FIELD-BASED HAZARD RATING (FBHR): A DECISION-MAKING FRAMEWORK FOR RECREATIONISTS IN DATA-LIMITED ENVIRONMENTS

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ABSTRACT: Backcountry recreationists often travel where formal avalanche forecasts, dense observation networks, and real-time snowpack data are unavailable. In these data-limited settings, fragmented observations and heuristic shortcuts can increase uncertainty around terrain selection and exposure. The Field-Based Hazard Rating (FBHR) is a conceptual decision-support framework for use outside forecast coverage or season. It synthesizes five domains—weather, snowpack structure, avalanche problems, uncertainty, and group dynamics—into a conservative day-level rating of LOW (Normal), MODERATE (Selective), or HIGH (Restrictive). LOW reflects generally stable conditions, limited avalanche potential, high confidence, and broad terrain options with normal caution. MODERATE reflects mixed or changing conditions, possible human triggering, information gaps, or group complexity and calls for selective terrain and deliberate exposure management. HIGH reflects unstable snowpack, active loading, widespread or consequential avalanche problems, substantial uncertainty, and/or elevated human-factor risk; avoiding avalanche terrain becomes the primary strategy. FBHR does not replace professional forecasts or regional danger ratings. It provides recreationists a structured way to translate incomplete observations into terrain choices, reduce cognitive load, improve group communication, and favor conservative decisions when confidence is low. This paper presents the framework, its assessment domains, applications, limitations, and opportunities for validation through field use, practitioner feedback, and comparison with existing hazard communication systems.

KEYWORDS: backcountry decision-making, hazard rating, data-limited environments, heuristic traps, human factors, avalanche education

1. INTRODUCTION

When traveling outside the geographic or seasonal coverage of a public avalanche forecast, backcountry recreationists must make terrain and travel decisions without a regional danger rating. The challenge is usually not a total absence of information, but how to synthesize what is available into a rating with little room for heuristic influence. Weather trends, isolated snowpack observations, and recent avalanche activity may still be available, yet recreational education primarily teaches users how to apply an existing forecast rather than what to do without one.

Without a professional forecast, recreationists may place disproportionate weight on the most obvious or recent observations, regardless of how representative they are, and may interpret an absence of obvious instability as evidence of stability rather than an information gap. Without a structured tool, fragmented information may also leave decisions more vulnerable to heuristic traps involving familiarity, commitment, and group dynamics.

Purpose of FBHR. This paper introduces the Field-Based Hazard Rating (FBHR), a tool for translating incomplete field information into a conservative, actionable hazard assessment when a public avalanche forecast is unavailable.

FBHR is not intended to replace public or operational forecasts produced by professional avalanche forecasters.

Section 2 reviews existing tools and the gap FBHR addresses; Sections 3–4 present the framework and ratings; Sections 5–8 discuss application, limitations, validation, and conclusions.

2. BACKGROUND AND MOTIVATION

2.1 Regional Avalanche Danger Ratings

Regional avalanche danger ratings standardize communication of avalanche hazard across a defined area. In North America, the Public Avalanche Danger Scale uses five levels from LOW to EXTREME.

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Professional forecasters assign ratings from the expected likelihood, size, and distribution of avalanches using weather stations, snowpack and avalanche observations, field reports, remote sensing, and numerical weather and snowpack models when available.

A regional danger rating provides a starting point for daily trip planning and terrain selection, but represents a broad area rather than specific locations. Recreationists must still determine how the regional assessment applies to terrain and conditions encountered in the field.

Regional ratings are one component of a broader public avalanche-information system. Despite substantial growth in backcountry use, annual U.S. avalanche fatalities remained relatively stable from 1995 through 2017, a trend attributed broadly to avalanche education, improved safety equipment, and expansion of the public avalanche-center network (Birkeland et al., 2017).

Outside established forecast areas or seasons, recreationists may still have weather, snowpack, and avalanche observations but must determine independently what those pieces mean together. A regional forecast tells users what the hazard is across a forecast area; it does not teach them how to generate an operational assessment when that infrastructure is unavailable.

