

Alpine Touring Access Management on Public Lands in Avalanche Terrain

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ABSTRACT

In Jackson Hole, Wyoming skiers and snowboarders access rugged avalanche terrain on publicly owned land from privately owned ski lifts. Backcountry avalanche terrain in Bridger-Teton National Forest (BTNF) and Grand Teton National Park (GTNP) is easily accessed by tourers from an aerial tramway operated in the National Forest. These areas are managed in a cooperative effort by the US Forest Service, the National Park Service, the Jackson Hole Ski Corporation (JHSC) and the Teton Sheriff's Department (TCSD).

To manage these areas the US Forest Service requires an assessment of avalanche hazard and incident response planning. Daily regional avalanche hazard forecasts are provided by employees of the BTNF who operate from an avalanche forecasting laboratory located at the Jackson Hole Ski Area in Teton Village, Wyoming. On-site instrumentation, daily observations and historical meteorological avalanche activity data are used to develop these forecasts. Initial incident response is provided by the Jackson Hole Ski Patrol. Secondary response is available from the TCSD and GTNP.

The management of public access to this terrain has evolved during the last 31 years primarily in response to changes in liability issues and user demands. This paper has attempted to present the current access management policy, recount the historical development of this policy and offer insight into future management issues. A discussion of alternative management options and the advantages and disadvantages of alternative options has not been the goal of this paper.

INTRODUCTION

The Jackson Hole Ski Resort is located in the southern portion of the Teton Mountain Range near the Idaho-Wyoming border in the Rocky Mountains of North America. The steep eastern slope of this range plunges from an elevation of 3,185 meters to the valley known as Jackson Hole. The crest of this range is the location of the starting zones of numerous major avalanche paths some of which extend 1,250 vertical meters to the valley floor.

The climate is primarily continental with some maritime influences. The average annual snowfall is approximately 10 meters with an average February temperature of -10° Centigrade at the mid mountain elevation. Snow densities typically range from 5 to 15% moisture content. From November to May prevailing southwest winds create numerous soft slab avalanches and occasional hard slab and wet slide events which typically run on sun crust, radiation recrystallization crust, light density layers and weak strata comprised of temperature gradient crystals.

From the top of the resort's aerial tramway easy access is available with minimum physical effort to out-of-area alpine touring terrain to the south, west and north of the ski area. Glacially carved valleys transect the range and drain to the east. These features provide easy egress from the touring areas to the resort base. This topography allows a wide range of users including snowboarders and skiers with conventional ski resort equipment to easily access Class I avalanche terrain.

For 31 years, the JHSC has operated a ski resort on public land under a special use permit with the BTNF. The operations plan for the resort includes daily avalanche forecasting and avalanche hazard reduction within the ski boundaries and in unskied avalanche starting zones which overhang the resort.

PRESENT ACCESS MANAGEMENT

The touring terrain and all of the resort except for the base are publicly owned land within the BTNF and GTNP. As the permitting authority the BTNF ultimately has the lead role in public access management to these areas. The permittee, JHSC, is responsible for the development and implementation of an operations plan which addresses backcountry access. Access to the touring terrain has traditionally been managed by designated members of the Jackson Hole Ski Patrol. The patrol has also historically provided primary incident response. Secondary or backup response can be provided by the TCSD via the Teton County Search and Rescue Group and by GTNP rangers if the incident occurs within the boundary of the national park.

BOUNDARIES

The touring areas to the north and west of the resort are in GTNP. If an incident occurs in the park the ski patrol provides an initial response and if necessary GTNP personnel will provide a secondary response. The touring areas to the south of the resort are located in the BTNF. If an incident occurs in the National Forest the ski patrol provides an initial response and if necessary TCSD personnel will provide a secondary response.

On the BTNF touring area, slope stability evaluation efforts including the use of test bombs is allowed, however the systematic use of explosives to reduce the avalanche hazard is not allowed. The use of explosives is not permitted within the boundaries of GTNP.

The ski resort operates on 2,400 acres which is located in the BTNF. This area is marked by an operational ski area boundary comprised of barricades and signs. The permitted operational area of the resort extends beyond this boundary on the BTNF. This terrain is available for future expansion of the resort and is presently managed as an alpine touring area. In this terrain the special use permit allows for avalanche hazard reduction efforts in-

cluding the systematic use of explosives and or artillery. The resort occasionally uses this terrain for special events such as the powder eight competitions in Cody Bowl.

