

Northwest Weather and Avalanche Center



2008-2009 Annual Report

Report prepared by Mark Moore, Kenny Kramer and Garth Ferber



A partnership between the USDA Forest Service, Washington State Parks and Recreation Commission, National Park Service, National Weather Service, Pacific Northwest Ski Area Association, Ski Washington, Washington State Department of Transportation, Washington State Snowpark and Snowmobile Programs, USDA Forest Service Fee Demo programs, Title II RAC programs, Ski Schools, Friends of the Avalanche Center and others.



United States
Department of
Agriculture



Forest Service
Pacific
Northwest
Region

Cover Photo credits:

Long propagating natural slab avalanche on a steep NE exposure slope at around the 5200 ft elevation on Table Mt near Mt Baker, WA. Photo was taken in the early morning hours on March 21, 2009, courtesy Mt Baker Ski Area. Moderate to heavy rain or snow during the 48 hours prior to the slide added significant weight to several buried weak layers formed during the previous week (facets or surface hoar). On the day before the event, the NWAC automated weather station recorded over an inch of new water equivalent which resulted in 6 inches of very wet heavy snow at the base of the ski area (4400 ft) at rising freezing levels. On the day that the slide released (the slide released overnight on the 20th), another 1.5+ inches of water and an additional 9 inches of snow were received, with the step type appearance to the slide possibly indicating a small surface release triggering the deeper (2-4 ft+) slab pictured. The avalanche forecast for the day of the release called for high danger above 6000 feet and considerable below, and mentioned that “*small slides initiating within the most recently deposited snow may still trigger some isolated larger releases*”. Note the secondary and lower slab releases that may have been triggered by the larger slide that originated higher on Table Mt.

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A MESSAGE FROM THE DIRECTOR

After an exciting December and early January, an unusual weather break in mid-late January and February, and an intensely stormy March into early April, the past very interesting avalanche and mountain weather forecast season is slowly winding down in the Northwest as this annual report goes to press. Snow pack depths in most NW mountain locations closely followed the weak La Niña seasonal weather trends, rising to above normal by late December, dropping to below normal in February, and rising to above normal in March into early April, with mostly above normal snowdepths continuing into early May. These trends in climatological snow depths are presented in the seasonal weather, snowpack and avalanche review below, as are summary charts for selected seasonal weather parameters.

While this last winter season was challenging both meteorologically and snowpack wise, it was also difficult avalanche accident wise, not only for the NW but for the United States and North America as well. As of early May, the three avalanche fatalities recorded in the Northwest (two in WA and one in OR) are slightly above the running 10-year average of 2.9/year, while the 54 fatalities for North America are approaching the modern day (post 1950) record of 58 set in 2002/03. As in many of the past winter seasons, these large national and international tolls are being driven in large part by snowmobiler incidents that account for ~73% and ~57% of the Canadian and US totals, respectively (65% overall). In the Northwest, one (33%) of the avalanche fatalities this past year was snowmobile related, while one was from back country skiing (NE Oregon) and one was attributed to a “roofalanche” (an avalanche released from a roof, catching, trapping and ultimately killing an elderly woman out shoveling her walk in Rockford near Spokane in eastern Washington). Details about these incidents are available on the NWAC web site, with some summary descriptions contained in the seasonal summary that follows.

In other noteworthy news unfolding during this past season, a new web site to display NWAC generated products and services is being developed in a joint venture with the Friends of the Avalanche Center who will administer the site. The site is currently undergoing final development, testing and content migration, with operational status expected by the fall of 2009. The new web site is being developed using Django code by Web Collective Cooperative of Seattle. When completed the newly enhanced site should offer users a more user-friendly and more graphical web experience as they collect weather and snowpack information. It should sport much improved site navigation and easier to use forecasts and data displays, along with avalanche danger tables that show the “danger at a glance” for specific regions, just to name a few of the major enhancements and improvements. Being administered and maintained by the FOAC, operating plans include use of on-site advertising for funding support. Meanwhile, the NWAC will continue to provide much of the data, forecast and avalanche/weather/snowpack content, all of which should be more interactive including future plans for more easily retrievable and user specified historical weather station data and archived forecasts.

Finally, as has become an increasingly common theme over the recent past, funding challenges abound for the NWAC. In these increasingly difficult economic times, neither federal nor state nor private monies appear readily available to fully fund the NWAC next year. Although NWAC operations have already been finely honed to the leanest program possible short of

either a shorter season or fewer days of operation each week, forecast staff are diligently working to ensure that the most streamlined and most effective operations continue into the future. At press time for this report, increasing grant support (Title II/RAC) for the Center's operation are ongoing. However despite the best of efforts, the funding issues faced today will more than likely arise to a greater degree in the future unless a stable, long term funding solution is developed. To address this need for steady, established funding, several WA state "surcharge tax" Bills were proposed by the Washington State Legislature during the past year. Unfortunately these were met with resistance by the more heavily impacted user groups and were subsequently dropped by the Bill sponsors in the current session. Although the Forest Service (in response to the varied funding efforts that have been made by WA state, FOAC and private groups) has agreed to continue administering the program for one more year in order to allow for further evolution of the perennially sought "long term, stable" funding solution, it remains uncertain as to how such annual monies will be made available in the future. —Mark Moore, Director (June 2009)

NWAC MISSION STATEMENT

To reduce the impacts of adverse mountain weather and avalanches on recreation, industry and transportation in Washington and northern Oregon through data collection, forecasting and education. This promotion of public safety is accomplished by providing cooperating agencies and the public with:

- * Mountain Weather Data
- * Mountain Weather Forecasts
- * Avalanche Forecasts
- * Education
- * Applied Research and Technology

How to get NWAC mountain weather and avalanche forecast information:

<http://www.nwac.us>

206-526-6677 (Seattle Hotline)

503-808-2400 (Portland Hotline)

How to reach us for other information:

Northwest Weather and Avalanche Center

7600 Sandpoint Way NE

Seattle, WA 98115

206-526-6164 (office unlisted); 206-526-4666 (messages)

nwac.sew@noaa.gov

OPERATIONS SUMMARY

Forecast staff at the NWAC are employed by the USDA-Forest Service from mid September to mid-June. The following is a summary of the main NWAC tasks during the three distinct parts of our season:

Fall Season (mid September to mid November):

- * Plan for upcoming season, discuss priorities and implement changes for better operation and enhanced products.
- * Prepare cooperator agreements and administer budgetary items as needed (ongoing through season)
- * Attend and provide input and/or instruction at the International Snow Science Workshop (ISSW), Regional Avalanche Center Meetings, Northwest Snow and Avalanche Summit (NSAS), and National Avalanche School (NAS).
- * Office preparation especially of forecasting and weather station computers.
- * Weather station installation, upgrades and repairs.
- * Preliminary mountain weather forecasting for ski areas and highways (WSDOT).

Winter Season (mid November to mid April):

- * Provide daily mountain weather and avalanche consultations to ski areas, WSDOT crews and other cooperating agencies, starting at ~3 am, 7 days a week.
- * Prepare and disseminate twice daily public mountain weather forecasts (7 am) and daily avalanche forecasts (9 am) 7 days a week; provide updates and special statements as necessary.
- * NWAC weather station repairs; ensure high quality automated hourly data via the NWAC web site.
- * Gather snow pack information first hand and from others; integrate into avalanche forecasts.
- * Provide avalanche awareness presentations as time and staffing allows.
- * Prepare and update web site pages with accident and snowpack statistics, and other educational information on weather, snowpack and avalanche awareness.

Spring Season (mid April to mid June):

- * Continue to provide mountain weather and avalanche consultations to cooperating agencies, such as WSDOT crews at Washington and Cayuse/Chinook passes.
- * Issue special avalanche statements as necessary.
- * NWAC weather station upgrades or repairs; continue to provide quality data via the NWAC web site.
- * Prepare for and host annual meeting; prepare and issue annual report.
- * Plan operations for next season.

INFORMATION EXCHANGE

Incoming Information

Through the winter NWAC forecasters rely on incoming information and data to make assessments of current mountain weather and avalanche observations. This information comes from the following sources:

- * **Observer Network:** The duty forecaster at the NWAC receives at least daily weather and avalanche observations via telephone from most ski areas, WSDOT crews, and observers at

Hurricane Ridge and Paradise on Mt Rainier. Updated observations and forecasts may be exchanged several or more times/day as the situation requires.

- * **Backcountry Observations:** The NWAC makes as much use as possible of available back country snow and avalanche observations via phone calls and e-mail messages, the [FOAC Snowpack Information Exchange](#), and sources on the Internet such as [Turns-All-Year](#).
- * **NWAC Weather Stations:** The 44 NWAC weather stations at Hurricane Ridge and in the Cascade Mountains provide temperature, relative humidity, wind, precipitation and snowfall information automatically via phone, radio and Internet connections.
- * **National Weather Service:** NWAC staff has access to all products and expertise of the National Weather Service Seattle office, including their AWIPS (Advanced Weather Information Processing System) computer system.

Outgoing Information

The NWAC distributes mountain weather and avalanche information via the following means:

- * **Phone Consultations:** at least once daily with most ski areas, DOT avalanche crews, and observers at Hurricane Ridge and Paradise. Consultations may increase to multiple times/day during periods of rapidly changing weather and avalanche conditions.
- * **Public Avalanche Forecast Hotline Phone Recordings:** in Seattle and Portland. See Product Dissemination section for more information.
- * **Internet:** Visits to the NWAC web site for a variety of forecast, data and other mountain weather and avalanche information products have greatly increased over the past few years. See Product Dissemination section for more information.
- * **NWS Seattle Weatherwire:** NWAC forecasts are distributed to the media and commercial vendors via the NWS Weatherwire service. NWAC forecasters are continuing to add an “Avalanche” section to the highly popular and nationally distributed NWS Area Forecast Discussion (AFD) product during periods of Avalanche Watches, Warnings, and Special Conditions.
- * **Search and Rescue Assistance:** The NWAC provides weather and avalanche forecast assistance to County Search and Rescue teams when requested.
- * **NWAC mountain weather station data:** Data for NWAC weather stations for up to the past 21 years is available upon request.

2008-2009 WEATHER AND AVALANCHE SUMMARY

The 2008-09 winter season as a whole in the Pacific Northwest can be characterized as an operatic drama, complete with prologue followed by three dramatically different acts:

Prologue—The MUCH—The LITTLE—The MUCH MORE!