2.2 Decision-Making in Low-Information Environments

When a professional forecast is unavailable, recreationists still make hazard judgments, but with a narrower and potentially less reliable set of inputs. The central problem is the lack of structure for synthesizing fragmented information. Decisions may therefore rely more heavily on heuristics: mental shortcuts that enable rapid judgment under uncertainty but can systematically bias decisions in avalanche terrain.

McCammon's FACETS framework identifies six heuristic traps: familiarity, acceptance, consistency, expert halo, tracks/scarcity, and social facilitation (McCammon, 2004). These can respectively raise risk tolerance in familiar terrain, encourage approval-seeking, discourage abandoning a plan, promote deference to a perceived expert, make tracks seem reassuring or create urgency, and alter risk tolerance in the presence of others.

These traps occur in any avalanche terrain but may be more consequential without a professional forecast, which otherwise provides an independent, professionally synthesized reference against which recreationists can compare their observations, assumptions, and group dynamics.

The patterns described in Section 1—overweighting recent observations and treating no obvious instability as evidence of stability—are not FACETS traps themselves, but can reinforce them. A group returning to familiar terrain, for example, may interpret no obvious instability as confirmation of safety rather than an information gap.

FBHR does not attempt to eliminate heuristic influence. It structures the assessment so group dynamics and susceptibility to heuristic traps are considered explicitly rather than operating unnoticed; Section 3.2 incorporates these concepts into the Group Dynamics domain.

2.3 Existing Field-Based Decision Tools

Decision-making frameworks (DMFs) structure avalanche hazard and terrain decisions but address different parts of the process. Landrø et al. (2020) found 44 factors across ten DMFs, with 11–31 per framework; nine additional factors identified by professionals raised the total to 53.

These factors fall broadly into snow and avalanche conditions; snowpack evaluation and stability testing; forecast information; group and group management; and terrain. Frameworks weight them differently according to the decision each is designed to support.

Table 1: Comparison of existing avalanche decision-making frameworks.

Framework	*What does it solve?*	*Information required*	*Decision/output*
ALPTRUTh	Identifies obvious avalanche clues	Avalanches, loading, path, terrain traps, danger rating, unstable snow, thaw instability	Normal caution, extra caution, or skiing not recommended
Avaluator 2.0	Connects avalanche conditions with terrain characteristics	Avalanche-condition factors + terrain characteristics	Caution, extra caution, or not recommended
Conceptual Model of Avalanche Hazard	Structures assessment around avalanche problems and expected behavior	Avalanche problem, location/distribution, likelihood/sensitivity, size, and supporting snowpack/weather information	Avalanche hazard assessment used to inform terrain decisions
NivoTest	Assesses avalanche risk without requiring an avalanche forecast	25 questions addressing weather, snowpack, avalanche activity, route, and participants	Three-level risk assessment (smiley, neutral, frowny face)
Travel protocols / checklists	Structures travel and exposure management	Terrain, group, conditions, and field observations	Procedural decisions about how and where to travel

ALPTRUTh uses seven observable clues and increasingly conservative recommendations as clues accumulate. Because one clue is the regional danger rating, it depends in part on an existing professional forecast (McCammon, 2006; Landrø et al., 2020).

The Avaluator combines avalanche-condition and terrain-characteristic scores to produce three travel recommendations: caution, extra caution, or not recommended (Haegeli et al., 2006).

The Conceptual Model of Avalanche Hazard structures assessment around avalanche problems and expected behavior, including location/distribution, likelihood of release, potential size, and supporting snowpack and weather information (Statham et al., 2018).

NivoTest is especially relevant because, like FBHR, it was designed for use without a professional forecast. It uses 25 weighted yes-or-no questions covering weather, snowpack, avalanche activity, route characteristics, and participants to assess risk for a specific route (Bolognesi, 2000; Landrø et al., 2020).

NivoTest combines responses into a route-risk score. FBHR retains separate domain ratings so users can see where concern or uncertainty originates, then links the overall rating to terrain guidance. Instead of scoring a predetermined route, it sets conservative limits on terrain considered for the day.

