

Gallatin National Forest

AVALANCHE CENTER



2022-23 Annual Report



GRIZZLY OUTFITTERS

HIGHLINE PARTNERS

SPARK R&D

BLITZ MOTORSPORTS and YAMAHA

YELLOWSTONE CLUB COMMUNITY FOUNDATION

GALLATIN COUNTY SEARCH AND RESCUE

AVALANCHE ALLIANCE

Archer Construction

Uphill Pursuits

World Boards

Mystery Ranch

Cooke City Super 8

OnX Backcountry

Alpine Orthopedics

Stronghold Fabrication

Gallatin Valley Snowmobile Association

Community Food Co-op

MAP Brewing

Cooke City Motorsports

Knoff Group Real Estate

Community Food Co-op

Montana Backcountry Alliance

Upper Yellowstone Snowmo Club

Werner Wealth Management

Advanced Innovation

Bridger Bowl

Beartooth Powder Guides

Yellowstone Ski Tours

KLIM

Chad Bunting-Edward Jones

Bozeman Splitfest

GNFAC Staff: Doug Chabot, Alex Marienthal, Ian Hoyer and Dave Zinn



2022-2023 Annual Report

Gallatin National Forest Avalanche Center

We just ended our 33rd year of operation with a winter of cold temperatures, above average snowfall and snow depth measuring 100% to 152% of normal on April 1. After a few anemic seasons this was a reminder that the snowfall pendulum swings both directions. A basic tenet of forecasting is that more snow equals more avalanches. The first snow fell on October 21 and the first recorded avalanche was seen the next day in Beehive Basin. We issued 12 early season bulletins before starting daily avalanche forecasts on November 23. On April 11 we issued our 140th and last forecast which was followed by bi-weekly updates through April.

Our team of 4 full-time avalanche specialists remained the same. Myself, Alex Marienthal, Ian Hoyer and Dave Zinn dug pits, made movies, investigated avalanches, wrote forecasts and taught classes. This season our intern was Alex Haddad, an MSU graduate student who accompanied us on 28 field days, learned to snowmobile, broke trail, dug many snowpits and helped us in the office.

Weak snow formed at the ground early in the season, and a few more weak layers were created during brief periods of clear weather through the winter. Steady snowfall loaded these layers, which resulted in an elevated avalanche danger for days at a time. On New Year's Eve, a snowmobiler was killed in an avalanche near Cooke City. We issued Avalanche Warnings on 8 days in our forecast area. The public also took advantage of our new Observation Page and submitted observations, including 62 avalanche incidents. Nationally there have been 30 avalanche deaths, near the 10-year average of 27.

The Friends of the Avalanche Center and the GNFAC worked together to teach avalanche classes. Shannon Regan, Education Coordinator, infused the avalanche education program with new energy and focus. In total we offered 100 classes to 5,489 people, including 626 kids under 18 and 566 snowmobilers.

GNFAC INDEX

- Total number of people getting our daily forecast: 6,595
- Number of field days: 132
 - Number of snowpits we recorded in SnowPilot.org: 146
- Number of observations submitted this season: 686
- Number of belts we burned through on our Yamaha Mtn Max sleds: 3
 - Total number we burned through in the last 5 years: 0
 - #1 reason why: deep snow

- Miles off trail in Lionhead that Doug ripped the A-arm off a sled: 12
 - Number of hours it took Dave to ride it back out on 1 ski: 4
 - Frequency that Dave reminds Doug that he did this for him: Every. Single. Day.
- Miles ridden on each new sled: 1,700
- Scariest words I heard all season: Ian saying, “I think this will go, we should be alright”, before dropping off the trail on a sled into thick trees. (It worked. Barely.)
- Reported avalanche incidents last season and this winter: 29 and 62
- Number of videos and total views: 141 and 1,349,958 views
- Total followers on Instagram, Facebook, YouTube and Twitter: 21,700; 18,557; 7,761; and 2,335.
 - Percentage increase from last year: 12%

THIS WINTER
6,595 PEOPLE A
DAY RECEIVED
OUR AVALANCHE
ADVISORY.



AVALANCHE FORECASTS

Last winter we issued 140 advisories that reached 6,595 people a day, mostly through email. We also wrote 12 pre-season avalanche bulletins and 6 post-season. To put out accurate forecasts we lean heavily on our field days and observations from the public, which typically include pictures and videos. This past season we received 686 observations, a record.