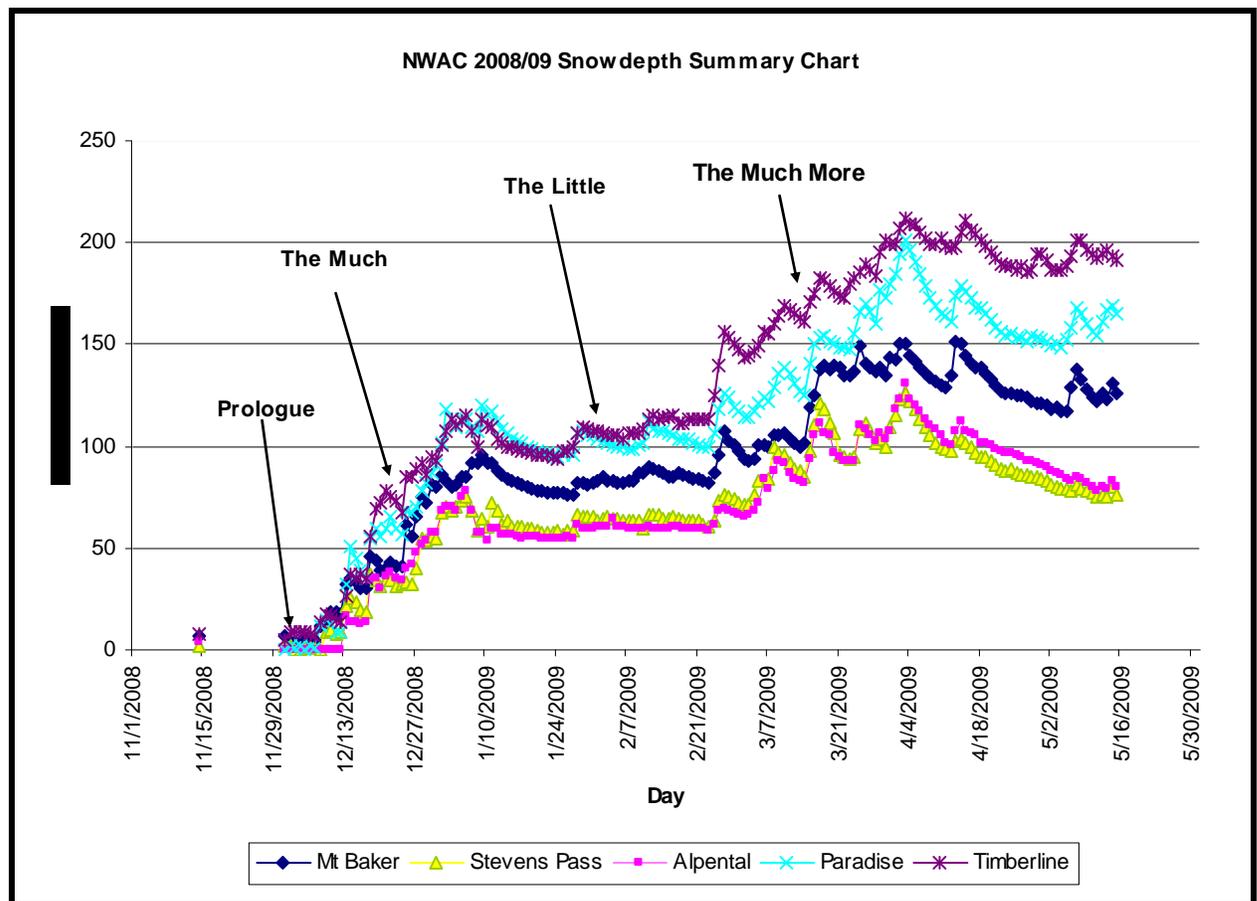


Figure 1. Pacific Northwest Snow depths for 2008-09

The Prologue- The drama begins like many that have come before. Underfunded, but snow begins to accumulate in early November anyway as winter enthusiasts hopefully anticipate yet another big season! Mt Hood accumulates 30 inches of snow by November 5th. But Wait! This avalanche opera is set in the Pacific Northwest where the stage can quickly change. Indeed it did on November 12th when some 3 to 6 inches of water arrived in a day ruining all those carefully arranged sets. Many stage hands abandoned the project and it took another month before the production could begin again.

The MUCH- On December 12th the freezing levels plummeted and snows began to blanket the stage in earnest. By Christmas, Mt Baker in the north Washington Cascades had received 100 inches of new snow and Mt Hood in the northern Oregon Cascades over 140 inches had fallen! Freezing levels remained extremely low through this period with multiple snowfalls covering Seattle in a deep white, a rarity in these parts. Most ski areas opened around the 13th or 14th of December with epic deep cold snow. However with the difficult travel conditions and copious snow in town, many folks could not or did not venture to the mountains.

The very cold temperatures through late December not only deposited lots of low density snow but weakened and faceted the pre-existing shallow but slowly increasing snowpack, as well as the November rain crust basal layer. The deep unconsolidated snowpack that had developed by late December set the stage for the inevitable soprano's entrance. She was big, heavy and loud! Once she started in there was no letting up. Between Christmas and the 6th of January most areas received an additional 7 to 8 feet of snow at warmer but still relatively cold temperatures by Northwest standards.

As "she" was set to come onstage the warnings went out. We urged folks of the dangerous developments that were on the way and many heeded the warnings. Despite the warnings, on December 28th Washington recorded its first avalanche fatality when a snowmobiler was buried and killed after triggering a large slide near Hart's Pass in the North Cascades. The group was untrained in avalanche safety but not unknowing of the dangers they were in. It seems they had a plan to accommodate the conditions but failed to stick by it. After leaving the safety of the lower angled and treed terrain after not seeing any signs of instability, the group of four snowmobilers decided to test the steeper slopes above tree line and on a loaded northeast facing slope. Besides abandoning the safer terrain, they were all riding on the slope at the same time when it released. Numerous other close calls were reported in the same area that weekend.

Brunhilde was singing loudly now! Those new to the NW avalanche opera scene may have thought that was as loud as she goes. Well, they were truly initiated when she came out for her first encore! Freezing levels climbed to over 8,000 feet on January 7th. Between the 6th and 8th of January most areas had received 6 to 8 inches of water with Snoqualmie Pass recording over 11 inches over those two days! Many folks at that time decided they really couldn't understand the hype about the opera thing. Some were sorry for trying, quickly returning to the steady drone of familiar low land sounds. Those that stuck it out witnessed some massive activity, including a true ground failure and full depth mixed mud, rock and slush slide that took out several lifts at the base of the Hyak Ski Area at Snoqualmie Pass, forcing the area to remain closed the entire season. The big rain produced the biggest reactions of the season and in some cases 20 to 30 seasons! The rain crust left behind from this event remained a benchmark in the snowpack the remainder of the season.

A few of the many log entries:

- highway closures—I-90, SR542, US12, US2—due to avalanches, mudslides, slush/debris flows etc.
- large avalanche from Excelsior (second slide of the series) punched through timber and deposited 20 feet of debris on state highway 542, then turned and ran down the road.

- confirmed first hand slide in Wenatchee Bowl near Stevens Pass ski area from storm. W aspect 5600' Slide went to just above ground on old firm layer from Nov. Failed on facets above that ~25cm above gnd. Avg crown 7 ft. max 8 ft. class 4.
- Varden ridge in the northern Washington Cascades went R5 to the ground, Crown at West summit of Silver Star - looks close to 3m, #14 was at treeline and was 180cm deep!.

Following the “big sing”, *Brunhilde* left a few morsels of snow as things cooled then the big dame left the stage well before her frenzied fans were satisfied. In typical diva fashion she kept them waiting...and waiting!

The LITTLE- The willing left in attendance were unsatisfied by the basically unsuitable conditions for enjoyment in the backcountry as deep wet snow gradually refroze and turned into a death crust. Not all those that decided to stick it out until the concluding chorus would make it however. A big ridge had raised the freezing level bar to above 13,000 feet in mid January in the midst of two full weeks of dry weather. Another rarity in these parts! Following the ridge, a strong split flow developed in the eastern Pacific. The persistent pattern directed storms towards California into late February, most completely missing their usual mark on the region. The combined snowfall totals for January and February equaled about what was received the last three weeks of December. The story that had begun with some real promise had become quite dull. The spectators had become restless, calling out for the slumbering *Brunhilde* to return to the stage. A glimpse of her was caught in the wings the last few days of February. She appeared in full, the word spread and soon the throngs were clambering to the hills once again.

The MUCH MORE! - Aria after aria rang through the mountains...the final act had begun. March proved to be the biggest month of the season. Freezing levels averaged about 2500 feet with snowfall amounts averaging about 140 inches along the Cascade west slopes for the month of March. The second fatality in the NW occurred during this stormy period in the Wallow Mountains of NE Oregon, outside the forecast area of NWAC. A party of three skiers was caught, two totally buried one partially. One recovered alive one not. A warming event around March 18 to 20 produced a big cycle, especially in the Mt Baker area producing some rather impressive slides. Another log entry tells the basic story.

- Crown on Shuksan Arm is 3-4' up to 8' x ½ mile, all knobs released, mostly filled valley with debris up to ½ mile below. Yesterday afternoon north side of Herman slid 4-8' x 400 yards. Pit today at Austin Pass 2-3' storm snow over 4" F snow over hard rain crust from last week.



Figure 2. Long propagating avalanche on Shuksan Arm, in the wilderness near Mt Baker WA, 3-20-09, photo courtesy Lief Hazelet

Cool showery weather prevailed through much of April with most areas reaching their peak snow depths in early April. Strong cold upper trough passages in early May deposited some 3 to 6 feet additional snowfall, producing a secondary maximum in snow depths and requiring several special statements to cover the warming and sunshine that followed these storm cycles. The final act appears to be winding down now in mid May as freezing levels should reach their highest levels of the spring at around 14,000 feet. If the models are right, this will carry us into the off season awaiting next seasons unfolding dramas in the Pacific Northwest.

However, before heading off into the sunsets of late May and June, it is interesting to see how the past forecast season drama unfolded in terms of avalanche warnings or special statements issued by the NWAC. As indicated by the summary above and the following figures, the season was above normal in terms of both total avalanche warnings issued and those issued in March-May (note that these charts do not include avalanche watches). All in all, quite a year!