Travel protocols and checklists structure movement and exposure management through factors such as group size and ability, rescue preparation, spacing, one-at-a-time exposure, safe stopping locations, and travel plans. They improve consistency and reduce exposure but do not necessarily produce an overall assessment of the day's conditions.

2.4 The Gap

Existing frameworks address different parts of the decision-making process:

Observe conditions → Assess hazard → Evaluate terrain → Manage exposure → Make a decision

Without a professional forecast, this process becomes harder because recreationists must integrate multiple, incomplete observations and consider how they interact.

FBHR fills this gap without introducing new avalanche factors or recreating professional forecasting. It asks:

Given the conditions we have observed, the information we are missing, and the capability of our group, how restrictive should our terrain choices be today?

FBHR organizes those considerations into a LOW / MODERATE / HIGH operational rating, each linked to a corresponding terrain approach: Normal / Selective / Restrictive.

3. THE FIELD-BASED HAZARD RATING (FBHR) FRAMEWORK

FBHR is a conceptual, day-level decision-support framework for use outside established forecast areas or seasons. It supplements, rather than replaces, professional forecasts when available.

3.1 Design Principles

FBHR is guided by four design principles.

Conservatism by default. When information is incomplete or confidence is low, FBHR favors the more restrictive rating. Because field assessments lack the breadth of observations and professional synthesis supporting regional forecasts, uncertainty should increase caution rather than be interpreted optimistically.

Minimal factor count. Landrø et al. (2020) identified 53 factors across existing frameworks and professional practice. FBHR limits assessment to five domains (Section 3.2) to reduce cognitive load and remain practical under time pressure or fatigue.

Explicit accounting for uncertainty. FBHR treats what is unknown or unconfirmed as an assessment input rather than omitting it, as reflected directly in the Uncertainty domain.

Direct translation to terrain behavior. FBHR's LOW, MODERATE, and HIGH operational ratings correspond to Normal, Selective, and Restrictive terrain approaches so the rating directly informs what a group does.

3.2 Assessment Domains

FBHR synthesizes five domains used in trip planning and backcountry travel:

Weather: What is happening now, and how are conditions changing?
Snowpack Structure: What do we know about the structure and stability of the snowpack?
Avalanche Problems: What avalanche processes could produce an avalanche today?
Uncertainty: What important information is missing or unconfirmed?
Group Dynamics: How capable is this group of managing the conditions and uncertainty?

Weather considers recent snowfall, precipitation intensity, wind loading, temperature, rapid warming, rain, forecast trend, and rate of change.

Snowpack Structure considers known persistent weak layers (PWLs), layering, stability tests, signs of instability, and confidence that observations represent the terrain under consideration.

Avalanche Problems considers problem type, likelihood, potential size, distribution, and affected terrain.

Uncertainty considers both information uncertainty—what is unknown or unconfirmed—and spatial uncertainty—how well observations represent conditions across the terrain.

Group Dynamics considers group size, experience, familiarity, communication, fitness/fatigue, risk tolerance, leadership, and objective pressure, incorporating McCammon's heuristic traps (2004), factors discussed by Landrø et al. (2020), and other influences on a group's ability to manage hazard and uncertainty.

Terrain is the application of the rating rather than a separate domain. FBHR first establishes how restrictive choices should be from conditions, uncertainty, and group capability, then evaluates objectives against the Normal, Selective, or Restrictive approach. This helps keep commitment to a route from influencing the rating.

3.3 Rating Synthesis

The five domains are not averaged because a serious concern, such as an active persistent weak layer or widespread avalanche problem, should not be offset by favorable ratings in unrelated domains. Instead, the overall rating is set by the domain with the highest level of concern.

This threshold approach applies FBHR's conservative design: an active persistent weak layer, ongoing wind loading, widespread avalanche problem, substantial uncertainty, or group limitation can elevate the overall rating regardless of other domains. The domains function as independent checks rather than tradeoffs.

Synthesis has two steps: assess each domain independently as LOW, MODERATE, or HIGH, then set the overall FBHR rating to the highest domain rating. One HIGH domain therefore produces an overall HIGH rating.

The method is intentionally qualitative. Additive scoring may imply unsupported precision and obscure what drives the result; a threshold approach keeps both the rating and its controlling observations traceable.