Within the boundaries of the resort are many restricted access areas that are not presently accessible from the ski lifts. Much of this terrain is comprised of the starting zones of major avalanche paths that overhang open areas of the resort and therefore the reduction of the avalanche hazard on these slopes is part of the daily avalanche hazard reduction efforts of the resort. This terrain is not part of the alpine touring area and a separate access management plan has been developed for this terrain. Public access to these areas is believed to improve the safety of the resort due to the increase in snowpack stability achieved by skier compaction.

ACCESS MANAGEMENT CRITERIA

Criteria have been established for the management of public access to the touring areas. The primary condition for access requires the general regional avalanche hazard to be evaluated as low by BTNF avalanche forecasters. The definition of low hazard is mostly stable snow exist and avalanches are unlikely except in isolated pockets.

Secondary criteria for access assess visibility, ski conditions and manpower (incident response) capabilities. The touring terrain consists of cliffs, rockbands, corniced ridges and steep snow-covered slopes many of which end in hanging snowfields. No routes are marked and no warning signs exists in this terrain, therefore good visibility has been established as one of the conditions for public access to these areas. In addition, the availability of patrol manpower for in-area and out-of-area response is a consideration with respect to opening the touring areas. An incident in the touring areas typically requires four patrol personnel to address any injury. The dispatching of more than four patrollers to the backcountry has a significant impact on the response capabilities of the patrol to top priority in-area incidents.

Poor ski conditions in the backcountry which are not hazardous with respect to avalanches may greatly increase the potential for user injury and associated patrol manpower commitment. Therefore, in cases of poor snow conditions access to the touring terrain may be closed solely for potential injury hazard.

FORECASTING

Daily avalanche forecasting is conducted at the laboratory located at the base of the resort. The backcountry forecasts are an extension of the daily forecast required by the forest service to manage the avalanche hazard within the resort.

Avalanche forecasts are developed based on data derived from snow study plots located at the base of the resort and remotely obtained data from snow study plots and instrumentation located upon the mountain. This information is supplemented by weather forecast, snowpack stability considerations and by observations of avalanche activity within the forecast region.

A base elevation study plot allows for the observation of 24 hour snowfall accumulations and associated snow density on a snowboard. Daily snowpack depth measure-

ments are recorded to determine 24 hour snowpack settlement. A modified tipping rain gauge at this plot records the moisture associated with new precipitation events. The correlation of the moisture data from the rain gauge with the snowfall, temperature and density measurements obtained from this study allows the forecasters to judge the reliability of the rain gauge moisture data for specific events and to relate this data to remotely obtained data from other study plots inaccessible in the early morning hours.

Three other study plots are located upon the mountain. Instrumentation at these remote locations transmit a continuous record of temperature and moisture associated with snowfall to the laboratory. At one of these plots a television camera focused on a lighted snowstake records new snowfall within the last 24 hours. Wind speed is also continuously transmitted to the laboratory from this station, and a continuous record of wind direction and speed parameters is obtained from instrumentation near the top of the resort. These instruments continuously record total miles of wind and the intensity of wind gusts.

These data sources are supplemented by communication with snow grooming personnel who are on the mountain all night, instrumentation on the tramway towers which record temperature, wind speed and wind direction at six locations and visual observations if possible. After this data has been obtained, evaluated and processed into a forecast, hazard reduction measures are devised for the resort and instituted by ski patrol hazard reduction team leaders. The results of these efforts are documented by the forecasters, entered into the historical record and considered in the re-evaluation of the forecast for the next day. Study plots are then visited to compare the remote data obtained to real time data obtained from 24 hour snowboards and snowstakes.

A computer historical search program has been developed based on accumulated data obtained during 31 years of operation. By inserting storm-specific meteorological data and snowpack information, this program allows forecasters to obtain information regarding historical avalanche events in the resort and the backcountry during similar conditions. This program provides a good forecasting tool especially when complex conditions arise from an extended active avalanche cycle.

Backcountry forecasting was developed in 1975 for the BTNF in a standard format and is provided to the public on a phone message and on a form which is transmitted by facsimile to various public and private entities located in western Wyoming and eastern Idaho. These entities include the local media, sports shops, Forest Service district offices, snowmobile clubs, the National Outdoor Leadership School (NOLS), motels and sponsors. The forecast is broadcast daily on the local radio station and is also accessed via the Internet. Forecasts are issued by 7:00 AM. Forecasts provide general avalanche hazard conditions for the morning and afternoon at the lower, mid and upper elevations. The forecast region is comprised of an area of approximately 15,000 square miles. During the 1995-1996 season about 90,000 telephone calls were made by the public to obtain the forecast report.