NWAC Days with Avalanche Warnings or Special Statements

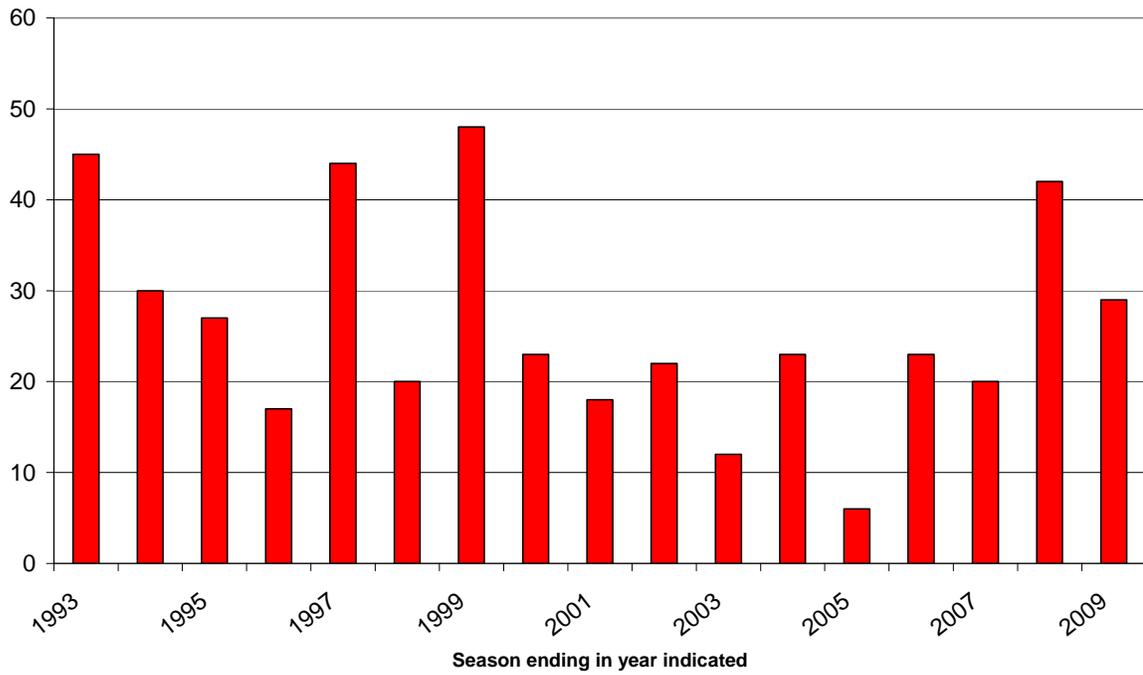


Figure 3. Days with warnings or special statements by year.

NWAC Days with Avalanche Warnings or Special Statements - Normal and 2008/2009

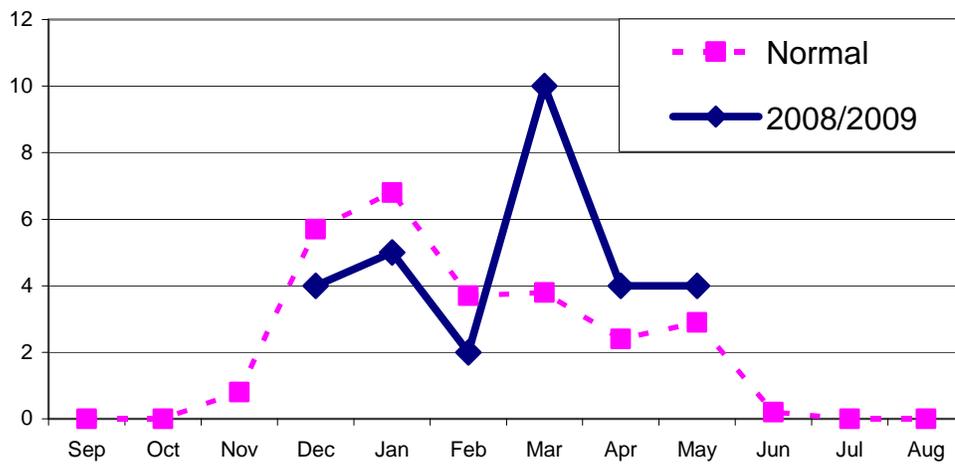


Figure 4. NWAC days with warnings or special statements by month versus normal.

IMPORTANCE OF HOURLY WEATHER DATA

Example of Avalanche Forecasting Using Hourly Weather Data

As the Weather and Avalanche Summary section of this report indicates, most of the month of March was a very stormy period for much of the region with a deep upper low rotating a series of frontal systems over the region at initially low but gradually rising freezing levels. And as the associated figures for the northern Washington Cascades weather station at Mt Baker suggest for the period March 14-21, 2009, this stormy episode manifested in periods of heavy snowfall, very slowly rising temperatures, and intermittently strong southerly winds (primarily south-southeast through south-southwest) in the Mt Baker area—all of which helped to significantly increase the avalanche danger through enhanced load on buried weak layers, especially on northwest through northeast exposures.

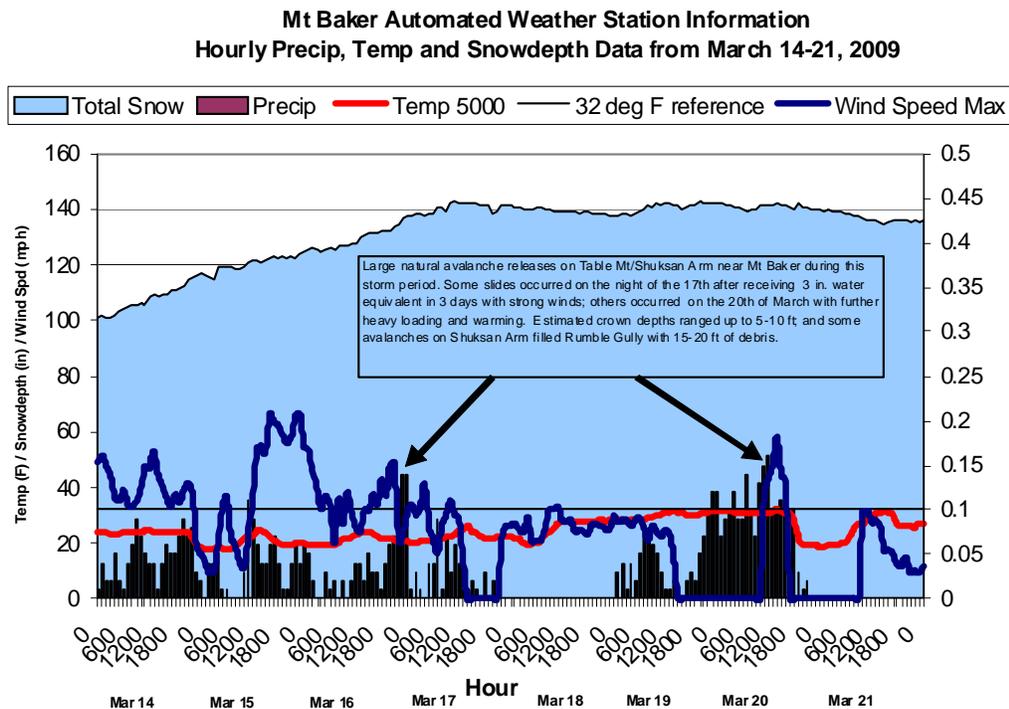


Figure 5. Hourly precipitation, total snow depth, wind gust and temperature data from Mt Baker, March 14-21, 2009.

**Mt Baker Automated Weather Station Information
Hourly Wind and Snowfall Data, March 14-21, 2009**

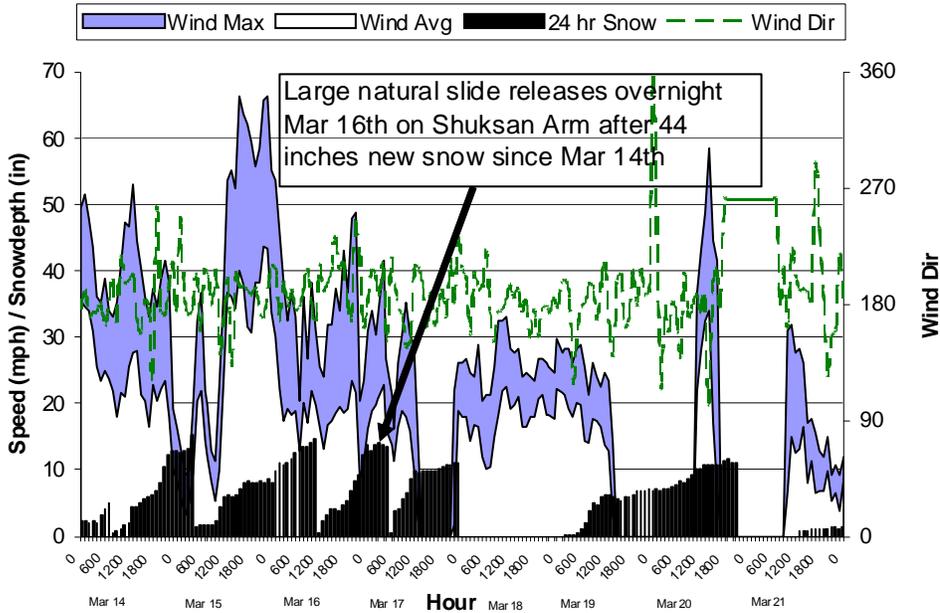


Figure 6. Hourly snowfall and wind data from Mt Baker, March 14-21, 2009.

The detailed snowpack analysis contained in the forecast issued on the morning of the 18th described some of these weather developments that produced an “*increasing considerable avalanche danger above 4000 feet*”:

Some natural and many triggered storm cycle avalanches were seen due to the rapid accumulations Sunday and Monday according to reports received at the NWAC, Turns All Year and the Friends Exchange. Most but not all releases seem to have remained within the storm snow. A couple notable avalanche were a very large natural avalanche on the north side of Shuksan Arm adjacent to the Mt Baker ski area Monday night, a 2-4’ natural avalanche in Moonlight Bowl on Tuesday, and 1 skier triggered 2’ slab avalanche on a north slope at 6700’ in the Crystal Mountain ski area.

Further heavy snowfall on the 19th and 20th with continued slow warming produced further instability within the large amounts of snowfall, resulting in several more large slab releases and a continued high danger above about 6000 feet with considerable danger below. The hourly data figures are included here since they show how tracking such data can be very important in helping travelers determine local avalanche danger... some of which can result in avalanches of the type and magnitude discussed above and shown in Figures 2 (above) and 7 (below).



Figure 7. Avalanche releasing from Shuksan Arm on 3-20-09 leaves this pile of debris in Rumble Gully. Photo courtesy Mt Baker ski area.

AVALANCHE ACCIDENTS AND TRENDS

US AND NORTH AMERICAN STATISTICS

Figure 8. North American Avalanche Fatalities by year, 1985-2009.

