SNOW AND AVALANCHE

COLORADO AVALANCHE INFORMATION CENTER

ANNUAL REPORT 1989-90

Colorado Geological Survey
Colorado Department of
Natural Resources
1313 Sherman Street, Room 715
Denver, Colorado 80203

JUNE, 1990

COLORADO AVALANCHE INFORMATION CENTER

ANNUAL REPORT
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COLORADO GEOLOGICAL SURVEY
COLORADO DEPARTMENT OF NATURAL RESOURCES
1313 SHERMAN STREET, ROOM 715
DENVER, COLORADO 80203

JUNE, 1990

STATE OF COLORADO

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MEMORANDUM

TO: Winter Travelers in Colorado

FROM: John W. Rold, State Geologist JWR

DATE: June 25, 1990

SUBJECT: CAIC Annual Report

I am pleased to announce that the Colorado Avalanche Information Center has just completed its third year under the management of the Colorado Geological Survey. The program has been a success, as measured by the support of the sponsors, by annual increases in the use of the public hotlines, by the number of persons attending avalanche educational seminars, and by a downward trend in serious avalanche incidents.

The purpose of the Center is to minimize the economic and human impact of snow avalanches on recreation, tourism, commerce, industry and the citizens of Colorado. It achieves this through a dual mission of forecasting and public education.

The Center is wholly funded by grants and donations (no Colorado General Funds). It depends solely on contributions from both the public and private sectors. Most government programs are asked to do too much on too few dollars, and the Avalanche Center is no exception. Nonetheless, the Center performs well despite a lean and declining budget. To counter this trend, it is our goal to obtain additional funding to meet an expanding role for the Center and the needs of its customers.

Enclosed is your copy of this year's Annual Report, which highlights the operations and accomplishments of the Center. This report is prepared primarily for the Center's sponsors, whose belief in its mission and support have made the Center possible. I would welcome your suggestions of how the Center might improve or expand its services.

COLORADO AVALANCHE INFORMATION CENTER

Colorado Department of Natural Resources

Colorado Avalanche Information Center
10230 Smith Road
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(303) 371-1080

DIRECTOR'S STATEMENT

To Our sponsors and Patrons:

As we close the books on another Colorado winter, I find myself reflecting on the life of an avalanche forecaster. It is indeed a chameleon's life: six months of commuting in the dark, working in the snow on days too cold for words, working overtime, meeting hourly deadlines involving complex decisions, managing stress while staying one step ahead of storms, and taking my ulcer medicine; and then six months of regenerating in the warmth of summer, working part-time, meeting monthly deadlines, organizing last year's data, writing reports, planning the long-term future, courting new sponsors, putting the ulcer medicine on the shelf, and getting reacquainted with my wife.

Mind you, I'm not complaining. It's a great life and a most challenging job. After all, my coworkers and I keep coming back every year. It's easy to return when we look at our accomplishments and see how each year we're a few steps ahead of the last. For example:

- We are maintaining a broad base of support, as our sponsors are a diverse group ranging from large government agencies to small private businesses.
- Our public hotlines continue to see increased use, this year up 14%.
- Despite cutting back from four to three forecasters, we still managed to increase the number of people attending our avalanche talks, seminars, and schools.
- All three Center staff members were invited to teach at the National Avalanche School in Denver last November.

On the other hand, there is one troubling trend -- decreasing revenues. This year operating funds were $109,759, compared to $111,609 last year and $112,010 two years ago. This declining base is further eroded by the increased cost of doing business. We are working hard to cut costs (as shown by the elimination of one staff position this year), but this essentially means that we are doing less. We would rather do more, which means that we must increase our revenues. Thus, we are actively pursuing new sponsors. We will keep you informed of our progress.

The Colorado Avalanche Information Center remains committed to providing the best possible service to the citizens of Colorado and our sponsors. It is your support that makes the Center possible. We thank you.

Sincerely,

Knox Williams
Director

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EXECUTIVE SUMMARY

Administration: The Colorado Avalanche Information Center is managed by the Colorado Geological Survey of the Department of Natural Resources. Knox Williams is program director.

Funding: The Center is totally cash funded. In FY 89-90, total revenues were $109,759 (compared to $111,609 last year.)

Housing: The Center is housed at the National Weather Service in Denver, with an office also at the U.S. Forest Service in Fort Collins.

Staff: Three forecasters shared the responsibilities of a 7-day work week during the winter season from November through April.

Summary of avalanche events: A total of 1,391 avalanches were reported to the Center this season (25% below normal). Avalanche Warnings were posted on 20 days (15 below normal). Four people died by avalanche (normal). There was negligible property damage.

Avalanche hotlines: The Center maintains avalanche message phones in seven Colorado cities and towns for the public to call for current conditions. Some 49,590 calls were made to the hotlines this winter, up 14% from last year. And new this year was our participation in the Colorado TravelBank, a computer bulletin board into which we put our daily forecasts. Users made 25,613 contacts seeking weather and avalanche information.

Media contacts: The Center logged 197 contacts with broadcast and print media, once more achieving a timely and accurate dissemination of avalanche information and a high profile for the Center. Additionally, five mountain radio stations broadcast our hazard evaluations and forecasts daily.

Public education: Center personnel presented 51 avalanche awareness talks and field seminars, reaching on a personal level some 2,674 people. For the third year, we participated in Avalanche/Back Country Safety (ABC'S) Week. We continued to distribute to the public the Center's avalanche awareness cards, brochures, and posters.

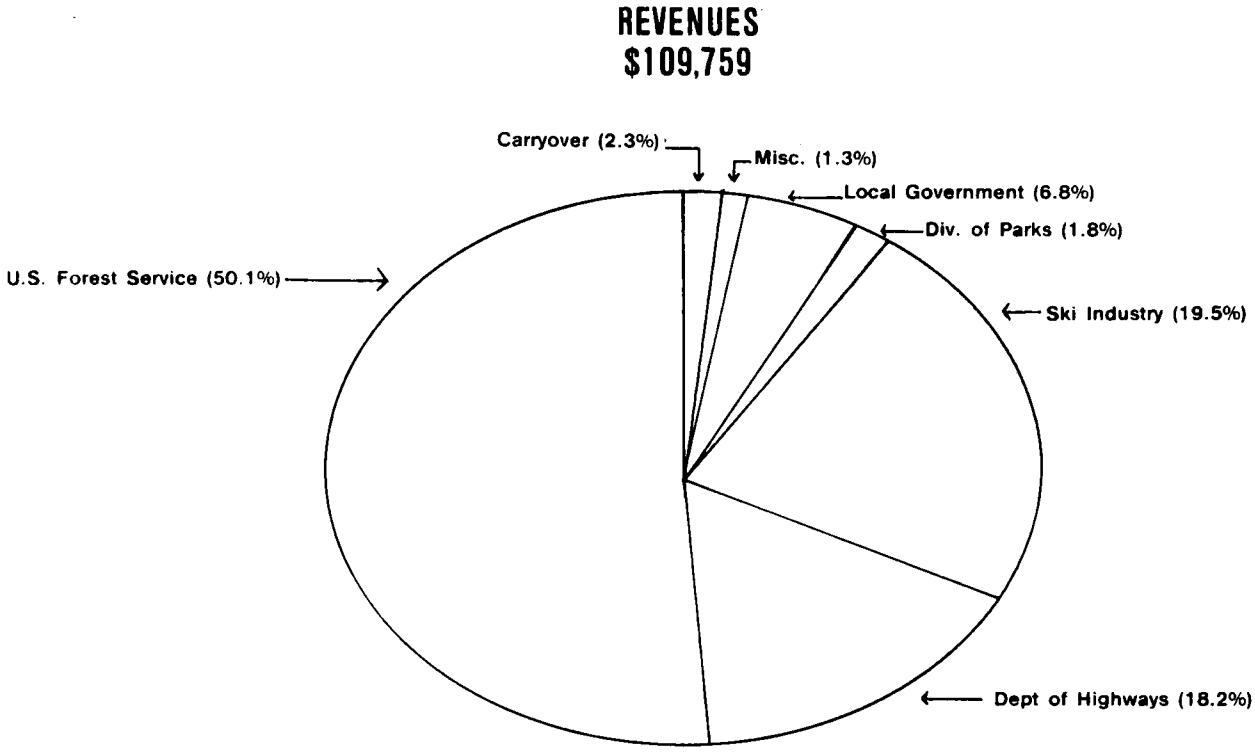
Hazard grading: Each year the Center grades itself on its daily avalanche hazard forecast. This year the results were 91% correct forecast, 6% over-forecast, and 3% under-forecast.

FUNDING and BUDGET

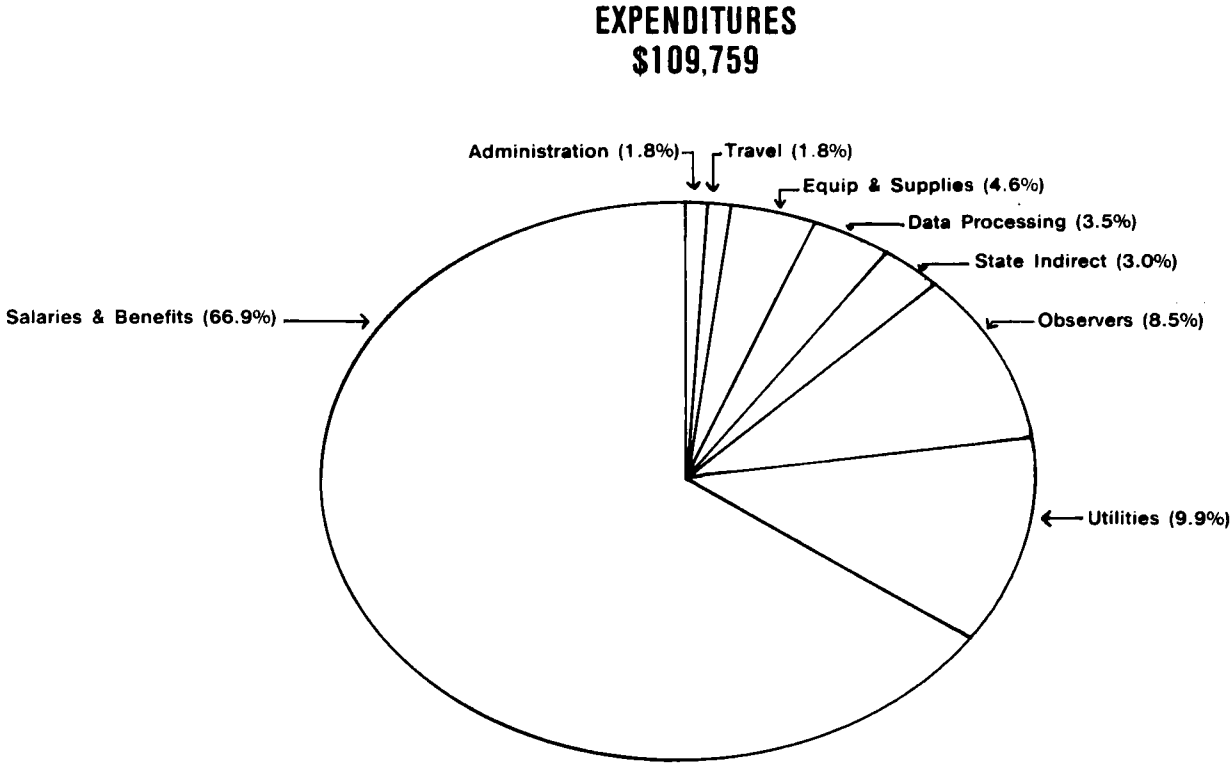
The Colorado Avalanche Information Center is totally funded by grants and donations. A year ago funding was $111,609. For FY 1989-90, funding of $107,282 came from the 21 sponsors listed below, plus a carry-over of $2,477, for a total of $109,759.

Federal	
U.S. Forest Service	$55,000
State	
Colorado Department of Highways	$20,000
Colorado Division of Parks, Snowmobile Fund	$ 2,000
Local Government	
Pitkin County	$ 3,000
Summit County	$ 2,500
Town of Breckenridge	$ 1,000
Town of Frisco	$ 1,000
Ski Industry	
Colorado Ski Country USA	$15,000
Winter Park Recreational Association	$ 1,000
Breckenridge Ski Area	$ 1,000
Vail Associates	$ 1,000
Steamboat Ski Area	$ 1,000
Crested Butte Resort	$ 850
Arapahoe Basin	$ 500
Copper Mountain Resort	$ 500
Telluride Ski Corp	$ 500
Miscellaneous	
Colorado Mountain Club	$ 395
Tenth Mountain Trail Association	$ 300
Henderson Mine and Mill	$ 300
Alfred Braun Hut System	$ 200
Sale of avalanche slide sets	$ 187
Friends Hut Inc	$ 50
Carryover from FY 88-89	$ 2,477
TOTAL	$109,759

WHERE THE MONEY CAME FROM



HOW THE MONEY WAS SPENT



OPERATIONS

Administration: The Center is managed by the Colorado Geological Survey under the directorship of State Geologist John W. Rold. Founded in 1983, the Center was administered for four years by the Executive Director's Office of the Department of Natural Resources before moving to the Geological Survey in April 1987. The Center is totally funded by grants and donations.

Housing: The Center is primarily housed at the National Weather Service Forecast Office in Denver (at 10230 Smith Road.) The space provided is shared with NWS Fire Weather operations. Secondary office space is provided by the U.S. Forest Service in Fort Collins.

Season: The Center operates on a full-time basis seven days a week from November through April. During the summer months, the Center is closed and the staff works on a part-time basis.

Purposes: The purposes of the Center are to:

- monitor the changing weather, snow cover, and avalanche conditions in the Colorado mountains (see Data Sites below);
- provide twice-daily information to the public, via recorded telephone messages (hotlines) (see Section VII);
- warn of dangerous avalanche conditions by issuing avalanche warning bulletins via the NOAA Colorado Weatherwire and the news media (see Section VII);
- present educational avalanche awareness talks, seminars, and public service announcements (see Section VIII);
- be a focal point of avalanche information (in general or for specific events) for sponsors, news media, government or private agencies, researchers, writers, etc.
- provide specialized information to sponsoring agencies; and
- maintain a computer data set of mountain weather and avalanche events, from Colorado and other mountain states (see Section VI).

