

FLATHEAD NATIONAL FOREST
FLATHEAD AVALANCHE CENTER
2018-2019 ANNUAL REPORT



Table of Contents

Director's Summary	3
Background	4
Media	5
Publications and Presentations	7
Weather, Snowpack, and Avalanche Summary	7
Incidents	18
Education	21
Finances	24
Observations	26
Volunteers	27
Partnerships	27
Friends of the Flathead Avalanche Center (provided by Jenny Cloutier)	28
The Future of the Flathead Avalanche Center	32



FAC Staff from left: Chris Prew, Mark Dundas, Zach Guy, Blase Reardon, Jenny Cloutier, Guy Zoellner, and Clancy Nelson.

Cover Image: Crown of a natural slab avalanche above Dickey Lake, Flathead Range. Credit: FAC, 1/15/19.

Director's Summary

A polarizing winter - unusually warm, unusually cold, exceptional riding, horrendous riding - was an exciting and challenging year for our forecast staff. Our snowpack was highlighted by several nagging persistent weak layers culminating with an impressive wet cycle in March. There were 25 avalanche fatalities in the U.S. this season. Regionally, there were several near misses and a snowmobile fatality near Choteau, MT, east of our forecast area, highlighting the continuing need for avalanche forecasting and education in our area. The Flathead Avalanche Center (FAC) continues to grow to meet increasing public demands. This year we hired a second permanent USFS position and continued to expand our field presence and education offerings. The public applauded the quality of our daily avalanche forecasts. The FAC continues to focus on clear, tangible travel advice supplemented by informational photos and videos. Outreach efforts are making a clear impact: user statistics continue their upward trend. Despite an unprecedented number of canceled classes due to extreme cold weather mid-winter, our education numbers surpassed any season to date. Community feedback has been overwhelmingly positive. These successes would not be possible without the dedication and support from our community and partners. Thank you to everyone who contributed time or resources towards avalanche safety in the Flathead Valley.

Sincerely,
Zach Guy
FAC Director



Figure 1: T-shirts and wet slabs: this photo sums up the abrupt and disheartening end to an otherwise successful season for the FAC, with positive growth in education and outreach. Credit: FAC, 3/21/19.

Background

The purpose of the Flathead Avalanche Center is to prevent the loss of human life, limb, and property by human and naturally occurring avalanches through information and education to the community. The FAC operates as a Type 1 Avalanche Center. With four full-time forecast staff and a professional observer program, current resources allow for daily avalanche forecasts for three geographic regions: the Swan Range, the Whitefish Range, and the Flathead Range and Glacier National Park. The FAC began issuing weekly snowpack updates on October 12, 2018, began full operations on December 9, 2018, conducting daily fieldwork and issuing forecasts every day at 7 a.m. until April 6, 2019. Backcountry usage and the snowpack both quickly diminished by late March, and we scaled back operations in April to include observations and snowpack updates on alternating days until April 15, 2019. Partnering with the Friends of the Flathead Avalanche Center (FOFAC), the FAC also provided numerous education classes including free avalanche awareness, Introduction to Avalanche courses, Level 1 Avalanche courses, companion rescue courses, and avalanche basics for school-aged children throughout Flathead Valley.

Avalanche information product season totals:

- Pre-season avalanche information updates (beginning on 10/12/2018) = 8
- Avalanche forecasts (12/9/2018 through 4/6/2019) = 119
- Post-season avalanche information updates (beginning on 4/7/2019) = 5

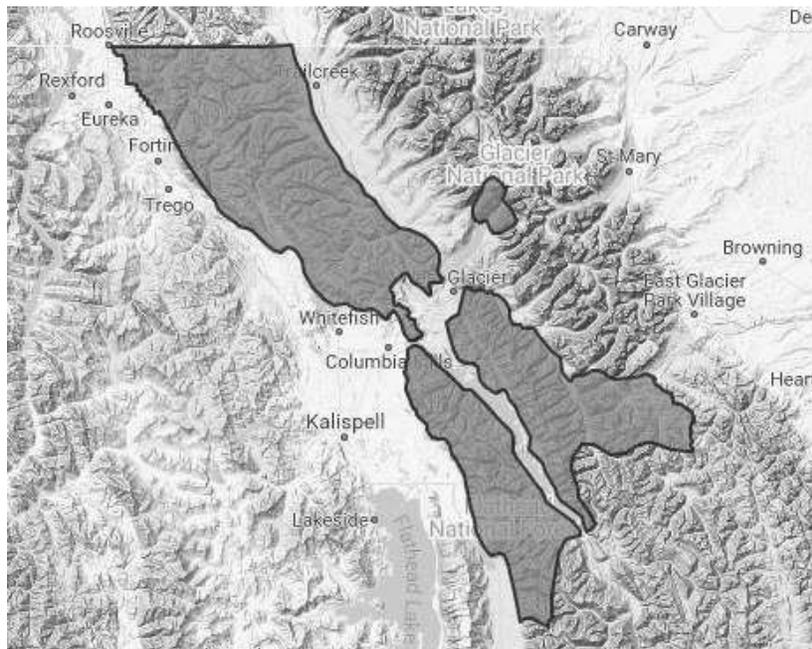


Figure 2: Overview of the Flathead Avalanche Center advisory area, showing the three forecast regions in shaded grey.

Several new forecasters brought a wealth of experience to complement the returning staff of the FAC, operating under the US Forest Service (USFS) in Hungry Horse, MT. Zach Guy returned for his second year as FAC's Director. Mark Dundas, with over 20 years of experience in the Flathead Valley, returned for his 4th season as a forecaster. Blase Reardon was hired as lead forecaster, returning to the Flathead Valley after gaining valuable forecast experience in Idaho and Colorado for the past 10 years. Clancy Nelson joined the forecast team this year with 12 years of on-the-snow professional experience from the Eastern Sierra. Guy Zoellner contributed to the fieldwork and educational efforts as a part-time professional observers. Tara Vasella served as the FAC's intern for a month. The program is supervised by Chris Prew under the umbrella of the Recreation Program for the Flathead National Forest. The Friends of the Flathead Avalanche Center (FOFAC) is a non-profit partner of the FAC, with

the mission of financially supporting the FAC and saving lives through avalanche education. FOFAC is steered by a board of directors, and Jenny Cloutier is FOFAC's education coordinator.

The FAC website (www.flatheadavalanche.org) is the primary source for communicating avalanche information to the public. The website houses all of the avalanche forecasts, observations, media, reports, and other information provided by the FAC. FOFAC owns the website and funds website maintenance and development. Modifications to the website this season include improvements to back-end workflow efficiency and a publicly accessible avalanche database (<https://www.flatheadavalanche.org/avalanche-list>). Website statistics have been collected since the introduction of the new site in November 2012. Site visits and use show substantial growth during this time period. This year's website statistics were slightly less than last year's. This could be attributed to a shorter season with less snowfall, fewer newsworthy avalanche cycles, accidents, and fatalities, and increased use of social media. The FAC emails daily avalanche forecasts to a growing list of email subscribers which increased to 988 users this year. We also record the forecasts on a phone hotline.

Table 1: Descriptive statistics of the FAC website for 2018-2019.

Total Visits	Total Unique Visitors	Page Views	Pages/Visit	Avg. Visit Duration (minutes)
66,043 Decrease of 13% from 2017-2018	22,537 Decrease of 6% from 2017-2018	239,688 Decrease of 0.4% from 2017- 2018	3.63	2:48

Media

New this year, the Flathead Avalanche Center began daily avalanche information broadcasts on several regional radio stations (FM 96.5 - KGEZ, FM 98.5 - KBBZ, FM 103.1 - KRVO, and AM 600 - KGEZ). The four stations broadcast the one-minute clips every morning, which highlighted the day's avalanche danger and travel advice.

Over the course of the season, the Flathead Avalanche Center was featured in at least 35 media pieces, including television, newspaper, online news, podcasts, and radio outlets from regional to national level. Topics included avalanche conditions, avalanche incidents, educational opportunities and highlighting the work and resources provided by the avalanche center. Examples of media featuring the FAC include: 1) a [Daily Interlake article](#) narrating the avalanche fatality and cornice fall incident. 2) an [NBC Montana news piece](#) describing how FAC forecasters predict conditions 3) a [Missoulian article](#) about the use of drones for avalanche forecasting. 4) a [US News article](#) highlighting warm weather and wet avalanches 5) [The Avalanche Hour podcast](#) interview of FAC forecaster Mark Dundas.

The FAC continues to develop and improve its social media content, and our efforts are reflected in significant growth during the past two years. The center uses Twitter, Instagram, Facebook, and YouTube to reach a broader audience. The goal is to steer users to our website while engaging them more frequently with avalanche information and short learning moments. The goal of our videos is to form a holistic message incorporating snowpack observations into decision making and terrain selection. Our general strategy is to provide daily morning social blasts that coincide with our forecasts and afternoon updates of observations from the field or notable incidents. The backcountry community applauded our social media presence, although our staff expressed concern that some recreators neglect to read the daily forecasts in lieu of social media. The FAC will continue to develop and refine this important means of public communication to best serve the users.

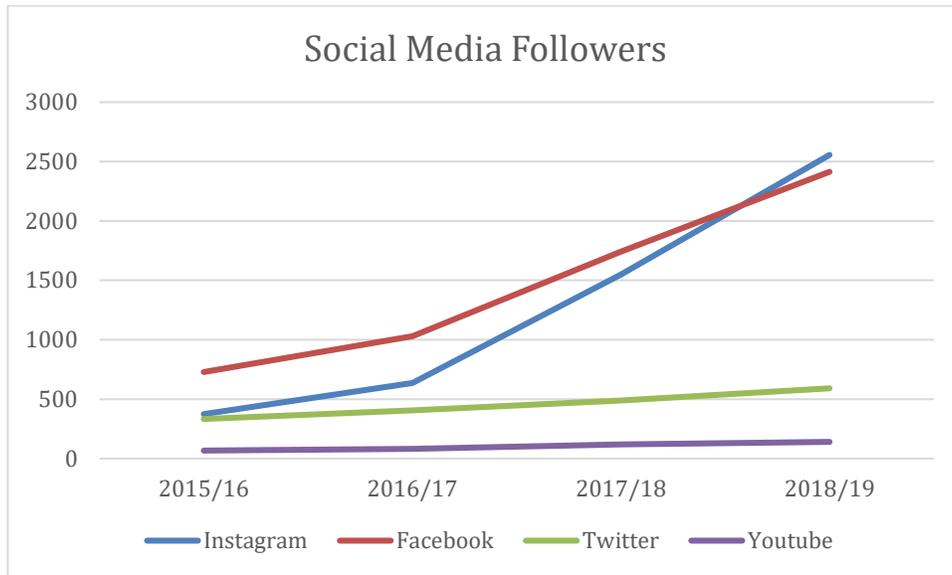


Figure 3: Four year plot in FAC social media followers highlights substantial growth in the past two seasons.

