the parking lot that accesses the most substantial avalanche terrain in the eastern United States. Other avalanche proven locations certainly exist, but the short 4km hike from the car to avalanche terrain does little to weed out or turn back lesser athletes. Mount Washington and its ravines have a rich heritage among many families and outing groups. Many first-time visitors stand at the base of a steep gully not because their skills make it desirable, but because of many other social and human factors. Often the rationale for risking great physical harm comes down to either their great grandfather did it or their college outing club came here every season for the past 50 years, so they're doing it!

Based on the mountain's elevation and weather compared to the rest the East, each October and November bring the first snowfields and water ice in New England to Tuckerman and Huntington Ravines. This draws many ski and climbing enthusiasts out to crowd a limited amount of snow and ice covered real estate in the pursuit of their sport. If any instability issues are present they will likely be found during the early season coverage because no other options exist to make a weighted decision of risk between alternatives. In the past 15 years more incidents and close calls have occurred during the limited coverage of early season conditions than the full snow coverage of spring.

As winter continues the number of terrain options increase as does the number of alpine visitors. The competition to get first in line for a desired route in either Ravine can be intense. Therefore climbers and skiers may be all over the mountain at hours deemed inconceivable by others. What this translates into on a busy winter day is users descending routes while others are still ascending unbeknownst to either party. This concentrated use by visitors in avalanche terrain, albeit limited by world standards, brings enormous potential for avalanche incidents.

A factor working against good avalanche terrain decision making on Mount Washington is extreme weather. There are days when users go into survival mode because getting out of the arctic alpine conditions cannot be delayed. West winds at 160+kph with blowing snow and temperatures below -30C are certainly conditions that may contribute to your demise on the upper reaches of the mountain. Although poor planning has created this situation, moving into avalanche terrain rapidly without a good stability evaluation may be a valid action given certain weather factors that may be a greater hazard if you delay. Due to the area's prevailing W to NW winds, putting the wind to one's back sends visitors directly into avalanche terrain on the eastern flanks of Washington.

Visitor's lack of avalanche knowledge is a global problem for the snow professional, but the easterner in Mount Washington's avalanche terrain presents some unique challenges. For the vast majority of visitors the concept of avalanches is a first time pretense when they step on the mountain. They have not lived with avalanches in the least. They have not seen "slide path ahead" signs on roads or a ski lift delayed start after a patrol's control run, and the term "interlodge" is thought to be a European city. Frequently people standing on debris at the base of a number of slide paths in February are surprised to hear that avalanches happen at all on Mount Washington. This lack of knowledge or concept must be overcome by our avalanche program when they arrive. Many visitors that travel long distances, whether it's from Quebec City, New York, or the Carolinas, have a set schedule and specific goals. This issue drives decision making and risk taking in mountains around the world, but is exacerbated on Mount Washington by the ease of access paired with brutal arctic weather. The apprenticeship one goes through to travel, climb, and ski on the remote mountains of North America and the world with similar weather conditions often brings a certain level of experience and equipment. The MWAC Snow Rangers often witness the opposite due to easy and rapid access to serious mountain conditions by anyone willing to walk for an hour. Although this is true for a high percentage of visitors, many have good solid ski and climbing skills with some avalanche awareness, but still have major deficiencies linking avalanche knowledge and good route finding. More avalanche safety equipment is being worn by

visitors than ever before, but it is still less than approximately 1% of our visiting public.

As winter winds down and spring blossoms the environmental factors needed to produce avalanche activity decrease, but the number of daily skiers, riders and hikers grows exponentially. Although spring numbers have decreased compared to our winter growth, some very busy days still exist. The spring of 2008 saw Tuckerman's busiest day in almost 30 years with 4200 visitors on April 19th. These large numbers in a confined alpine cirque bring the greatest potential for a mass causality avalanche catastrophe on the mountain. Seeing 2000+ people coming up the trail, all headed for one backcountry bowl that received 30cm of new snow and high W winds is one of our greatest challenges. Among large groups there will always be a number of individuals willing to take risk, calculated or otherwise. If these initial stability testers are successful the masses move onto the slope unknowingly looking for the ultimate weakness. Micro-scale forecasting and its advantages for the MWAC have the greatest impact in these situations due to the shear number of people effected and the potential for a large incident involving many individuals.

These social and human visitation concerns in combination with environmental factors led by a high degree of spatial variability present a unique problem. The ultimate solution is a multi faceted approach using micro-scale forecasting as a cornerstone.

4. APPROACH AND SOLUTION

The MWAC issues ratings for 8 areas Tuckerman and 8 areas in Huntington Ravine each morning once 5-scale danger ratings advisories have begun for the season. The morning process and data used to determine the individual ratings include typical forecasting tools and atypical methods unique to our program. The majority of necessary information is determined by standard avalanche forecasting techniques. Namely, the previous afternoon's stability results and field observations, online weather data, an early morning team meeting to discuss concerns, early morning data from 2 manual snowplots and the data collected by the Mount Washington Observatory located on the mountain's summit.