The forecast laboratory is entirely financed by private donations and corporate sponsors. The funds provided by these entities are placed in an account which is used

by the BTNF to employ the forecasters and provide equipment. Technical support is provided by the BTNF and the JHSC.

Observations regarding backcountry avalanche activity and snowpack conditions are provided to the laboratory by backcountry users via a phone line and answering machine. In addition to observations from private parties, observations are routinely received from High Mountain Helicopter Skiing Guides who operate in the Snake River and the Grays River Ranges, climbing rangers who operate in GTNP, NOLS instructors who operate within the forecast area, highway personnel who manage active avalanche paths which impact roads on Teton Pass, Hoback Canyon and the Snake River Canyon and Forest Service personnel who document conditions, events and incidents within their districts.

When visibility permits observations are made by forecasters who have visual access to portions of the forecast region. The forecasters also enter the touring terrain and unskied areas of the resort to conduct snowpit analyses and perform snow stability evaluations.

A system of remote meteorological recording stations (SNOTEL) is also located throughout the forecast area and can be accessed via modem. These stations provide the forecast laboratory with temperature and precipitation observations from numerous remote locations. Other forecast centers located in southwestern Montana, Idaho and northern Utah are sources of information regarding snowpack, meteorological and avalanche conditions in regions to the north, west and south of the forecast area.

PHYSICAL ACCESS MANAGEMENT

Present user access to the touring areas is provided from four control points. These access points are comprised of gates and signs located along the operational boundary of the resort. Access is only provided via these gates at times when the criteria necessary for opening have been met as determined by a member of the ski patrol designated as the touring officer or his assistant.

These four access points have a swinging exit gate. The gate has a locking flip sign which can read closed or can be flipped down to read "You Are Leaving The Jackson Hole Ski Area Boundary. This Is Your Decision Point". Users must physically push through the gate to access the touring areas.

Two other signs are posted at each gate. The backcountry avalanche hazard report issued by the forecast laboratory is posted on one of these signs. The second sign is a locking flip sign which when flipped up reads closed and when flipped down has language which states hazards exist in the touring area, guides are recommended and that individuals are responsible for their own safety and rescue.

Touring status boards are located at the base and top stations of the aerial tramway and at the top stations of the Sublette and Apres Vous chairlifts. These signs list the touring gates and whether each gate is presently open or closed. A determination regarding whether the gates should be open or closed is made in the morning and may rely on information obtained by the touring officer and assistants after an early morning reconnaissance run in the touring areas. The gates close early if the avalanche

hazard increases significantly, if poor visibility develops and/or if manpower resources are in demand. If none of these conditions exist the gates may remain open until the early afternoon.

PAST ACCESS MANAGEMENT

The aerial tramway was constructed in 1965. Early access to the backcountry was informal and was primarily early morning corn skiing on well established melt/freeze crust or occasional runs in stable powder snow conditions. Backcountry excursions were generally limited to experienced parties who ventured into Rock Springs and Green River Bowls which are the most easily accessed areas.

During the 1970s, interest and use in the touring areas increased and a touring management program was developed. During periods of low avalanche hazard, good visibility and when good ski conditions existed guests of the resort were allowed access to the backcountry. Users were required to sign out with the ski patrol for specific runs in the touring area. The signout procedure required the users to be in groups with a designated leader who was familiar with the terrain. Group members were required to sign a liability release form and specify the group's destination and route. Groups were required to call in to the patrol when they returned to the base area. Searches were conducted for groups which did not call in. The call in requirement was dropped in the 1980s, although the signout procedure was still in effect until 1994.

This program provided an interchange of information between the users and the ski patrol. The patrol routinely advised users regarding route selection, local pockets of instability, snowpack stratigraphy and mountaineering hazards. Groups were routinely directed to areas believed to be low in hazard and advised against entering areas believed to have greater hazard potential. During spring conditions when the daily warmup was forecast to result in a significant increase in the hazard tourers were advised to leave the backcountry by a specified hour. Users were also able to communicate their observations to the patrollers.

Increasing use of the backcountry in the 1980s eventually led to a request by ski resort guides to review the access management plan. A review in 1990 resulted in the determination that the rescue resources of the TCSD, GTNP and the JHSC were insufficient to handle an open gate policy. In addition, a determination was made that guided parties could not be allowed preferential access during periods of greater than "low" hazard. This determination was based upon the premise that members of the public who did not have guides could not be unilaterally denied access during these periods. The "one goes, all go" management philosophy resulted.

As pressure for access increased during the early 1990s, it became apparent that a substantial number of users were circumventing the signout procedure. This introduced some potential liability to the resort in that these tourers were not afforded the opportunity to be advised of potential hazards associated with the touring area.