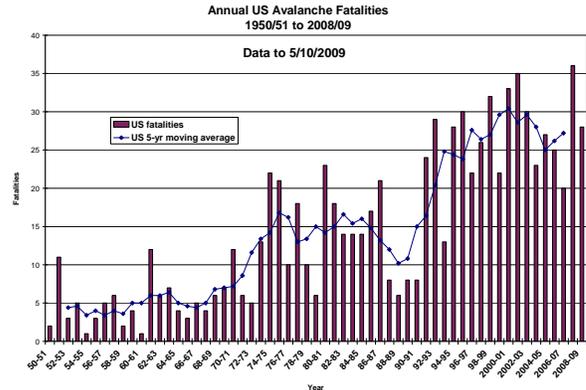
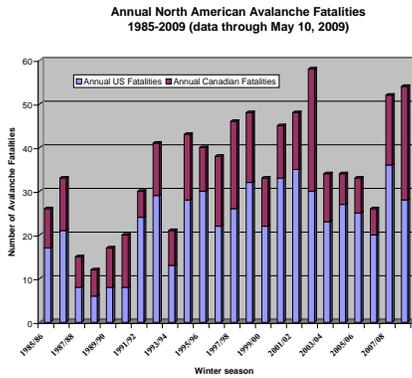


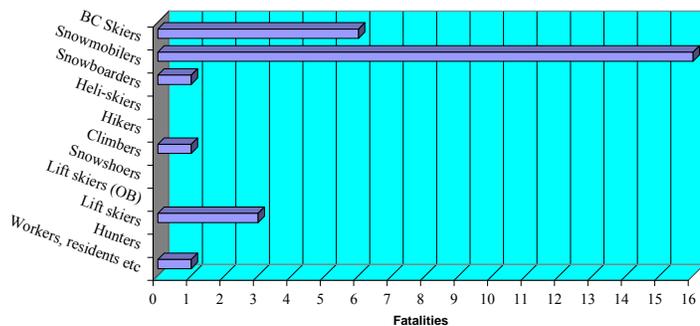
Figure 9. US annual avalanche fatalities by year, 1950-2009.

As mentioned in the *Message from the Director* the past winter was a challenging one avalanche-wise throughout the US. In addition to almost 30 avalanche fatalities (US fatality toll through May 25 continues at 28, slightly above the 5-year moving average of 27.2), the difficulties in dealing with a relatively weak and facet driven snowpack in the early part of the winter became manifest through a rash of “in-bounds” avalanche incidents that occurred within some major ski area boundaries (e.g., Squaw Valley CA, Jackson Hole WY, Snowbird UT, Telluride CO). While professional ski patrol personnel do an outstanding job of avalanche control and associated avalanche danger mitigation within ski area boundaries, the evolution of this winter’s snowpack and the ensuing three fatal in-bounds avalanche accidents attest to the notion that weather is often in control and that explosive and other control efforts are not infallible in avalanche hazard reduction. As the associated avalanche fatality figures so graphically illustrate,

2008/09 was a bad winter for North America (annual total of 54 through 5/10/09, 4 shy of the modern day record of 58 set in 2002/03) and for snowmobilers in particular (snowmobilers accounted for 65% of the North American total).

Figure 10. US avalanche fatalities by activity category, 2008-09.

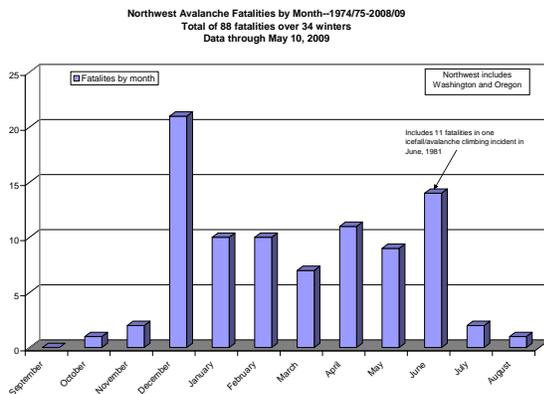
2008/09 US Avalanche Fatalities by Activity Category
28 total to May 10, 2009
 [Data courtesy NWAC, CAIC and WAN]



Avalanche deaths by activity category in the US were once again similar to many past years with snowmobilers leading the way. However, a major variation is evident in that a not inconsequential number of lift skier fatalities (in-bounds) were reported. Note that the fatalities by activity category figure shown here does not include an additional 26 fatalities in Canada (19 snowmobilers, 2 snowboarders and 3 skiers in BC, 1 hiker in Alberta, and 1 BC skier in Quebec). See www.avalanche.ca for more detailed Canadian avalanche information.

NORTHWEST STATISTICS

Although the Northwest avalanche fatality total of three for the 2008/09 winter was slightly above the 10-year running average of 2.9 fatalities/year, two of the fatalities occurred outside the NWAC forecast area with one resulting from a roof avalanche which caught, buried and

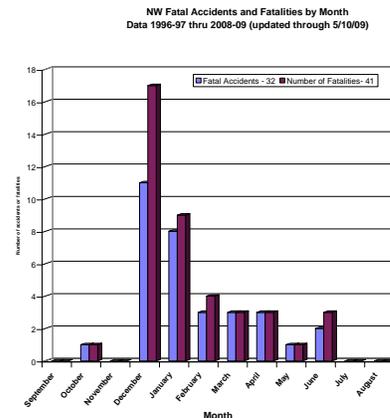


killed an elderly woman out shoveling her walk, and the other a skier triggered event in the Willowa Mountains of NE Oregon. Reports on these incidents and most of the past season's accidents back through 1997/98 can be found on the [NWAC web site accidents page](#).

Figure 11. NW avalanche fatalities by month, 1974-2009.

Figure 12. NW avalanche accidents and fatalities by month, 1996-2009.

From an analysis of NW avalanche fatalities by month for both the more recent term (past 13 years) and longer term (34 years), it appears that the majority of NW avalanche incidents and fatalities occur in December and January—a period often characterized by a more continental (i.e., faceted and weaker) snowpack in many NW mountain locations, one commonly associated with PWL's or persistent weak layers. Such snowpack instability/danger tends to last for a longer time (sometimes persisting into the subsequent spring in one fashion or another), and is often more difficult to discern by back country travelers as the unstable layers may be more deeply buried than casual examination may reveal. This bias toward early season incidents is well illustrated in Figures 11 and 12 which span the more recent 13 years and the longer term (past 34 years) as well. However, they both underscore the fact that avalanche danger should be a year round concern as fatalities and accidents occur in almost every month of the year (they do occur in every month of the year if the monthly statistics are expanded to include the whole US).



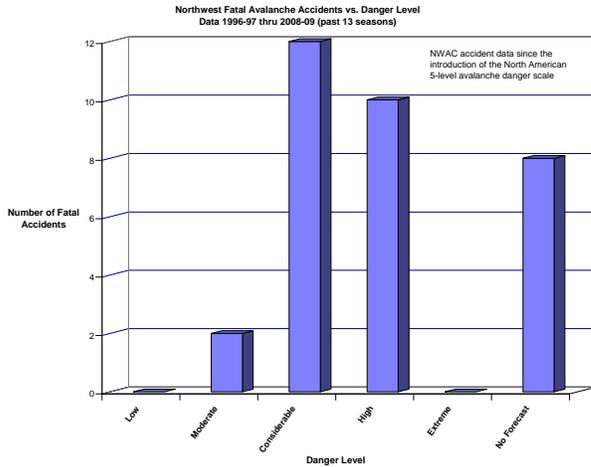


Figure 13. Northwest Fatal Avalanche Accidents by danger level, 1996-2009.

As Figure 13 shows, most of these incidents occurred when NWAC had forecast either a considerable or high danger for the back country, although a few occurred under moderate danger conditions. Some also occurred either in areas not covered by the forecast or during times when the NWAC was closed (forecasters either in non-pay status or transitioned toward summer time fire-weather work).

Also as is evident from Figure 14, while the annual avalanche toll for the NW has experienced large year to year variability over the past almost 60 years, there has been a slow increase from the early 1990's. This gradual increase may be driven by a combination of factors, including greatly increased use of the back country overall, a more "extreme" mentality among back country users and the evolution of some "newer" and more independent users such as snowboarders and snowmobilers.

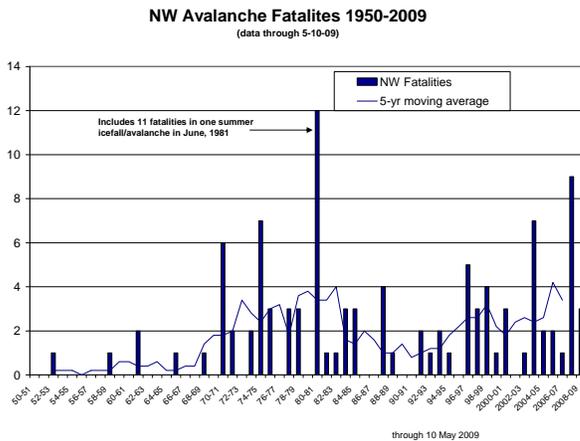


Figure 14. NW Avalanche Fatalities by season, 1950-2009.

During the 24-year time period for the US fatality table by state below (Table 1), a total of 554 (54) avalanche fatalities have occurred in the US (Northwest) since 1985. This averages over 23 avalanche deaths/year in the US as a whole and about 2.3/year for Washington and Oregon combined—or about 10% of the US total since 1985.

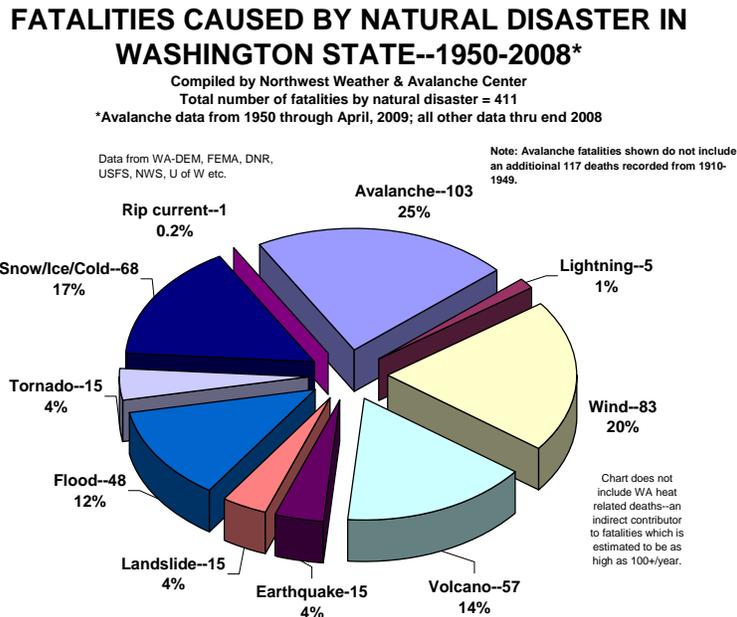
Although the 5 and 10-year running averages for the NW are up slightly from the average of 2.3/year since 1985/86 (3.4 and 2.9 respectively), this modest shorter term increase is largely due to the record setting avalanche toll of 2007/08 when 9 fatalities were recorded in the Northwest.