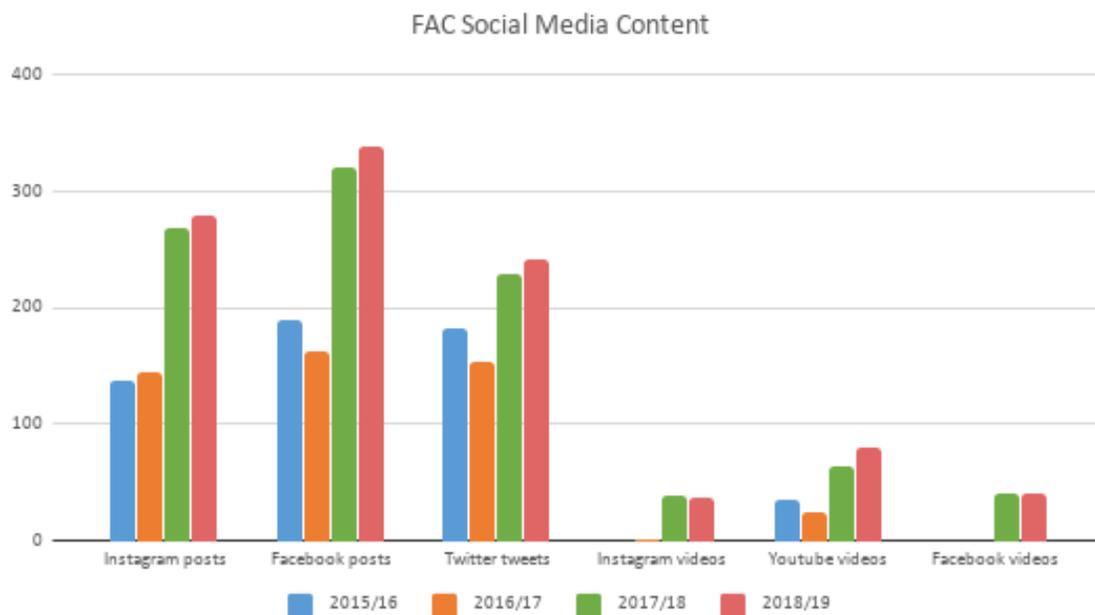


Figure 4: Graphs of FAC authored social media content for the past four seasons demonstrates increasing FAC generated video and photo content.

The FAC Instagram account (<https://instagram.com/flatheadavalanche/> and @flatheadavalanche) is our fastest growing outreach platform. We made 281 posts this season (up from 269 last year and 144 the year before), and increased our followers from 1,549 to 2,556. We posted 37 informative videos with 20,256 views. We continue to use #flatheadavalanche to link our content and also experimented with Instagram stories on occasion.

Our Facebook page (<https://www.facebook.com/friendsofflatheadavalanchecenter> and @friendsofflatheadavalanchecenter) continues grow and engage a large number of users. Our Facebook audience grew from 1,743 followers to 2,414. We published 338 posts with 412,903 post reaches and 35,022 engagements; similar metrics to last season and a substantial increase from previous seasons. Our 41 Facebook videos were viewed 20,941 times.

The FAC Twitter account (<https://twitter.com/FACAvalanche> and @FACAvalanche) continues to grow in popularity. Followers increased from 489 to 591 this season. Our 116,232 impressions and 4004 engagements were substantial increases from last season. We published 241 tweets with 207 retweets and 349 likes.

The Flathead Avalanche YouTube channel (<http://www.youtube.com/user/FlatheadAvalanche>) stores all of our field based videos which we embed into forecasts and observations pages. This season we produced 80 videos from the field, over four times the content two seasons ago. Our YouTube channel had 14,336 views, 15,472 minutes watched, and subscribers increased to 140. Our most popular videos were investigations of the cornice-fall incident and snowmobiler fatality, both released shortly after the accidents on January 5, 2019.

Publications and Presentations

New this year, the FAC hosted a professional development seminar in Hungry Horse, MT in November. The seminar catered to regional professionals in avalanche, search and rescue, and law enforcement. Three FAC staff members presented: Zach Guy on the 2018 deep slab cycle, Blase Reardon on developing expert intuition, and Clancy Nelson on forecasting highlights from the Sierra Nevada.

Zach Guy presented at the 2019 GNFAAC Pro Development Workshop in Bozeman, MT on the wet avalanche cycle. <https://www.youtube.com/watch?v=xhIdlj2Tig0>. Zach had several articles published in The Avalanche Review, including highlights from ISSW, a recap of NRSAW, and a 2017-2018 season summary.

Weather, Snowpack, and Avalanche Summary

If the 2018-19 winter went to a shrink, it might be diagnosed as bi-polar. Warm periods (both wet and dry) bookended an atypically cold mid-winter. Several tricky persistent weak layers made early-season travel challenging, a January inversion created a moat of surface hoar, and early-February warming and rain created a crust-facet combination that persisted for several weeks. The most intense and destructive avalanche cycle, however, occurred in mid to late March and involved wet snow avalanches.

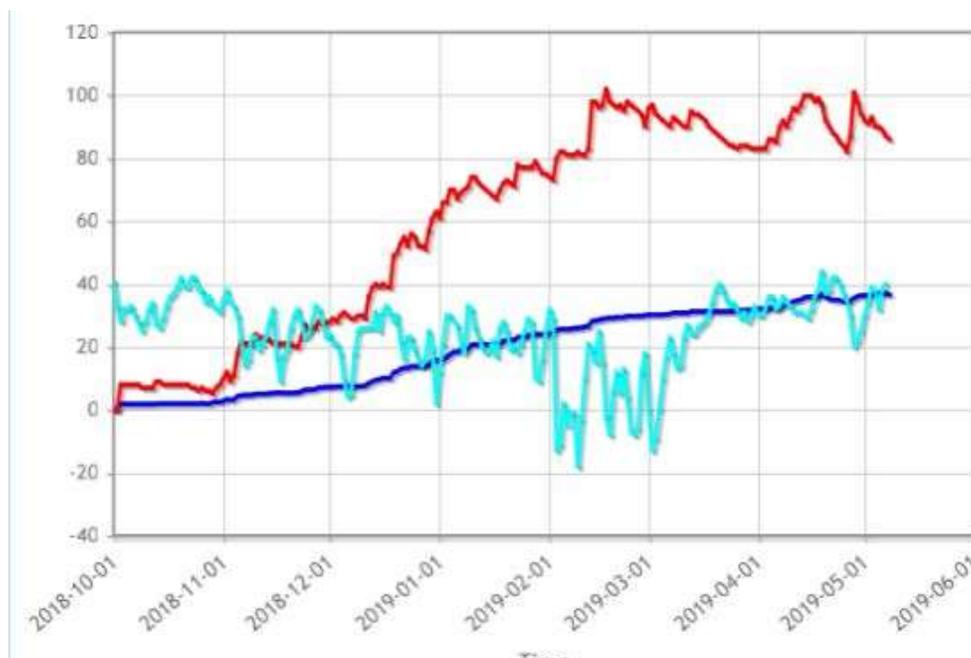


Figure 5: Winter 2018-19 snow depth in inches (red), snow water equivalent in inches (dark blue), and mean daily air temperature in degrees Fahrenheit (light blue) from Flattop SNOTEL station in Glacier National Park.

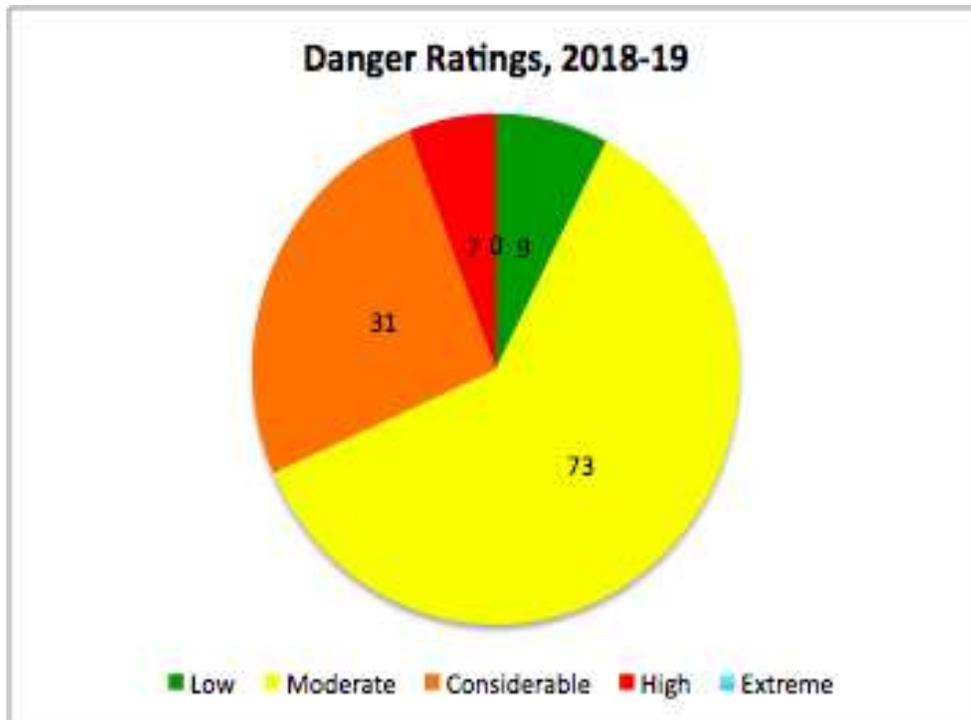


Figure 6: Frequency of danger ratings for the 2018-19 season. The values reflect the highest rating for a given day across the forecast region.