FBHR uses three levels for the same reason it uses five domains: finer distinctions may exceed what limited field observations can reliably support. Three tiers keep rating differences meaningful and terrain approaches clear.

4. RATING LEVELS AND OPERATIONAL MEANING

4.1 LOW (Normal)

Conditions are generally stable, avalanche potential is limited, confidence in available information is relatively high, and broad terrain options remain appropriate with normal caution.

4.2 MODERATE (Selective)

Conditions are mixed or changing, human-triggered avalanches may be possible, meaningful information gaps remain, or group factors increase the difficulty of managing the day. Terrain should be selected carefully, and exposure should be managed deliberately.

4.3 HIGH (Restrictive)

The snowpack may be unstable, active loading may be occurring, avalanche problems may be widespread or consequential, uncertainty may be substantial, or group factors may limit effective risk management. Avoiding avalanche terrain becomes the primary travel strategy.

5. APPLICATION AND USE CASES

FBHR is a repeated decision process, not a one-time morning rating. Groups can assess during planning, confirm or revise at the trailhead, and reassess as information changes. The rating should become more restrictive when hazard increases, consequential uncertainty remains, or the group's ability to manage conditions deteriorates.

The process has four steps:

1. Assess each of the five domains independently as LOW, MODERATE, or HIGH.
2. Identify the observations or information gaps supporting each assessment.
3. Assign the overall FBHR rating based on the highest-rated domain.
4. Select terrain consistent with the corresponding Normal, Selective, or Restrictive terrain approach.

The following hypothetical scenario illustrates the process.

5.1 Worked Example: Remote Hut Trip

A group is several days into a remote hut trip in Idaho's Sawtooth Mountains. After a week near 15°F under overcast skies, weather clears and temperatures are forecast to rise rapidly into the upper 40s. About eight inches of snow fell in the previous 48 hours with light to moderate upper-elevation winds.

Observations indicate a persistent slab problem on northwest through east aspects at mid and upper elevations, with several recent avalanches including one D3. The group can see large alpine lines from the hut but has not traveled through the upper-elevation terrain.

The group includes one relatively inexperienced skier and several competent members with limited experience managing persistent slabs. One person is viewed as the expert and expected to lead. After several conservative days, the group is restless and eager to attempt a larger objective in the clear weather.

Before choosing an objective, the group assesses each domain.

Domain	**Assessment**	**Basis**
Weather	HIGH	Rapid warming, full sun, recent snow, and temperatures rising from approximately 15°F into the upper 40s create the

		potential for a rapid increase in wet-snow instability.
Snowpack Structure	HIGH	Recent persistent slab avalanches demonstrate that a consequential weak layer remains active on northwest through east aspects. The largest reported avalanche was D3.
Avalanche Problems	HIGH	A persistent slab problem remains possible and potentially large on shaded aspects. Wet-loose avalanches are also expected to become increasingly likely on solar aspects as temperatures rise.
Uncertainty	MODERATE	The group has several days of local weather and snowpack information, but no direct observations from the upper-elevation terrain. It is unclear how representative the available observations are across the proposed terrain.
Group Dynamics	HIGH	Limited persistent-slab experience, growing restlessness, objective pressure, unfamiliar terrain, and reliance on a perceived expert may reduce the group's ability to make conservative decisions.

Because the highest domain determines the overall assessment, the rating is HIGH (Restrictive), independently supported by Weather, Snowpack Structure, Avalanche Problems, and Group Dynamics.

The Restrictive approach means avoiding terrain connected to the persistent slab problem, including slopes, runouts, and overhead exposure on northwest through east aspects. Solar terrain is not automatically safer because rapid warming and recent snow create a wet-loose problem; solar travel would need to precede warming and remain where even a small slide has minimal consequences.

Given the persistent slab hazard, rapid warming, unfamiliar upper terrain, and group pressure, the defensible plan is to abandon large alpine objectives for low-angle terrain disconnected from steeper slopes, terrain without overhead exposure, or a non-avalanche objective near the hut. If safe terrain cannot be identified confidently, the group should not enter avalanche terrain.