The official forecast is released every morning at 7: 30 a.m., but those who follow us on social media get a teaser of the next day's forecast by watching our afternoon field videos on Instagram and YouTube. We consider these supplements for our daily forecast because they give viewers information about the next day's avalanche concern.



FIELD DAYS

“To know there, go there”, are words we take seriously. This season we had 132 field days digging and recording 146 pits and investigating avalanches. We never go in the field solo. We go out with each other, our intern, or a carefully selected group of volunteers. This season most field days were in the Bridger Range (27), followed by Cooke City (23) and Lionhead and the Northern Madison Range (20 each), Southern Madison Range (18), Northern Gallatin Range (15), and Island Park (9). Our attendance changes year-to-year as we follow the worst, most unstable snows that affect the most popular recreation sites.

YOUTUBE, INSTAGRAM, AND TWITTER

We created 141 videos this winter that were watched 1,349,958 times on YouTube, Facebook and Instagram. Most days we would film a 1-minute clip about our avalanche concerns and post it that same afternoon. By evening hundreds would have seen it. At the very least, a person could watch just our videos and still understand the region’s snowpack stability.

The number of likes and followers increased 12% this year with 21,700 Instagram followers, 18,557 on Facebook, 18,557 subscribing on YouTube, and 2,335 on X, formerly Twitter.

AVALANCHE INCIDENTS AND ACCIDENTS

Nationally, 30 people died in avalanches this season, slightly higher than the 10-year average of 27 (page 20). In southwest Montana, we had 1 avalanche fatality, a sledder in Cooke City on New Year's Eve.

This winter was punctuated by heavy snowfall that sometimes buried weak layers. As Alex wrote in the Season Snowpack Summary on page 14, “Like most of the west, southwest Montana had average to above average snow and cold temperatures the entire season. These conditions brought plenty of avalanche activity.”

- 62 avalanches were unintentionally triggered by skiers, snowboarders and sledders that resulted in 28 being caught with 10 being partially or completely buried. One person died.

Over the last ten years Montana has had 34 avalanche fatalities, the second highest in the nation behind CO.

AVALANCHE EDUCATION

By Shannon Regan , Education Coordinator

I want to thank all the Friends of GNFAC board, staff, students, community and business partners for contributing to a great education season. Friends of GNFAC would not be able to accomplish this amount of programming without you. Friends had a great education season thanks to a generous snowpack and interest in our programs from the community. As the program grows with the growth of Gallatin Valley and the recreational community in Southwest Montana we have the strong support of all-star staff and the community at large. Below you can find the numbers at a glance, program successes and a look to the next season and beyond!

Season Totals:

- We taught avalanche awareness to 5529 students at 100 unique events
 - 626 youth under 18
 - 566 snowmobilers
- Avalanche Fundamentals Course ran 15 field days in Bozeman for 365 students
 - Offered public Livingston and Dillion Fundamentals courses with help from PCEC and UM Western.
- 45 instructors taught lectures, field days, rescue courses, school programs and outreach days across Southwest Montana
 - 10 new staff (2 snowmobile specific, 2 out of town lecture staff and 6 ski based)

Successes:

- We had a longer and busier season for 22-23 winter that started with awareness programs and MSU SAW in October and ran field and lectures programs through March. Oftentimes Friends would have events every day of the week and multiple overlapping events, teaching this volume of programs would not be possible without amazing staff!
- Friends of GNFAC ran our 6th annual staff training, in person and off ZOOM after 3 seasons of meeting virtually.



- Training highlighted best use of GNFAC forecast products in teaching students and use of new scheduling software WheniWork.
- Return to in person awareness lectures Friends of GNFAC taught 50+ awareness session
 - Public programs were well attended
 - Continued offering private awareness programs for groups and businesses in addition to public lectures
 - Lectures returned to venues like: Uphill Pursuits, REI Bozeman, City of Bozeman, MSU campus series with ORP, Montana Science Center, Basecamp Billings, BIF.
 - Partnered with new venues, businesses and clubs including: Beartooth Mountain Guides, BSCO BASE, MAP, Great Falls Snowmobile Club, REI Billings, Belgrade Library and Crosscut Mountain Sports Center.
- Increased the number of middle school programs offered from 2022!
- Taught 3 Companion Rescue Clinics at Crosscut Mountain Sports Center, a new venue for this program.
- Taught lecture and field based SAR specific programs in Gallatin Valley, Red Lodge, Ruby Valley and Fremont Co.
 - Content updates in collaboration with Alexis Alloway, and use of her book Avalanche Search and Rescue: A Backcountry Field Guide as a teaching tool.
- Re-started weekly in-person Cooke City avalanche awareness and conditions updates due to strong partnerships with UYSC, Antler's Lodge, Beartooth Powder Guides.
 - Friends of GNFAC ran 12 weekends of programming in Cooke City, with over 400 participants between evening lectures, Saturday outreach at Round Lake safety shelter, and private group talks at the Super 8 and the Antler's lodge.
- In partnership with MAP and Spark R&D launched a community outreach and lecture series in December with two evening lectures, a pint night series and raffle fundraiser.