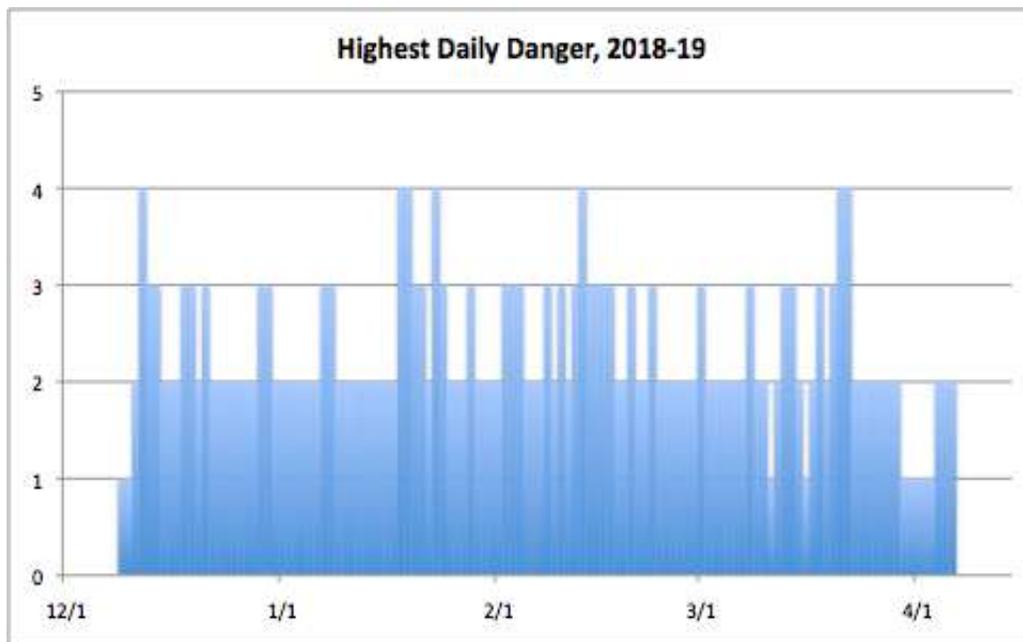


Figure 7: Temporal trend of overall danger ratings (1=Low, 5=Extreme) for the 2018-2019 winter season. The graphic highlights brief periods of more dangerous conditions, with the most persistently dangerous conditions in late January and late March.

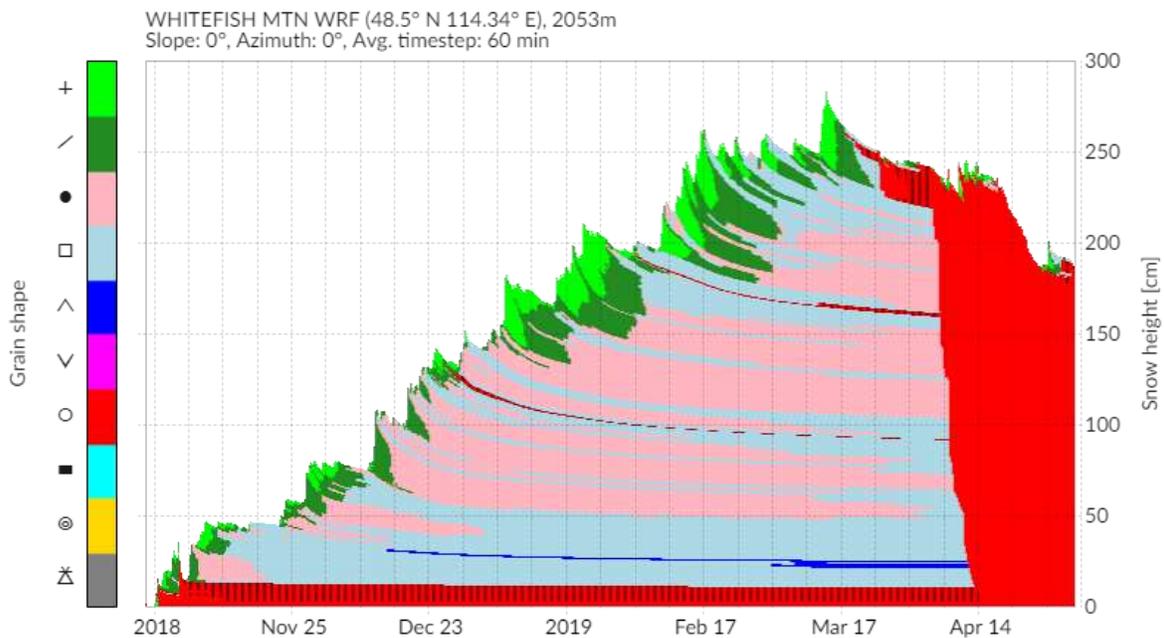


Figure 8: Modeled snowpack structure, using the SNOWPACK model with WRF inputs, for Whitefish Mountain Resort. Of note is the poor basal structure that formed early season and the faceted crust that formed on February 2nd.

November

After an atypically dry fall, a sustained mix of rain and snow marked the end of October and the beginning of November. SNOTEL stations above 6000 feet recorded six to nine inches of precipitation between Oct. 25 and Nov. 5, only 40-50% of which accumulated on the snow pillows. This left a thin blanket of snow coverage at high elevations, with patchy conditions or bare ground at lower elevations. The remainder of the month was drier and colder; only three inches of precipitation fell, nearly all of it snow at the station elevations. Existing snow coverage metamorphosed to weak facets and surface hoar, in some cases over melt-freeze crusts. The FAC posted weekly conditions updates through the month.



Figure 9: Warm, dense snow in early November brought a promising base to the snowpack. However, subsequent dry weather later metamorphosed the bottom of the snowpack into a weak base. Credit: FAC, 11/08/18.

December

The November dry spell continued into December. FAC started publishing daily forecasts on December 9 as the weather shifted to a wetter pattern. We issued the season's first Avalanche Watch on December 11 as a powerful storm loaded early-season facets with a foot or more of new and drifted snow, spurring a natural avalanche cycle. Two days later, a ski patroller at Whitefish Mountain Resort was almost fully buried while conducting avalanche mitigation work.

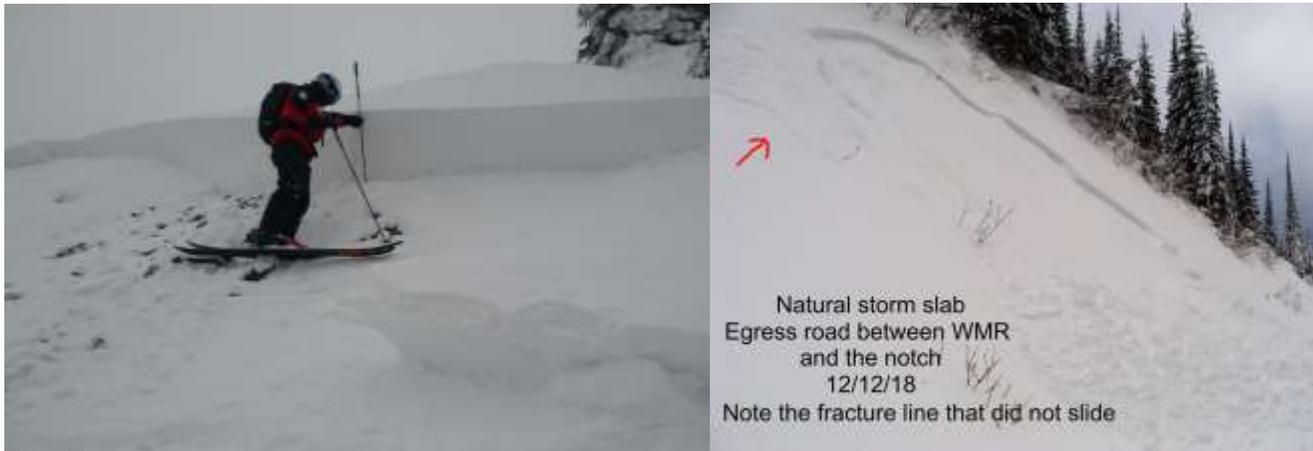


Figure 10: Triggered and natural avalanches that ran the second week in December. The left-hand image shows the crown of a slide triggered during mitigation work at WMR that left a patroller almost fully buried. Credit: WMR Ski Patrol, 12/13/18; FAC, 12/12/18.

The rest of the month saw regular snowfall that gradually thickened slabs over basal weak layers. A storm that swept through the region December 18-20 did not generate much natural avalanche activity, though we received reports of several remotely triggered slides. Persistent slabs grew less sensitive to human triggering during a week or so of benign weather. The danger ramped up again Dec. 28-30 as a more powerful storm hit the area with strong winds and 1-1.5" of SWE in 24 hours. This brought an uptick in instabilities and a few avalanches that failed on the early-season weak layers. The danger quickly dropped to Moderate for New Year's Eve. Despite the storms, the snowpack at low and mid elevations remained thin, forcing FAC staff and winter recreationists to hike trails or force their way through long stretches of brush to reach a seasonal snowpack.



Figure 11: A storm at the end of the December Holiday week brought strong winds, a foot or more of new snow, and reactive slabs near ridges. Credit: FAC, 12/28/18.



Figure 12: Though a storm just before New Years produced a cycle of storm slabs, a few slides appeared to break on facets that formed earlier in December, like these on Mt. Cameahwait in the Flathead Range. Credit: BNSF Avalanche Safety, 12/31/18.

January

The stormy pattern extended well into January, with the upper-elevation SNOTELs recording three to five inches of SWE in the first 10 days of the month and the snowpack reaching 88-99 percent of median at higher elevations by January 10. The primary avalanche concerns during these 10 days were fresh wind slabs and the lingering potential for triggering persistent slabs, with two days at Considerable danger and the rest at Moderate. The season's two most serious avalanche accidents occurred on January 5. A snow biker barely survived a fall down a rock face and a full burial after a cornice collapsed beneath him in the Swan Range. On the same day, a snowmobiler was fully buried and killed in a very large hard slab avalanche near Teton Peak on the Rocky Mountain Front, southeast of the FAC forecast region.