Staffing and Duties: Personnel for the 1989-90 winter were: Knox Williams (Director), Nick Logan (Associate Director), and Dale Atkins. (This was the only season since opening in 1983 that the Center had less than four

forecasters, a change forced by reduced fund availability.) One of the three forecasters was on duty daily from 6:30 am to 4:30 pm, from opening day on November 13, until closing on April 22.

Each forecaster is responsible for:

- monitoring mountain weather, snow, and avalanche conditions;
- logging all incoming data from observers;
- evaluating field data and National Weather Service data;
- making daily snow stability evaluations and forecasts;
- updating recorded telephone messages (hotlines) twice daily;
- issuing and terminating avalanche warnings when warranted;
- handling special requests from sponsoring agencies; and
- initiating or responding to calls from the news media.

Data Sites: The Center maintains a network of mountain observation sites for providing weather, snowpack, and avalanche data to the forecast office. Altogether there are approximately 32 manned sites: 20 are ski areas, and the remainder are highway and backcountry locations. The Center supports contract observers at Berthoud Pass, Gothic, and Red Mountain Pass; it also has access to data from remote weather stations maintained by the Soil Conservation Service.

Education: Forecasters present avalanche awareness talks and field seminars to many groups, providing educational opportunities to citizens, tourists, and avalanche practitioners. In addition, forecasters maintain frequent contact with news media personnel to give broad (and accurate) coverage of current avalanche conditions. Such news stories not only inform but also enhance avalanche education among the public. Section VIII details our efforts toward public education and safety.

WEATHER and AVALANCHE SYNOPSIS

The winter of 1989-90 produced two contrasting types of snow cover: in the Northern Mountains[1], a deep snow cover developed quickly during December creating a generally stable pack, while in the Central and Southern Mountains, dry conditions prevailed that made for a shallow and weak snow cover.

Seasonal temperatures were above normal throughout the mountains. The early-winter storm track repeatedly favored the Northern Mountains with normal to above-normal snowfall. The Central and Southern Mountains remained unseasonably dry with snowfall well below normal. Towards the end of the winter, the spring storm track favored the Southern Mountains. However, by season's end, snowfall totals were slightly below normal in the Northern Mountains to far below normal in the Central and Southern Mountains. The number of reported avalanches as well as the number of days with Avalanche Warnings in effect were both below normal. Deaths caused by avalanches were right on the long-term average. Property damage was practically nil.

Snowfall

Table 1 shows monthly and seasonal snowfalls for all sites that regularly reported data to the Avalanche Center this year.

On the first of November, the mountain snow cover was spotty, ranging from shallow to nonexistent. November snowfall was 60-98% of normal over the Northern and Central Mountains and only 5-20% in the Southern Mountains, and thus did little to enhance the snowpack.

December snowfall showed large variability over short distances. Monthly totals showed a strong bias toward the Northern Mountains as a sustained period of snow fell from the 10th-19th. In the Northern Mountains, amounts ranged from 80-100% of normal; in the Central Mountains, 40-80%; and in the Southern Mountains, 10-30%.

[1]The geographical regions called Northern, Central, and Southern Mountains of Colorado are used extensively in this report. The Northern Mountains extend from the Wyoming border to a line from Denver to Hoosier Pass (just south of Breckenridge) to Glenwood Springs, as the southern boundary. This boundary roughly follows the I-70 corridor but dips south in the area of Breckenridge to include the Ten Mile Range. The Central Mountains extend south from this line from Denver-Hoosier Pass-Glenwood Springs to a southern boundary line from Pueblo to Montrose. The Southern Mountains lie between this Pueblo-Montrose line and the New Mexico border.

Table 1. 1989-90 snowfall totals in inches (percents of normal are for sites with 10 or more years of record)

	Nov	Dec	Jan	Feb	Mar	Apr	Total Dec-Mar	% of Norm	Total Nov-Apr	% of Norm
Northern Mountains										
Arapahoe Basin	37	58	33	33	75	60	199	96%	296	93%
Bear Lake	33	35	27	28	77	38	167		238	
Beaver Creek		57	28	26	66		177			
Berthoud Pass	27	50	36	34	76		196	97%		
Breckenridge	39	63	34	21	37		155	72%		
Copper Mountain	32	52	28	20	48		148	82%		
Eldora		43	18	7	66		134			
Loveland	29	63	34	32	81	63	210	89%	302	87%
Steamboat		132	45	51	63		291	117%		
Vail		101	30	32	80		243	92%		
Winter Park Resort	35	74	32	45	72		223	87%		
Winter Park Town			16	27	52					
Central Mountains										
Aspen Highlands	34	32	22	22	40		116	66%		
Aspen Mountain		22	20	23	34		99	60%		
Cooper	30	32	18	20	33		103			
Gothic	42	26	41	62	55	85	184	71%	311	93%
Monarch	10	48	39	43	74		204	116%		
Snowmass		31	24	25	35		115			
Sunlight		25	16	24	26		91	46%		
Southern Mountains										
Purgatory			27	44	58					
Red Mountain Pass	3	30	25	37	61	77	153		233	
Telluride		15	20	23	64		122	81%		
Wolf Creek	6	6	58	78	102		244	81%		

January was a dry month without significant storms for all mountain regions. Amounts in the Northern Mountains ranged from 44-71%; in the Central Mountains, 30-81%; and in the Southern Mountains, 53-64%.

February was another unexciting month with generally light snowfall. Only Monarch and Wolf Creek were above normal. In the Northern Mountains amounts ranged from 44-90%; in the Central Mountains, 54-110%; and in the Southern Mountains, 60-130%.

March saw a stormy period at the beginning of the month that insured normal to above-normal snows at most sites. For the month in the Northern Mountains amounts ranged from 67-135%; in the Central Mountains, 46-130%; and in the Southern Mountains, 110-140%.

April brought typically fickle weather with a mixture of dry heat, snowshowers, and a sustained stormy period from the 24th-30th. Cloud cover was greater than normal, and snowfall was generous, which contributed to little wet-snow avalanche activity.

For the seasonal trend, note in Table 1 the percent-of-normal totals for December-March. Only Steamboat and Monarch managed above-normal snows, while most sites in the Northern Mountains ended this four-month period with 82-97%; in the Central Mountains, 46-71%; and in the Southern Mountains, about 81%. Also note that only three sites have entries for percent-of-normal for the six months of November-April. Gothic, with nice snowfalls in November and April, was able to boost its seasonal total from 71% to 93% of normal.

Avalanches

A total of 1,391 avalanches was reported to the Avalanche Center from November through April. This number is 25% below the average of 1,850 avalanches. Table 2 shows the monthly distribution of the avalanche total.

November produced few avalanches (83, as shown in Table 2), mainly because of the lack of snow cover. December was active (174) because of the stormy period between the 10th-19th, though very few avalanches were reported in the Central and Southern Mountains because of lack of snow. January produced few avalanches because of below normal snowfall. February also produced few avalanches because of generally subnormal snowfall. March was

the most active month (458) because of the stormy period from the 6th-8th that caused an overload on the weak layer of depth hoar that had been forming all season. Few days in March were without clouds, so no significant cycle of wet snow avalanches occurred. April saw avalanches during the stormy periods, and very little wet-snow activity between storms.

Avalanche Hazard and Warnings

Tables 2, 3, and 4 present several looks at the avalanche hazard and warning days this season. Table 2 shows the daily hazard ratings (low, moderate, high, extreme) for the Northern, Central, and Southern Mountains on a monthly basis. During an average winter the number of days with a widespread "high" hazard is greatest in December, January, and February, for these are the months that most often threaten backcountry travelers with deep-slab, delayed instability. This winter in the Northern Mountains deep-slab instability extended into March, such that from December-March, 8-10 days per month carried a "high" hazard. In the Central and Southern Mountains, below-normal snowfall meant the greatest number of days with "high" hazard occurred in the latter half of the season (in February and March.) An "extreme" hazard occurred only on one day in March in the Southern Mountains during a period of heavy snow and wind.

Table 3 shows a monthly summary of warning days for the 1989-90 season, plus the previous 15 seasons. (A warning day is one on which the hazard was rated high and an Avalanche Warning was issued.) Warnings were issued on 20 days, about 15 days below average. This was the fewest number of warning days on record. No warnings were issued in November, January, and April. Only March had more warning days than the long-term average.

Table 4 breaks the warning days this season into regional statistics for the Northern, Central, and Southern Mountains. This winter the Northern Mountains had more warning days than other regions. Typically the Southern Mountains lead in warning days.

Table 5 shows the impact of avalanches this season on Colorado mountain highways. It lists the number of events and dates on which both natural and artificially triggered avalanches reached highways. The total of 14 natural releases is the fewest for the last seven years. We have not kept accurate records of triggered events long enough to establish a meaningful average.

Avalanche Accidents

The last part of table 2 lists a monthly breakdown of avalanches involving people and property in 1989-90, while table 6 compares these same statistics with long-term annual averages. The winter of 1989-90 was worse than normal in the number of people caught and injured. The number of people partly buried and totally buried were below the long-term average, yet the number killed -- 4 -- was precisely the long-term average. Finally there were no property sites damaged.

Table 7 lists all accidents reported to the Avalanche Information Center this winter. Note that there were only four fatal accidents (January 2, February 18 and 25, March 7).

This synopsis has presented a general and statistical overview of the 1989-90 season, with Tables 1-7 showing different aspects of the season. For a more detailed description of events, the reader should continue to the next section, the Detailed Winter Summary.

Table 2. 1989-90 winter summary of avalanches, hazard days, and accidents

	Nov	Dec	Jan	Feb	Mar	Apr	TOTAL
No. of avalanche warning periods	0	1	0	2	2	0	5
No. of days with warning in effect	0	6	0	4	10	0	20
No. of observed avalanches	83	174	236	301	458	139	1391
No. of days with 1 or more avalanches	10	22	27	25	26	20	130
Northern Mountains							
No. of days with:							
low hazard	7	6	7	0	6	8	34
moderate hazard	8	15	15	20	16	14	88
high hazard	2	10	9	8	9	0	38
extreme hazard	0	0	0	0	0	0	0
Central Mountains							
No. of days with:							
low hazard	11	6	11	0	9	10	47
moderate hazard	4	23	13	17	13	12	82
high hazard	2	2	7	11	9	0	31
extreme hazard	0	0	0	0	0	0	0
Southern Mountains							
No. of days with:							
low hazard	17	29	25	3	8	9	91
moderate hazard	0	2	6	15	12	13	48
high hazard	0	0	0	10	10	0	20
extreme hazard	0	0	0	0	1	0	1
Avalanche accidents							
people caught	2	8	6	14	17	3	50
people partly buried	0	1	1	1	5	0	8
people buried	0	1	1	3	1	0	6
people injured	1	1	1	2	0	1	6
people killed	0	0	1	2	1	0	4
vehicles caught	0	0	0	0	1	0	1
property sites damaged	0	0	0	0	0	0	0

Table 3. A 16-year summary of avalanche warning days

Winter	Nov	Dec	Jan	Feb	Mar	Apr	Total
1974-75	0	9	16	10	15	2	52
1975-76	3	4	6	12	4	0	29
1976-77	0	4	7	5	5	2	23
1977-78	2	5	7	8	15	0	37
1978-79	0	13	12	0	9	5	39
1979-80	6	5	20	9	5	4	49
1980-81	0	6	2	6	16	5	35
1981-82	4	8	3	3	4	0	22
1982-83	1	7	3	14	16	5	46
1983-84	8	15	3	3	12	9	50
1984-85	2	10	4	6	12	3	37
1985-86	12	3	0	12	0	0	27
1986-87	0	0	15	6	5	0	26
1987-88	0	8	17	4	3	0	32
1988-89	3	11	0	13	0	3	30
1989-90	0	6	0	4	10	0	20
Total	41	114	115	115	131	38	554
Average	2.7	7.1	7.2	7.2	8.1	2.4	34.6

Table 4. Avalanche warning days by region, 1989-90 (dates in parentheses)

Region	Nov	Dec	Jan	Feb	Mar	Apr	Total
Northern Mountains		(15-20)		(17-18)	(6-10) (13-15)		
Days	0	6	0	2	8	0	16
Central Mountains					(6-10) (13-15)		
Days	0	0	0	0	8	0	8
Southern Mountains				(14-15)	(6-10) (11-15)		
Days	0	0	0	2	10	0	12
Total	0	6	0	4	26	0	36

Table 5. Avalanches reaching Colorado highways, 1989-90

Highway	Location	Natural aval.		Triggered aval.	
U.S. 6	Loveland Pass	6	Dec. 15 Jan. 11, 18, 23 Feb. 17 Mar. 6	22	Nov. 28 Dec. 16, 19 Jan. 26 Feb. 13, 18 Mar. 6, 7, 15 Apr. 27, 30
I-70	W. side Ike Tunnel	1	Dec. 17		
	Vail Pass			1	Mar. 8
U.S. 40	Berthoud Pass	2	Jan. 11 Mar. 6	2	Mar. 8, 9
U.S. 50	Monarch Pass	3	Mar. 7		
U.S. 550	Red Mountain Pass	4	Feb. 2 Apr. 4, 19	7	Feb. 21, 24 Mar. 13
Rd. to Eldora Ski Area		1	Mar. 8		

Total: 49 avalanches; 17 natural and 32 triggered

Table 6. Summary statistics of Colorado avalanche victims

	1970-89 Total	(19 winters) Average	1989-90 Total
People caught	687	36	50
People partly buried	192	10	8
People totally buried	131	7	6
People injured	60	3	6
People killed	75	4	4

Table 7. Colorado avalanche accidents, 1989-90 (italics indicate fatal accident)