- Due to great in-town snow conditions, Friends of GNFAAC maintained a beacon park at the Story Mill Park in Bozeman for over 4 months, and maintained a beacon park in Cooke City for the 3rd season.

Looking Forward to the 23-24 season and beyond:

- Continue streamlining program communications with public, students, staff and partners
 - Explore proven solutions to manage existing communication traffic and prepare for more as the program grows
 - Evaluate process and outcomes through surveying students and users of Education program products
 - Consistent use of social media channels for updates, programming and learning
 - Hire additional supporting roles under the coordinator to assist with these task and more
- Return to pre-pandemic school program operations, get back into more middle schools, with updated curriculum.
 - Attend teacher and STEM conferences to expose more schools to our program
- Train more staff into awareness and classroom programs, formalize training and evaluation process for lecture program
- Update Avalanche Fundamental classroom portion
 - Include snowmobile specific content for rescue, terrain management and decision making
 - Update all 4 video sections, consider additional or new segments
 - Evaluate options for returning to in-person or hybrid option Q and As
- Increase number of Sled specific dates for Avalanche Fundamentals to decrease group size/ ratios.
- Increase number of Companion Rescue Clinics offered
- SAR program updates to reach more groups and accommodate different training goals in SWMT

WE TAUGHT 100
CLASSES TO
5,489
PARTICIPANTS.



- Primary goal to provide industry standard training/ instructional support for training and team coordinators to bring bring back to their communities
- Use momentum from 22-23 season to hold more public outreach events
 - Invest in new tabling materials
 - Invest in paid outreach time for staff
 - Consider new locations or trial-run trailhead outreach locations



A natural hard slab avalanche at Lionhead.

Finances of the GNFAC

The Custer Gallatin National Forest provided the Avalanche Center with 45% of its funding to cover salaries, benefits, travel, vehicles, computers, and office space. We rely on our long-term supporters, Friends of the Avalanche Center and Montana Fish, Wildlife & Parks, for the remaining 55%.

Board of Directors

Friends of the Avalanche Center

Jeannie Wall (President), Ben Nobel, Tyler Allen, Mark Greeno, Laura Ryan, Dawn Brown and Leah Knickerbocker.

Friends of the Avalanche Center

The Friends of the Avalanche Center is a nonprofit organization whose mission is simple and focused:

The Friends of GNFAC supports the Gallatin National Forest Avalanche Center in providing quality avalanche education and awareness programs.

Their support falls into 3 core areas:

- Direct support of the GNFAC,
- Avalanche Education Program,
- SnowPilot (funded through a restricted donation).

The Friends cover expenses related to the avalanche education program, as well as administrative, snowmobile, weather station, and website costs. The Friends is run by a Board of Directors, all volunteers, with two paid staff: an Education Coordinator (Shannon Regan) and a Treasurer (Allyson Fauver).

The Friends were founded in 1992 and have donated over \$1,249,916 to the operation of the GNFAC. This year their total contribution was \$149,956 This total reflects spending \$83,820 for avalanche education, \$63,820 for direct GNFAC support and \$2,316 for SnowPilot maintenance. Almost all monies came from local businesses and individuals in southwest Montana with the following long term, recurring support:

- 23rd Annual Powder Blast, *online* (\$55,954)
- Yellowstone Club Community Foundation (\$10,000)
- 20th Annual King and Queen of the Ridge at Bridger Bowl (\$31,506)
- Bozeman SplitFest (~\$7,000)
- Give Big Gallatin Valley (~\$7,000)



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\$1,249,916 TO
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OF THE GNFAAC.

Dave Zinn measures snow density in a pit.