Figure 13: Two images of the surface hoar that formed at mid-elevations in mid-January. Credit: FAC, 1/13 and 1/15/19

Then the snowfall petered out. A classic mid-winter high pressure system put loose wet avalanches on the problem list before inversions developed. The avalanche danger dropped to Low by January 16 as triggering deeply buried persistent weak layers became unlikely. However, a buffet of new persistent weak layers was developing under the inversions, most prominently at mid-elevations. When a storm on January 17-19 buried these layers, the FAC issued a Special Avalanche Bulletin to highlight the unusual and dangerous conditions. The danger ratings spiked to Considerable and High. People reported natural and triggered slides as the storm continued, and the danger reached High again at mid-elevations on January 23. Forecasters nicknamed this ring of surface hoar “The Moat,” and the easily-triggered slabs there “Gators.” The Gators in the Moat snapped their jaws through the end of the month with continued human triggered slides, though we had no reports of near-misses or incidents.

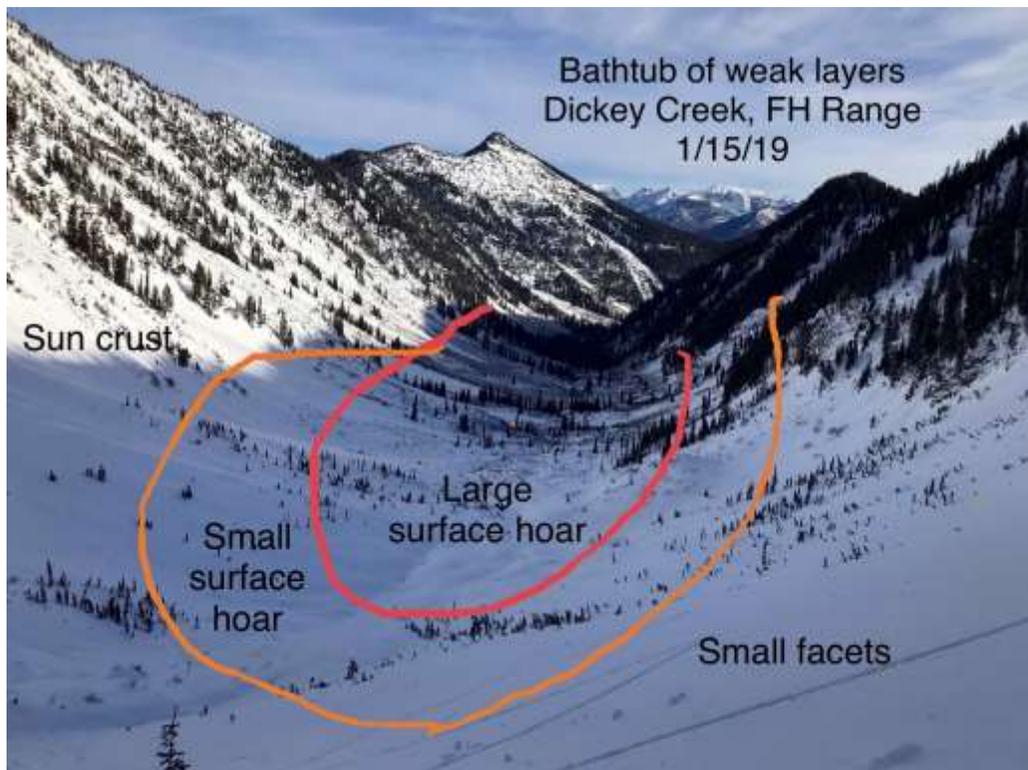


Figure 14: This photo from the Flathead range depicts how various weak layers formed in mid-January formed a moat which had to be crossed to reach upper elevation terrain. Credit: FAC, 1/15/19

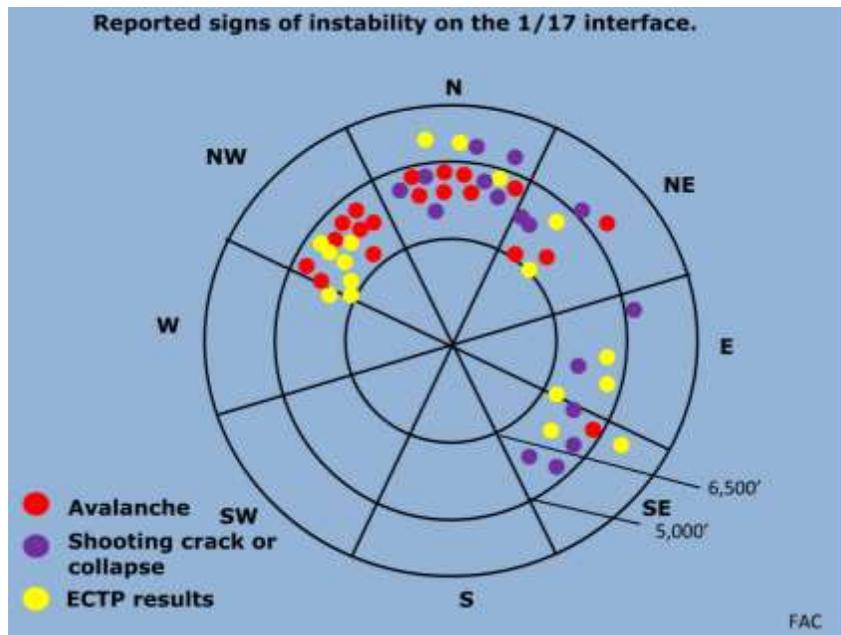


Figure 15: An aspect/ elevation rose that summarizes avalanche activity and signs of instability on the mid-January persistent weak layers. It shows the problem was concentrated in a mid-elevation moat on shady aspects. Credit: FAC, 1/30/19

February

On February 2 – Groundhog Day - temperatures spiked into the mid 30s before a dramatic blast of arctic air swept over the region. Temperatures plummeted below zero in a matter of hours. The crust that formed on the snow surface extended to roughly 6200 feet elevation on shady aspects, and higher on sunny aspects. It was promptly buried by six to ten inches of snow. The crust sealed the Gators in the Moat with icy, refrozen snow that limited human triggering on the mid-January weak layers. But the crust and faceted snow around the Groundhog Day crust created a new failure plane that would reappear the rest of the season.



Figure 16: One example of the Groundhog Day crust, this one from Elk Mountain in Glacier National Park. Credit: FAC 2/5/19

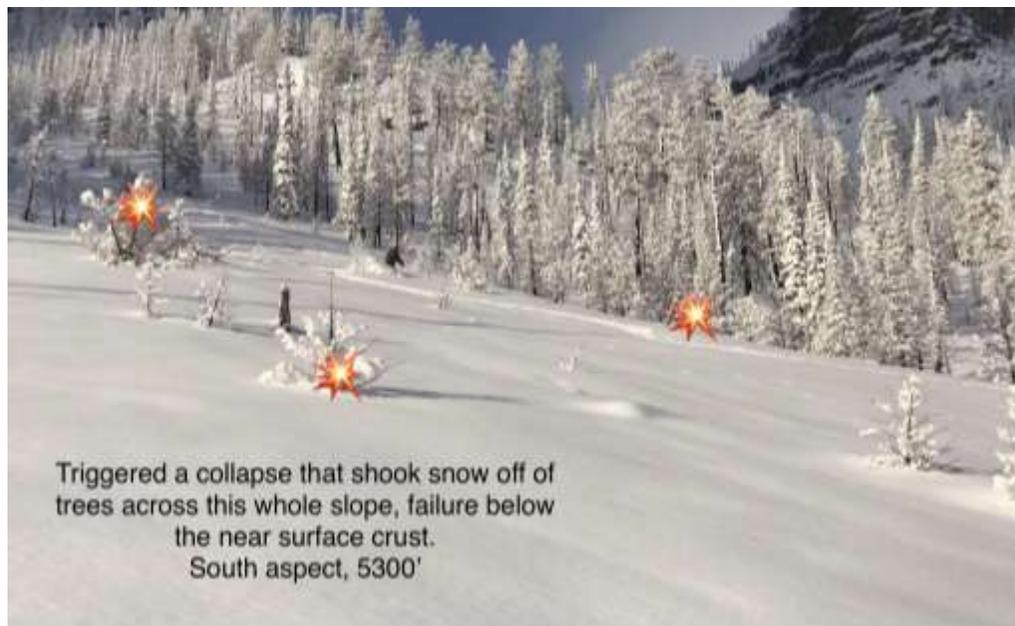


Figure 17: The Groundhog Day crust showed signs of instability shortly after it was buried. Credit: FAC, 2/6/19.

A mid-February storm cycle culminated in High Danger and an Avalanche Warning on February 13. The loading produced a widespread natural cycle of soft slab avalanches breaking on mid-storm layers and the Groundhog Day crust. Less than a week later, more snowfall and gusty northerly winds thickened slabs above the Groundhog Day crust/ facets, and a string of human-triggered avalanches, near-misses, and accidents ensued. In the most serious, a snowboarder escaped unharmed after triggering a very large, hard slab avalanche while ascending a steep, southerly slope near Red Meadow Pass in the Whitefish Range. The slide broke on facets above the Groundhog Day crust.



Figure 18: A mid-February storm produced an avalanche cycle that disrupted transportation in the Middle Fork of the Flathead. Credit: FAC, 2/14/19.



Figure 19: The mid-February storm was generous to Northwest Montana. Credit: FAC, 2/14/19.



Figure 20: A snowboarder triggered this large avalanche on Feb. 20, one of two incidents that occurred that day. The crown averaged four feet deep and the rider escaped uninjured. Credit: FAC, 2/21/19.

The rest of the month saw more episodes of Arctic air spilling over the Continental Divide, sometimes producing very strong northeasterly winds that raked normally sheltered terrain. While weather like this is not unusual in the Flathead Valley, it was unusual to see northeasterly flow dominating the weather pattern, unbroken by warmer southwest flow for nearly five weeks. FAC forecasters found it difficult to predict the extent and timing of northerly and easterly winds, and the lack of automated winds sensors in the Flathead and Swan Ranges often left us driving highways to visually check which slopes had snow blown from the trees and were thus wind-affected. The bitter cold often posed a danger in and of itself. However, cold air entrenched in the valley also contributed to deep accumulations of low-density snow as small doses of moisture intruded into the region. Increasing snow depths at lower elevations made for straightforward access and quality riding conditions. The avalanche danger cycled between Low, Moderate, and Considerable as the low-density snow and subsequent wind events formed loose dry and wind slab concerns. Persistent weak layers grew dormant as the cold and relatively minor loading pattern

carried on. In the lulls between pulses of low-density snow and wind transport, there were several windows of generally stable conditions and great riding.