At first light we attempt to visually verify what we have determined to be the rating for each area prior to posting if we feel it is necessary. This typically is not a lengthy process due to our forecast area size given good snow coverage for machine access. Based on the meteorological data and forecast for the day this visual check may or may not be needed. Because we see our entire forecast each day, visibility permitting, we have a tremendous advantage to monitor very subtle changes in each gully or snowfield. This has been extremely valuable for the advisory's consistent accuracy and long term quality. These visual markers have been essential in the morning verification process within our direct avalanche regime. We track cornices, fracture lines, depth of rocks, footprints, ski tracks, surface texture by wind scouring, and other terrain features that may help us in the following day's advisory. We feel fortunate to physically see each forecast area in detail for each forecasting period. Photographs are often used to assist the memory and document minor details. Following a snow event these details become critical in observing new snow accumulations from a safe distance and either verifying the proposed rating or providing new information. This can obviously not determine stability, but it is an enormous asset to confirm no additional loading has occurred if the previously observed terrain features are unchanged.

As would be expected, loading that occurs will create instabilities on certain aspects and leave adjacent slopes unaffected or affected to a lesser degree. Having the ability to rate these areas differently even though they may be very close together allows point specific stability information to assist the user in making exact route choices. This detail for the best travel route, describing the precise locations of most concern, and why they are unstable has been a focused improvement point within our advisories. Multiple ratings highlight detailed nuances difficult to convey with a single rating for each Ravine. This allows a weighted risk assessment and more informed choices to be made by the public.

The first priority once the individual ratings are determined is communicating this to the public already on the mountain. Many of the earliest arrivals in avalanche terrain are those who have slept at the base of either Ravine. The Harvard Mountaineering Club Cabin and dispersed camping area at the base of Huntington Ravine give climbers quick access to climbs early in the morning and a place to get the weather and avalanche information hot off the press. We will spend time conveying snow stability concerns and other objective hazards to climbers as well as offering other options if their intended route has an

elevated level of snow instability. As already discussed, it can be hard to convince a made up mind to consider other alternatives. Most often they change their plans and attempt another gully or snowfield with a lower rating. Providing multiple ratings for each Ravine gives the public strong rationale to alter their goals when more prudent options exist. Snow Rangers have spent upwards of an hour helping people make alternative climbing and skiing routes during periods of high instability. We altruistically do it for them with the additional incentive that it will prevent us from searching for them later if overdue. Ultimately no closure occurs due to instability and the decision to go or not is theirs alone. At the base of Tuckerman Ravine, the Hermit Lake Shelters house one hundred people, most of whom are either summit bound or interested in skiing. We go through the same process there helping people with any questions they may have. Posted hard copies of the advisory are accompanied by traditional slat boards in three locations to quickly convey the ratings for each forecast area. When the MWVSP begin in March we hold a morning briefing each day transferring all the hazards of concern and plan out location assignments. On the busiest days we attempt to talk to every single person that comes into avalanche terrain and discuss the avalanche rating for different aspects. On the 2000-4000 person days we corral large groups and talk to ten to thirty people at a time.

Having a detailed micro-scale system highlight how right or wrong your forecast is for a given day. Field truthing and rating confirmation is often verified by the mountain's recreational traffic. Most gullies are narrow enough that a climber, skier, or rider will find instability if it exists. If you call a forecast area Low and it fractures and fails from wall to wall in deep new snow or you called it High and skiers are on it all day scraping a veneer of stellars off crust your forecast is verified…wrong. This can make the blood pressure do interesting things when you've just finished rating 16 gullies and snowfields with several hundred people on their way to test your evaluation. These demands keep us focused to be as accurate and detailed as possible. Highlighting cross loading problems as an example in a forecast area may include recommending "hugging the rock wall after the first fixed belay due to new slab on a weak layer of light density unconsolidated loose snow on the climbers right for the next 200m". This may be evaluated as spoon feeding visitors and doing them a disservice, but this has proven itself as an excellent educational teaching tool. Many positive interactions over the years have people saying "Hey I saw what you said in the advisory and now I see what large facets over an ice lenses can do." This is one of the greatest benefits of a micro-scale forecast. They don't have to search for issues you reference in the advisory you tell them exactly where to look. The information assists them in recognizing hazards in the field as they might in an avalanche book or film. They see it and understand as it moves from conceptual education to hands on learning.