Snowmobiles

This winter Yamaha Blitz Motorsports and Yamaha loaned us 4 snowmobiles. Two of them were used in Cooke City and the other 2 were trailered in Bozeman. These loaners were essential to our ability to gather snowpack data in popular riding areas. Sleds are an expensive part of our operation and having Yamaha support us was a huge help.

Avalanche Intern

This winter Alex Haddad was our intern. He is a graduate student at MSU studying snow in the Earth Sciences Department. He was our primary field partner for 29 days, taught for the FOAC, and helped us post pictures, videos, and snowpits. We relied on him to help us get out in the field.

Field Volunteers/Observers

We do not go in the field solo and it's not always possible for us to partner with each other, so we rely on a team of skilled volunteers to help. Twenty-nine volunteers accompanied us on 38 field days: Tim Baucom, Zach Bailey, Karl Birkeland, Jackson Breen, Darcy Chenowith, Nata de Leeuw, Brian DiLenge, Eliza Donohue, Brooke Dunnagen, Max Erpenbach, Mike Fiebig, Randy Gravatt, Nina Hance, Jerry Johnson, Josh Lipkowitz, Pete Maleski, Eliza Maleski, Jordan Mancy, Jake Mundt, Heather Myers, Mike Pagel, Zach Peterson, Shannon Regan, Andrew Schauer, Yogesh Simpson, Jed Wiengarten, Rusty Willis, Oliver Wood, and Ben Zavora.

29 VOLUNTEERS
ACCOMPANIED
US ON 38 FIELD
DAYS.

We owe a special thanks to Big Sky and Bridger Bowl Ski Patrols for their daily observations as well as Beartooth Powder Guides, Yellowstone Ski Tours, and Six Points Avalanche Education.



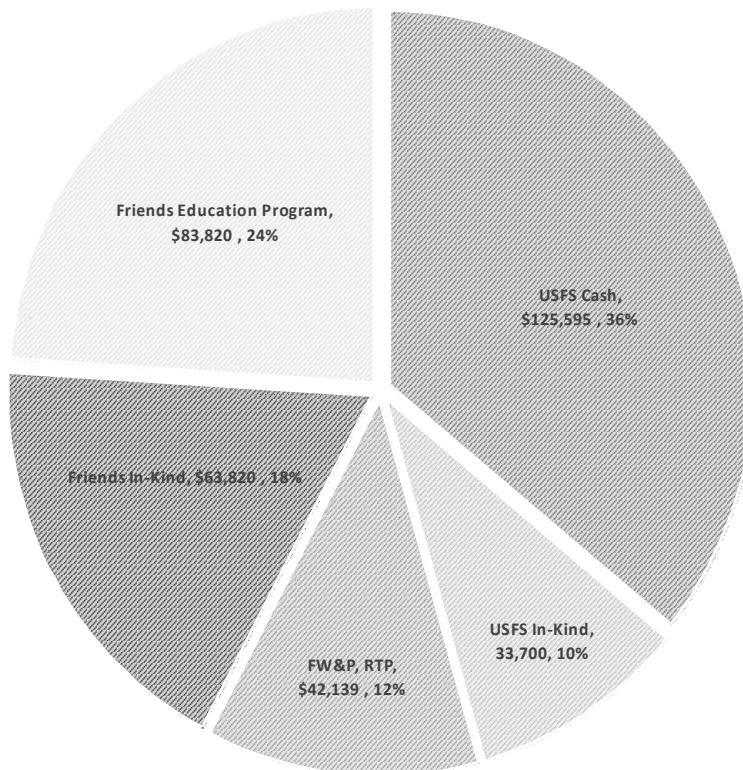
The weather station on top of Sawtelle Peak in Island Park.



Total Costs

Custer Gallatin National Forest (salaries/benefits)	\$125,595
◆ CGNF In-Kind (vehicles, office, etc)	\$33,700
Montana FW&P Rec Trails Program (salaries)	\$42,139
Friends of the Avalanche Center: Education program	\$83,820
Friends of the Avalanche Center: Direct Support	\$63,820
Friends of the Avalanche Center: SnowPilot	\$2,316
Total Costs	\$351,390(100%)
<i>CGNF Contribution</i>	<i>\$159,295(45%)</i>
<i>Outside Contributions (non federal government)</i>	<i>\$192,095 (55%)</i>

TOTAL COSTS



GNFAC Season Snowpack Summary 2022-23

by Alex Marienthal

June 26, 2023

After a warm start to fall, winter abruptly began with 1-3 feet of snow in the mountains on October 22-24. Like most of the west, southwest Montana had average to above average snow and cold temperatures the entire season. These conditions brought plenty of avalanche activity.