March

The unusually cold weather prevailed through the first week of March. A round of more typical southwesterly flow and winds bumped the danger to Considerable on March 8. A few days later, the southwesterly flow brought 10-14 inches of snow and a cycle of small natural and triggered soft slab avalanches. The instability diminished quickly as a ridge of high pressure built over the forecast region. The focus shifted to wet snow avalanche concerns, and FAC forecasters expected a cycle of small to large wet loose avalanches running on the surface. FAC Director Zach Guy even proclaimed the week ahead "Recovery Week" for FAC staff to catch up on sleep and projects.

It wasn't to be. As temperatures soared higher than expected through the next week, the area saw the season's most widespread and destructive avalanches which turned out to be larger than expected as they gouged into the weak snow left by February's cold weather. These slides ran full track, dumping trees and piles of very dense debris across groomed snowmobile trails. As mountain temperatures spiked near 60 degrees with poor overnight freezes, a cycle of very large wet slab avalanches followed, many breaking on the Groundhog Day crust/ facets or on weak layers at the ground. Many paths produced repeated wet avalanches as generations of the entire winter's snowpack came unglued. Glide cracks opened, and some failed as catastrophic avalanches. The prolonged warming and extensive avalanching prompted the FAC to issue two days of High danger and an Avalanche Warning on March 21 before clouds and colder temperatures put an end to the cycle. We received only one report of a near-miss during the cycle: a group of inbound snowboarders at Whitefish Mountain Resort triggered a large wet slab while riding in closed terrain.

Wet snow avalanche concerns lasted through the end of March, mostly because cloudy weather limited overnight refreezes. The focus swung to northerly slopes where greenhouse effects and rain wet the snow that had remained dry during the previous week's solar-induced warming.

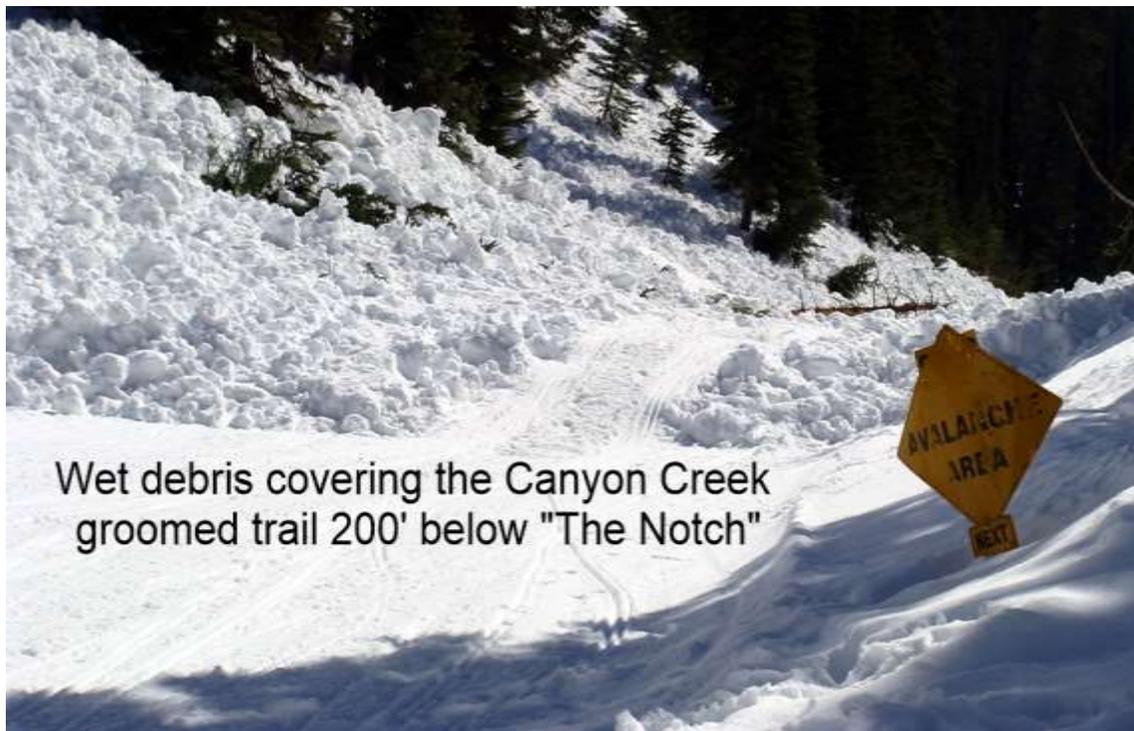


Figure 21: When the five-week cold spell ended and temperatures warmed to seasonal values, a widespread and destructive wet snow avalanche cycle ensued. Credit: FAC, 3/22/19.



Figure 22: In the only reported incident during the March wet snow avalanche cycle, a party of snowboarders in a closed area triggered a wet slab avalanche in a closed area at WMR. The slope had been mitigated with explosives the day before. The slab broke on the Groundhog Day crust. Credit: WMR, 3/21/19.

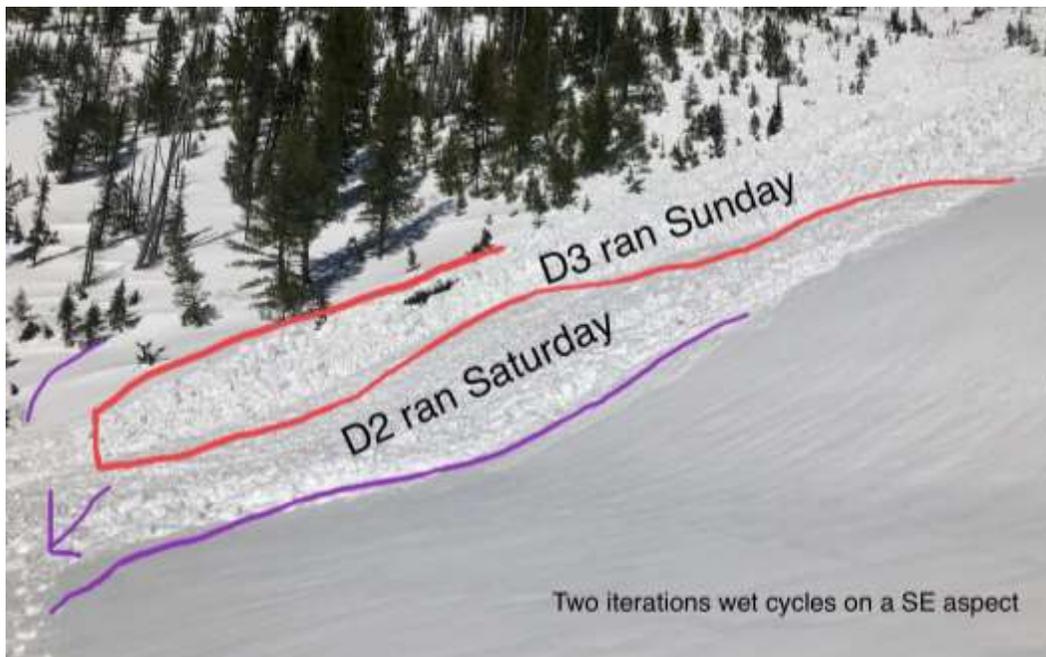


Figure 23: Because of the prolonged warm weather, some paths saw multiple avalanches as deeper layers in the snowpack became wet and unstable. Credit: FAC, 3/18/19.

April

By April 1, the snowpack at upper elevation SNOTELs had dropped to 74-83% of median, thanks to the mostly dry conditions that had ensued since mid-February. The weather turned wetter, with regular rain that washed away much of the low-elevation snowpack. The storm track favored the Swan Range, where nearly 10 inches of SWE accumulated by April 21. Other areas saw five to six inches of SWE, most falling as snow at upper elevations. Sadly, warm temperatures accompanied the precipitation. With poor to no refreezes and new snow rapidly turning to mush, many found their corn- and powder-riding dreams dashed until a shot of cold weather at the end of the month. During the first week of April, when FAC was still operating, the avalanche danger remained Low or Moderate, with wet snow and storm snow avalanche problems the primary concerns. Before a ridge of high pressure built the third week in April, the upper-elevation snowpack peaked at 83-96% of median.

Incidents

In a perfect world, this section would be blank because we had no near-misses, incidents, or accidents to report. That's not the case this year, and may never be. We include links to accident reports that document the snowpack and weather leading up to the incident, the events leading up to rider(s) getting caught, rescue efforts, and potential lessons. Our aim is to objectively document what happened when things went wrong in hopes readers will learn lessons to keep things from going wrong for them. Read one or two reports, imagine yourself in similar circumstances, and consider what you might do differently to avoid a similar incident. Being geeks, we distinguish between near-misses, incidents and accidents in our data; simply read these categories as grading from "Whoa, that was close!" to life-threatening or deadly.

Over the course of the winter, the FAC recorded eight near-misses or accidents, in which seven people were caught and carried. This tally includes all of the accidents that were reported to us by members of the involved party and/or that we investigated to confirm details. Undoubtedly, there are other near-misses or accidents that go unreported. Thank you to all of the groups that contributed to learning opportunities by sharing.

The most serious accident in the forecast region occurred January 5; [a cornice collapsed beneath a snowbiker standing on a ridge in the Swan Range](#). The rider fell off the ridge, down a cliff, and came to a stop fully buried by the debris from the cornice and an avalanche triggered by the falling cornice (Figure 24). His partners dug him out, and Two Bear Air winched him from the scene. He is still recovering from his life-threatening injuries.



Figure 24: A view of the Jan. 5, 2019 accident site on Spring Slide Mountain. The cornice broke in the saddle in the top center of the image, triggered a slab on the snowfield below, and left the rider buried below the face. Credit: Two Bear Air, 1/5/19.

On the same day, [a snowmobiler was killed in a very large, hard slab avalanche near Teton Peak](#) on the Rocky Mountain Front (Figure 25). He was fully buried by the slide, while watching a rider higher on the slope. The victim was not wearing a beacon. The other rider who triggered the slide was not buried and survived with relatively minor injuries. Although the accident site is outside the FAC's forecast region, FAC staff visited the site and issued a report at the request of the local SAR team. In mid-April, the same area saw a second incident; [a skier on a nearby peak was uninjured after he triggered and was carried in a large avalanche](#).

