

Appendix G

Avalanche Danger, Hazard, and Snow Stability Scales

G.1 Introduction

There are many ways to communicate the current avalanche conditions. Categorical scales of avalanche danger, avalanche hazard, and snow stability can improve communication amongst forecasts and between forecasters and customers. Forecasting operation managers should select an appropriate scale based on the definitions that follow. The scales presented in this appendix are examples of commonly used communication methods.

G.2 Definitions

Stability

The chance that avalanches *do not* initiate. Stability is analyzed in space and time relative to a given triggering level or load.

Hazard

The potential for avalanches to cause death, injury or loss to people, things of value and the environment.

Danger (to backcountry recreationists)

The potential for avalanches to cause death or injury to backcountry recreationists.

Risk

The probability or chance of death, injury or losses, including adverse effects on health, property and the environment. Avalanche risk can be analyzed in terms of the probability of the avalanche, the exposure of the element-at-risk (people, property or environment) and the consequences of the avalanche on the exposed elements.

G.3 General Guidelines for the use of Avalanche Conditions Scales

Avalanche conditions within a forecast area can be separated based on terrain or snowpack characteristics.

Specify the area based on:

- Elevations
 - Numerical range
 - Geographic feature (i.e. Alpine, Treeline, Below Treeline)
- Aspect
- Slope angle
- Specific conditions such as wind loaded slopes or depth of new snow
- Spatial extent (localized or widespread)
- Time of day

Note: Timberline (treeline) describes a transition area between closed forest and the open treeless areas above.

Where practical give the expected stability trend for the next 12 to 24 hours. Use the terms: improving, steady, and decreasing stability to describe the trend.

Specify a confidence level in the ratings when appropriate; describe sources of uncertainty in forecast. Note the level of the unstable layer in the snowpack (i.e. near surface, mid level, deep).

Observers may qualify the rating based on:

- Topography (aspect, slope angle, etc.)
- Spatial extent (localized or widespread)
- Time of day

G.4 Snow Stability Scale

Stability refers to the chance that avalanches will *not* initiate, and does *not* predict the size or potential consequences of expected avalanches. Avalanche hazard and risk evaluation includes consideration of these factors. “It is possible for highly unstable snow to exist with no hazard if people or facilities are not threatened” (McClung and Schaerer, 1993).

Note: Statements about avalanche activity take precedence over results of stability tests.

For regional and larger forecast areas, isolated natural avalanches may occur even when stability for the area as a whole is good.

Table G.1 Snow Stability Rating System

Stability		Expected Avalanche Activity		
Stability Rating	Comment on Snow Stability	Natural Avalanches <i>(excluding avalanches triggered by icefall, cornice fall, or rock fall)</i>	Triggered Avalanches <i>(including avalanches triggered by human action, icefall, cornice fall, rock fall or wildlife)</i>	Expected Results of Stability Tests
Very Good (VG)	Snowpack is stable	No natural avalanches expected	Avalanches may be triggered by very heavy loads such as large cornice falls or loads in isolated terrain features	Generally little or no result
Good (G)	Snowpack is mostly stable	No natural avalanches expected	Avalanches may be triggered by heavy loads in isolated terrain features	Generally moderate to hard results
Fair (F)	Snowpack stability varies considerably with terrain, often resulting in locally unstable areas	Isolated natural avalanches on specific terrain features	Avalanches may be triggered by light loads in areas with specific terrain features or certain snowpack characteristics	Generally easy to moderate results
Poor (P)	Snowpack is mostly unstable	Natural avalanches in areas with specific terrain features or certain snowpack characteristics	Avalanches may be triggered by light loads in many areas with sufficiently steep slopes	Generally easy results
Very Poor (VP)	Snowpack is very unstable	Widespread natural avalanches	Widespread triggering of avalanches by light loads	Generally very easy to easy results

Definitions / Examples

- Natural avalanches: Avalanches triggered by weather events such as snowfall, rain, wind, temperature changes, etc.
- Heavy load: A cornice fall, a compact group of people, a snowmobile or explosives.
- Light load: A single person, or a small cornice fall.
- Isolated terrain features: Extreme terrain; steep convex rolls; localized dispersed areas (pockets) without readily specifiable characteristics.
- Specific terrain features: Lee slopes, sun-exposed aspects.
- Certain snowpack characteristics: Shallow snowpack with faceted grains, persistent weaknesses, identified weaknesses.

G.5 Avalanche Danger Scale

The Avalanche Danger presented in this section is used by regional avalanche forecast centers in the United States. The scale was designed to facilitate communication between forecasters and the public. The categories represent the probability of avalanche activity and recommend travel precautions.

Table G.2 The United States Avalanche Danger Scale (after Dennis and Moore, 1996).

Danger Level (color) ...What...	Avalanche Probability and Avalanche Trigger ...Why...	Degree and Distribution of Avalanche Danger ...Where...	Recommended Action in the Backcountry ...What to do...
LOW (green)	Natural avalanches very unlikely. Human triggered avalanches <u>unlikely</u> .	Generally stable snow. Isolated areas of instability.	Travel is generally safe. Normal caution advised.
MODERATE (yellow)	Natural avalanches unlikely. Human triggered avalanches <u>possible</u> .	Unstable slabs <u>possible</u> on steep terrain.	Use caution in steep terrain on certain aspects (defined in accompanying statement).
CONSIDERABLE (orange)	Natural avalanches possible. Human triggered avalanches <u>probable</u> .	Unstable slabs <u>probable</u> on steep terrain.	Be increasingly cautious in steep terrain.
HIGH (red)	Natural and human triggered avalanches <u>likely</u> .	Unstable slabs <u>likely</u> on a variety of aspects and slope angles.	Travel in avalanche terrain is not recommended. Safest travel on windward ridges of lower angle slopes without steeper terrain above.
EXTREME (red with black border)	Widespread natural or human triggered avalanches <u>certain</u> .	Extremely unstable slabs <u>certain</u> on most aspects and slope angles. Large and destructive avalanches possible.	Travel in avalanche terrain should be avoided and travel confined to low angle terrain well away from avalanche path run-outs.

G.6 Avalanche Hazard Scale

Avalanche hazard scales can be used when forecasting the threat of avalanches to structures and transportation arteries. The scale should be tailored for each individual operation. Table G.3 contains a scale used by the Colorado Avalanche Information Center/Colorado Department of Transportation. This scale is presented as an example of an operational avalanche hazard scale.

Table G.3 Avalanche Hazard Scale

Hazard Level	Description	Operational Impact
None	Insufficient snow for avalanches to reach the highway.	Normal highway operations.
Low	Mostly stable snow. Natural avalanches are unlikely to affect the highway. Small triggered and natural avalanches are possible.	Normal highway operations.
Moderate	Areas of unstable snow. Natural and triggered avalanches possible. A moderate amount of snow on the highway is possible.	Normal highway operations continue with caution. Explosive mitigation may be necessary.
High	Mostly unstable snow. Natural and triggered avalanches across the highway are likely. A moderate to large amount of snow on the highway is possible.	Highway closure may be necessary. Explosive mitigation will be required. Maintenance and emergency traffic may continue prior to avalanche control if hazard and need warrants.
Extreme	Widespread unstable snow. Natural and triggered avalanches certain. A large amount of snow on the highway is likely.	Highway closure necessary until explosive mitigation completed.

Note: Arrows may be used to indicate the trend in avalanche hazard. Avalanche control operations may be recommended at any condition rating.