To address this issue the management policy was modified to the existing format where access to the backcountry is provided through controlled points where warnings and liability disclaimers are posted. This new policy was devised in 1993 and instituted in 1994.

As a result of this change in policy, patrollers and resort employees (except ski guides) are presently restricted from communicating information regarding snow conditions, avalanche hazards and suggested routes to potential backcountry users. The present required response to inquiries regarding the backcountry is that it is a hazardous area and travel in the touring area is not recommended without a guide.

The former management policy allowed the patrol to restrict users (voluntarily) to certain areas and therefore allowed access to some areas which were believed to have a low hazard potential while other areas which were believed to have a greater hazard remained voluntarily closed. This policy was well-received at the time. Under the present management plan if a gate is open the user is permitted to access any slope they choose. This change in policy has ultimately limited access by the associated stipulation that none of the touring terrain can be opened until all areas within the extensive forecast region are considered to have a low avalanche hazard.

Three avalanche events have been documented in the touring areas. No fatalities have occurred as a result of these events. One skier was seriously injured in an event which occurred in 1969 and a skier caught in a slide in 1992 was buried and rescued with the aid of a ski patrol dog without significant injury. Numerous incidents of users sliding or falling into cliff areas have occurred and several have resulted in serious injury or death.

FUTURE ACCESS MANAGEMENT ISSUES

Recent increases in the number of tourers and changes in user habits have been observed. A discussion of some of these changes follows.

Former access management considered the quality of the skiing and users were requested to leave the backcountry during spring conditions when corn snow became too soft and ski surfaces were scarred with tracks. This policy resulted in exceptional early morning corn skiing during extended periods of spring high barometric pressure and encouraged users to leave the area before the hazard associated with daily warming became a threat. Some of today's snowboarders and skiers are content to remain in the backcountry well after the warm-up has occurred resulting in an exposure to the hazard from avalanches and causing adverse impacts to the quality of skiing.

The popularity of extreme skiing and snowboarding has resulted in the flocking of inexperienced and experienced masses to the extreme aspects of the touring areas. Concurrently, an increasing number of extremely skilled users are demanding an open gate policy for the touring areas. These people are extremely skilled in avalanche evaluation, self rescue and route finding, and possess local knowledge of the terrain. Some of these users have organized and are seeking legal aid in an effort to obtain an open gate policy and to address violation issues.

During the past several years it has become very popular to access the touring area when it is closed. Skiing closed areas in Wyoming is a misdemeanor violation of state law. Numerous undocumented avalanche events have resulted from these users. None of these avalanche events have resulted in a fatality to date. Anonymous re-

ports of these events are sometimes communicated to the forecast laboratory. These accounts have become an important source of information for the backcountry forecasters. Enforcement of the boundaries is the responsibility of the JHSC and the TCSD, however the logistics and problems associated with apprehending and persecuting violators in avalanche terrain make enforcement difficult and costly.

The present consensus of the Forest Service, the national park, the Sheriff's Department and the ski resort are that future management options are open for discussion but options are likely to be limited by incident response limitations, liability issues and the potential for a significant number of fatalities.

SUMMARY

The increase in use of the alpine touring areas and changes in users habits and demands are factors which are likely to have future influence upon the management policy for public access to these areas. The potential for liability associated with providing access to the areas has already influenced management policy. The litigation potential has resulted in revisions to the management plan which have affected the manner in which avalanche hazard information is communicated to users. The popularity of the alpine touring areas, changes in user habits and user demands have also had an impact on the overall quality of skiing and have necessitated management reviews which have resulted in recent changes in access policy.

In the future, it is expected that injuries and fatalities will occur in the touring areas simply as a result of the increasing number of users, the premise that low hazard does not mean that no hazard exists and the reality that the low hazard forecast is in fact just a forecast. It is expected that incidents will occur when the touring areas are closed, that the JHSC, GTNP and TCSD will be required to respond to an increasing number of incidents, that public pressure for an open gate policy will continue and that boundary enforcement is likely to become a significant issue.

To address these issues public education with respect to avalanche awareness and self rescue capabilities are necessary.

Finally, the present management scenario places a unique emphasis on the forecasting of the distinction between a moderate and low hazard designation. Avalanche activity within the forecast region versus time, snowpack settlement versus time, temperature variations versus time, deep slab instability considerations and recent meteorological trends are some of the parameters which are considered in making this evaluation. Although low hazard is well defined the transition from the moderate to low hazard designation is possibly slower than the transitions from the higher hazard categories. The BTNF forecast laboratory often uses the low to moderate designation during the transition from moderate to low hazard.