Date	Location	Details
11/18	Breckenridge	1 out-of-bounds snowboarder caught
11/26	Copper Mountain	1 lift mechanic caught & injured
12/3	Loveland Pass	1 ski tourer caught
12/14	Copper Mountain	1 patroller caught & ptly bur (knees)
12/15	Snowmass Ski Area	1 patroller ct & buried 3', injured
12/18	Copper Mountain	1 patroller caught
12/22	Breckenridge	2 patrollers caught, (two incidents)
12/23	Yankee Boy Basin	1 ski tourer caught
12/27	Loveland Pass "Overlook"	1 snowboarder caught
1/2	*Vail "Mushroom Bowl"*	*3 ob skiers ct, 1 inj, 1 bur & killed*
1/16	Wolf Creek	1 patroller caught
1/18	Aspen Mountain	1 out-of-bounds skier ct, broke ski
1/28	Wolf Creek	1 lift skier caught
2/3	Loveland Pass	2 ski tourers caught
2/3	Snodgrass Mountain	1 ski tourer ct, bur 4', beacon rescue
2/3	Aspen "McFarlane's Bowl"	1 ski tourer caught
2/7	Vail Pass abv Black Lks.	1 ski tourer caught, inj, lost shovel
2/9	Vail Pass	1 snowmobiler caught
2/10	Vail Pass	1 ski tourer caught
2/18	*Crested Butte*	*1 ob skier ct, bur 7', 21 hrs, killed*
2/18	Red Mtn. (nr. Vail P.)	1 ski tourer ct
2/18	Ashcroft	1 ski tourer ct, ptly buried, injured
2/19	Crested Butte	1 patroller caught
2/22	Telluride	1 patroller caught
2/25	*Fremont Pass*	*2 snowboarders ct, 1 buried 3', killed*
3/4	Loveland Ski Area	1 ob skier caught & partly buried
3/6	Telluride	1 patroller caught
3/6	Berthoud Pass	1 motorist caught in car
3/7	*Red Mountain Pass*	*2 bc skiers ct, 1 bur 7', killed*
3/7	Telluride	1 lift skier caught
3/7	Telluride	1 patroller caught
3/7	Telluride	3 patrollers caught
3/8	Berthoud Pass	1 patroller caught & partly buried
3/8	Arapahoe Basin	1 ob skier caught & partly buried
3/8	Telluride	1 patroller caught & partly buried
3/9	Berthoud Pass	1 backcountry skier ct & partly buried
3/13	Telluride	1 lift skier caught
3/15	Vail Pass (near)	1 heli-ski guide caught, 1 dog caught
3/16	Aspen Mountain	1 out-of-bounds skier caught
4/4	Arapahoe Basin	1 out-of-bounds skier ct, & injured
4/22	Breckenridge	1 patroller caught (cornice fall)
5/6	Loveland Pass (near)	1 backcountry skier ct in wet slide

DETAILED WINTER SUMMARY

The following narrative is a detailed, month-by-month description of weather and avalanche events and trends of the 1989-90 winter season. If you are into details, this is the section for you.

Preseason

For the second summer in a row, mountain rains were well below normal, especially in the southern half of Colorado. More and more, the dreaded "d" word -- drought -- was appearing in news reports. Everyone was hoping for generous winter snows to replenish stream runoff and water reserves.

October brought only one snowstorm to the mountains: in mid-month, 1-2 feet of snow fell which provided the base for the winter snowpack. Without additional snows, this layer began the deteriorating trend toward depth hoar, which would leave the mountain snow cover with little basal strength all season long.

November

The first two weeks of November were dry, and the Avalanche Center opened on the 13th under clement conditions. On that day, snow depths at our data sites were shallow, generally ranging from 6-18", though Gothic had no snow at all, a first in 15 years of record-keeping.

The first mountain storm of November came on the night of the 14th, and by the morning of the 15th, it had dropped 4-7" in the Northern Mountains, and none elsewhere. The weather quickly shifted back to its preferred pattern of a ridge over the western United States, such that fair, dry conditions dominated through the 24th. Late on that day, however, skies clouded over as a storm approached from the west.

By the morning of the 25th, 2-10" of snow had fallen in the Northern, 4-12" in the Central, and only a trace (T)-1" in the Southern Mountains. Snow continued on the 26th and 27th and ended early on the 28th. Some representative storm totals were: in the Northern Mountains, Beaver Creek, 28"; Mary Jane, 26"; Berthoud Pass, 25"; Loveland, 22"; Breckenridge, 20"; and Eldora, 18; in the Central Mountains, Gothic, 30"; Sunlight, 23"; Snowmass,

21"; and Aspen Mt., 18"; and in the Southern Mountains, Telluride, 8"; and Red Mt. Pass, 2". The final three days of November were clear.

Snowfall, expressed as a percentage of November's normal, was: Gothic, 98%; Copper Mt., 94%; Arapahoe Basin, 80%; Berthoud Pass and Loveland, 60%. In the Southern Mountains, amounts ranged from 5-20% of normal.

The two storms of November set a pattern that would endure through December and beyond: storms riding in on persistent northwest flow would favor the northern half of the Colorado mountains at the expense of the south.

Our ratings of the backcountry avalanche hazard remained at low through the 25th. Then, with fresh snow accumulating, we raised the hazard to moderate in the Northern and Central Mountains on the 26th-27th, and to high on the 28th-29th.

A total of 83 avalanches was reported to the Center in November, and most of these fell on the 27th-28th. Only two avalanche incidents occurred: on the 18th near Breckenridge, a snowboarder was caught, and on the 26th at Copper Mt., an employee was caught, carried on a short ride, and slightly injured by the rough terrain.

December

The first five days of December brought mild, dry weather to the Colorado mountains. A ridge of high pressure kept the storm track well to the north. The ridge flattened out by the 6th allowing impulses to pass through, and the Northern Mountains began to see the first flakes of what would develop into a long snowy period.

On the morning of the 6th up to 4" of new snow had fallen in the Northern and Central Mountains. Sites in the Southern Mountains received only a trace. Snow continued to fall and by the morning of the 7th all mountain areas reported 2-9". During the first week of December, few slides ran, but one ski tourer was caught on Loveland Pass in a small soft slab on the 3rd.

Mild and dry weather briefly returned on the 8th and 9th, but snow started to fall during the afternoon of the 9th. By the 10th, the Southern Mountains had gotten a T-1"; the Central Mountains, 3-5"; and the Northern

Mountains, 4-8", but Steamboat reported 17". (At Steamboat this would be the first of six snowfalls greater than 12" in December.) Light snow continued during the day, and on the morning of the 11th an additional 2-7" had fallen in the Northern Mountains. Central and Southern Mountain sites got up to 4".

During this time a stationary ridge was building over the West Coast, and an upper-level low formed over the Great Lakes creating a strong northerly jet over Colorado. This pattern favors snow in the Northern Mountains, at the expense of the Central and Southern Mountains; it would persist all month.

On the 14th, 2-6" of snow fell in the Northern Mountains, but Vail got 9". The Central Mountains received 1-4" and the Southern Mountains remained dry. That day a patroller was caught and partly buried at Copper Mountain.

Snowfall intensified overnight. On the morning of the 15th, sites in the Northern Mountains reported 6-14" with 19" at Steamboat and 20" at Vail. During the previous six days snowfall amounts in the Northern Mountains ranged from 18-27", but were locally heavier at Vail (40") and Steamboat (54"). At the same time, the Central Mountains got only 6-14", and the Southern Mountains, 0-3".

The new snow on the 15th was accompanied by winds gusting to 50-60 mph. This necessitated the first Avalanche Warning of the season to be issued for the Northern Mountains early that morning. The Seven Sisters avalanche released naturally, closing Loveland Pass in the predawn hours. Also on the 15th a ski patroller at Snowmass was caught and buried 3'. Quick action by his partner with a shovel saved his live.

Snow continued to fall and on the morning of the 16th, 6-13" were reported in the Northern Mountains. Once again Vail and Steamboat received more: 17" and 14", respectively. The Central Mountains reported 1-6", and some moisture reached the Southern Mountains with 2-5" being reported.

Unsettled weather continued as weak short waves embedded in the jet stream moved over the mountains. On the 17th the Northern Mountains reported 1-6", but Steamboat was dumped on with 14". The Central and Southern Mountains reported only a dusting. Again on the 18th, the Southern Mountains got skipped while the Central and Northern Mountains got 3-9", but once again

Vail and Steamboat received heavier snowfall: 16" and 17", respectively. A ski patroller was caught at Copper Mountain in a small soft slab.

Snow that had been falling in the Northern Mountains since the 10th finally stopped on the 19th when high pressure moved over the region. The Avalanche Warning for the Northern Mountains was dropped the morning of the 20th. Eighty avalanches were reported during the warning episode.

A fast-moving short wave briefly interrupted the fair weather on the 22nd. Sites in the Northern and Central Mountains reported 1-6", and 0-4" fell in the Southern Mountains. Though little snow fell, it was accompanied by winds gusting to 50-70 mph. Two ski patrollers at Breckenridge were caught in separate slides while conducting control work. Neither was injured.

A ridge of high pressure kept the storm track to the north of the state, but two weak short waves did clip the Northern Mountains on the 23rd and 24th with a dusting of snow. Conditions stayed dry and sunny through the 28th as the ridge stayed over Colorado. Temperatures remained seasonal in the Northern Mountains while the Central and Southern Mountains were springlike, reaching a high of 49 degree at Purgatory on Christmas Day. Two people were caught -- one backcountry skier in the San Juans on the 23rd, and one snowboarder on Loveland Pass on the 28th.

The 29th-31st saw only a dusting of snow each morning for all mountain areas, except Mary Jane and Steamboat. Both areas received 6" on the 30th, and Steamboat reported 12" on the 31st.

For the month, the prevailing northwest flow favored the Northern Mountains with sustained snows between the 10-19th. Steamboat recorded 185% of normal; Vail, 142%; Breckenridge, 120%; Copper Mountain and Loveland, 106%; Berthoud Pass, 100%; and A Basin, 95%. In the Central Mountains only Monarch (106%) was above normal. Aspen Highlands received 71%; Aspen Mountain, 60%; Sunlight, 55%; Gothic, 52%; and Crested Butte, 34%. In the Southern Mountains, Telluride received 41%; and Wolf Creek, only 10% of normal.

The snowpack was untypically stable in the Northern Mountains. Above-normal snowfall slowed the temperature-gradient process and even eliminated it completely in the Steamboat and Rabbit Ears Pass areas. In the Central and

Southern Mountains the shallow snowpack continued to weaken as the temperature-gradient process dominated. In the Southern Mountains the hazard remained low for the entire month. Only on five days was the hazard rated moderate around Telluride. Lack of snow also meant few avalanches -- only four reported in the Southern Mountains, 50 in the Central Mountains, and 117 in the North. (For comparison, last year 490 avalanches were reported.) The only Avalanche Warning issued for the Northern Mountains was valid for five days. Seven avalanche incidents occurred during December: eight people were caught, one was partly buried, one was buried, and one was injured.

January

The snowy pattern of December for the Northern Mountains came to an end with the arrival of January. A mild New Year's Day was followed by increasing clouds on the 2nd as a short wave moved in from the southwest. Before any snow fell, the first avalanche fatality of the season was recorded on the 2nd.

A party of three skiers left the marked boundary of the Vail Ski Area to photograph themselves cliff jumping. They triggered an avalanche when two of them jumped from a 20-foot cliff into the starting zone. The victim, the photographer standing below in mid-track, was swept 600 feet through trees and buried 4 feet deep. He did not respond to resuscitation when uncovered 3 hours later by the Vail Ski Patrol. One of the cliff jumpers suffered a broken leg, caused by the avalanche. The victims carried no avalanche rescue equipment. If they had, the outcome would have been different, for the deceased had a small airspace around his head and would have survived a 30-minute burial.

Only a dusting of snow was reported by most observers on the 3rd, but Steamboat got 5"; Purgatory, 8.5"; and Wolf Creek, 18". Weak impulses moved over the mountains on the nights of the 3rd-4th. Once again most areas received only a dusting.

A ridge of high pressure moved over Colorado on the 5th, bringing clear, bluebird days through the 7th. By late morning on the 8th, very strong wind gusts began. Aspen Mountain reported a gust of 70 mph. Shortly after, Winter Park reported one to 104 mph. By early afternoon Loveland and Winter Park were reporting consistent gusts to 80-95 mph. In a 90-minute period Winter Park reported five gusts over 100 mph, with a peak at 109. Ski Cooper

reported a gust of 104. That afternoon Winter Park, Berthoud Pass, Loveland and Ski Cooper were closed. Many other areas closed upper mountain lifts.

The culprit was a mountain wave that enhanced the jet-stream winds aloft. The ridge had flattened out, with westerly flow aloft over the mountains. Also that morning a mid-tropospheric (600-400 mb) inversion was present, creating a barrier to upwardly moving air. The mountains, perpendicular to the wind, deflected the flow upwards. It then struck the impenetrable inversion layer, bouncing the flow downward, increasing the amplitude and velocity of the wave, and creating the strong surface winds.

The winds abated that night and light snow fell over the Northern and Central Mountains. The Southern Mountains stayed dry. High pressure moved back over the state to bring a taste of spring. Afternoon high temperatures reached into the 30's and 40's between the 10-12th, while temperatures on the eastern plains reached into the 70's. The ridge cracked on the 13th as a broad trough formed over the West Coast, and light snow fell during the day. By the end of the day a dusting had fallen, but Wolf Creek received 4". On the morning of the 14th Northern and Central Mountain sites reported 3-9", while Gothic got 12". In the Southern Mountains 3-6" fell.

Occasional light snow fell from the 15th-18th as Colorado remained on the east edge of the trough. Two avalanche incidents occurred. On the 16th a ski patroller was caught at Wolf Creek. On the 18th an out-of-bounds skier at Aspen Mountain had a close call: triggering an avalanche, he broke a ski colliding with a tree but ended up uninjured and on top.

On the 19th a closed low-pressure center moved over New Mexico and brought upslope snows to the east slope and the plains of Colorado. Very little snow fell in the mountains: only Monarch excelled with 8".