No riders suffered serious injuries in the season's other incidents. In December, [a ski patroller triggered a hard slab while ski cutting](#) at Whitefish Mountain Resort (WMR). Although it left him almost fully buried, a quick response from his well-trained partners prevented more than a scare. In mid-January, a snowboarder was [caught and carried in a small wind slab](#) while climbing a steep slope in the Flathead Range. The rider recognized that the combination of solo travel and traveling above consequential terrain could have resulted in a different outcome. In February, another snowboarder triggered a very large persistent slab in the Whitefish Range, also while ascending. The 3-foot crown broke above him and the debris ran over a thousand feet, snapping trees along the way. The solo rider was fortunate to escape injury or burial by getting hung up in some trees near the start zone. [In the account he posted on the FAC website](#), he described ignoring numerous warning signs of danger. In another February near-miss, a skier in the backcountry adjacent to WMR [triggered a large persistent slab avalanche](#) that broke just below his skis in a steep, rocky chute above the Half Moon slide. In March, a snowboarder triggered [a large, wet slab avalanche](#) in a closed run at WMR. Fortunately, no one in his group was caught and the destructive wet debris did not impact anyone else in the runout.



Figure 25: Looking up at the crown of the Jan. 5, 2019 fatal avalanche near Teton Peak. The crown extends out of the frame to the right. A rider triggered the slide midway between the small trees and the ridge. Credit: FAC, 1/6/19.

Half of the season's incidents occurred in the Whitefish Range, three of them within or adjacent to the Whitefish Mountain Resort. No incidents were reported from Glacier National Park or by recreationists staying overnight at rental cabins or yurts. Half of the incidents also involved motorized recreation – snowmobiles, snow bikes, or riders who used snowmobiles to access terrain.

A review of reported near-misses, incidents, and accidents over the past three winters shows similar patterns. Most reported events have occurred in the Whitefish Range (Figure 27), because it is the most accessible terrain. The most common setting has been the backcountry, which we define as terrain accessed from trailhead or road (Figure

28). If we include Hybrid Riders (using a snowmobile or snow bike to access terrain before skiing or riding) amongst motorized users, then incidents are split evenly between foot-powered and motorized users (Figure 29). A disturbing number of incidents involve solo travel - three this year, and two last season, including a fatality.

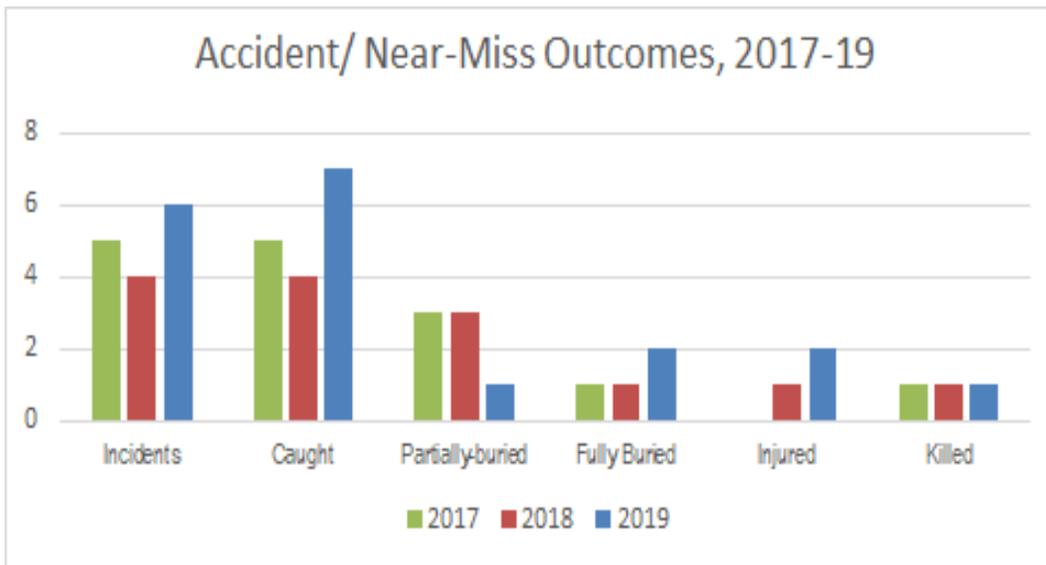


Figure 26: Outcomes for reported near-misses and accidents, winters 2017-19.

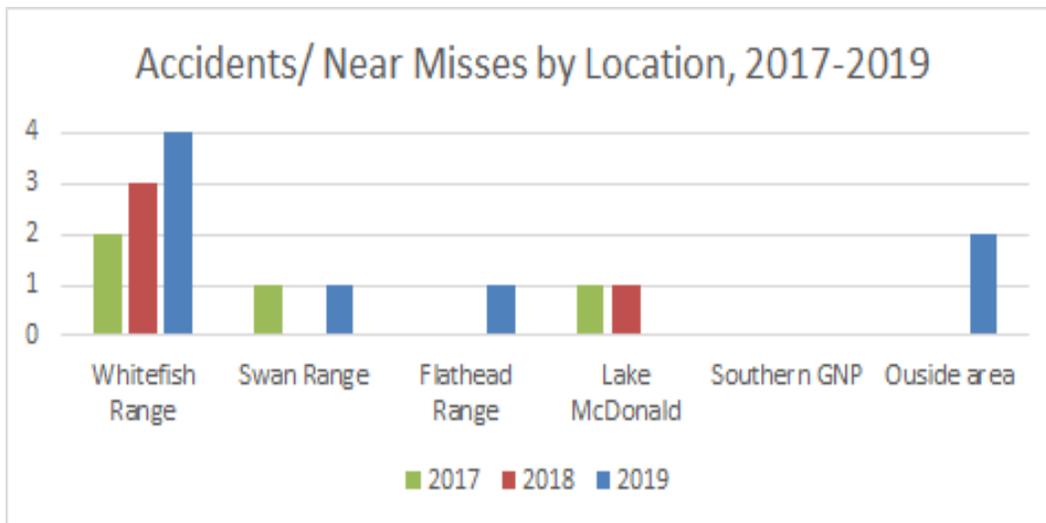
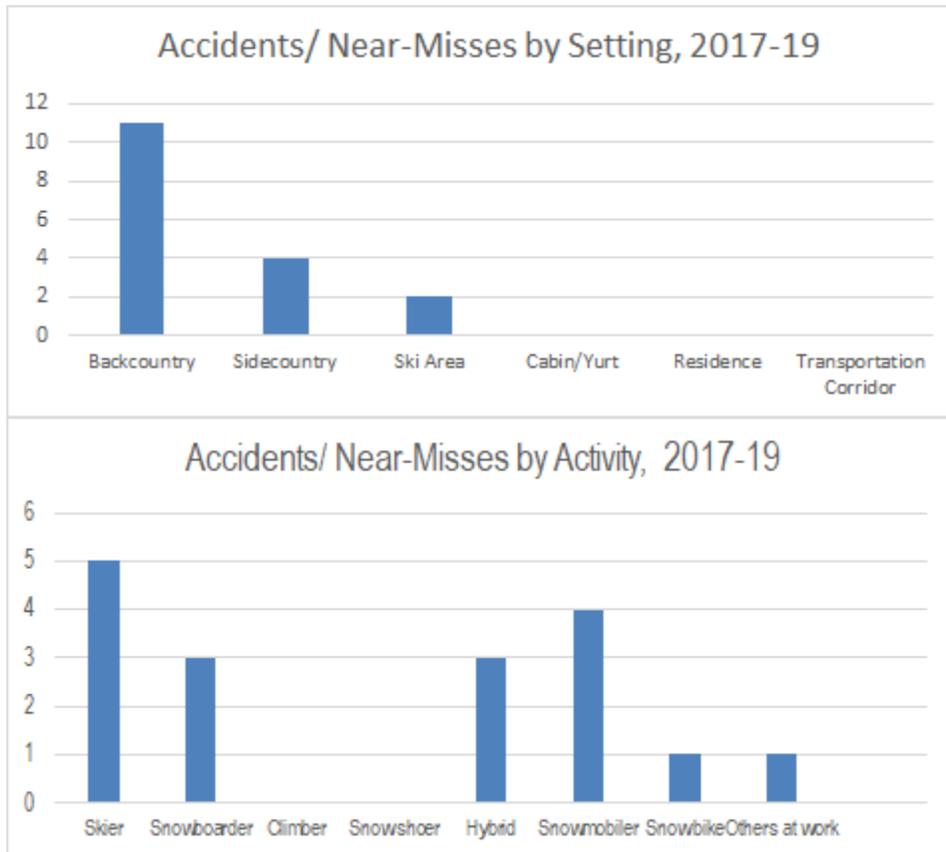


Figure 27: Reported near-misses and accidents by location, winters 2017-19.



Figures 28 and 29: Setting and activity for reported near-misses and accidents for the 2017-19 winters. The first four activity categories encompass non-motorized users; the second four, motorized users.

By the end of April, the U.S. had seen 25 avalanche fatalities, three of them occurring in Montana. We send our sincere condolences to all the family and friends of those killed in avalanches this year, as well as a big thank-you to the many hundreds of people who participated in rescues, attempted rescues, and body recoveries.

Education

The FAC hosted a large variety of classes this year, 46 in total. These included the annual snow and avalanche workshop, 22 avalanche awareness classes and five Introduction to Avalanches classes. We presented to 1757 students, 700 of which were under 21 years old. We diversified student demographics through several womens-specific and motorized-specific courses, and the addition of new youth programming. Many of these classes were held at various retailers and businesses throughout northwest Montana. The FAC would like to thank those entities for their support in hosting these very valuable classes. Other classes are listed below in Table 2.

Youth (school-aged) programs for Flathead Valley Schools and other youth programs grew this year and reached almost 700 total students with 18 youth-specific classes. While the frigid temperatures of February led to the cancellation of a variety of classes, numbers of youth served still increased due to the addition of programs with the entire Whitefish Middle School 8th grade, Salish Kootenai College and Bissell Olney school. Courses provided are coordinated by FOFAC Education Coordinator Jenny Cloutier in conjunction with Flathead National Forest Winter Program at Whitefish Mountain Resort coordinated by Teresa Wenum.

