

GNFAC Season Snowpack Summary 2022-23

by Alex Marienthal

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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.



Avalanche that 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: GNFAC

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



Avalanche triggered remotely by snow bikers riding on the flat bench above the slope, below Mt. Abundance near Cooke City on March 11, 2023. It broke 3-4 feet deep and nearly 1000 feet wide on a weak layer buried in January. Photo: D. Green