UNITED STATES AVALANCHE FATALITIES by STATE																														
1985/86 to 2008/09 (to May 10, 2009)																														
Winter Season																												24 Years		
State	85/86	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	Total	Avg	State			
CO	4	11	5	4	4	6	9	12	1	9	7	1	6	6	8	4	6	6	3	5	4	5	5	4	135	5.6	CO			
AK	0	6	2	0	1	1	2	7	2	6	8	4	3	12	5	4	11	4	3	1	4		4	3	93	4.0	AK			
UT	5	2	0	0	1	0	5	3	1	5	2	6	2	5	2	6	5	1	4	8	4	4	3	4	78	3.3	UT			
MT	2	1	0	0	1	0	1	1	6	3	3	1	7	2	2	7	9	4	0	3	4	6	3	6	72	3.0	MT			
WA	2	0	4	0	0	0	2	0	0	1	0	5	2	3	1	3	0	1	7	2	2	1	9	2	47	2.0	WA			
WY	2	0	0	0	0	0	2	1	1	1	3	2	1	2	0	7	2	7	1	0	2	3	4	2	43	1.8	WY			
ID	0	1	0	0	0	0	0	2	0	0	3	3	3	0	2	0	1	3	4	3	4	1	2	3	35	1.5	ID			
CA	2	0	0	0	1	0	2	1	0	2	0	0	1	1	0	2	1	1	1	3	1		4	3	26	1.1	CA			
NH	0	0	0	0	0	1	0	0	0	0	3	0	0	0	1	0	0	2	0	0	0		1		8	0.4	NH			
OR	0	0	0	1	0	0	0	1	2	0	0	0	1	1	0	0	0	0	0	0	0			1	7	0.3	OR			
NV	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0				4	0.2	NV			
NY	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0				2	0.1	NY			
VT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0				1	0.0	VT			
AZ	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0				1	0.0	AZ			
ND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		1	0.0	ND			
NM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0				1	0.0	NM			
TOTAL	17	21	11	6	8	8	24	29	13	28	30	22	26	32	22	33	35	30	23	27	25	20	36	28	554	23.1	TOTAL			

Table 1. Annual US Avalanche fatalities by state, 1985-2009.

Avalanche fatalities continue to lead the way for deaths by natural disaster in Washington State, as indicated by this updated chart showing fatalities by natural disaster from 1950-2009. However, it should be noted that this chart does not include heat related deaths in Washington. While an indirect and difficult to measure statistic, it is estimated that approximately 100+ deaths/year (personal communication with Dr. Lawrence Kalkstein, Research Professor of Geography and Regional Studies, University of Miami) may be attributable to excessive heat in the Puget Sound area and perhaps twice that number statewide.

Figure 15. Fatalities caused by natural disaster in Washington State, 1950-2008.



PRODUCT DISSEMINATION AND EDUCATION

Internet Access and Phone Hotlines

A plot of data and forecast access to the NWAC shows that Internet access to the data and forecasts continues to greatly increase. Phone recording access to avalanche forecasts has decreased significantly since the forecasts have been available on the Internet. The mountain weather forecast recording was ended after the 2003-2004 season after analysis had shown that its annual use had become minimal.

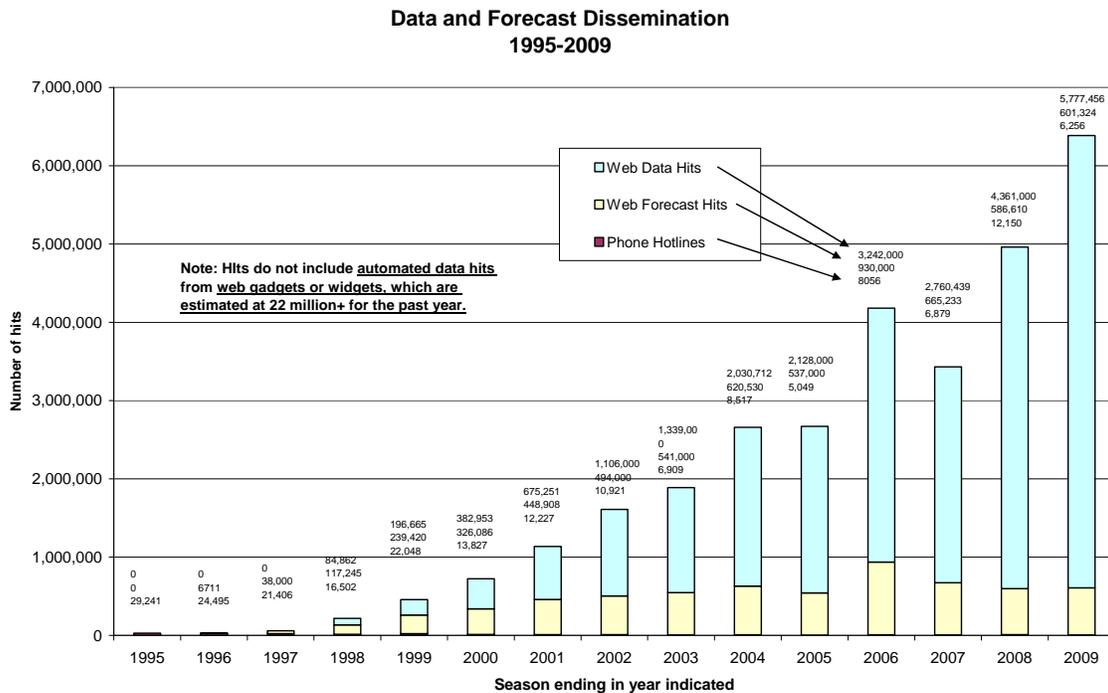


Figure 16. Data and forecast product dissemination by year, 1995-2009.

Data from the primary NWAC Web server log analysis package ([Wusage](#)) indicates that over 29.5 million hits were recorded on just NWAC data and forecast files alone for the period October 1, 2008 through mid-May, 2009. This remarkable increase in accesses to the web site has been driven in large part by web gadgets or widgets that automatically update hourly weather information from a variety of NWAC weather stations. However, these data widgets have now been around for several years and the increased total for 2008/09 accesses for data and forecast products is still up over 8 million from the previous season. Also, the numbers of unique visitors to the site continues to increase annually (now ranging between 20,000 to over 40,000/week during the core season) with over 600,000 hits on the weather and avalanche forecast products alone. This is a far cry from the phone-call-only days when 20-30,000 calls were received for the entire season. The following graph shows the dramatic increases in weekly views of NWAC web site pages by week over the past six seasons.

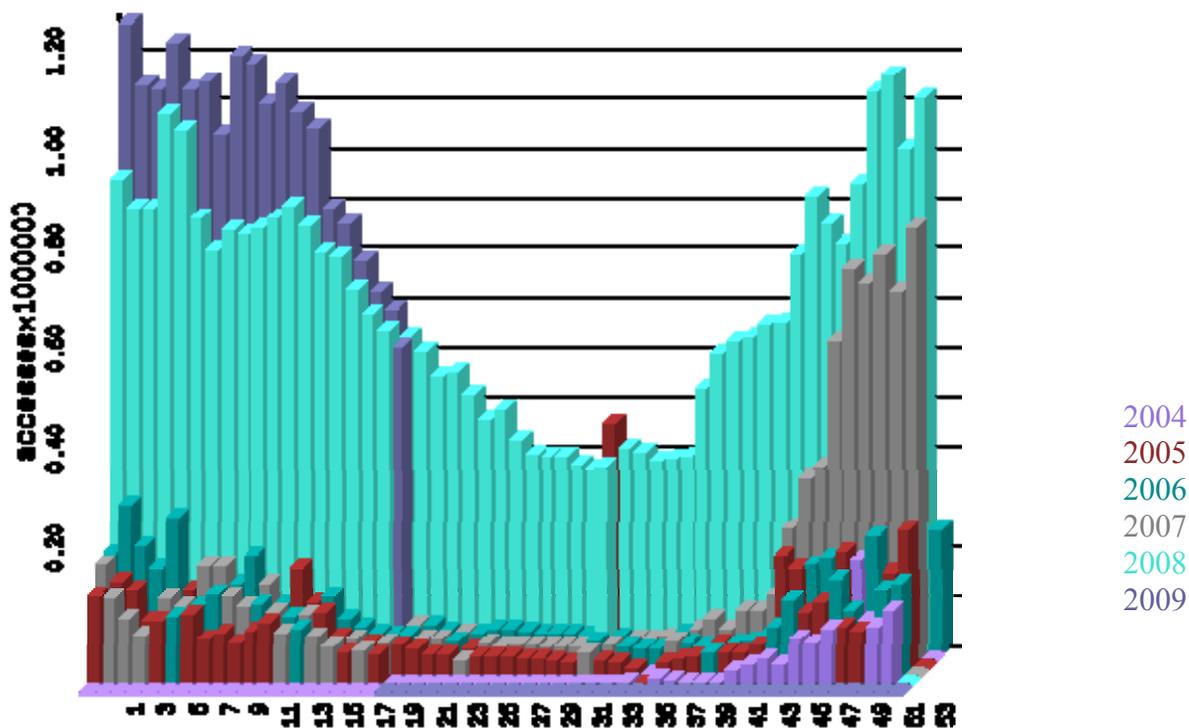


Figure 17. Annual plot of weekly page views (in millions) on NWAC web site, 2004-2009

Education

The NWAC staff along with retired Forest Service volunteers and FOAC board members Roland Emetaz and Ken White provided a substantial number of avalanche awareness presentations over the last season. The table below presents a summary of presentations with these sessions reaching over 1900 interested attendees.

2008-09 NWAC Avalanche Education Efforts				
DATE	GROUP	LOCATION	ATTENDANCE	SPEAKER
1 Oct	NWS Newsmedia Workshop	NOAA	50	Moore
2 Oct	NWS Newsmedia Workshop	NOAA	70	Moore
18 Oct	WA State Snowmobile Show	Puyallup	15	Ferber
18 Nov	Northwest Snow and Avalanche Summit	Seattle	250	Ferber
2 Nov	WA State Snowmobile Association	Spokane	100	Emetaz
5 Nov	Oregon Mountain Community	Portland	50	Emetaz
2 Dec	Oregon Nordic Club	Portland	50	Emetaz
5 Dec	Central WA University	Ellensburg	50	Ferber
5 Dec	USFS	Wenatchee	30	White
6 Dec	WA State Snowmobile Association	North Bend	25	Moore/Ferber
9 Dec	USFS	Okanagon	16	White
9 Dec	Next Adventure	Portland	65	Emetaz
12 Dec	USFS	Naches	15	White
29 Dec	Government Camp Museum	Government Camp	10	Emetaz
6 Jan	Cascade Wild	Portland	10	Emetaz
9 Jan	Dog River Coffee House	Hood River	30	Emetaz
10 Jan	REI – Winter Trails Event	Mt Hood	100	Emetaz
11 Jan	Cascade Wild	Mt Hood	8	Emetaz

