AUSTRALIAN ALPS SURFACE HAZARD RATING SYSTEM

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ABSTRACT: Winter backcountry hazard communication has traditionally focused on avalanches, yet in many alpine environments, snow surface conditions can present an equally significant hazard. In the Australian Alps, hard snow and ice surfaces can result in slide for life conditions (Outdoors, 2025). Despite this, there has been no standardized approach to assessing or communicating surface hazards and associated risk of uncontrolled sliding falls to the public.

The Australian Alps Surface Hazard Rating System (AASHRS) was developed through the operational work of the Mountain Safety Collective (MSC) to address this gap. The system assesses surface hardness and spatial distribution, combining these parameters in a decision-making matrix to assign Low, Moderate, or High surface hazard ratings. Each rating provides information on the likelihood of uncontrolled sliding falls, self-arrest potential, and appropriate terrain and travel advice.

An anonymous online survey was distributed to backcountry users in Australia to assess awareness, understanding, perceived usefulness, and reported application of the system. A total of 142 responses were received. Awareness of AASHRS was high among respondents, and the majority of respondents reported that the system was useful and influenced their awareness of surface conditions as well as terrain selection. Interpretation of the Moderate and High ratings was strong, while the Low rating was substantially less well understood. Respondents who consulted the Backcountry Conditions Report more frequently were also more likely to report using the rating in terrain selection and finding it helpful.

The findings provide an initial evaluation of AASHRS as an operational surface hazard communication tool and identify a specific opportunity to improve communication of the Low rating. Continued operational use and user feedback will support further refinement of the system.

KEYWORDS: Hazard Communication, Risk Communication, Crust, Ice, Slide for Life, Uncontrolled Sliding Falls

1. BACKGROUND

The Australian Alps span approximately 12,000 km2 in the states of Victoria and New South Wales which are in the southeast corner of the country. The highest peak, Mount Kosciusko, sits at 2228 m. The winter season is primarily from June until September, with snow coverage occasionally lasting through November. Although snow can fall to approximately 1000m of elevation, accumulation typically occurs above 1500m. There are several ski resorts in both Victoria and New South Wales that provide easy access to the backcountry as well as numerous popular trailheads where the public can access remote areas.

The Mountain Safety Collective is a not-for-profit, membership-based association that supports backcountry recreation in the Australian Alps through the delivery of mountain hazard information. Its primary operational product is the free Backcountry Conditions Report, issued daily throughout the Australian snow season and produced by professionally qualified field observers and forecasters. The reports communicate prevailing and expected alpine hazards, including weather, avalanche, and surface conditions, to support informed backcountry travel decisions.

During the winter of 2022, prolonged low cloud early in the season saturated the snowpack in the Australian Alps. This resulted in one of the thickest and most persistent rime crusts encountered during operational forecasting in Australia. The crust was widespread, approximately 5-10 cm thick, largely impenetrable, and persisted for approximately six to seven weeks without softening, even on solar aspects.

During this period, avalanche danger remained low and the existing Backcountry Conditions Report therefore provided limited indication of the surface hazard present in the mountains. The hard surface created a significant slide for life condition,

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particularly on steeper terrain. Existing mountain hazard communication provided limited means of describing or communicating this type of non-avalanche hazard to the public. The event highlighted a broader gap in mountain hazard communication: the need to communicate surface conditions that can substantially influence the risk of an uncontrolled sliding fall.

2. INTRODUCTION

In the Australian Alps, hard snow and ice surfaces are a recurring feature of the maritime snowpack. Surface hazards are influenced by both the hardness of the surface and how extensively the hard surface occurs across the terrain. A breakable surface condition confined to specific terrain features presents a different travel problem from an impenetrable surface condition occurring across most of the alpine environment. Consequently, a useful surface hazard assessment needs to consider both its Surface hardness and spatial distribution (Fig 1 and Fig 2).

Surface Hardness Descriptions	Hardness and Thickness	Impact of Skis	Impact of Ski Boots	Travel with Crampons
Breakable Ice	Knife or Ice <3 cm thick	 Skis leave a mark on the surface	 Crust or ice is easily broken with firm steps	 Crampons are not required
Non-Breakable Ice	Knife or Ice >3 cm thick	 Skis do not leave a mark on the surface	 Crust or ice is challenging or impossible to break	 Crampons may be required
Impenetrable Ice	Ice	 Skis do not leave a mark on the surface	 Ice is impossible to break	 Crampons are required

Figure 1: Surface hardness descriptions.