Table 2: List of 2018/2019 education classes provided by FAC staff or instructors affiliated with FAC or FOFAC

Date	Class	Location	City	Attendees	Attendees < 21 y/o
11/3/2018-Saturday	Northern Rockies Avalanche Safety Workshop	O'Shaughnessy	Whitefish	250	20
11/7/2018	General Awareness	Swan Valley Connections	Condon	45	5
11/19/2018	Awareness Instructor Training	Sweetgrass Psychological Services	Whitefish	10	
11/20/2018	General Awareness	Sportsman and Ski Haus	Whitefish	45	5
11/29/2018-	Avalanche Awareness	Rocky Mountain Outfitter	Kalispell	40	3
12/2/2018	FNBP Training	Blacktail	Lakeside	28	
12/06/2018	Avalanche Awareness	Sportsman and Ski Haus	Kalispell	15	2
12/12/2018	GNP Interp Staff Training	WMR	Whitefish	13	
12/13/2018	FVSEF Coach Awareness Talk	Ski Heritage Museum	Whitefish	16	
12/13/2018, 12/15/2018	Introduction to Avalanches (non-motorized) Classroom	Flathead Valley Community College and Whitefish Mountain Resort	Kalispell and Whitefish	26	
12/17/2018	HS Awareness Talk	Glacier HS	Kalispell	28	28
12/18/2018	North Valley SAR	North Valley SAR Building	Columbia Falls	28	
12/20/2018	Motorized Avalanche Awareness	Penco Power Products	Kalispell	26	4
12/27/2018	General Awareness	Stumptown Snowboards	Whitefish	5	
1/3/2019	Avalanche Awareness	Montana Bonfire	Woods Bay	35	5
1/8/2019	Flathead Vo-ag Awareness	Vo-Ag Center	Kalispell and Whitefish	31	30
1/10/2019-Thursday	General Avalanche Awareness	Stonefly Lounge	Coram	30	
1/12/2019	FVSEF Youth Field Day	WMR	Whitefish	45	45
1/11/2019-1/13/2019	Motorized L1	FVCC, Canyon Creek	Kalispell	7	1
1/17/2019, 1/19/2019	Ladies Introduction to Avalanches (non-motorized) Classroom	Flathead Valley Community College and Whitefish Mountain Resort	Kalispell and Whitefish	20	
1/23/2019	General Awareness	Browning Hospital	Browning	18	2
1/24/2019	Name that Tune, NTA	Montana Taphouse	Whitefish	38	2

2/12/2019	Ruder Elementary Assembly	Ruder Elementary	Columbia Falls	104	100
1/29/2019	WLP Youth	Lion Mountain	Whitefish	32	30
1/30/2019	Ladies Awareness	KBC	Kalispell	35	3
1/30/2019	FNF Youth-Fortine	WMR	Whitefish	31	30
1/31/2019	FNF Youth-Elrod	WMR	Whitefish	34	32
1/31/2019 and 2/2/2019	Introduction to Avalanches (motorized)	Flathead Valley Community College and Canyon Creek, Flathead National Forest	Kalispell and Columbia Falls	14	1
2/5/2019	Avalanche Awareness	Browning Hospital	Browning	17	2
2/8/2019	USFS Regional Carnivore Study	HHR	Hungry Horse	9	
2/13/2019	FNF Youth-Peterson	WMR	Whitefish	30	28
2/14/2019	FNF Youth-Hedges	WMR	Whitefish	30	28
2/21/2019	General Awareness	REI	Kalispell	17	1
2/22/2019	Smith Valley School	Smith Valley	Kalispell	90	85
2/23/2019	Salish Kootenai College	WMR	Whitefish	17	15
2/28/2019, 3/2/2019	Introduction to Avalanches (non-motorized) Classroom	Flathead Valley Community College and Whitefish Mountain Resort	Kalispell and Whitefish	18	2
3/5/2019	Olney-Bissell Outdoor Class	Olney-Bissell	Whitefish	6	4
3/6/2019	FNF Youth-Stillwater	Stillwater Christian	Kalispell	30	28
3/11/2019	WFMS	WMR	Whitefish	30	28
3/19/2019	WFMS	WMR	Whitefish	24	22
3/20/2019	WFMS	WMR	Whitefish	17	14
3/21/2019	WFMS	WMR	Whitefish	24	22
3/22/2019	WFMS	WMR	Whitefish	28	26
3/22/2019	Connect Kalispell	Lone Pine	Kalispell	50	6
4/2/2019	Rescue Awareness	Jesco	Kalispell	50	7
4/11/2019	The Scoop on Spring	RMO	Kalispell	21	5



Figure 30: FAC forecaster taking students into the field for hands-on learning.

Table 3: Participant totals of avalanche education component of FAC and Flathead National Forest.

All classes (taught by Friends and Center)	All students	Motorized specific classes	Motorized Users
50	1757	3	47
Students (<21 y/o)	Awareness Classes	Intro. To Avalanches Classes (2-day)	School Classroom Visits
691	19	5	8

Finances

The Flathead Avalanche Center is funded through federal dollars, public and private grants, and community partners. The U.S. Forest Service Region 1, Glacier National Park, Flathead National Forest, and the Montana Department of Fish Wildlife and Parks Recreation Trails Program are the major federal and state contributors. The Friends of the Flathead Avalanche Center (FOFAC) is a 501(c)3 organization that leverages funding through grants, private donations, sponsorships, events, and other fundraising opportunities. FOFAC financially supports the avalanche center by absorbing the costs of website, education programming, and various purchases and travel expenses. The USFS provides additional operational support outside of FAC's budget including office space, administrative support, and resources from other USFS programs.

Table 4: Cash revenue for the Flathead Avalanche Center Winter 2018-2019.

Source	Value (\$)	Details
Forest Service	68,000	Flathead National Forest and U.S. Forest Service Region 1
Glacier National Park	23,000	Glacier National Park for avalanche center operations within GNP and training for GNP staff.
State of Montana	45,000	Montana Department of Fish, Wildlife and Parks (FWP) Recreational Trails Program (RTP) Grant
FOFAC	0	
Total Cash Revenue	136,000	*Note \$20,049 carried over from FOFAC's contribution last year

Table 5: Expenses of the Flathead Avalanche Center Winter 2018-2019.

Expense	Value (\$)	Details
Salary	138,977	Forecaster, pro observer, and educator wages
Vehicles	8,297	Maintenance and fuel for trucks and snowmobiles
Gear & Supplies	8,150	Uniforms, snow safety gear, and office supplies
Training & Travel	1,054	Registration and travel expenses for professional development
Miscellaneous	150	
Total Expenses	156,628	

Table 6: Estimated In-kind contributions Flathead Avalanche Center Winter 2018-2019.

Source	Estimated Value (\$)	Details
Forest Service in-kind	10,000	Vehicles, office space and maintenance, admin, supplies
FOFAC in-kind	5,900	Website development and maintenance, contracting, training, weather stations, and miscellaneous
Total in-kind	15,900	

Observations

The FAC relies heavily on field observations to improve the accuracy and content of our advisory products. Our center strives to improve the quality, frequency, and geographic extent of professional fieldwork within the scope of our resources. FAC professional staff published 209 observations from field visits this season, an increase from 172 field visits last season and 105 the season before. These written observations included numerous annotated photographs each day of avalanche activity and snowpack observations. Additionally, FAC staff produced 80 field videos about conditions and travel advice. Anecdotal feedback from backcountry users showed that videos and photos are welcomed and helpful. Sharing point-specific observations are valuable for making safe travel plans and for illustrating avalanche concerns in our forecasts.



Figure 31: FAC staff and volunteers visiting the site of a large avalanche in the Flathead Range. Credit: FAC, 12/20/18.

We use an observation platform on FAC's website for collecting, maintaining, and sharing all public and professional field observations. The observations page was viewed 35,257 times this season, second in popularity only to the homepage. Avalanche, snowpack, and weather data in the observations page is also databased for analysis, a valuable tool for forecasting and future research.

The Flathead Valley community continues to contribute to our products with a steady flow of valuable observations relating to snow, weather, and avalanches. We published 232 observations crowdsourced from public or professional partners. The public's participation effectively doubles our field reach and substantially improves the quality of our forecasts. This season, we offered gift certificate incentives through FOFAC to encourage public observations. Avalanche centers operate in a world of spatial variability and forecaster uncertainty: public observations are a tremendous value to our operation. Thank you for your observations!

We'd also like to acknowledge several professional operations for their continual data sharing: Ted Steiner and Adam Clark of the BNSF Railway Avalanche Safety Department; Lloyd Morsett and the Whitefish Mountain Resort professional ski patrol. WMR patrol also helps maintain the Big Mountain Weather Station that is owned and operated by FOFAC. We look forward to continued partnerships with these avalanche professionals in the future.

Volunteers

Volunteers for FAC were extremely valuable as field assistants, instructors, and event hosts. Volunteers donated approximately 844 hours of field time towards FAC operations, and FOFAC board members and volunteers contributed 645 hours to avalanche education, outreach, events, and fundraising. Without their efforts much of our work would not be possible. FAC extends our personal gratitude to everyone who donate time towards avalanche safety in the Flathead Valley, and special recognition to all of our field volunteers: Michael Reavis, Jackson George, Brock Bolin, Colin Sibbersen, Lizzy English, Robin Connel, Tyler Johnson, Zach Miller, Jeff Dobroyni, Jess May, Louis Schmidt, George Dangleo, Stephen Ettinger, Karine Malcome, Michael Bestwick, Keith Meehan, James Paetsch, Kevin Freund, Erich Peitzsch, Robert Millspaugh, Jason Griswold, Zach Rutt, David Pfeifer, Mary Nolan, Julie Nissi, Sam Strait, Felicia Ennis, Adam Clark, Lisa Steiner, Kim Weichers, Keegan Zoellner, David Powder Steele, Gaelen Engler, Alissa Lachance, Alan Swanson, Jake Frerk, Deana Dewire, Brittan Elliston, Shane McMillen, and Luke Domenico.

Partnerships

The National Weather Service-Missoula (NWS) continues to be a strong partner, providing valuable support through regular weather forecasts and disseminating avalanche information to the public through warning platforms and social media. Through support from the NWS, we also used snowpack modeling as an additional resource to supplement forecasting and field observations.

Through an interagency agreement with the National Park Service, the FAC provides forecasting resources for Glacier National Park and educational opportunities for their staff in exchange for financial support. Through their valuable support, we have the resources to conduct fieldwork and accident investigations in Glacier National Park, as well as operate as a Type 1 Avalanche Center to produce daily avalanche advisories.