High pressure moved over the region with mostly sunny skies and dry conditions from the 21st-23rd. The ridge began to flatten out with steady and strong west-northwest flow. Often this pattern is a good one for bringing big snows to the mountains, but not this time, because of lack of moisture. However, the jet stream would remain over the mountains for the next week and cause fairly continuous blowing snow.

A short wave on the night of the 23rd left 2-6" in the Northern and Central Mountains, and only 1-2" in the South. Another system blew through late at night on the 26th. Winds gusted to 105 mph at Monarch and 85 at Red Mountain Pass. Snowfall lasted less than 6 hours, so accumulations were light: 1-5" in the Northern, 1-3" in the Central, and 0-2" in the Southern Mountains. One more weak short wave moved in on the night of the 28th, but brought only a dusting of snow by the morning of the 29th. One minor avalanche incident occurred on the 28th when a lift skier was caught at Wolf Creek.

By the 30th an upper-level trough had formed over the West Coast, changing the flow over Colorado to southwesterly. Very light snows fell on the 30th-31st to bring the month to an end.

The week's worth of strong winds above 10,000 feet elevation had built widespread hard slab conditions. The hard slab was thick and strong, and few slides were reported, even though the slab had formed on top of weak depth hoar -- a very troublesome, avalanche-prone stratigraphy.

For the month snowfall was below normal at all sites. In the Northern Mountains, Steamboat and Berthoud Pass got 71% of normal; A Basin, 70%; Copper Mountain, 65%; Loveland, 59%; Breckenridge, 57%; and Vail, 44%; in the Central, Monarch, 81%; Aspen Highlands, 62%; Gothic, 54%; Crested Butte, 32%; and Sunlight, 30%; and in the Southern, Wolf Creek, 64%; and Telluride, 53%.

The lack of a slab at lower elevations and a strong hard slab at the higher elevations made for quiet avalanche month. Only 248 slides were reported. In all six people were caught in four avalanche incidents, one person was partly buried and injured, and one was buried and killed.

February

By now, the foundation for a consistently weak snowpack had been laid. Being consistent with the earlier part of the winter, February did not hold any surprises as to weather anomalies. There were a number of accidents, however, and two of the four avalanche fatalities this winter occurred in February.

The first two days brought very erratic snowfall to all of the mountains. Some reporting stations received little if any snow, while others were blessed with the needed moisture, such as Wolf Creek where 22" of snow accumulated by the 2nd. Numerous avalanches were reported where the snow fell, and Highway 550 over Red Mountain Pass was closed briefly when the "Blue Point" avalanche path dumped five feet of snow onto the road.

From the 3rd-7th, high pressure dominated Colorado, providing generally mild weather except for a few snow showers in the Central and Southern Mountains on the 5th. Even though warm temperatures and lack of fresh snow helped stabilize the upper layers of the snowpack, avalanches managed to catch four backcountry travellers shortly following this early snowfall.

The most dramatic of these accidents occurred on the 3rd when a backcountry skier near Crested Butte was totally buried under four feet of snow. Only the quick actions of his companion saved his life when he was located by a rescue beacon and uncovered within four minutes. This is a prime example of knowing what to do, and being properly equipped in the event of an emergency. That same day, two ski tourers were caught in a small slide on the "Little Professor" avalanche path, across from Arapahoe Basin; a ski tourer was also caught on a steep slope near Aspen. Fortunately no one was injured. On the 4th, rescue teams searched the debris of an avalanche on the west side of Berthoud Pass. Ski tracks were in the vicinity, but it was later determined that no one was buried in the slide.

Light to moderate amounts of snow fell across the mountains from the 8th-10th. Snow drifting in avalanche starting zones, and high temperatures being only in the teens kept the hazard moderate to high. A Special Avalanche Advisory issued on the 9th warned of cold windchill factors and windblown snow being deposited on an already weak snowpack. (See Appendix A for sample Avalanche Warnings and Advisories.) Nearly 40 avalanches were reported during this period. A snowmobiler and two ski tourers were caught in separate slides near Vail Pass. Only one of the skiers was slightly injured, and he lost his avalanche shovel in the ride down.

Temperatures rebounded on the 11th and for a short time blue sky dominated above the peaks. This changed abruptly the next day as a cold front and more moisture moved in from the west. While snowfall amounts were light,

southwest winds were fierce with some gusts in excess of 60 mph by the 13th.

Valentines Day was not sweet for the mountains, especially in the San Juan's. Strong orographics created blowing snow and poor visibility. Moderate to heavy snowfall and winds gusting to 60-70 mph rapidly increased the avalanche danger. As a result, an Avalanche Warning for the Southern Mountains was issued at 10:45am on the 14th. The fast-moving low pressure system passed over Colorado on the 15th but not before depositing 3-6" of new snow in the Northern and Central Mountains, and 6-14" in the Southern Mountains. Winds were light to moderate, and with no new snow in the immediate forecast, the Avalanche Warning was terminated late on the 15th.

By now the coldest period of the month had set in. Daytime highs were only in the single digits, and overnight lows dropped well below zero (-22 F at Red Mountain Pass). This inhibited snow stabilization and kept the avalanche hazard high for the likelihood of triggered releases by aggressive backcountry travellers.

If the sheer cold was not enough, winds on the 17th made travelling in the backcountry brutal. For the second time this month, southwest wind of 40 mph was common and gusts of 50 to even 80 were reported. Once again snow was being transported onto steep open slopes. As a result, an Avalanche Warning was issued for the Northern Mountains. By the following day, with little new snow and decreasing wind, the Warning was dropped in the afternoon.

But the hazard remained high above timberline and moderate-high below treeline due the weak snowpack being slowly stressed by windloading and almost daily amounts of light to moderate snowfall. On the morning of the 18th another 1-5" of fresh snow was reported from all mountain sites. But 12-14" fell at Wolf Creek and in the Elk Mountains around Gothic, Irwin Lodge and Crested Butte. This resulted in more than 30 avalanche sightings.

It was on this day that the second avalanche fatality of the season occurred. Two skiers passed through the Crested Butte marked ski area boundary only to find themselves in steep snowloaded terrain. One of the skiers triggered a soft slab avalanche that was 2-3' deep, trapping and burying him in the slide. Since they were not carrying avalanche rescue gear, his companion's search was in vain. He finally abandoned the search and then,

not sure of finding a safe way back, spent a cold night at the accident site. He returned to the ski area the following morning. The ski patrol responded and found the body in a short time under seven feet of debris, 21 hours after the accident.

From the 19th-21st a slow-moving, closed low-pressure system passed along the southern Colorado border but provided only scant snowfall for all mountains. But with recent snowfall and winds loading avalanche starting zones, plus cold temperatures inhibiting stabilization, the hazard remained high. Much cracking and settling was taking place in the weak snow layers. Avalanche control work by the Highway Department along Red Mountain Pass, plus some natural slide activity, accounted for more than 50 avalanche releases.

Toward the end of the month Colorado was under the influence of a ridge of high pressure. By then temperatures began to climb into the 30's and upper 40's, and winds were only light to moderate. Clear skies dominated except for the last two days when split flow aloft let in some moisture that produced snow showers in all mountain areas. The avalanche hazard decreased to moderate above timberline and low to moderate below treeline. Many shallow wet snow releases were beginning to occur. Also, slopes 35 degrees or steeper that faced north through east were still suspect of being weak and potentially dangerous.

On the afternoon of the 25th this suspicion proved true. Two snowboarders were caught in an avalanche they triggered just south of Fremont Pass near Leadville. One survived by grabbing onto a tree, but the other was carried nearly 800 vertical feet and buried at the bottom of the steep, east-facing chute. He was found dead under three feet of snow three hours later by an organized rescue team. The 18-year-old man became the third avalanche fatality of the season.

In all, about 300 avalanches were reported to the Center during February. Twelve people were caught in slides with two injured and two killed.

Snowfall for the month was generally light. Only Wolf Creek and Monarch were above normal. In the Northern Mountains, Steamboat got 90% of normal; Winter Park and Arapahoe Basin, 87%; Berthoud Pass, 77%; Loveland, 68%; Copper

Mountain and Vail, 58%; and Breckenridge, merely 44% of normal. In the Central Mountains, Monarch fared well with 110%; Gothic, 96%; Crested Butte, 70%; Aspen Mountain, 63%; Sunlight, 60%; and Aspen Highlands, 54%. And in the Southern Mountains, Telluride, 60%; with Wolf Creek 130% of normal and still trying to catch up for the losses in the early part of the season.

The snowpack at the latter part of February was not significantly stronger than in the beginning. Even the warmer temperatures toward the end could not overcome the foreboding temperature gradient metamorphism that had taken place in December and January. A major storm in the coming weeks would be able to crumble the snowpack's weak foundation with ease.

March

For the first few days, March offered a hint of spring in the air. A few snow showers could be found among the scattered clouds, but temperatures were warm enough to melt a shallow layer of the snow surface. On the night of the 4th, a weather system slipped down out of Idaho to give the Northern Mountains several inches of fresh snow. But on the horizon a more ominous picture loomed.

On the afternoon of the 5th, a well organized storm was inching its way ever closer toward Colorado. Before it departed on the 10th, the snowpack would surrender many avalanches and one backcountry skier would lose his life. Let's look closer at some of the details.

In satellite photos, the storm resembled a hurricane, complete with an "eye" in the center. Aware of existing weak snowpack conditions, the Avalanche Center issued an Avalanche Warning for all mountains on the morning of the 6th -- the fourth warning period of the winter. The storm arrived on schedule, and snowfall was intense at some locations, thus spawning a vigorous avalanche cycle. When the 48-hour storm passed, Arapahoe Basin, Berthoud Pass and Winter Park had 30" of new snow. Monarch got 22", while the Southern Mountains gained from 17-32" of fresh snowfall. Unlike a hurricane, though, winds fortunately were not severe.

Even without the tempestuous conditions of a major blizzard, the peril of avalanches continued to climb. During the five-day Warning, highways over Loveland and Monarch passes were struck by snowslides, and a car was caught

(without serious consequences) on Berthoud Pass. Even the road to the Eldora ski area was inundated by a snowslide on the 8th.

The worst mishap during this period occurred on the 7th. Two backcountry skiers left the summit of Red Mountain Pass to ski steep snowloaded terrain in a well-known avalanche area. Only one would return. During a time of extreme avalanche danger they were engulfed in a slide which they carelessly had triggered. One survived by catching onto a tree; the other skier, standing near the bottom of the path, didn't have a chance when he was buried beneath 9' of crushing snow. He became the fourth, and last, avalanche victim of the season. Neither was carrying rescue beacons; thus, a prolonged search effort resulted. A search team recovered the body 23 hours after the accident.

In a four-day period between the 6th-9th, 241 avalanches were officially reported to the Center. In addition to these, a helicopter flight spotted many more paths which ran but were too numerous to count. In the end, the mountains had finally exhausted themselves of avalanches. The Warning was terminated on the 10th as warming temperatures helped stabilize the new snow, and the storm moved out onto the plains.

The snowpack had but a temporary rest. A trough of low pressure over the Great Basin produced strong wind in Colorado on the 11th. This provided good orographic snows from moisture in the southwest flow. It was obvious the San Juan Mountains were slated for deep drifting and building slab conditions. Consequently, the winter's fifth Avalanche Warning period had begun. No region escaped this last Warning of the season which began in the Southern Mountains on the 11th, spread to the Central and Northern Mountains on the 13th, and lasted until its termination late in the afternoon of the 15th.

Certainly, winter was not over as it shrewdly dealt yet another hand. Winds gusted to 40-50 mph at times, loading and stressing avalanche starting zones. By the 15th some 15-35" of snow had blanketed the landscape, with much more drifting into high-elevation lee areas. Compounding the problem were plummeting temperatures with lows dipping into the single digits and below zero, while daytime highs reached only into the teens and low 20's. Thus, stabilization in the new snow would be further delayed.

Even though more than 100 avalanches again roared down snowcovered slopes, this time their effects were minimal. During the previous cycle a dozen people were caught in slides, while just two were captured this time around, along with one dog who swam out of the moving snow at the beckoning of his master. And motorists were delayed only briefly on Red Mountain and Loveland passes while highway crews cleared the roadways of debris resulting from avalanche control efforts.

In its last two weeks, March strained to break out of winter's icy grip. It succeeded. By the middle of the third week, temperatures had risen into the 30's and 40's, and blue skies were common except for occasional snowshowers that brought meager amounts of snow to some locations.

By now a bridge of firm snow shrouded the weak layers underneath. The snowpack had begun its spring warming trend and free water was being observed in the insulated stratum near the ground. During the day as the snow surface melted, wet-loose avalanches were popping out of steep rocky areas that absorbed even more heat as the days grew longer. Light rain was mixed with snow showers at lower elevations. Night, though, still brought the assurance of refreezing and a strengthening of the surface layers -- until the cycle repeated itself the following day.

On the 25th, strong winds with gusts to 60 mph lashed at the high elevations, and some ski areas were faced with lift closures. This did little to increase the avalanche hazard, though, except in isolated pockets: the snow surface was just too firm from recent warm weather, thus preventing significant blowing snow.

The month ended with much needed water falling in the drought-stricken southern region. On the night of the 28th, mid- and high-level clouds penetrated Colorado's borders. They dropped only 1-5" in the Northern and Central Mountains, but the San Juans were blessed with 6-11" of moisture-laden snow. By the 31st, many areas had accumulated over a foot, and Wolf Creek was bolstered by 31" of high-density powder.

This did little to increase the avalanche danger as the new snow bonded well to the old crust, and mild temperatures helped it to settle and strengthen fast. At this point, it would take either a major storm or

sustained thaw to make a significant impact on the avalanche hazard. Neither was in the immediate forecast.

In summary, 451 avalanches were recorded during the month, and two cycles resulted in 10 days of avalanche warnings. Of the 17 people caught by the "White Monster," 16 survived and one lost his life. Snowfall-wise, sites in the Southern Mountains and along or east of the Continental Divide received above-normal snows while almost all others were below normal. Telluride had 140%; Wolf Creek, 110%; Monarch, 130%; Berthoud Pass, 135%; Winter Park, 124%; Arapahoe Basin, 120%; and Vail, 110%. On the light side were Copper Mountain, 91%; Gothic, 81%; Aspen Mountain and Breckenridge, 68%; Crested Butte, 55%; and Sunlight, 46%.