Through the season we had eight days with avalanche warnings, compared to two days the previous season. Danger was rated low no more than three times for any mountain range, and near Cooke City there were zero days with a low danger rating. We recorded 517 avalanches, of which 382 were D-size 2 or larger, and 62 were avalanche incidents including one fatality near Cooke City on December 31.

We issued our first snowpack and weather information on October 23, and updated early season information 2-3 times per week until daily forecasts began on November 23. The first forecast danger was MODERATE throughout the forecast area as multiple storms had formed a layered snowpack which made us concerned about avalanches breaking on buried persistent weak layers. Many storms over the winter favored the southwest portion of our forecast area, near West Yellowstone, Island Park and south of Big Sky, and we issued the first avalanche warning of the season on December 2 for West Yellowstone and Island Park.

December started with a couple large snowmobiler triggered and many natural avalanches breaking 2-6' deep on weak snow near the bottom of the snowpack. Through December, avalanches continued to break on weak snow that formed early in the season, and were the first of many large to very large human-triggered avalanches that broke on persistent weak layers through the season.



This avalanche killed a snowmobiler on December 31, 2022 on Crown Butte near Cooke City. The rider was not wearing a transceiver and was located with a probe line an hour after being caught and buried. Photo: GNFAAC

On December 31 a snowmobiler was killed in an avalanche on Crown Butte near Cooke City. The avalanche broke 1.5-4 feet deep on a persistent weak layer, 500 feet wide, and ran 600 vertical feet. The rider was not wearing an avalanche beacon and was recovered with a probe line an hour after he was buried. Over the prior week the area received 2-3 feet of snow equal to 3.2" snow water equivalent (SWE). Danger was rated MODERATE. Earlier in the day a snowmobiler 2 miles east of the fatal avalanche triggered a 1-4' deep, 150' wide hard slab that broke on a similar layer of weak snow near the bottom of the snowpack. That rider was unharmed.

January was relatively dry and cold with occasional storms. This allowed weak layers of surface hoar and near surface facets to form, get buried and survive to cause problems through the second half of the season. From late January through mid-February these recently buried weak layers were nearly inactive, even with multiple heavy storms that prompted avalanche warnings. A large storm that prompted an avalanche warning in late February was not accompanied by much activity on these layers. Snowfall followed the warning, but at lower rates. Due to a lack of avalanches on these January weak layers we discussed being done talking about them. Within a couple days of this discussion these layers began breaking under the cumulative load of storms from the past few weeks. In late February natural and human triggered avalanches broke 2-4 feet deep on the January persistent weak layers. These avalanches were abundant near Cooke City and became common near West Yellowstone and south of Big Sky, and eventually surprised us a few times in the mountains near Bozeman.



A skier triggered and was caught in this deep slab avalanche on Hyalite Peak on March 4, 2023. They were luckily not injured. It broke on near surface facets formed in January. Photo: Anonymous

Avalanches breaking on persistent weak layers became deeper and more destructive through the start of April. With every storm we were wary of the possibility of large, destructive avalanches. Our concerns were often validated with people having close calls with avalanches or evidence of natural slides after each storm. March and April were unusually cold, preventing us from worrying about the typical wet snow avalanches at the end of the season, but we remained alert for dry snow avalanches on deep persistent weak layers later than usual.



This avalanche was triggered by the fifth rider high-marking the slope on March 18, 2023. He was stuck at the crown and luckily uninjured. The slide broke 5-6 feet deep on a layer of surface hoar that was buried in January. Doug Chabot measured 17" of snow water equivalent (SWE) in the slab above the weak layer at the crown. Photo: C. Diffley

One week into April, temperatures frequently climbed above freezing and the snowpack started to get wet. On April 8 a wet slide from a low elevation south facing starting zone buried a section of highway by Quake Lake near West Yellowstone. As we prepared to culminate daily forecasts, temperatures stayed above freezing in many locations for multiple nights in a row and wet snow avalanche activity continued. With the season's first onset of free water in the snowpack we issued two extra avalanche forecasts which were high danger for large wet snow avalanches on April 9 and 10.