12 Jan	WSDOT Safety Training	Leavenworth	25	Kramer
12 Jan	Explorer Post #58	Portland	60	Emetaz
14 Jan	Mountaineers	Olympia	55	Emetaz
15 Jan	City of Bellevue Parks	Bellevue	12	White
17 Jan	Government Camp Museum	Government Camp	6	Emetaz
18 Jan	Northwest Avalanche Institute	Crystal Mtn	30	Moore
21 Jan	Sled Shop	Hood River	40	Emetaz
22 Jan	Mountaineers	Everett	28	White
26 Jan	Northwest Avalanche Institute	Crystal Mtn	26	Moore
27 Jan	REI	Hillsboro	40	Emetaz
29 Jan	Mt St Helens Institute	Vancouver	15	Emetaz
30 Jan – 1 Feb	Kent Swanson Memorial Avalanche Class	Mt Hood	30	Emetaz
2 Feb	Seattle Art Institute	Seattle	26	White
3 Feb	REI	Tualatin	35	Emetaz
5 Feb	Search and Rescue	Dufur	15	Emetaz
9 – 11 Feb	Holden Village Staff	Holden	35	Emetaz
21 Feb	Government Camp Museum	Government Camp	3	Emetaz
5 Mar	BoeAlps	Seattle	20	White
10 Mar	Vista Academy	NOAA	20	Ferber
12 Mar	NW Avalanche Forecasters Meeting	Mt Hood	25	Moore
21 Mar	AMS Workshop	NOAA	130	Moore
21 Mar	Government Camp Museum	Government Camp	8	Emetaz
25 Mar	BoeAlps	Seattle	128	White
30 Mar	BoeAlps	Seattle	31	White
23 Apr	Mountaineers	Everett	20	White
28 Apr	Mountaineers	Everett	36	White
12 May	Skagit Valley Alpine Club	Mt Vernon	25	Kramer
14 May	UW Hydrology Seminar	Seattle	60	Moore
Total			1918	

Table 2. 2008-2009 Avalanche Education efforts by NWAC staff and volunteers.

As the table below indicates, during the past 13 winter seasons these educational efforts have reached over 24,000 people. Another 4,000 students were involved in avalanche awareness courses taught by “Know the Snow” instructors of the [Alpine Safety Awareness Program](#) (funded in large part by the Friends of the Avalanche Center); see the FOAC section for more details.

Table 3. NWAC Avalanche Education Efforts by season.

Year	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09
Persons	1178	1820	2440	1800	1800	2600	1486	1657	2858	1396	1868	1362	1918
Total for 13 Seasons				24,183									

WEATHER STATION NETWORK

Major Station Work 2008-2009

Paradise, Mt Rainier – Last fall we needed to relocate the wind station due to the demolition of the venerable Johnson Visitor Center. The Park kindly installed a new Rohn 45G tower in the middle divider of the ski dorm parking lot in the fall of 2008. We added new Taylor heated wind speed and direction, Campbell data logger, modem, temperature and relative humidity sensors, and charging regulator. Two way communications to the station are via phone line, with the site also acting as the base station for a spreads spectrum radio link to the Camp Muir station.



Figure 18. Garth helping complete work on the new Paradise tower in October 2008.

Government Camp – By 2008 the Ski Bowl wind station was one of the oldest NWAC weather stations with much of the equipment having been installed sometime in the 1880's, or we mean 1980's. Increasing difficulties with maintaining some of the antiquated equipment made it obvious last season that this station was due for replacement. The Ski Bowl ski area installed a new tower adjacent to the top lift building for ease of power and phone line access in the fall of 2008. In November NWAC staff installed a suite of new equipment including a new Campbell CR10X data logger, modem, air temperature, and relative humidity, along with Taylor heated wind speed, and an ESI wind direction.

Pan Dome – our new wind station at the top of the Mt Baker ski area was actually installed in the fall of 2007. The Mt Baker ski area and the NWAC began to make the data from this station available to the public via our web site during the 2008/2009 season after a year of testing and analysis of wind data from the site. This station uses a new Campbell CR1000 data logger and Ethernet modem, Campbell air temperature and relative humidity instruments, and Taylor

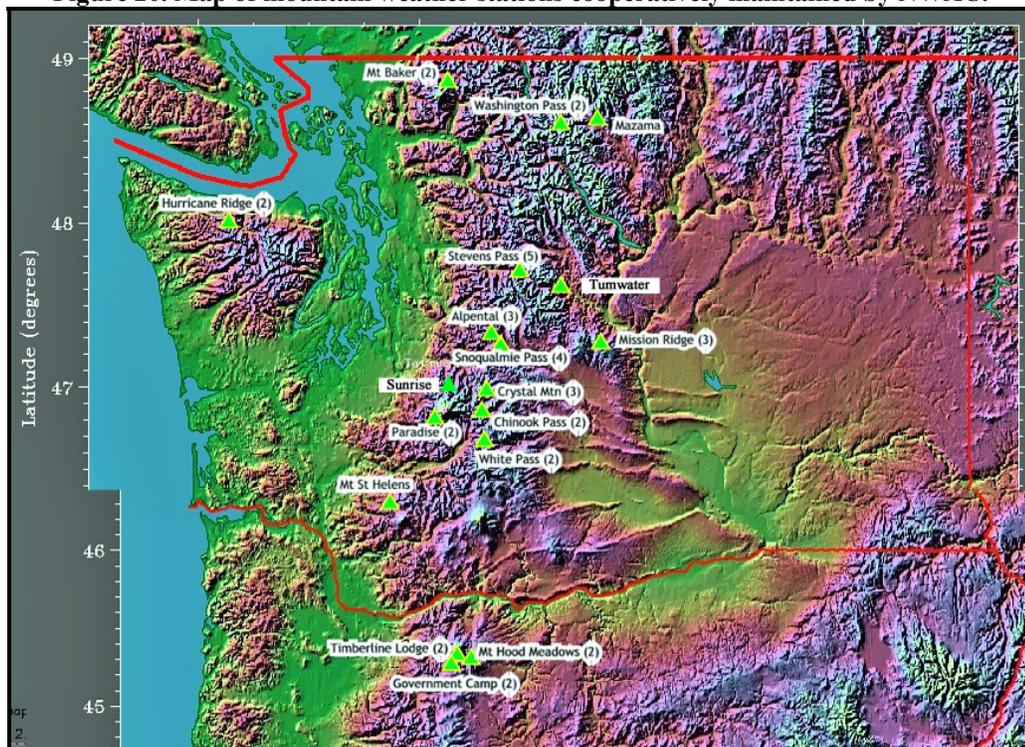
unheated wind speed and direction. This station was especially needed because there are no non-pass mountain top wind stations in the Cascades north of Alpentel near Snoqualmie Pass.



Figure 19. Kenny and Garth tighten bolts on the Pan Dome wind cross arm assembly, February 2009.

The NWAC maintains and downloads data from our network of weather stations at Hurricane Ridge and in the Cascade Mountains from Mt Baker to Mt Hood. We make the data available to program cooperators and the public via our web site.

Figure 20. Map of mountain weather stations cooperatively maintained by NWAC.



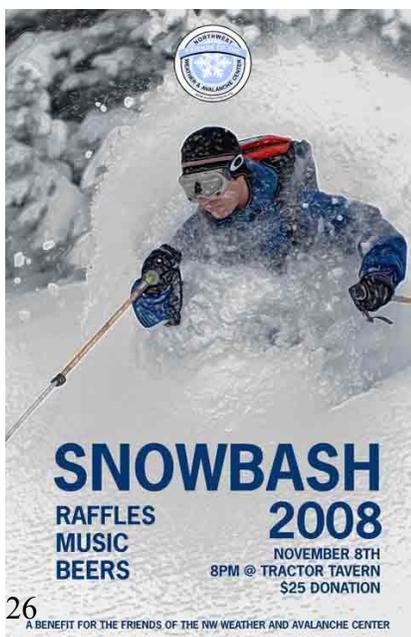
Upcoming Weather Station Plans

Hurricane Ridge Station Relocation – For many years the Hurricane Ridge precipitation and snowdepth measurements have been poor due to the windy location of the station at the current generator building site. The winds cause major snow drift formation or erosional features under the total depth sensor, and poor precipitation measurements by the heated gage. In order to reduce or eliminate such inconsistencies at this important site, the NWAC in collaboration with Olympic National Park have made plans to relocate the station to a new and more protected location about 100 yards to the west of the generator building. The Environmental Assessment required by the Park has now been completed and approved, and work should begin when the snow has melted over the coming summer. Initial plans will be to work with Park staff to install the new tower and new cables to the tower. Later this summer or fall NWAC staff will move the data logger, phone modem, air temperature and relative humidity, precipitation and snowdepth gages to the new site and troubleshoot any communication problems that arise.

Crystal Mountain Wind System – we plan to replace the very old wind instrument system at the top of the Crystal Mountain ski area next fall. The original infrared bulb heating system may have been designed in Colorado and installed by the ski area and NWAC personnel in the late 1970's or early 1980's.

Precipitation Gage Development – Phil Taylor of Taylor Scientific (the primary engineer who has been repairing and refurbishing a variety of NWAC equipment since the early days) is currently developing a new all season precipitation gage with versions for either electric or propane heat. Presently there are no commercially available propane heated precipitation gages, while the electrically heated gages currently in use have become increasingly expensive to both purchase and maintain. They have also been very susceptible to the at times intermittent power surges common at remote sites adjacent to ski areas. We hope to test the new precipitation gage as soon as the upcoming 2009/2010 season.

FRIENDS OF THE AVALANCHE CENTER



[The Friends of the Northwest Weather and Avalanche Center](#) (FOAC), an increasingly effective and very important NWAC cooperater, promoted the popular SNOWBASH function and fundraiser to kick off the snow season. The 2008 edition proved to be another fun and grand event, helping to raise funds and awareness for the NWAC. SNOWBASH 2008 was held November 8th at the Tractor Tavern in the heart of Ballard and included a professionally called live auction, silent auction, gear raffles, great Blue Grass music, camaraderie and much more. While it was a great



success, FOAC engineered an even higher profile sit-down catered dinner/auction/presentation in the spring, Snowball 2009.

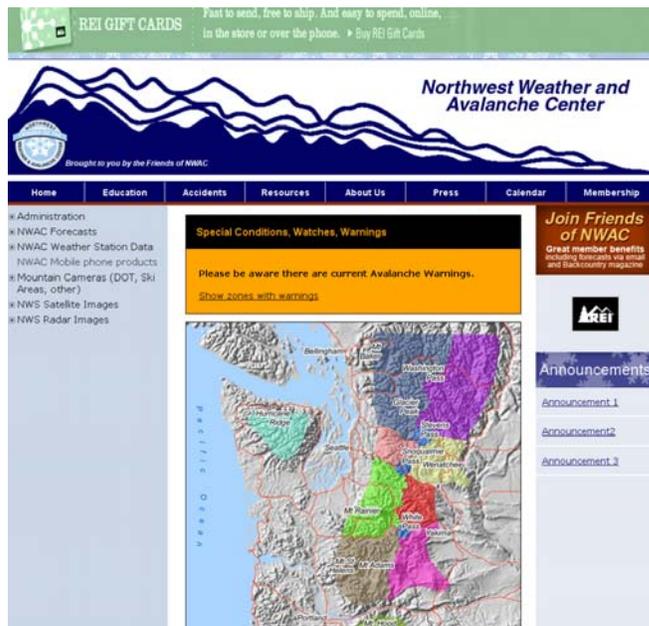


Figure 21. Planned home page for the newly revised FOAC-NWAC web site.