April

It's April's job to ease winter out and usher spring in. Thus, April is usually temperamental weatherwise, with sudden contrasts from one day to the next. This means warm, sunny days that frequently deteriorate to afternoon snowshowers, and at least one or two significant storms that bring substantial mountain snows. April of '90 fit the mold perfectly.

The month began with dry weather on the 1st-2nd, followed by snowshowers on the 3rd-4th that dropped a T-2" of snow. A serious avalanche accident occurred on the 4th on Loveland Pass when a ski tourer triggered a slide that swept him down a rocky slope. He suffered a broken leg and a skull fracture in the fall.

A weak short wave moved over the mountains on the 5th-6th, with all mountain sites recording 2-9" of snow. This snowfall resulted in 16 avalanches spotted and reported to the Center. All were shallow, new-snow releases running on an old suncrust.

The 8th-10th saw a more vigorous storm system move into Colorado. This three-day storm left snow totals of 3-12" in the Northern Mountains, 5-12" in the Central (though Gothic got 24"), and 18" at Red Mountain Pass in the Southern Mountains. On the 10th, 21 direct-action avalanches were reported.

Two days of dry weather were followed by light-to-moderate snows on the 13th that dropped 2-8" in the Northern and Central Mountains. High pressure

rapidly returned to bring fair weather from the 14th-17th. This warm-up produced wet-snow instability, resulting in 40 small, wet avalanches reported on the 15th-17th.

Moist southwest flow brought snow to the Southern and Central Mountains on the 18th-20th. Red Mountain Pass got 25", and Gothic, 11". Three days of fair weather followed. On the 22nd, a ski patroller at Breckenridge escaped serious injury when a cornice collapsed beneath him and he rode out a fairly large avalanche.

The largest storm of April began on the 24th and continued until the 30th, the result of a massive low-pressure system that stalled over the Great Basin and Continental Divide. Snow fell every day of this seven-day storm in all mountain areas. Some representative totals were: 26" at Bear Lake in Rocky Mountain National Park, 27" at Red Mountain Pass, 35" at A Basin, and 37" at Gothic. On the 27th-28th, winds caused blizzard conditions at high elevations; A Basin recorded a gust to 73 mph on the 28th.

In the midst of the blizzard on the 27th, a single-engine plane crashed into a mountainside near Leadville, killing all six aboard. The crash itself triggered several avalanches, and the recovery effort the next few days was hampered by a high avalanche hazard.

For the month, Gothic recorded 85" of snow -- its largest monthly total of the season and 260% of its April normal. A total of 139 avalanches was reported statewide. Two avalanche incidents resulted in two people caught and one injured. A final incident on May 6 caught a backcountry skier on Loveland Pass.

The Avalanche Center closed its full-time operations on April 22, but continued to operate on a part-time basis through May 1.

INFORMATION ACQUISITION

Daily Weather, Snowpack and Avalanche Data

The Avalanche Center relies on incoming data to make accurate assessments of current avalanche stability, and to make mountain weather and avalanche hazard forecasts. There are two main sources of these data -- the Colorado observer network and the National Weather Service.

Colorado observer network: The Center has established a network of some 32 manned observation sites in the Colorado mountains. Twenty of the sites are developed ski areas, from which snow-safety personnel report current weather, snowpack, and avalanche data. The remaining sites are highway, heli-ski, and backcountry sites, from which volunteers or contract observers report to the Center. One additional site was added for the 1989-90 season -- the Henderson Mine, located at the east foot of Berthoud Pass.

A toll-free WATS line, linked to a Code-a-phone, is available for the observers' convenience. This gives quasi-24-hour reporting capabilities. Observers make mandatory morning calls, plus timely updates during changeable conditions. All data are logged by the forecaster at the Center.

National Weather Service: Avalanche Center personnel have access to all the products and expertise of the NWS staff. Computerized weather maps from the new DARE-II work station, satellite photos, radar data, radiosonde data, information from manned and remote weather stations, and written analyses and forecasts are available. Additionally, discussions with NWS forecasters in interpreting data and products are an immense help.

Westwide Data Network

The Colorado Avalanche Information Center is responsible for the administration of the U.S. Forest Service Westwide Data Network. A portion of the funding received from the Forest Service is earmarked for managing this computer data base. In this capacity, the Center serves as a repository for mountain weather, avalanche events, and avalanche accident data for avalanche-prone areas of the United States. The weather and avalanche data from some 60 sites in the mountain West are computerized and stored on magnetic tape at the Colorado State University Computer Center in Fort

Collins. Information on fatal avalanche accidents in the United States is stored in a data base, at the Center, on an IBM-compatible PC.

The Center also compiles Avalanche Notes, a monthly newsletter which contains summaries of the computerized weather and avalanche data, as well as avalanche accident information. The newsletter is distributed monthly from November-April to 300 contributors and other interested people and agencies.

These data are used by Center personnel on a real-time basis and also for later analysis. Trends in avalanche accidents, relationships between survival and burial times and depths, and types of rescues are essential information to be passed on to snow scientists and the public. Lectures, field seminars, media contacts, and publications by Center personnel are some of the methods for disseminating this information. Additionally, the Center responds to 10-20 requests a year for raw or tabulated data. These requests come from the ski industry, Forest Service offices, universities, snow researchers, and lawyers.

DISSEMINATION of HAZARD FORECASTS

The Colorado Avalanche Information Center continues to provide vital information both to the public and to specialized audiences. The following are avenues by which the Center disperses data pertaining to mountain weather, avalanche, and snowpack conditions.

Public Hotlines

The avalanche forecaster combines data from 30 field-observation sites to prepare forecasts for seven recorded-message systems located in Colorado. The message is composed of three parts: an up-to-date mountain weather forecast, current snow conditions, and an avalanche hazard evaluation. The public made good use of this service as some 49,591 calls were placed to the hotlines this season. While usage fluctuates from winter to winter, we saw yet another increase in the overall call count. This increase, almost 14% over last year, was encouraging in light of the mild winter. (See figure 1). The following are the locations and other related data for each hotline:

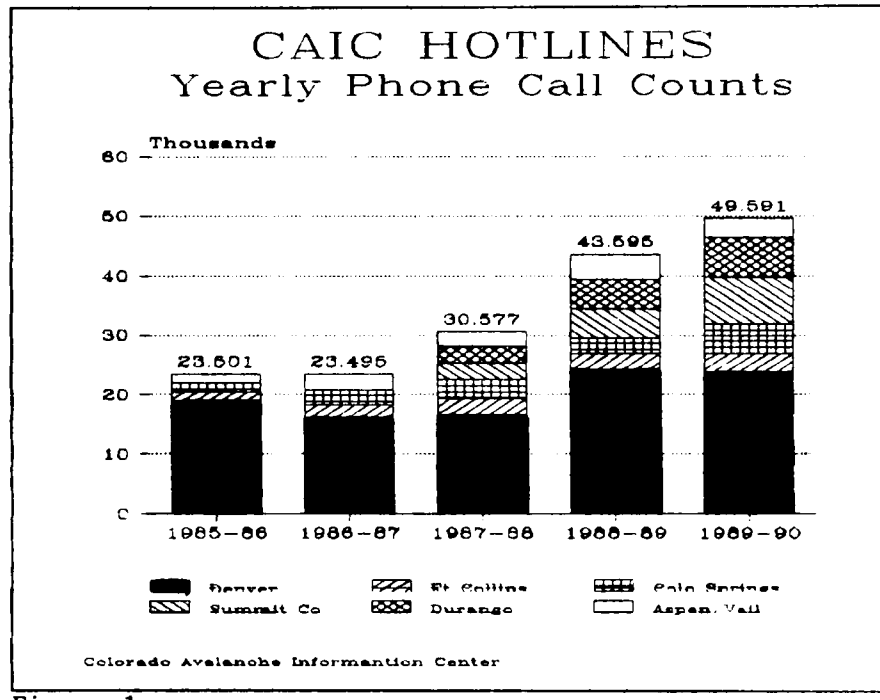


Figure 1

Denver: Telephone messages are recorded twice daily on the U.S. Forest Service telephone in Lakewood. People in the Denver/Boulder area made a total of 23,794 calls to this phone (236-9435) this winter. In the wake of a 46% increase last year, call counts dropped 2% in 1989-90.

Fort Collins: This message phone is sponsored by The Mountain Shop. The recording system is owned by the Avalanche Center and is housed and administered by the Larimer County Sheriff's Office. There were 3,173 calls made to the 482-0457 number this winter. Callers were very responsive along the northern Front Range which resulted in a 23% increase in the phone's use over last season.

Colorado Springs: In the fifth year of operation for this phone, call counts were up by a whopping 72% with 4,925 calls placed to the 522-0020 number! As with the Denver and Fort Collins telephones, updates were made on a twice daily schedule, seven days a week. The recording equipment is owned by the Avalanche Center and is sponsored by The Mountain Chalet, where the phone is housed.

Summit County: This area has consistently shown overwhelming support for the Center's services. This was their third season on an upgraded hotline system in Summit County (668-0600). Local residents and visitors alike have responded most favorably to its longer and more complete message capabilities. With Summit County located amidst much avalanche terrain, the need there for precise information is vital. And the users' vote was firmly cast this winter, exhibited by placing 7,816 calls over the course of the winter. It represented another increase for the system, this time by 63%! The 24 hour message phone is housed and sponsored by the county, through the Summit County Rescue Group.

Eagle County: The public message phone here is housed and maintained by the U.S. Forest Service in Minturn. It has no call counter, so the actual volume of use is not known. A conservative estimate is a call count of 1,600-2,000 calls. In addition to this hotline, the Vail and Beaver Creek Ski Patrols use daily information from the Center to update their own recorded message phone -- a service available to skiers leaving the ski area boundary with the phone located at the gate of departure.

Pitkin County: The Forest Service in Aspen maintains a public message phone for local residents and tourists. Forest personnel get daily information from the Center's WATS line and add appropriate local information

to their recording. As with the Vail area, an estimated 1,600-2,000 calls were made to this phone this winter.

Durango: We have been very pleased with the public's response in the Durango area. This hotline, in place for its third season, provides mountain weather and avalanche information for residents of southwest Colorado. Utilization of the system has taken off from 2,760 calls the first year, to over 6,680 inquiries this winter. That represents an astounding increase of over 140% in just two winters.

Radio Broadcasts

The Avalanche Center continues to find a large listening audience through radio stations located in mountain communities. This is especially beneficial in regions where a call to one of the hotlines would be long distance. Some stations broadcast our message daily, while others have been most helpful by transmitting Avalanche Warnings or Special Avalanche Advisories when necessary. Listed are some of the stations conveying our bulletins.

Public radio station KVNF-FM in Paonia must be mentioned foremost. For five winters they have called the Center on a daily basis to record and broadcast our messages. Transmitting on a main frequency of 90.9 MHz, and three translators reaching out on 88.9, 89.1, and 89.9 MHz, this station services the towns of Paonia, Montrose, Delta, Ouray, Ridgway, and other communities in southwestern Colorado. This is made possible from funding and contributions to a memorial fund for an avalanche victim killed near Ridgway in 1984.

Radio station KOTO in Telluride also broadcast our messages throughout the winter to residents in that area. This was done by recording the daily message on the Durango hotline. For an area that has proven to be high risk for avalanche accidents, this service has been a benefit for local backcountry enthusiasts.

In Summit County, K-Summit Broadcasting (television and radio) continued to support the Center's efforts in reaching the public with timely weather and snowpack information. KYSL-FM in Frisco and KHTH in Dillon also provided Summit County and surrounding communities with vital updates and interesting

features. Through these means people were able to keep abreast of current conditions, and learn about timely avalanche seminars -- all in an area that is no stranger to dangerous avalanche conditions.

NOAA Colorado Weatherwire

During times when the avalanche hazard is rated high or extreme, CAIC forecasters issue Avalanche Warning bulletins, twice daily, until the hazard subsides. At that time an Avalanche Warning Termination bulletin is dispensed. Special Avalanche Advisories may be sent out as well during transition periods when the avalanche danger is increasing. These bulletins are transmitted to the news media via the National Oceanic and Atmospheric Administration (NOAA) Weatherwire. Sample warning and advisory bulletins are shown in Appendix A. Tables 3 & 4 contain related information.

News Media

Each winter, numerous weather or avalanche events occur that become newsworthy. These are usually avalanche incidents involving people, property or highways, or abnormal mountain weather conditions. When these occur, CAIC forecasters act as official spokes-people, responding to, and sometimes initiating contacts with television, radio, newspaper, and magazine reporters. This is done to provide accurate information for broad news coverage, and for high visibility for the Center. There were 197 of these contacts in 1989-90.

Media personnel frequently called for information on current avalanche warnings, public interest stories, avalanche accidents, and current avalanche and mountain weather conditions. In addition, we gave many live and taped interviews for radio and television broadcasts.

About eight inquiries came from outside Colorado, including calls from Good Morning America (ABC) in New York, the "911" television show in Los Angeles, and the "Weather Channel" in Atlanta. The Associated Press and United Press International were also frequent callers.

Colorado TravelBank

This winter the Avalanche Center utilized yet another channel to get our messages out to the public. We were excited to be able to make our reports available to users directly through their own personal computers. The

Colorado TravelBank made this possible. Located in Denver, this computer network system can be accessed from anywhere in the United States.

The service provides its customers information on more than 90 topics. This was the first winter that mountain weather and backcountry avalanche forecasts were available, and these were dispensed by the Avalanche Center on a daily basis. Our written forecast was transferred, via modem, right into the system with just a few simple keystrokes. It became available instantly to anyone wanting to call it up on their home monitor.

In addition to individual users, the service is utilized by travel agents, travel and recreation organizations and other agencies. Our product was also available on 500 cable TV systems throughout the country.