The Flathead Avalanche Center works closely with the National Avalanche Center (NAC) and the American Avalanche Association (AAA). These organizations provide guidance, financial support, and cost-sharing opportunities for website development, warning platform development and weather station products. The FAC collaborates with Avalanche Canada (AvCan) through cross-border observation sharing. Our center also exchanges information and guidance with other U.S. avalanche centers.

U.S. Geological Survey Northern Rocky Mountain Science Center (USGS) partners with the FAC through their research program. The USGS shares snow science research resources and maintains a number of useful mountain weather stations. We plan to continue working with the USGS and their research component to improve our forecasting operations.

The FAC also partnered with Flathead Valley Community College (FVCC) for four Introduction to Avalanches classes, including one motorized-specific Level 1. The FVCC provided instructor compensation, logistical support, and classroom space. We intend to continue this valuable collaboration.

Two local snow safety programs continue to be invaluable assets. The BNSF Railway Avalanche Safety Department shares field observations of the John F. Stevens Canyon corridor while maintaining several remote weather stations in the area. The Whitefish Mountain Resort Ski Patrol assists with maintenance of FOFAC's Big Mountain Summit weather station, shares observations, and provides access to FAC personnel for education venues and field observations. Their snowpack and avalanche observations are an asset to our forecasting operations.

The FAC cooperates with local businesses for education venues, financial contributions to FOFAC, and other operational needs. Rocky Mountain Outfitter supported staffing gear needs and provided a venue for several

courses. Sweetgrass Psychological Services, the Ski Heritage Museum, Penco Power Products, Jesco Marine and Power Sports, Sportsman & Ski Haus, Stumptown Snowboards, Kalispell Brewing Company, REI, Montana Tap House, and the Stonefly Lounge all hosted avalanche classes. These local businesses also offered incentives such as discounts on avalanche safety gear or raffles for class attendance. The generous support of these community businesses continues to foster a thriving and educated backcountry community.

Both FOFAC and FAC increased outreach to local youth by partnering with schools throughout the Flathead Valley to provide snow and avalanche education to over 690 students under the age of 21. A partnership with the Whitefish Legacy Partners connected FAC staff with 6th-grade students in Whitefish for field days focused on rescue skills and snow metamorphosis. The Flathead Valley Ski Education Foundation and Whitefish Freestyle partnership also grew in scope this season with local racers, coaches and parents attending FAC awareness talks and custom field courses.

The FAC also partnered with Flathead County Search and Rescue (FCSAR) and the Flathead Nordic Backcountry Patrol (FNBP), providing expertise and several field training sessions.

Friends of the Flathead Avalanche Center (provided by Jenny Cloutier)

FOFAC volunteers invested substantial time in continuing the organization's mission to financially support the Flathead Avalanche Center and save lives through avalanche education. A variety of event income, grants, and private donations came together to make for the organization's most successful year financially. This year's education efforts were the organization's most productive year since its inception, with more courses than ever before despite 12 courses being cancelled due to inhospitable weather.

The Northern Rockies Snow and Avalanche Workshop (NRSAW) is FOFAC's largest event of the year and fits perfectly with the group's mission. This educational event provides the community with lectures from renowned experts in the snow science field and raises considerable funds for future educational offerings. Over 250 attendees gathered at the O'Shaughnessy Center in Whitefish for this day long learning opportunity that generated over \$8,000.

In addition to the Avalanche Safety Workshop, FOFAC participated in several other successful fundraising events. The Great Fish Community Challenge, sponsored by the Whitefish Community Foundation (WCF), helped raise over \$35,000. FOFAC also had outstanding community support through our annual Snowball held at the Great Northern Bar as well as donations from private individuals and businesses.

FOFAC was very successful this season in supporting the Flathead Avalanche Center's increased education and outreach to the winter sports community. Our program offerings continue to grow, with FAC reaching 1,757 class participants this year. Of those students, 691 were under the age of 21.

Highlights of the youth education season included new partnerships with the Salish Kootenai College and the Whitefish Middle School 8th grade. Programs with the Flathead Valley Ski Education Foundation and the Whitefish Mountain Resort Freestyle Ski and Snowboard Team continued. The Snow Safety Educational Trunk visited 10 classrooms this season. This trunk, available for check out through the Flathead National Forest, provides local educators with various lessons and materials to help students better understand the mechanics of avalanches and safe travel in avalanche terrain.

On the motorized front, FOFAC provided two free awareness courses this season and the Motorized Introduction to Avalanches course and Motorized Level 1, offered in conjunction with FVCC, both saw full enrollment. FOFAC also teamed up with Jesco Marine and Power Sports to produce a Rescue Awareness day.

All these courses and community outreach would not be possible without the tireless work of the FOFAC Board of Directors. This volunteer group volunteers hundreds of hours a year to make all of this programming possible.

Current Board of Directors:

President - Dow Powell
Vice President – Ronald Bachrach
Secretary – Cheri DeBeau
Treasurer - Roland Frey
Zach Miller
Becky Smith-Powell
Lloyd Morsett
Felicia Ennis
Ed Visnovske
Ben Parsons – In Memoriam

FOFAC volunteers and lone staff member invested substantial time in continuing the mission of financial support of FAC and delivering lifesaving avalanche education and resource opportunities for Northwest Montana. For more information about FOFAC please email friends@flatheadavalanche.org.



Figure 32: Youth practicing avalanche rescue skills at Whitefish Mountain Resort, one of many classes organized through FOFAC.

Table 4: Donation structure and number of supporters for FOFAC for 2018-2019 season.

Extreme - Sponsors who donated more than \$500

			Dow & Becky Smith-Powell
			Felicia Ennis
			In memory of Jon Torgerson
			Lizzy English
		AGL Foundation	Robert Novy
		Don & Colleen Scharfe	Tom & Teresa Quinn

High - Sponsors who donated between \$250 and \$499

Alan Myers-Davis	In memory of Jack Marciel	Patricia Ogle	Seth Carbonari
Annika Silverman	Joseph Kagol	Peter Byl	Whistling Andy
Danielle Coffman	Kim & Jan Richards	Richard & Cheryl Gordon	Whitefish Mountain Resort
Glacier Bank	National Ski Patrol	Sara Boilen	

Considerable - Sponsors who donated between \$100 and \$249

Ameriprise Financial	Grant Hughes	Ken & Karen McFadden	Roland Frey
Anna Eastley	Grete Gansauer	Kent & Kim Taylor	Ron Bachrach
Bill Sugars	James & Catherine Heitel	Kim Givler	Stephen Miller
Bonfire Restaurant	Jane Wheeler	Kramer Family Fund	Sydney Lillard
Cheri DuBeau Carlson	Jeremy Rossman	Linda Cloutier	Tamarack Foundation
David Simpson	Jim Watson & Carol Bibler	Linda Maetzold	Tim Strand
Erin & Noah Bodman	Joe Grabowski	Marc & Kelly O'Brien	Tucker and Martin, Inc.
Fred & Sarah Jones	Josephine Parsons	Mark Dundas	Whitefish Freestyle Team
Gabriel Dillon	Karen Perser	Matt Brake	Will & Leslie Hunt
Gary Danczyk	Kellsey Perkins	North Valley Hospital Foundation	Wink & Joy Jordan
Glacier Guides & Montana Raft Co			

Moderate - Sponsors who donated between \$50 and \$99

Adam & Aubrey Clark	Keagan Zoellner	Morgan Sadler	Tess Coxen
Allyson Hakala	Kenny Gasch	Pete Francisco	Tim & Allison Good
David & Linda Grady	Lisa Slagle	Randy Gayner	Timothy Haymond
Don & Sue Lewis	Lloyd & Stephanie Morsett	Rebecca Briber	Travis Berro
Durae Belcer	Louis Schmidt	Sarah Cobler	Trevor & Kacy Howard
Jeremiah Martin	Martha Hunt	Terrie Palmer	Zaneray Group

Low - Sponsors who donated between \$25 and \$49

Alice Ford	Clare Manzel	Jen & Jerry Croskrey	Peter & Michelle Edlund
Becca Wheeler	Clint Keyser	Julie Sebby	Peter Browne
Beth Sobba	Dave Ruoff	Keith Meehan	Rebecca Powell
Brigid Fray	Genevieve Thomas	Lisa Jones	Richard & Glenda Gehri
Burket & Claire Kniveton	Gordon Johnson	Megan Eandi	William Thomas
Chantel Schieffer	Holly & Craig Hemp	Nathan Russell	Zach Guy
Chris Gearhart	Jane Kollmeyer		

The Future of the Flathead Avalanche Center

2019/2020 Goals:

- Improve the accuracy and quality of avalanche advisories and expand public outreach through media and public engagement.
- Maintain income sources by honoring the terms of grants and agreements and being fiscally responsible.
- Continue to work with FOFAC to develop a sustainable education model through increased fundraising and structuring a robust network of volunteers and staffing.
- Continued training and staffing of the director, lead avalanche forecaster, avalanche specialists, and professional observers.
- Continue to organize training opportunities for educators, field assistants, and industry professionals in the fall, including the Northern Rockies Snow and Avalanche Workshop, a pro development workshop, and on-field training sessions.
- Continue to expand education opportunities to meet increasing demands for courses such as Avalanche Awareness, Introduction to Avalanches, Level 1, and motorized specific classes.
- Continue collaborations with existing partners while seeking new opportunities that augment our mission.
- Continue to keep stride with advancing web and mobile technology by partnering with the National Avalanche Center on mobile app development and shared website platform initiatives.
- Respond when an incident occurs and work closely with all rescue agencies and personnel involved. Prepare a timely report on incident.
- Install a wind sensor on Mt. Aeneas and a weather station on Tunnel Ridge to fill much-needed data gaps in the Swan and Flathead Ranges.
- Purchase replacements for aging FAC snowmobiles.

FAC would like to extend our gratitude to all of the partners, collaborators, volunteers, supporters, and USDA Forest Service personnel who helped FAC produce advisories, teach classes, provide observations, and generally help in disseminating avalanche information. Thank You!

Any questions regarding this report or the Flathead Avalanche Center can be directed to Zach Guy, 406.407.1394 or zach@flatheadavalanche.org.

References

NRCS (National Resources Conservation Service). 2019. Snow Telemetry (SNOTEL) and Snow Course Data and Products. <https://www.wcc.nrcs.usda.gov/snow/>. Last accessed: May 17, 2019.