The most important component of our Snow Ranger program is the daily interactions with people in the field talking about the advisory and the particular stability issues of the day. Mini snow and avalanche seminars, redirecting plans or routes, and answering questions they have about the advisory are the usual topics of choice. All of this can happen while looking at the terrain in question. I can hand them a pair of binoculars and direct them to a particular crown line, we can bend over and pull facets from under the surface crust, or get into a great diurnal recrystalization conversation. This is both the most rewarding and most essential part of our program for public safety.

We are seeing a change with some of our visitors as their avalanche education is improving. Over the past several years we have begun having great higher level avalanche discussions with the public in the field. Every season we hear more people saying they read the advisory everyday and check out our posted pictures. Our lighthearted approach while addressing serious topics and using humor keeps readers engaged and coming back to the advisory page. Many state they only come up once or twice a winter, but they read every advisory, in most winters being between 175 and 200 postings. This is certainly reflected in our website traffic which has increased 5 to 10 fold, depending on category, over the past 5 years. This season tuckerman.org was visited approximately 350,000 times for 12 million hits. Avalanche classes we assist with annually have also increased 10 fold from 3 to 30 over the last 8-9 years. Although avalanche safety equipment use is slow to increase it is absolutely improving. Undoubtedly we will continue our avalanche dog program and keep Recco close at hand far into the future.

5. CONCLUSION

Several Saturdays each winter when leaving our garage at the end of the day we look at each other and say "see you in a few hours". We go to our

cars believing that we will likely be responding to something on the hill before daybreak. In the morning our advisory probably discussed the day beginning at Moderate avalanche danger in most areas with those forecast areas with a SE aspect component to move towards High based on 15-20cm of new 6% snow expected through the day on increasing NW winds from 50 to 150kph. Through the morning we spoke with many of the 200-300 people crawling all over the mountain about new snow, increasing winds and dropping temperatures. All the valley shops have all their rentals out. We will certainly be back tonight. We arrive in the morning for our forecaster team meeting. Nothing happened. We've seen it many times before but it is no less amazing. While verifying the ratings we see SE and S aspects avalanched during the night. Through talking to many overnighters Sunday morning it became clear they read the advisory, took our advice and stuck to north aspects. After many animated interactions hearing about wicked conditions through the morning hours it dawns on us once again of the micro-scale ratings' impact to people recreating on the mountain. The smile on a climber's face after coming back from the summit using the safest route possible and knowing the avalanche center played a part in that success drives us to do it again and again and improve whenever possible. That one-on-one interaction has set the hook. He or she will read the nuances in every future advisory, understand the concept of different aspects and options brought out by the micro-scale forecast, and will be more likely to take an avalanche class.

Through a micro-scale forecast broken into distinct geographic areas we can give point specific information so people may better mitigate risk in a heavy use environment. High visitation in this concentrated use environment paired with Mount Washington's intense spatial variability has made micro-forecasting critical for successfully conveying stability issues to the public.

Future research potential- Effects of high wind on snow, Wind transport, Near Surface Faceting- (rain creating isothermal conditions followed by arctic temperatures)

SPECIAL THANKS- Many thanks go to my fellow Snow Rangers Brian Johnston Justin Preisendorfer and Jeff Lane who provided excellent feedback and critical editing. Thanks for all you do. And thanks to Brad Ray USFS Snow Ranger for +/- 40 years on Mt. Washington. I would know nothing without your years of knowledge and what you taught.

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Tuckerman Ravine and Huntington Ravine have HIGH avalanche danger today. Natural and human triggered avalanches are likely on a variety of slope angles and aspects. Travel in avalanche terrain is not recommended. The only exception to this is the Little Headwall which has Moderate avalanche danger.Â Use caution in steep terrain. Well any other day Iâ€™d say Iâ€™d be excited by what Iâ€™m seeing here at Hermit Lake. There is about 4â€³ of dense snow on the ground with some deeper drifts and it is currently snowing pretty hard. Iâ€™ll take all the snow we can get pretty much any day, but the unfortunate side of this weather event is whatâ€™s to come later. Warm air will slowly infiltrate the upper elevations bringing with it a change from snow to mixed precipitation and then rain later. Extreme skiing at Tuckerman Ravine, Mount Washington, New Hampshire !Â All forecast areas of Tuckerman Ravine have Low avalanche danger. Natural and human triggered avalanches are unlikely except in isolated terrain features. Unstable snow may exist on isolated terrain featurâ€¦ Tuckerman Ravine. Huntington Ravine is a glacial cirque on Mount Washington in the White Mountains of New Hampshire. It is named for Joshua H. Huntington, the Principal Assistant to State Geologist Charles H. Hitchcock (1836â€“1919) for the Geological Survey of New Hampshire. Of the four major cirques on Mount Washington (Tuckerman and Huntington ravines, Oakes Gulf, and the Great Gulf), it has the steepest and highest headwall. Only one hiking trail ascends Huntington Ravine toward Mount Washington's summit; that trail