Distribution	Description	What it looks like (example)
Isolated	Ice exists on the surface on limited terrain features or the pattern of ice distribution is difficult to determine.	• Scattered icy patches on a few features. • Distribution hard to predict.
Localized	Ice exists on the surface on terrain features with similar characteristics and the pattern of ice distribution is easy to determine.	• Icy areas on specific features (e.g., north-facing slopes, wind-scoured ridges). • Pattern is easy to identify.
Widespread	Ice exists on the surface on most terrain. The pattern of ice distribution is obvious.	• Ice covers most slopes and terrain features. • Distribution is obvious.

Figure 2: Surface condition distribution descriptions.

2.1 Development of AASHRS

The Australian Alps Surface Hazard Rating System was developed through an iterative operational process as part of the work of the Mountain Safety Collective. An iterative design approach was appropriate for AASHRS because the system was developed in response to an operational communication problem for which no established framework existed. Prior to AASHRS, slide for life conditions and the risk of uncontrolled sliding falls were communicated inconsistently in avalanche forecasts, both in how frequently the hazard was addressed and in the terminology used to describe it. Unlike avalanche danger, there was no standardized framework for determining when surface conditions warranted specific communication, how their severity should be assessed, or how that information should be translated into consistent travel advice. Developing a complete rating system at the outset was therefore impractical; the relevant assessment parameters and communication needs first had to be identified through operational experience.

Development occurred over several winter seasons as forecasters encountered slide for life conditions, identified limitations in existing communication practices, and developed and refined potential solutions. Operational use provided repeated opportunities to evaluate whether terminology, surface hardness classifications, distribution categories, hazard ratings, and associated travel advice adequately represented conditions encountered in the field. Gaps identified through this process informed subsequent revisions, allowing the system to evolve from operational experience rather than from a predetermined theoretical framework. This iterative approach was particularly valuable for developing a practical hazard communication system intended for routine integration into the MSC Backcountry Conditions Report.

The system provides a framework for assessing and communicating the potential for slide for life conditions and uncontrolled sliding falls associated with hard snow and ice surfaces.

Surface hardness and ice/crust distribution are assessed independently and combined using a decision-making matrix to produce a surface hazard rating of Low, Moderate, or High (Fig 3). Each rating is associated with corresponding descriptions of uncontrolled sliding fall likelihood, self-arrest potential, and terrain and travel considerations (Figure 4).

ICE / CRUST HARDNESS	ICE / CRUST DISTRIBUTION		
	ISOLATED	LOCALIZED	WIDESPREAD
IMPENETRABLE	MODERATE	HIGH	HIGH
NON-BREAKABLE	LOW	MODERATE	HIGH
BREAKABLE	LOW	LOW	MODERATE

Figure 3: Surface hazard rating decision matrix.

Hazard Rating	Likelihood of Falls and Self-Arrest	Travel and Terrain Advice
HIGH	Uncontrolled sliding falls are likely and self arrest is difficult to impossible.	Travel in steep terrain is dangerous and requires experience using crampons and ice tools. 
MODERATE	Uncontrolled sliding falls requiring self arrest are possible.	Travel in steep terrain requires cautious route finding and/or the use of crampons. 
LOW	Uncontrolled sliding falls are unlikely.	Travel is generally safe without the use of crampons. Isolated areas of non-breakable ice are easily avoided. 

Figure 4: Surface hazard rating descriptions.

3. SURVEY

For a hazard communication system to be effective, users must not only encounter the information but also understand its meaning and incorporate it into their decision-making. The extent to which back-country users encounter understand and use the AASHRS had not previously been formally evaluated. A survey was therefore developed to assess user awareness, understanding, perceived usefulness, and reported application of the AASHRS.

3.1 Survey design and administration

An anonymous online questionnaire was developed using Google Forms. The questionnaire comprised 14 questions, consisting primarily of closed-ended questions, with one open-ended question allowing respondents to provide comments and suggestions for improving the system (Appendix).

Questions were grouped broadly into four areas: (1) respondent characteristics and backcountry experience; (2) awareness and familiarity with the AASHRS and MSC Backcountry Conditions Report; (3) understanding and interpretation of the Low, Moderate, and High surface hazard ratings; and (4) reported use and influence of the rating on trip planning, terrain selection, equipment choices, and backcountry decision-making. The questionnaire also included a question assessing the perceived helpfulness of the Surface Hazard Rating.

The survey was distributed by email to approximately 1,030 MSC members and promoted through the MSC website and Instagram. A total of 142 responses were received.