Reassess during travel. Earlier warming, rollerballs, pinwheels, wet-loose avalanches, cracking, collapsing, or recent slab evidence would confirm HIGH and could require further restriction or returning to the hut. No obvious instability alone would not justify lowering the rating because it does not resolve the persistent slab or uncertainty in unfamiliar terrain.

5.2 Supporting Group Communication

FBHR makes the basis for a terrain decision visible to the whole group. Rather than stating only the final rating, groups identify the controlling domains and supporting observations or information gaps. For example:

Today is HIGH because of the persistent slab problem and our uncertainty about its distribution. We will use a Restrictive terrain approach.

This format separates assessment from individual preferences and gives the group a basis for disagreement. Members can question observations, add information, or identify changes requiring reassessment. Mixed-experience groups can participate without every member producing an independent assessment; deference may remain, but the reasoning is easier to examine collectively.

6. LIMITATIONS

FBHR is an early-stage framework with one season of informal field use and practitioner review; its current version should be interpreted with several limitations.

Unvalidated framework. FBHR has not been empirically validated or systematically compared with regional forecasts or documented avalanche activity. Its domain relationships and most-restrictive-domain synthesis reflect initial design rather than demonstrated performance and may change through the validation described in Section 7.

Incomplete variable coverage. Five domains keep FBHR usable in the field but cannot represent individually every factor relevant to avalanche hazard, including all factors identified by more comprehensive frameworks such as Landrø et al. (2020).

Reduced rating resolution. FBHR compresses the five-level public danger scale from LOW to EXTREME into three operational ratings. This reduces cognitive load and clarifies terrain guidance but cannot preserve every distinction meaningful in a professional forecast.

Reliance on recreationist judgment. Reliability depends on the observations and judgment used to assess each domain. Users may misinterpret snowpack structure, misidentify an avalanche problem, overlook information, or overestimate the spatial representativeness of observations; limited training and experience compound these issues.

Not a substitute for a professional forecast. FBHR supplements rather than replaces professional forecasts, and its output is not equivalent to a public or operational forecast. Users may still apply it outside its intended scope or place more confidence in a self-generated rating than the information supports.

Ultimately, FBHR is only as reliable as its inputs. Conservative synthesis may reduce the effects of uncertainty but cannot correct missing, misinterpreted, or unrepresentative observations.

7. FUTURE WORK AND VALIDATION

FBHR was developed with avalanche forecasters and guides during its first season of use, and practitioner feedback informed its current structure. Field-based refinement is ongoing.

FBHR is an additional resource in the Mountain Training Center’s Avalanche Forecasting online course, which primarily teaches traditional forecast systems. In less than a year, 42 participants have used it, creating an opportunity to collect structured feedback on clarity, usability, and application and compare participant ratings with regional forecasts.

Future work should test recreational and professional users across experience levels and snow climates. Comparisons with professional forecasts and documented avalanche activity could evaluate conservatism, while inter-rater testing could determine whether users given the same information produce similar domain and overall ratings.

Results should guide revisions to domain criteria, rating thresholds, and the most-restrictive-domain synthesis method. Because FBHR does not numerically weight domains, validation should focus on whether domain criteria and threshold logic require refinement rather than weighting alone.

8. CONCLUSIONS

Outside established forecast areas or seasons, recreationists are rarely without information entirely; they more often lack a structured way to translate fragmented information into terrain decisions. FBHR addresses this gap by organizing Weather, Snowpack Structure, Avalanche Problems, Uncertainty, and Group Dynamics into a conservative, threshold-based operational rating.

FBHR does not replace professional forecasting and should defer to professional forecasts whenever they exist. Its most-restrictive-domain synthesis reflects its data-limited role by favoring caution when professional cross-checking and information breadth are absent.

FBHR may also provide shared vocabulary for mixed-experience groups. Making the basis for a rating explicit can help groups identify disagreement, question assumptions, and recognize otherwise-unaddressed human factors.

The framework remains unvalidated and will require field testing, comparison with professional assessments and observed avalanche conditions, and refinement from user and practitioner feedback. Its premise is simple: without a professional forecast, recreationists may benefit from a structured, conservative method for translating incomplete information into terrain choices.

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