[The Feathered Friends](#), an outdoor climbing and backcountry oriented retailer in Seattle, also sponsored a early season fund raiser for the NWAC on November 6th.

Much of the FOAC efforts and considerable expenses were geared toward development of the new FOAC—NWAC web site that is slated to undergo extensive testing and evolution this spring and summer, with full implementation planned for the upcoming 2009/10 season. The site is to be administered by the FOAC with NWAC providing much of the educational,

forecast and data content. A snapshot of the newly designed and much more user-friendly and more graphical home page is shown in Figure 21.

The Alpine Safety Awareness Program (ASAP) in cooperation with FOAC hosted the second annual Northwest Snow and Avalanche Summit (NSAS) that took place November 8th in Seattle.

After generating great interest and success in its inaugural year of 2007, the 2nd year's event was another well attended (about 230) professional development program. NSAS was designed to reach a wide audience



including ski patrollers, avalanche forecasters, WSDOT and county road maintenance personnel, ski guides, search and rescue teams, avalanche instructors, undergraduate and

Speakers included:

Garth Ferber – NWAC forecasts: Scientific call or crystal ball?

Don Sharaf – Stability tests: An explanation of various stability tests and their strengths and weaknesses in application.

Martin Volkken – The interplay between likelihood and consequence and motivation and risk

PANEL – Decision-making in high risk environments - perspectives from guiding, highways, and ski areas. Speakers include Craig Wilbour, Margaret Wheeler, Sky Sjue.

Tom Murphy – Decision-making in high-risk environments

Lowell Skoog – Safety and success on a Cascade high route

Sam Kavanaugh – A Dozen More Turns, a story of lessons learned. The film is online here: <http://revver.com/video/310519/a-dozen-more-turns/>, and will give you an idea of Sam's perspective.

graduate students in snow science programs, applied researchers, outdoor leaders, and advanced recreationalists. The atmosphere was interactive, with presentations followed by an open panel discussion.

Plans are already relatively firm for the third NSAS next fall to be held at the flagship REI store on October 24th, 2009.

The 1st Annual FOAC SnowBall was held on 10 April 2009 with 230 attendees and over \$30,000 raised. This good time had by all was held at the Ballard Elks Club on Shilshole Bay.



Fun included a buffet dinner, silent and live auction and live classical music entertainment.

The NWAC forecasters make periodic trips to the back country in order to assess snow conditions but those efforts must be supplemented to ensure accurate and meaningful forecasts. NWAC relies on regular field observations from a variety of users and locations to help achieve this. The Friends of the Northwest Avalanche Center began an information exchange forum during the 2006-07 season that has proved to be increasingly successful over the past few years. It was once again highly successful this season with almost 90 snowpack observations posted (the forum has received a total of approximately 180 snowpack,

avalanche and snow stability observations during the past 2 seasons).

NWAC BUDGET AND FUTURE

With both the federal and state economies in rather dire straits during both the recent past and the present, future stable financial and operational future of the NWAC remains elusive. That the viability of such a popular and important program remains so uncertain is difficult to understand in light of so many recent positive developments. Such developments during the past few years have included:

- passage of Washington State Senate Bill (SSB 5219) in 2007. This bill's purpose was to establish recommendations and a plan to establish the necessary framework and support structure "to ensure that the Northwest Weather and Avalanche Center program has the resources to continue operating at its current level of service into the future" (Sec 2(4) of SSB5219),
- many positive results and findings about the critical nature of the NWAC program were contained in several very positive reports and analyses that resulted from SSB 5219. These include:
 - Berk and Associates Final Report—[*Benefit Assessment and Economic Impact Analysis for the Northwest Weather and Avalanche Center, December 1, 2008*](#)),
 - Consultant Knox William's Final [*Report on the Northwest Weather and Avalanche Center*](#)

- The WSPRC's final report on the NWAC, [Final Report to the Washington State Legislature On The Northwest Weather and Avalanche Center Pursuant to SSB 5219 \(Chapter 141 Laws of 2007\)](#)
- increased commitment from the state toward the Avalanche Center through Supplemental Budget monies during the current state biennium (\$58,000 in FY08 and \$73,000 in FY09),
- increased voluntary donations toward NWAC operation by a variety of private groups, including ski areas, professional ski patrols, ski schools, outfitting guides, local and national companies and others
- efforts by the Washington State Legislature to pass a new bill (SSB 5596) that would helped ensure future stable funding of the NWAC by a small (\$2.00) surcharge on Washington snowmobile registrations and Snowpark permits.

The content of SSB 5596 (which did not make it out of committee) is included below for reference:

S-1072.2

SENATE BILL 5596

State of Washington **61st Legislature** **2009 Regular Session**
 By Senator Jacobsen
 Read first time 01/27/09. Referred to Committee on Transportation.

1 AN ACT Relating to promoting safe winter recreation by supporting
 2 the continued operation of the northwest weather and avalanche center;
 3 adding a new section to chapter 46.10 RCW; adding new sections to
 4 chapter 79A.05 RCW; and creating a new section.

5 BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:
 6 NEW SECTION. **Sec. 1.** The legislature finds that the northwest
 7 weather and avalanche center provides valuable avalanche forecasting
 8 and education services, provides valuable information to the public,
 9 and reduces the impacts of adverse mountain weather and avalanches on
 10 recreation, industry, and transportation in Washington state.
 11 The northwest weather and avalanche center is cooperatively funded
 12 by a number of public and private entities. In recent years, however,
 13 several budget crises have threatened to shut down the avalanche
 14 center, posing risks to recreation safety, tourism, and freight and
 15 passenger mobility.

16 Therefore, it is the intent of the legislature to ensure, in
 17 continued cooperation with the federal government, appropriate states,
 18 and private sources, that the northwest weather and avalanche center
 19 receive the resources necessary to continue providing weather and

p. 1

SB 5596

1 avalanche forecasts for the benefit of Washington state. It is also
 2 the intent of the legislature that any resources provided to the center
 3 through this act be in addition to, and not supplant, current support
 4 from the state.

5 NEW SECTION. **Sec. 2.** A new section is added to chapter 46.10 RCW
 6 to read as follows:

7 (1) In addition to the registration fees collected under RCW
 8 46.10.040, the department shall collect a northwest weather and
 9 avalanche center surcharge of two dollars. The revenue generated from
 10 the surcharge must be deposited in the northwest weather and avalanche
 11 center account established in section 4 of this act to be used solely
 12 to support the operation of the northwest weather and avalanche center.

13 (2) This section applies to registrations due or to become due on
 14 or after October 1, 2009.

15 NEW SECTION. **Sec. 3.** (1) In addition to the fees collected for
 16 winter recreation area parking permits authorized under RCW 79A.05.230,
 17 the commission shall collect a northwest weather and avalanche center
 18 surcharge of two dollars. The revenue generated from the surcharge
 19 must be deposited in the northwest weather and avalanche center account

20 established in section 4 of this act to be used solely to support the
21 operation of the northwest weather and avalanche center.
22 (2) This section applies to winter recreation area parking permits
23 purchased on or after October 1, 2009.
24 NEW SECTION. **Sec. 4.** The northwest weather and avalanche center
25 account is created in the state treasury. All receipts from the
26 northwest weather and avalanche center surcharges collected under
27 sections 2 and 3 of this act must be deposited into the account.
28 Moneys in the account may be spent only after appropriation.
29 Expenditures from the account may be used only to support the operation
30 of the northwest weather and avalanche center.
31 NEW SECTION. **Sec. 5.** The commission shall collaborate with
32 appropriate public and private entities to seek sustainable and
33 cooperative funding for the northwest weather and avalanche center,
SB 5596 p. 2

1 with equitable contributions from the federal government, appropriate
2 states, and private sources.
3 NEW SECTION. **Sec. 6.** Sections 3 through 5 of this act are each
4 added to chapter 79A.05 RCW.

--- END ---
p. 3

SB 5596

Among the many positive conclusions in the [Berk and Associates Key Findings Report](#) are:

- *NWAC saves lives by forecasting, tracking, and reporting weather and avalanche conditions.*
- *Historical avalanche fatality data suggest NWAC saves between two and nine lives per year.*
- *How much should be invested to save a life? The U.S. Department of Transportation pegs the value of a statistical life between \$3.2 million to \$8.4 million.*
- *Using U.S. DOT guidelines, lives saved by NWAC translate to annual economic benefits ranging from \$6.4 million to more than \$75 million.*

The conclusions in the report are quite compelling and refer to the *Important Tangible Benefits* and *Broader Fiscal and Economic Impacts* of the program:

- *NWAC saves between two and nine lives per year.*
- *NWAC makes the backcountry more accessible and enjoyable.*
- *NWAC improves the efficiency of enterprises that operate in the backcountry.*
- *Conservative estimates of NWAC's benefits are at least \$7.5 million annually. More likely benefits range from \$20 million to \$79 million annually. Given an annual budget of \$340,000, this translates to an annual return on investment of at least two thousand percent.*
- *NWAC brings revenue streams and economic activity to rural areas of Washington State.*
- *NWAC increases the overall competitiveness of Washington State.*

These key points are echoed in the WSPRC Final report which states that the NWAC:

- *is an integral part of the state's public-safety infrastructure for winter travel and recreation*
- *provides mountain weather and avalanche forecasts, special watches and warnings, hourly mountain weather data, awareness classes and related information to the*

general public and to avalanche safety personnel. These life-safety services also foster economic development by stimulating tourism, ensuring freight and passenger mobility through mountain passes, and leveraging the state's natural resources into a competitive advantage for corporate relocation and retention

While the key findings listed above allude to the importance and great return on investment for the NWAC, they do not address what is needed to keep the Avalanche Center whole and viable in the future. At least one approach to the necessary framework for keeping the Avalanche Center alive in the future may be contained within consultant Knox Williams' report which states:

The avalanche centers that are sustainable will have these traits:

- *A budget spread over many committed partners for stable funding*
- *Strong community awareness, use, and support of the service*
- *A staff of respected and well-spoken professionals*
- *Products and services that timely, accurate, clear, concise, and user-friendly so that users get what they need*
- *A strong brand name, earned via reputation, advertising, and word of mouth*
- *A good business/operations plan*
- *An innovative entrepreneurial strategy*
- *An exciting website*

It is strongly believed that forecast staff at the NWAC are making considerable effort to ensure that the traits summarized by Williams are alive and well in the production and dissemination of the daily suite of products and services. To this end of maintaining the most efficient and useful program possible, the following annual budget figures have been developed. However, for both the present and the anticipated budgets summarized below [Federal fiscal years include October-December of the previous year and January-September of the indicated year—e.g., FY 09 runs from October of 2008 through September of 2009], please note that these projections were developed with the additional following assumptions:

- * Significant carryover funds are anticipated from FY09 to FY10
- * Flat support levels are expected to continue from the Forest Service in terms of appropriated monies from the Mt Baker Snoqualmie National Forest
- * A 3% COLA increase has been added to annual cooperator contribution figures from the National Park Service, WSPRC and WSDOT
- * In FY07, NWAC received \$31,562 from Title II/RAC programs (North MBS, South MBS and Kittitas) and \$19,516 in FY08 (North MBS, South MBS). However, due to the fact that the Title II/RAC program was reenacted very late by the federal government for FY09, most counties chose to carry such funding into FY10. Hence NWAC received no RAC monies for operations during this current FY. Such a decline in previously important program contributions played a significant part in NWAC's need for monies provided by the State Supplemental Budget during the current and past FY. Although no RAC monies are projected for FY10, NWAC has or will submit proposals and presentations for a variety of grant funding and it is hoped that at least some will be successful.