The response was tremendous. In less than five months, 25,613 contacts to the Avalanche Center's bulletins were documented! We are looking forward to using this network again next season to serve new customers and sustain such a high profile.

PUBLIC EDUCATION

One of the main responsibilities of the Center is to provide avalanche education. Through education and public awareness, we feel that accidents will be kept to a minimum. The Center provides education to the public through three outlets:

Avalanche Awareness Talks and Field Seminars

Avalanche education was off to a vigorous start with the first lecture as early as October 3rd. By the time the last talk was given on May 23rd, the Center staff had spoken on 51 different occasions, with a total of 2,674 persons attending 1-hour seminars to multi-day field sessions. Attendance was up by 37% over last season! (See figure 2). Betsy Armstrong, formerly a full time Center staff member, remains an associate of the CAIC and continues to educate the public about avalanches. Her classes are listed among others in table 8. Course participants had the opportunity to learn about such topics as mountain meteorology, avalanche terrain recognition, the Colorado snowpack, safe travel techniques, and survival and rescue techniques. The students' backgrounds ranged from professional ski patrollers, search & rescue volunteers, Colorado Mountain Club members, ski clubs, and members of the general public. Table 8 lists these courses in more detail.

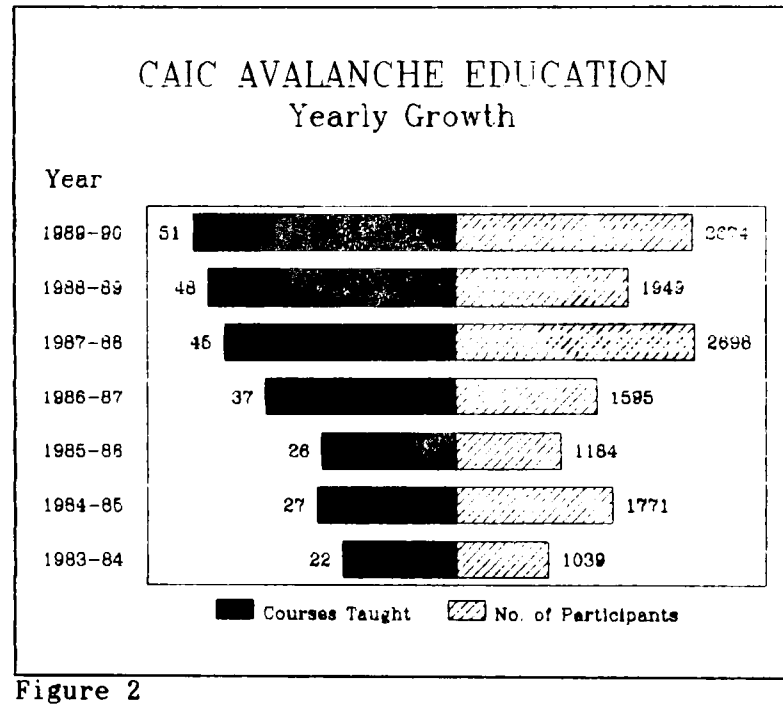


Figure 2

In order to monitor our efforts in providing avalanche awareness, Center personnel logged the time spent in course preparation, driving time and

presentation length. The outcome for 1989-90 was: preparation - 40 hours, driving time - 100 hours, and 133 hours spent teaching the various courses.

Avalanche Cards and Brochures

The Colorado Avalanche Information Center maintains a supply of printed material in the form of wallet-size avalanche cards, and brochures with simplified text and illustrations explaining the "what's", "where's" and "why's" about avalanches. These are distributed at all lectures and seminars, and are included in return letters of correspondence with the public. The handouts contain all of the public hotline phone numbers and a definition of the four hazard ratings. They are also disbursed at popular backcountry trailheads.

In Summit County, a generally high-risk avalanche region, the Summit County Rescue Group has printed special cards designed specifically for the Summit County area. This is in conjunction with their sponsoring of the local hotline. Rescue group members distributed and maintained avalanche poster/card holders in area which generated locally high phone usage.

Avalanche Information Packets

For the second season, the Avalanche Center provided a free information packet to anyone requesting one. Public hotline messages conveyed the announcement that callers had only to provide a self addressed stamped envelope to receive their own copy. The packet contained a CAIC brochure and wallet-size card, plus information about the Center's mountain weather and avalanche forecasts. To help the reader better understand our products, a glossary of terms commonly used in hotline recordings and avalanche courses was also included.

The response was good with 31 packets mailed out. It is a simple strategy aimed at furthering avalanche education. We will continue to provide this printed material next winter, and monitor the results to determine its viability for the future.

Table 8. Contacts with organized groups by Avalanche Center personnel, 1989-90

Date	Personnel	Group	Attendance
10/3	D. Atkins	Colorado Mountain Club, Boulder	47
10/11	N. Logan	Colo. Dept. of Highways, Silverthorne	60
10/22	D. Atkins	Alpine Rescue Team, Evergreen	18
11/1	K. Williams	REI awareness course, Denver	25
11/5-9	KW, NL, DA	National Avalanche School, Denver	160
11/7	D. Atkins	Natural Hazards class, CU, Boulder	190
11/8	D. Atkins	Evergreen Jr. High School, Evergreen	98
11/11	N. Logan	Summit County Awareness, Breckenridge	65
11/13	D. Atkins	EMS, Aurora	7
11/14	B. Armstrong	EMS, Boulder	25
11/16	K. Williams	EMS, Westminster	7
12/2	KW, NL	Mountain Chalet, Colorado Springs	95
12/5	K. Williams	Mountain Shop, Fort Collins	55
12/6	D. Atkins	Rocky Mountain Rescue Group, Boulder	14
12/9-10	NL, DA	CSRB rescue seminar, Breckenridge	77
12/13	N. Logan	Summit County Awareness, Frisco	76
12/13	N. Logan	Breckenridge Elementary Sch., Breck.	34
12/14	K. Williams	Cherry Creek High School, Denver	36
12/18	N. Logan	Colo. Dept. of Highways, Eisenhower Tnl.	14
12/19	N. Logan	Keystone Sci. Sch. Inst., Loveland Pass	4
12/29	N. Logan	Colo. Dept. of Highways, Eisenhower Tnl.	15
1/6	B. Armstrong	Avalanche Awareness, RMNP	100
1/6	D. Atkins	NSPS Patch Course, Lakewood	16
1/8-9	K. Williams	Soil Conservation Service, Keystone	72
1/9	D. Atkins	ABC's Week, Golden	125
1/10	K. Williams	Paragon Guides, Vail Hut Tour	25
1/10	B. Armstrong	Mountain Miser, Englewood	80
1/11	N. Logan	Boy Scouts	7
1/11	D. Atkins	ABC's Week, Littleton	88
1/16&20	N. Logan	Vail Public Awareness, Vail	44
1/18-19	K. Williams	REI Advanced Avalanche Course, Denver	40
1/19-21	B. Armstrong	Silverton Avalanche School, Silverton	92
1/22-24	K. Williams	Braun Hut Avalanche Course, Aspen	32
1/23	N. Logan	Minturn Middle School, Minturn	34
1/25	K. Williams	Beaver Creek Ski Patrol, Vail	18
1/25-28	D. Atkins	National Ski Patrol, Steamboat	37
2/5-6	N. Logan	Breckenridge Ski Patrol, Breckenridge	5
2/8	B. Armstrong	Avalanche Awareness, Vail	45
2/9	B. Armstrong	Keystone Science School, Keystone	100
2/12-13	NL, DA	Summit Co. Pro Course, Summit County	29
2/14	K. Williams	Snow Craft Industries, Denver	11
2/18	D. Atkins	Irwin Lodge, Kebler Pass	42
2/19	N. Logan	Ski Haus, Steamboat	120
3/3	K. Williams	Steamboat Ski Patrol, Steamboat	25
3/8	D. Atkins	Mountain Miser, Englewood	11
3/20	D. Atkins	Colorado Outdoor Sports, Denver	11
3/26	N. Logan	Breckenridge Ski Patrol, Breckenridge	4
4/5	D. Atkins	McElwain Elementary School, Northglenn	74
5/4	D. Atkins	Evergreen Jr. High School, Evergreen	122
5/19	D. Atkins	Mountain Rescue Assn., RMNP	41
5/23	D. Atkins	Marshdale Elementary School, Evergreen	102
		TOTAL	2674

HAZARD GRADING

For the sixth year, the Avalanche Center has used a grading system for evaluating its performance of avalanche forecasting. This prediction focuses on the "avalanche potential" based on anticipated weather and current snowpack conditions. To arrive at a prediction, the forecaster makes an evaluation for the next 24-hour period for the Northern, Central, and Southern Mountains. Each afternoon this forecast is logged in the "Daily Hazard Information and Decision Chart" using one of the four categories (see below). On the following day, the actual hazard rating -- based on the field observers' estimates -- is compared to the previous day's forecast. A grade of "correct forecast", "under forecast", or "over forecast" is then entered onto the chart for each region.

Avalanche hazard forecasts are expressed by using the terms "low", "moderate", "high" or "extreme" to depict the hazard in a given area. Until recently, the staff had the freedom to combine two of these terms to describe the current hazard rating. It was felt that by doing so, the public was getting too general a forecast. Now each forecaster can choose only one of the four terms used to describe the hazard. If he feels a more complex hazard classification is warranted in a given area, he may qualify the hazard rating to apply to a specific mountain range, elevation, aspect, etc.

The scores for this and previous years are shown in the following table:

	1989-90	1988-89	1987-88	1986-87	1985-86
Correct forecast	91%	90%	86%	95%	92%
Over forecast	6%	5%	8%	2%	5%
Under forecast	3%	5%	6%	3%	3%

We have continued to maintain an acceptably high level of "correct" forecasts. The above results are quite satisfying for two reasons. First, the "correct" forecast remains well above 80% in a field that is as much art as science. Second, the "under" forecast rate does not exceed "over" forecasts. It is more desirable to err on the side of overestimating the danger rather than underestimating.

SAMPLE AVALANCHE WARNINGS & ADVISORIES

This appendix contains examples of products that Avalanche Center forecasters issued to the media via the NOAA Colorado Weatherwire. These include a Special Avalanche Advisory and selected Avalanche Warning Bulletins disseminated during the winter. Page 50 is an example of a Special Avalanche Advisory, pages 51-53 represent selections from a warning period in December, and pages 54-58 show segments of warnings issued in March. These illustrate the general content and format incorporated in the Center's announcements.

SPECIAL AVALANCHE ADVISORY
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
3 30 PM MST FRIDAY FEBRUARY 9, 1990

...AVALANCHE HAZARD INCREASING FOR THE WEEKEND...

A SMALL BUT SIGNIFICANT WEATHER SYSTEM WILL BRUSH THROUGH THE NORTHERN AND CENTRAL COLORADO MOUNTAINS TONIGHT AND SATURDAY. MORE SNOW ACCOMPANIED BY VERY STRONG WIND WILL CERTAINLY INCREASE THE BACKCOUNTRY AVALANCHE SITUATION TO A HIGH HAZARD BY SATURDAY.

TEN AVALANCHES HAVE BEEN REPORTED TO THE AVALANCHE CENTER IN THE LAST 24 HOURS. THIS IS A GOOD INDICATION OF AN ALREADY WEAK SNOWPACK THAT MAY NOT SUPPORT THE ADDITIONAL WEIGHT OF WIND DRIFTED SNOW..OR A SKIER OR SNOWMOBILER.

BACKCOUNTRY TRAVELERS SHOULD BE PREPARED FOR VERY COLD WINDCHILL TEMPERATURES AND POOR VISIBILITY AT TIMES AT THE HIGH ELEVATIONS.

WE RECOMMEND THAT PERSONS TRAVELLING IN THE BACKCOUNTRY AVOID SLOPES STEEPER THAN 35 DEGREES..ESPECIALLY THOSE NEAR AND ABOVE TIMBERLINE THAT FACE NORTHEAST THROUGH EAST THROUGH SOUTH.

THE BACKCOUNTRY AVALANCHE HAZARD IN THE SOUTHERN MOUNTAINS IS CURRENTLY RATED MODERATE WITH POCKETS OF HIGH ABOVE TIMBERLINE AND LOW BELOW TIMBERLINE.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

LOGAN
COLORADO AVALANCHE INFORMATION CENTER

AVALANCHE WARNING BULLETIN NO. 2
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
4 PM MST FRIDAY DECEMBER 15, 1989

...NORTHERN COLORADO MOUNTAINS...BACKCOUNTRY HAZARD IS HIGH...

AN AVALANCHE WARNING WAS ISSUED THIS MORNING AND REMAINS IN EFFECT FOR BACKCOUNTRY AREAS OF THE NORTHERN MOUNTAINS OF COLORADO. THIS WARNING COVERS ALL MOUNTAIN AREAS NORTH OF A LINE FROM DENVER TO BRECKENRIDGE TO GLENWOOD SPRINGS.

THIS WARNING IS VALID THROUGH SATURDAY DECEMBER 16.

THE HIGH BACKCOUNTRY AVALANCHE DANGER IS THE RESULT OF 6 DAYS OF SNOWFALL AND PERSISTENTLY STRONG WINDS. IN THE NORTHERN MOUNTAINS IN THE LAST 6 DAYS ... GENERALLY 18-27 INCHES OF SNOW HAVE ACCUMULATED BUT UP TO 54 INCHES -- AT STEAMBOAT -- HAVE FALLEN. IN ADDITION WINDS NEAR AND ABOVE TIMBERLINE HAVE AVERAGED 25 MPH AND GUSTED TO 60 MPH. THUS THE HIGH AVALANCHE HAZARD ABOVE 10,500 FEET ELEVATION IN THE NORTHERN MOUNTAINS. THE HAZARD AT LOWER ELEVATIONS IS MODERATE.

11 AVALANCHES HAVE BEEN REPORTED TODAY. LOVELAND PASS REMAINS CLOSED BY AN AVALANCHE THAT RAN THIS MORNING. MORE AVALANCHES ARE EXPECTED ... BOTH NATURAL AND CONTROLLED RELEASES. BACKCOUNTRY TRAVELLERS THIS WEEKEND SHOULD AVOID ALL SLOPES 30 DEGREES AND STEEPER AND LIMIT TRAVEL TO GENTLE TERRAIN.