3.2 Limitations

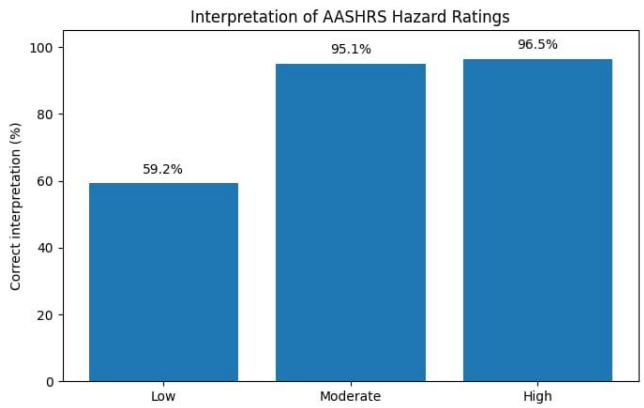
Participation was voluntary, resulting in a convenience sample that may not be representative of the broader Australian Alps backcountry user population.

3.3 Data analysis

Descriptive statistics were used to summarize the overall survey results. To check if user habits were connected, Fisher's exact tests were applied (Fisher, 1922). This process checked if the frequency of reading the Backcountry Conditions Report was linked to how the Surface Hazard Rating was used for terrain selection, as well as its perceived helpfulness. Results were considered statistically significant if the probability of a random fluke was under 5% ($p < 0.05$).

3.4 Results

A total of 142 responses were received. Awareness of the Surface Hazard Rating was high, with 88.7% of respondents reporting that they were aware of the system. However, only 15.6% described themselves as 'very familiar' with it.



Interpretation of the Moderate and High ratings was strong, with 95.1% and 96.5% of respondents respectively selecting the intended interpretation. In contrast, only 59.2% correctly interpreted the Low rating (Fig 5).

The AASHRS was considered useful by the majority of respondents who had used it, with 92.9% describing it as at least moderately helpful. It also influenced decision-making with 68.3% of respondents reporting increased awareness of surface conditions and 62.0% reporting that the rating influenced their terrain selection.

Figure 5: Percentage of respondents correctly interpreting rating.

Respondents who consulted the Backcountry Conditions Report more frequently were significantly more likely to report using the Surface Hazard Rating when selecting terrain ($p = 0.004$) and to consider the rating helpful ($p = 0.022$).

4. DISCUSSION

The survey results indicate that the AASHRS is generally understood by respondents, particularly the Moderate and High ratings, which were correctly interpreted by more than 95% of respondents. In contrast, interpretation of the Low rating was substantially weaker, with only 59.2% selecting the intended interpretation. This identifies a specific opportunity to improve how the Low rating and its associated travel implications are communicated.

More frequent use of the Backcountry Conditions Report was associated with both greater reported use of the AASHRS for terrain selection and greater perceived helpfulness of the rating. These findings suggest that engagement with the broader conditions reporting system may support greater use of the surface hazard information, although the survey design does not establish causation.

Overall, the results provide an initial indication that the AASHRS is a useful operational hazard communication tool, while highlighting the Low rating as an area for further development. Continued operational use and user feedback can be used to refine the system and evaluate whether changes improve understanding and application.

5. CONCLUSION

The Australian Alps Surface Hazard Rating System (AASHRS) provides a standard framework for communicating risks associated with hard snow and ice.

Survey results indicate strong awareness and adoption of the system, with most respondents finding the tool useful for terrain selection and condition awareness. While the Moderate and High ratings were well understood, comprehension of the Low rating was substantially weaker, and this should be addressed in the future. As anticipated, frequent readers of the MSC Backcountry Conditions Report demonstrated both greater utilization of the AASHRS and a higher perception of its helpfulness.

Ultimately, these findings offer an initial evaluation of the AASHRS as an operational communication tool, highlighting a clear opportunity to improve education surrounding the Low rating. Moving forward, continuous user feedback will be essential to refining the system and enhancing safety across the Australian Alps.

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REFERENCES

Outdoors NSW & ACT: Snow Activity Guidance, Outdoors NSW & ACT, 2025, available at: https://outdoors.kartra.com/page/snowguidance

Fisher, R. A.: On the interpretation of χ^2 from contingency tables, and the calculation of P, Journal of the Royal Statistical Society, 85(1), 87–94, 1922.

APPENDIX A: SURVEY QUESTIONS

1. What is your age group?
2. Where do you normally access the mountains?
3. How often do you check MSC's Backcountry Conditions Report?
4. What best describes your primary backcountry travel method?
5. How many seasons of backcountry snow travel experience do you have?
6. Were you aware of the Surface Hazard Rating in the MSC Backcountry Conditions Report?
7. How familiar are you with the Australian Alps Surface Hazard Rating System?
8. What does a Low Surface Hazard rating mean to you?
9. What does a Moderate Surface Hazard rating mean to you?
10. What does a High Surface Hazard rating mean to you?
11. How did you use the Surface Hazard Rating (Low, Moderate or High) when planning or completing your trip(s)?
12. Has the Surface Hazard Rating been helpful in your trip planning and travel decisions?
13. Any comments, suggestions or thoughts you have regarding the Australian Alps Surface Hazard Rating System?