- * Unemployment and Medical expenses of approximately \$14,000 in previous years have dropped to less than \$1,000 for both FY09 and FY10 due to year-round funding through fire or fire research related programs for two of the forecasters and a continued LWOP status during the summer months for the third forecaster.
- * Salaries increased approximately 3% in January of 2009; however, no salary increases are anticipated for calendar year 2010.
- * While FOAC's direct contribution toward NWAC operation is expected to remain at \$5,000, it is committed to the funding necessary to finish Phase I of the new web site. The web site expenses have already reached nearly \$30,000 and another \$20,000+ may be required to implement the planned enhancements and interactive forecast and data retrieval modules expected in Phase II.
- * No matter what the final level of program funding turns out to be, all normal forecast and data services will be provided for as long as funding allows; with current projected funding levels, these services should encompass the whole normal forecast season including spring forecasts. This "all or nothing" operational program response to funding levels has been previously agreed upon with cooperators as the best way to meet future monetary shortages.
- * While capital equipment expenditures of around \$24,000/year are projected for FY09, this amount declines to about \$13,000 in FY10. Note that with a projected average life span of 8-10 year/sensor and field capital equipment reaching upwards of ~\$300-400,000, a conservative 10% replacement rate equals \$30-40,000/year for the field data network alone.

As always it should be noted that the NWAC exists not only because of the direct funding by its many strong cooperators, but also through the many indirect and very important in-kind contributions that help to more completely reflect the overall value of the program. As shown below (Table 4), these indirect monies total almost \$200,000 annually, and result in a program that provides substantially more benefits (>\$600,000) to each cooperator than its individual contributions might otherwise suggest. Unfortunately, the projected budget for FY2010 shown below does not and can not include some unknown monies that may become available over the summer or fall through continued NWAC and FOAC efforts, such as Title II/RAC grants, web site advertising and other efforts.

Table 4. Sources of Funding for FY09 and FY10; Total direct and indirect funding.

NWAC Budget—Sources of Funding			
Funding Source	[Direct Support]	FY09	FY10
		[projected]	[projected]
Federal		\$117,000	\$117,500
	USDA-Forest Service	\$75,000	\$75,000
	National Park Service	\$17,000	\$17,500
	USDA-FS Fee Demo	\$25,000	\$25,000
Washington State		\$206,000	\$135,750
	Parks and Recreation Commission (includes State General Fund \$)	\$79,000	\$79,000
	Department of Transportation	\$45,000	\$46,250
	WA Supplemental Budget	\$73,000	\$0
	Snowpark Program	\$4,500	\$4,500
	Snowmobile Program	\$4,500	\$6,000
County		\$0	\$0
	Title II/Resource Advisory Comm.	\$0	\$0
Private + Carryover		\$50,811	\$76,142
	PNSAA & Ski Washington	\$25,000	\$25,000
	FOAC	\$5,000	\$5,000
	Other private	\$1,300	\$10,000
	Carryover from FY08/FY09	\$19,511	\$36,142
TOTAL [Direct Support]		\$373,811	\$329,392
Estimated In-Kind Support (+3% FY09, 0% FY10)		\$197,073	\$197,073
[Indirect support]	USDA-FS (~30% of direct support)	\$30,000	\$30,000
	WSDOT (obs + equip. support)	\$23,415	\$23,415
	NPS (obs + equip. support)	\$5,620	\$5,620
	NWS (office costs + product access etc)	\$68,105	\$68,105
	PNSAA (obs, power, phone etc)	\$7,770	\$7,770
	All (one time cost for data support)	\$62,163	\$62,163
	FOAC (web site development + equip)	\$32,664	\$30,000
GRAND TOTAL [DIRECT + INDIRECT]		\$603,548	\$556,465

Figure 22. NWAC—Projected FY09 Expenses

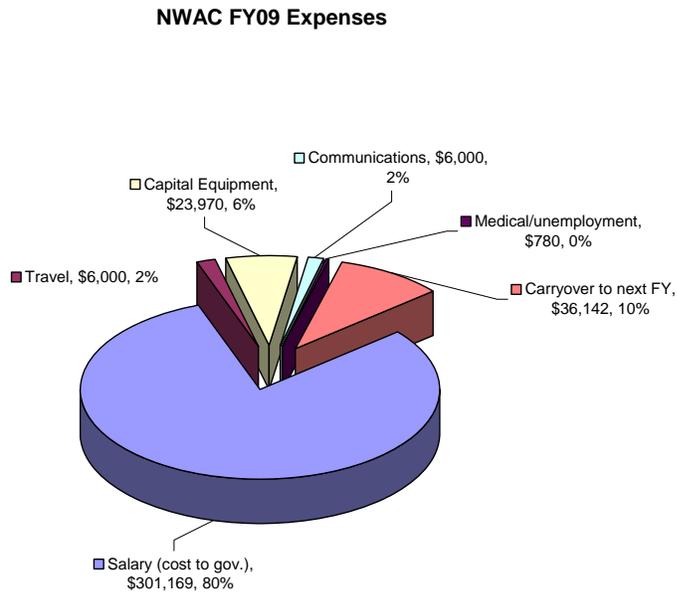
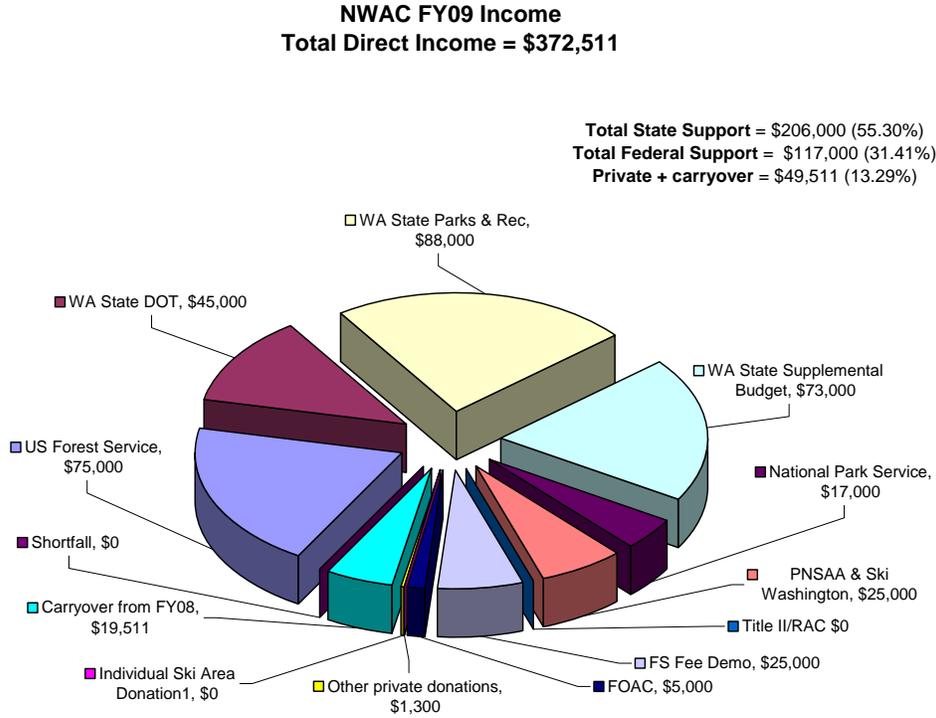


Figure 23. NWAC—Projected FY09 Income



NWAC STAFF

Biographies and photos of both current and past forecasters at the NWAC are available on the [staff page](#) of the NWAC web site. However, short summaries of current forecast staff (three full time avalanche-meteorologists) during the past winter are also given below.

- * **Mark Moore** – Director and forecaster at the NWAC since its inception in 1976. Focal point for budgeting, avalanche accident information, web site management and development, computer and weather station management. Experienced weather station guru and fire weather researcher in the summer (www.airfire.org).
- * **Kenny Kramer** – Forecaster at the NWAC since 1990. Focal point for AWIPS (Automatic Weather Information Processing system) maps and macros, Resource Advisory Committee (RAC/Title II) proposals. Northwest RAWS instrumentation coordinator in the summer
- * **Garth Ferber** – Forecaster at the NWAC since 1993. Focal point for weather station programs and data, forecast products, FOAC Snow Pack Information Exchange.

THE LAST WORD

*Here we are on April one, and no sign yet that winter's done.
With snow and winds on the way, avi danger seems here to stay.
Poor bonds to crusts or surface hoar, should make your travel not a bore.
To provide for safety in this weather, skill and experience must come together.*

*Knowing stability's not that great, let choice not chance determine fate.
Ski cut, shovel, Rutschblock test...ECT and all the rest.
Keep aware of whumpfs and cracks, storing info that you lack.
While untracked beckons with allure, objective choices are the cure.
- Mark Moore (from April 1, 2009 forecast)*

LIST OF ACRONYMS USED

AWIPS—Advanced Weather Information Processing System
FOAC—Friends of the Avalanche Center
ISSW—International Snow Science Workshop
NCDC—National Climatic Data Center
NCEP—National Center for Environmental Prediction
NPS—National Park Service
NSAS—Northwest Snow and Avalanche Summit
NWAC—Northwest Weather and Avalanche Center
NWS—National Weather Service
PNSAA—Pacific Northwest Ski Area Association
RAC/Title II—Resource Advisory Committee (Federal Grant Program)
USFS, USDA-FS—United States (Department of Agriculture) Forest Service
WSDOT—Washington State Department of Transportation
WSPRC—Washington State Parks and Recreation Commission