THE HAZARD IN THE CENTRAL MOUNTAINS IS RATED MODERATE ... AND IN THE SOUTHERN MOUNTAINS IT IS LOW.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

THE NEXT AVALANCHE BULLETIN IS SCHEDULED FOR 11 AM SATURDAY.

WILLIAMS
COLORADO AVALANCHE INFORMATION CENTER
8990 1-2

AVALANCHE WARNING BULLETIN NO. 7
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
1130 AM MST MONDAY DECEMBER 18, 1989

...NORTHERN COLORADO MOUNTAINS...AVALANCHE WARNING CONTINUES...

AN AVALANCHE WARNING REMAINS IN EFFECT TODAY FOR BACKCOUNTRY AREAS OF THE NORTHERN MOUNTAINS OF COLORADO. THIS WARNING COVERS ALL MOUNTAIN AREAS NORTH OF A LINE FROM DENVER TO BRECKENRIDGE TO GLENWOOD SPRINGS.

THIS WARNING IS VALID THROUGH MONDAY DECEMBER 18.

THE HIGH BACKCOUNTRY AVALANCHE DANGER IS THE RESULT OF 9 DAYS OF SNOWFALL AND PERSISTENTLY STRONG WINDS. IN THE NORTHERN MOUNTAINS IN THE LAST 9 DAYS..GENERALLY 35-45 INCHES OF SNOW HAVE FALLEN..BUT STEAMBOAT HAS GOTTEN 99 INCHES AND VAIL 76 INCHES. THUS THE HIGH AVALANCHE HAZARD ABOVE 10,500 FEET ELEVATION IN THE NORTHERN MOUNTAINS. THE HAZARD AT LOWER ELEVATIONS IS MODERATE.

25 AVALANCHES WERE REPORTED TO THE AVALANCHE CENTER ON SATURDAY..3 ON SUNDAY..AND NONE SO FAR ON MONDAY. BUT DON'T BE FOOLED BY THE LOW NUMBERS. POOR VISIBILITY MEANS NO RELIABLE BACKCOUNTRY OBSERVATIONS FOR MANY DAYS. ADDITIONAL AVALANCHES ARE EXPECTED. TRIGGERED AVALANCHE RELEASES BY BACKCOUNTRY TRAVELLERS ARE LIKELY IN THE NORTHERN MOUNTAINS. BACKCOUNTRY TRAVELLERS SHOULD AVOID ALL SLOPES 30 DEGREES AND STEEPER AND LIMIT TRAVEL TO GENTLE TERRAIN.

THE HAZARD IN THE CENTRAL MOUNTAINS IS RATED MODERATE..AND IN THE SOUTHERN MOUNTAINS IT IS LOW.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

THE NEXT AVALANCHE BULLETIN IS SCHEDULED FOR 4 PM MONDAY.

WILLIAMS
COLORADO AVALANCHE INFORMATION CENTER
8990 1-7

AVALANCHE WARNING TERMINATION BULLETIN NO. 11
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
1100 AM MST WEDNESDAY DECEMBER 20, 1989

...AVALANCHE WARNING TERMINATED FOR NORTHERN COLORADO MOUNTAINS...

AN AVALANCHE WARNING THAT BEGAN FIVE DAYS AGO FOR THE NORTHERN COLORADO MOUNTAINS HAS BEEN TERMINATED. DECREASED SNOWFALL..WINDS..AND AVALANCHES ARE THE REASON FOR THE TERMINATION.

HOWEVER..THE AVALANCHE HAZARD REMAINS HIGH FOR AREAS NEAR AND ABOVE TIMBERLINE IN THE NORTHERN MOUNTAINS AND LOCALLY HIGH IN HIGH ELEVATION POCKETS FACING NORTHEAST THROUGH SOUTHEAST AROUND MONARCH PASS AND ASPEN IN THE CENTRAL MOUNTAINS. BACKCOUNTRY TRAVELLERS ARE STILL URGED TO USE CAUTION ON ANY SNOWLOADED SLOPE STEEPER THAN 30 DEGREES IN THESE AREAS.

SNOWFALL THAT BEGAN ON THE 10TH..ACCUMULATING FROM 3 TO 8 FEET OF SNOW IN THE NORTHERN MOUNTAINS BY THE 19TH..ACCOUNTED FOR MORE THAN 80 AVALANCHES DURING THE WARNING PERIOD. ALTHOUGH LOVELAND PASS WAS CLOSED FOR A BRIEF PERIOD NO SERIOUS ACCIDENTS WERE REPORTED.

ELSEWHERE IN THE NORTHERN AND CENTRAL MOUNTAINS THE HAZARD IS RATED MODERATE. IN THE SOUTHERN MOUNTAINS THE HAZARD IS LOW OVERALL.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

THIS IS THE LAST BULLETIN CONCERNING THIS AVALANCHE SITUATION.

LOGAN
COLORADO AVALANCHE INFORMATION CENTER
8990 1-11

AVALANCHE WARNING BULLETIN NO. 2
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
4 40 PM MST TUESDAY MARCH 6, 1990

...ALL COLORADO MOUNTAINS ... BACKCOUNTRY AVALANCHE HAZARD HIGH...
... TELLURIDE AREA ... BACKCOUNTRY HAZARD EXTREME ...

AN AVALANCHE WARNING WAS ISSUED THIS MORNING AND REMAINS IN EFFECT FOR BACKCOUNTRY AREAS OF ALL COLORADO MOUNTAINS..ESPECIALLY AT ELEVATIONS OF 10,000 FEET AND ABOVE. THIS WARNING IS VALID THROUGH WEDNESDAY MARCH 7.

NEW SNOW AMOUNTS OF 15-30 INCHES (IN 27 HOURS) HAVE ADDED LOTS OF WEIGHT TO AN ALREADY WEAK AND UNSTABLE SNOWPACK. WINDS OF 10-30 MPH ARE CAUSING BLOWING SNOW AND FURTHER LOADING OF AVALANCHE STARTING ZONES ABOVE 10,000 FEET ELEVATION.

MORE THAN 70 AVALANCHES HAVE BEEN REPORTED TODAY. MOST HAVE BEEN SHOT DOWN AROUND TELLURIDE..WOLF CREEK..BERTHOUD PASS AND LOVELAND PASS. LOVELAND PASS IS CLOSED BY AVALANCHES AT THIS TIME. WE EXPECT MANY MORE NATURAL AND EXPLOSIVE OR SKI TRIGGERED AVALANCHES TONIGHT AND TOMORROW.

WE RECOMMEND THAT BACKCOUNTRY SKIERS..SNOWSHOERS..SNOWBOARDERS..AND SNOWMOBILERS AVOID SLOPES OF 30 DEGREES AND STEEPER AT THIS TIME ... EVEN POSTPONE TRIPS AT THIS TIME. PEOPLE TRIGGERED AVALANCHES ARE A VERY REAL THREAT IN STEEP TERRAIN.

THE NEXT BULLETIN IS SCHEDULED FOR 11 AM WEDNESDAY.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

WILLIAMS
COLORADO AVALANCHE INFORMATION CENTER
8990 4-2

AVALANCHE WARNING BULLETIN NO. 8
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
4 30 PM MST FRIDAY MARCH 9, 1990

...AVALANCHE WARNING CONTINUES ... HAZARD REMAINS HIGH FOR THREE AREAS OF THE COLORADO MOUNTAINS ... FRONT RANGE ... SAWATCH RANGE ... SAN JUAN MOUNTAINS...

AN AVALANCHE WARNING REMAINS IN EFFECT FOR BACKCOUNTRY AREAS OF THREE PORTIONS OF THE COLORADO MOUNTAINS BECAUSE TRIGGERED RELEASES BY BACKCOUNTRY TRAVELLERS REMAINS LIKELY. THE AVALANCHE HAZARD IS RATED HIGH IN THESE AREAS. 20-36 INCHES OF SNOW THAT FELL TUESDAY AND WEDNESDAY IS THE CAUSE OF THE HIGH AVALANCHE HAZARD. DETAILS FOR THESE AREAS ARE GIVEN BELOW.

THIS WARNING IS VALID THROUGH SATURDAY MARCH 10.

FRONT RANGE OF THE NORTHERN MOUNTAINS ... FROM CAMERON PASS SOUTH ALONG THE CONTINENTAL DIVIDE,TO HOOSIER PASS. THURSDAY NIGHT BACKCOUNTRY SKIERS IN THE MOONLIGHT TRIGGERED AN AVALANCHE AND AT LEAST ONE WAS PARTIALLY BURIED IN A SLIDE THAT DEPOSITED SNOW ONTO U.S. HIGHWAY 40 ... THE TOTAL SINCE TUESDAY..111.

SAWATCH RANGE AROUND MONARCH PASS ... TWO LARGE AVALANCHES HAVE HIT U.S. HIGHWAY 50 OVER MONARCH PASS THE LAST TWO DAYS..BRINGING THE TOTAL TO 49.

SAN JUAN MOUNTAINS SOUTH OF A LINE FROM ALAMOSA TO MONTROSE ... 18 AVALANCHES HAVE BEEN REPORTED TODAY..BRINGING THE TOTAL SINCE TUESDAY TO 72. THE SKI TOURER BURIED AND KILLED BY AN AVALANCHE ON RED MOUNTAIN PASS WEDNESDAY AFTERNOON WAS FOUND BY SEARCHERS AT 1345 THURSDAY.

WARM TEMPERATURES ARE HELPING TO STABILIZE THE SURFACE LAYERS OF THE BACKCOUNTRY SNOWCOVER..BUT WEAK LAYERS STILL PERSIST IN THE LOWER LAYERS OF THE SNOWPACK. THE AVALANCHE HAZARD IN THE COLORADO MOUNTAINS THIS WEEKEND WILL REMAIN AT MODERATE TO HIGH.

WE RECOMMEND THAT BACKCOUNTRY SKIERS..SNOWSHOERS..SNOWBOARDERS AND SNOWMOBILERS AVOID SLOPES 30 DEGREES AND STEEPER AT THIS TIME..OR EVEN POSTPONE TRIPS AT THIS TIME. TRIGGERED AVALANCHES ARE A VERY REAL THREAT IN STEEP TERRAIN.

THE NEXT BULLETIN IS SCHEDULED FOR 11 AM SATURDAY.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

ATKINS
COLORADO AVALANCHE INFORMATION CENTER 8990 4-7

AVALANCHE WARNING BULLETIN NO. 3
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
4 00 PM MST MONDAY MARCH 12, 1990

...AVALANCHE HAZARD INCREASES AND WARNINGS CONTINUE...

THE AVALANCHE HAZARD REMAINS HIGH AND AN AVALANCHE WARNING FOR THE BACKCOUNTRY SURROUNDING RED MOUNTAIN PASS..MOLAS PASS..AND WOLF CREEK PASS HAS BEEN EXTENDED THROUGH TUESDAY.

SNOW CONTINUES TO FALL WITH STRONG WIND IN THE WARNING AREAS. THIS IS CAUSING DEEP DRIFTS IN LEE AREAS PLACING ADDITIONAL STRESS ON AN ALREADY WEAK SNOWPACK.

FIFTEEN AVALANCHES HAVE BEEN REPORTED TO THE CENTER TODAY..BUT VISIBILITY IS TOO POOR TO SEE FAR INTO THE BACKCOUNTRY THIS AFTERNOON. HOWEVER..ONE OF SEVERAL AVALANCHES REPORTED SUNDAY WAS TRIGGERED BY A GROUP OF SKI TOURERS WHO MADE THE SNOW COLLAPSE IN GENTLE SLOPING TERRAIN AT THE BOTTOM OF A LARGE BASIN. IT BROUGHT DOWN A LARGE AVALANCHE FROM STEEPER SLOPES ABOVE. FORTUNATELY THEY DID NOT GET CAUGHT IN THE MOVING SNOW.

ELSEWHERE IN THE SOUTHERN MOUNTAINS THE AVALANCHE HAZARD IS HIGH..AND IN THE NORTHERN AND CENTRAL MOUNTAINS THE HAZARD IS MODERATE BUT WITH AREAS OF HIGH HAZARD FOR TRIGGERED RELEASES ON SLOPES STEEPER THAN 30 DEGREES. WE ARE MOST CONCERNED ABOUT TERRAIN FACING NORTHWEST THROUGH EAST AT THIS TIME..BUT WITH THE SNOWPACK CONDITIONS MADE UP OF DEPTH HOAR..WEAK CRUSTS..AND SLABS..VIRTUALLY ANY STEEP SLOWLOADED SLOPE IS SUSPECT.

THE NEXT BULLETIN CONCERNING THIS AVALANCHE SITUATION IS SCHEDULED FOR 11 AM TUESDAY.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

LOGAN
COLORADO AVALANCHE INFORMATION CENTER
8990 5-3

AVALANCHE WARNING BULLETIN NO. 5
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
5 00 PM MST TUESDAY MARCH 13, 1990

...BACKCOUNTRY AVALANCHE HAZARD IS INCREASING
IN ALL COLORADO MOUNTAINS...

...AVALANCHE WARNING EXTENDED FOR ALL COLORADO MOUNTAINS...

AN AVALANCHE WARNING HAS BEEN EXTENDED TO INCLUDE ALL BACKCOUNTRY AREAS OF THE COLORADO MOUNTAINS EFFECTIVE IMMEDIATELY. NEW SNOW AMOUNTS DURING THE DAY TODAY OF 4-7 INCHES HAS ADDED ADDITIONAL WEIGHT IN A SHORT PERIOD OF TIME. WINDS WILL BE INCREASING TONIGHT AT THE HIGHER ELEVATIONS CAUSING BLOWING SNOW AND FURTHER LOADING OF AVALANCHE STARTING ZONES ABOVE 10,000 FEET. COLD TEMPERATURES ARE DELAYING THE STABILIZATION OF THE NEW SNOW.