Through mid and late April, temperatures cooled to near or below freezing most nights and there were a few more significant snowstorms. Avalanche problems were

the typical spring mix of new snow, wind slabs, wet snow, cornices, and “don’t forget about lingering persistent weak layers on high, shady slopes”. We issued snowpack updates twice per week until May 1.

In May, temperatures were generally warm and there were several natural large wet slab avalanches that likely failed on the persistent weak layers that formed during the first half of the season. A warm, wet spring continued through the summer solstice. Most precipitation fell as rain in late May and June which caused the decent winter snowpack to melt relatively quickly.

We are thankful for the support from our partners in the community to help keep everyone safe. We could not succeed without the hundreds of observations submitted by the public, volunteers that join us in the field, and donations from sponsors and individuals.



This slide broke naturally the night of March 10-11, 2023 on Fisher Mtn near Cooke City, and appeared up to 10 feet deep. It is on a path that previously produced a 6 foot deep slide in December, triggered remotely by riders near the bottom of the slope. Photo: GNFAc



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US Avalanche Fatalities
2022-2023 SEASON

30 US fatalities

*Compiled by Colorado Avalanche Information Center

Activity	Killed
Skier †	9
Snowboarder †	3
Snowmobiler	9
Snowshoer/Climber/Hiker	8
Other	1
Total	30
† Inbounds skier/boarder	0



<u>Date</u> ▲	<u>State</u>	<u>Location</u>	<u>Description</u>	<u>Killed</u>
07/02	CA	Split Mountain, southwest of Big Pine	3 hikers caught, 2 injured, 1 killed	1
06/14	CA	Hurd Peak, southwest of Bishop	2 backcountry tourers caught, 1 killed	1
05/05 †	AK	West Ridge of the Moose's Tooth	2 climbers caught, killed	2
05/04 †	AK	Denali National Park, near Jenny Creek	1 backcountry skier caught and killed	1
04/29	CO	Bald Mountain, southeast of Breckenridge	1 backcountry tourer caught, buried, and killed	1
04/17	UT	Big Cottonwood Creek, east of Sandy	1 resident caught, partially buried-critical, and killed	1
03/27	UT	Pole Canyon, Oquirrh Mountains	1 snowmobiler caught, buried, and killed	1
03/22	ID	Trinity Lakes, east of Boise	1 snowmobiler caught, buried, and killed	1
03/19	CO	Maroon Bowl, north of Highland Peak	1 sidecountry rider caught, partially buried-critical, and killed	1
03/17	CO	Rapid Creek, southwest of Marble	3 backcountry tourers caught, 2 injured, 1 buried and killed	1
03/16	CO	Purgatory Creek, north of Durango	3 residents caught, buried, and 1 killed	1
03/15	OR	Paulina Peak, south of Bend	1 backcountry snowboarder killed	1
03/12	ID	Observation Peak, Stanley Lake Creek Drainage	1 snowmobiler caught, buried, and killed	1
03/12 †	ID	Red Mountain, northeast of Lowman	1 snowmobiler caught and killed	1
03/09	UT	Upper Weber Canyon, southwest of Windy Ridge	2 skiers caught and fully buried, 1 injured and 1 killed	1
03/02	OR	Black Crater, west of Sisters	1 backcountry skier caught, partially buried-critical, and killed	1
02/25	CO	South of Vallecito Reservoir	2 backcountry skiers caught, buried, and killed	2
02/25	CO	Red Lakes Trailhead, near La Manga Pass	1 snowmobiler caught, buried, and killed	1
02/23	WY	Poker Flats, Salt River Range	1 snowmobiler caught, buried, and killed	1
02/19	WA	Colchuck Peak, southwest of Leavenworth	4 climbers caught, 3 killed, 1 injured	3
01/09	NV	Mummy Mountain, Spring Mountain National Recreation Area	1 backcountry snowboarder, caught, partially buried-critical, and killed	1
01/07	CO	Pumphouse Lake, southwest of Rollins Pass	2 snowmobilers caught, buried, and killed	2
12/31	MT	Crown Butte, north of Cooke City	1 snowmobiler caught, buried, and killed	1
12/31	CO	Number 5, Carter Gulch southwest of Breckenridge	2 sidecountry riders caught, 1 partially buried-critical, 1 buried and killed	1
12/26	CO	Nitro Chute, north of Berthoud Pass	4 backcountry tourers caught, 2 fully buried, and 1 killed	1

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