WE EXPECT BOTH NATURAL AND EXPLOSIVE OR SKI TRIGGERED AVALANCHES TONIGHT AND WEDNESDAY. WE RECOMMEND THAT BACKCOUNTRY SKIERS..SNOWBOARDERS..AND SNOWMOBILERS..AVOID SLOPES AND GULLIES 30 DEGREES AND STEEPER. HUMAN TRIGGERED AVALANCHES ARE A VERY REAL THREAT IN STEEP TERRAIN.

31 AVALANCHES HAVE BEEN REPORTED TO THE CENTER TODAY. MOST WERE TRIGGERED BY SKI PATROL AND HIGHWAY DEPARTMENT CONTROL TEAMS ... 4 WERE TRIGGERED BY BACKCOUNTRY SKIERS IN THE SAN JUAN MOUNTAINS.

THE NEXT BULLETIN CONCERNING THIS AVALANCHE SITUATION IS SCHEDULED FOR 11 AM WEDNESDAY.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

ATKINS
COLORADO AVALANCHE INFORMATION CENTER
8990 5-5

AVALANCHE WARNING TERMINATION ... BULLETIN NO. 9
COLORADO AVALANCHE INFORMATION CENTER
NATIONAL WEATHER SERVICE DENVER, CO
4 15 PM MST THURSDAY MARCH 15, 1990

...AVALANCHE HAZARD MODERATING ... WARNING TERMINATED...

THE AVALANCHE WARNING FOR BACKCOUNTRY AREAS OF THE COLORADO MOUNTAINS IS NOW TERMINATED ... THOUGH WE CONTINUE TO RATE THE HAZARD NEAR AND ABOVE TREELINE TO BE HIGH BECAUSE OF THE THREAT FROM PEOPLE TRIGGERED AVALANCHES.

NATURAL RELEASES HAVE CEASED FOR THE MOST PART MAINLY BECAUSE BLOWING SNOW HAS STOPPED LOADING INTO AVALANCHE STARTING ZONES. A TOTAL OF 97 AVALANCHES HAS BEEN REPORTED SINCE WARNINGS WERE FIRST POSTED ON MONDAY.

TRIGGERED AVALANCHES REMAIN A THREAT IN STEEP TERRAIN AND THIS WILL BE THE CASE UNTIL MUCH WARMER TEMPERATURES RETURN TO THE MOUNTAINS. WE RECOMMEND THAT BACKCOUNTRY SKIERS..SNOWBOARDERS..AND SNOWMOBILERS.. AVOID SLOPES AND GULLIES 35 DEGREES AND STEEPER FOR SEVERAL MORE DAYS..ESPECIALLY ABOVE TIMBERLINE.

THIS IS THE LAST BULLETIN ON THIS AVALANCHE SITUATION.

THIS STATEMENT IS OF PARTICULAR INTEREST TO PERSONS USING THE BACKCOUNTRY OUTSIDE OF DEVELOPED SKI AREA BOUNDARIES. WHERE NECESSARY SKI AREAS USE AVALANCHE CONTROL METHODS WITHIN THEIR BOUNDARIES.

FOR ADDITIONAL AVALANCHE INFORMATION CALL ... 236-9435 IN DENVER AND BOULDER ... 482-0457 IN FT. COLLINS ... 520-0020 IN COLORADO SPRINGS ...668-0600 IN SUMMIT COUNTY ... AND 247-8187 IN DURANGO.

WILLIAMS
COLORADO AVALANCHE INFORMATION CENTER
8990 5-9

LETTERS and NEWSPAPER ARTICLES

This appendix includes a collage of letters and cards commenting on the service provided by the Avalanche Center and a sampling of newspaper stories which helped the Center get its information to the public.

Hi,

4/19/90

I find your forecast concise & easy to understand. What I appreciate most is the rational you give with your forecasts. By phoning everyday, I've learned how storms, wind, warm spells affect the forecast. Keep up the good work.

Thanks. Mike

S. [illegible] I've got to [illegible] something about that phone - it fades, & sometimes doesn't work.

Avalanche Center

No significance to this postcard except the message. I feel your reports are a real blessing to our area, & wholeheartedly tell visitors as well to "Listen to KOTO at 6 for the local news & weather plus snow/avalanche conditions from our experts." We are fortunate to have you. Sincerely, [illegible]

THOMASTON, MAINE
Main Street
© EIP Photo by Hastings
Pub. by EASTERN ILLUSTRATING, for HELEN [illegible] P.O. BOX [illegible] TELLURIDE CO [illegible]

ALWAYS USE ZIP CODE

POST CARD
ADDRESS

Avalanche Center
10230 Smith R.
Denver
CO
80239

4/10/90

To the Avalanche Center:

I just want to let you know that my friends and I have found the tape recorded message of mountain weather and avalanche conditions very valuable. We now make a habit of calling 236-9435 before every ski trip in the back country. I specially appreciate your educational analysis of what factors are causing the conditions.

Susan Conton

Windsurfers on the Columbia River at Hood River, Oregon. Windsurfers gather from all over to enjoy the most favorable conditions for windsurfing.
Photo: Tony Price

Thanks for helping make our best ski season ever! Your forecasts were right on & helped us plan our trips for fun & safety. We've got a few days left then we'll get on the new windsurfer.
Dave Carven
the gang of eight! XCD

Avalanche Center
10230 Smith R.
Denver, CO
80239

April 23, 1990

Colorado Avalanche Information Center
10230 Smith Road
Denver, CO 80239

Dear Sirs:

I have found your telephone information on avalanche conditions and mountain weather to be extremely useful, and I hope you will continue to offer the service in the future.

Your mountain weather reports are the best I have found anywhere. It would be very helpful if you could provide mountain weather reports all year, not just during ski season.

Sincerely,

David A Hill

David A. Hill
1850 Kohler Dr.
Boulder, Co. 80303

I would like to thank you for taking time out of your busy schedule to allow me to interview you. The answers to my questions and the information you sent me have been a great help in completing my science project. I have learned a lot about avalanches and find to be a very interesting topic and I appreciate your assistance.

Sincerely,
Jason Challis
Jason Challis

Apr 1990

Dear Sirs,
my wife + I find your weather and avalanche messages and forecasts invaluable. We cross country ski + Down hill all winter and I check your information several times every week and have the telephone no programed on my Auto. Dialer. We also appreciate the general information and historical data included.
Thanks for the service. Keep up the good work!
Leonard Hunter

DAVE MARTUS
3360 DOVER DRIVE
BOULDER, CO 80303

AVALANCHE CENTER
10230 SMITH ROAD
DENVER, CO 80239

4/17/90

Dear Sirs:

I am writing to thank the Avalnche Center for another season of accurate and detailed mountain weather and safety information. Your information is the only detailed source for "on mountain" weather info, the weather service forecasts are too general and are more geared for the valleys.

One improvement I enjoyed this season was the addition of an afternoon update on weekends. Details on wind, temperatures, and backcountry safety helped plan my ski days. Although I do not ski in the backcountry too much, your detailed yet easy to understand info on backcountry safety was/is very educational.

Please send me your informational packet if you have any available. Keep up the good work and have a great summer.

Thank you,
Dave Martus
Dave Martus

4-23-90

Dear Sirs,

Just a quick note to let you know I felt you did a great job in '89+'90 in regard to avalanche awareness. I feel this program is money well spent.

Thanks,
Steve Oliver
12059 S. Circle Dr
Conifer, CO 80433

Tom Schmidt
Box 394
Eldorado Springs
Colorado 80025
499-6611

I want to thank you for another very informative and helpful season of avalanche information. Your recording of avalanche and weather conditions is superlative.

Thanks —
Tom

Coors Brewing Company
Golden, Colorado 80401

December 14, 1989

Dale Atkins
Colorado Avalanche
Information Center
10230 Smith Road
Denver, CO 80239

Dear Dale:

Thanks once again for participating in the Guest Relations' 1989 Special Programs. They were a greater success because of your involvement.

We have a Certificate of Appreciation for you along with our sincere wishes for a *Happy Holiday Season and Best Wishes for 1990!*

Yours truly,

Maridale Powell
Special Programs Planner

MP/jr:13B080

THE DENVER POST

William Dean Singleton, *Chairman of the Board*
Donald F. Hunt, *Publisher*
Chuck Green, *Editor*
Robert W. Ritter, *Executive Editor*
Carl Miller, *Editorial Page Editor*
Gay Cook, *Managing Editor*
William H. Hornby, *Senior Editor*

'There is no hope for the satisfied man' - F.G. Bonfils, Publisher, 1895-1933

Outwitting the white death

ALTHOUGH it's been balmy in Denver, avalanche season is approaching in the high country. All outdoor enthusiasts — skiers, climbers, snowmobilers and sightseers — should know how to avoid and survive avalanches. Unfortunately, many don't. Colorado has the dubious honor of recording the highest number of avalanche deaths of any state in the country.

The grim statistics might be worse if not for a tiny branch of Colorado's Department of Natural Resources. Each year, the Colorado Avalanche Information Center hosts numerous seminars and classes on avalanche avoidance, survival and rescue.

Headquartered in north Denver, the center also collects information on avalanche hazards and operates an information hotline on snowslide conditions. In the Denver/Boulder area, that information number is 236-9435.

Additionally, the center works closely with other government agencies, including the U.S. Forest Service and the Colorado Highway Department, to assess snowslide hazards and reduce the danger to the public.

There's no telling how many lives have been saved by the Avalanche Information Center. But the number may be large.

Even unlucky souls who have been trapped by snowslides have reported they survived because they knew what to do when the avalanche broke. Untrained victims often die in similar circumstances.

As the winter sports season begins in earnest this weekend, Coloradans should take a moment to thank the Colorado Avalanche Information Center for making the mountains a bit safer for all of us.

THE ROCKIES

The Land & Nature

'Avalanches won't be targeted (for research funds) until there's a disaster here...'

White death haunts the slopes

FOUR people died last year on the pristine slopes of Colorado's mountain ranges, buried alive under the turbulent, tragic force of avalanches — the white death of winter.

Three years ago, 11 people perished under the snow, prompting a call for tight restrictions on back-country skiing and a push toward prevention and preparedness.

But despite the obvious dangers, little new has been done to advance the forecasting of avalanches or to analyze the conditions that contribute to the phenomenon.

"The science of avalanches is proceeding at a snail's pace," says Knox Williams, director of the Colorado Avalanche Information Center. "There's no money at all. Snow science has come to a standstill."

Armed with an annual budget of about $110,000, Williams and two other employees — associate director Nick Logan and forecaster Dale Atkins — provide a wide range of information and analysis about one of Colorado's major winter dangers.

Each year, more than 2,000 avalanches are reported to the Denver-based avalanche center — just one-tenth of the estimated 20,000 slides that occur throughout Colorado's mountain ranges, Williams said.

Unlike other mountainous states, with just one or two avalanche-prone sections, Colorado's proclivity toward avalanches stretches across every mountain range from west of Fort Collins to Durango.

On the average, Williams said, about four skiers or back-country enthusiasts will die each year in Colorado. Anywhere from 35 to 59 people have been caught in avalanches annually over the past several winter seasons. Property damage generally ranges between $50,000 and $100,000 in the state, Williams said.

Last year's victims included two men who triggered an avalanche in mid-February while skiing out of bounds in Telluride. A 6-year-old boy from Fort Worth, Texas, was killed about a week earlier on Mount Crested Butte when an avalanche swept down a hillside and buried the youth and two cousins while they were playing near a resort development. Rescuers quickly located the two other boys, but Taylor Huddleston died 10 hours later.

In early April, a 23-year-old Summit County man died when he set off an avalanche while skiing out of bounds near the summit of Loveland Pass. A lift operator at the Breckenridge ski area, Douglas Pinta had called in sick early on the last day of his life to take advantage of a fresh snowfall.

Pinta became the 103rd person to die in state avalanches since record keeping began in 1950, said Williams, co-author of *The Avalanche Book* and *Snowy Torrent*. He also co-wrote the script to the video *Avalanche Awareness: A Delicate Balance*. (Fulcrum Publishing, Golden).

In the United States, avalanches have claimed 252 people — a number that pales in comparison with Europe, where 1,851 people died in Austria, Switzerland, West Germany, Italy and France during a 20-year span ending in the late 1970s.

"Avalanches won't be targeted (for research funds) until there's a major disaster here — and that could happen," Williams said.

Williams knows of only two schools — Montana State University and the University of California — that offer full-time courses for students studying avalanches. His information center is one of three such organizations in the nation, joining the Utah Avalanche Forecast Center and the Northwest Avalanche Center in Seattle.

"We're actually reduced from what we were doing (in avalanche research) five years ago," said Theodore Lang, director of the engineering department at Montana State in Bozeman. "When there's a catastrophe involving avalanches, interest is renewed. We really haven't had any serious problems lately."

But avalanche experts such as Williams know enough about their inexact science to offer general predictions about where — if, not when — avalanches will occur in Colorado. Predictions are based on snow depth, temperature, wind speed and the most subjective science of all — human judgment.

Daily recorded reports on avalanche danger in the high country began Nov. 14, despite only a relative sprinkling of snow.

The center, based in the National Weather Service headquarters near Stapleton International Airport, monitors and forecasts avalanche dangers based on reports from 35 spotters in the mountains. Each day, the center produces reports for all mountain areas, rating the hazards in a system that ranges from low to extreme.

Twenty spotters report from Colorado ski resorts, most of which have their own employees to perform similar functions. An unstable snowpack in late November prompted the ski patrol at Copper Mountain to set off 15 slides in one morning.

Though slides can occur during any month in Colorado's mountains, most avalanches occur between November and April. The state is especially prone to avalanches because of its comparatively shallow and weak snowpack and its abundance of especially tall peaks — 52 higher than 14,000 feet.

There are two principal types of snowslides. A loose-snow avalanche starts at a point where loose grains roll down a steep slope, dislodging adjacent grains and gathering more and more snow. Slab avalanches — generally the most dangerous — begin with a roar when a huge section of snowpack dislodges and slides downslope.

Most avalanches occur in open areas with a slope of 30 degrees and more, set off because of the stress built up between one or more layers of snowpack.

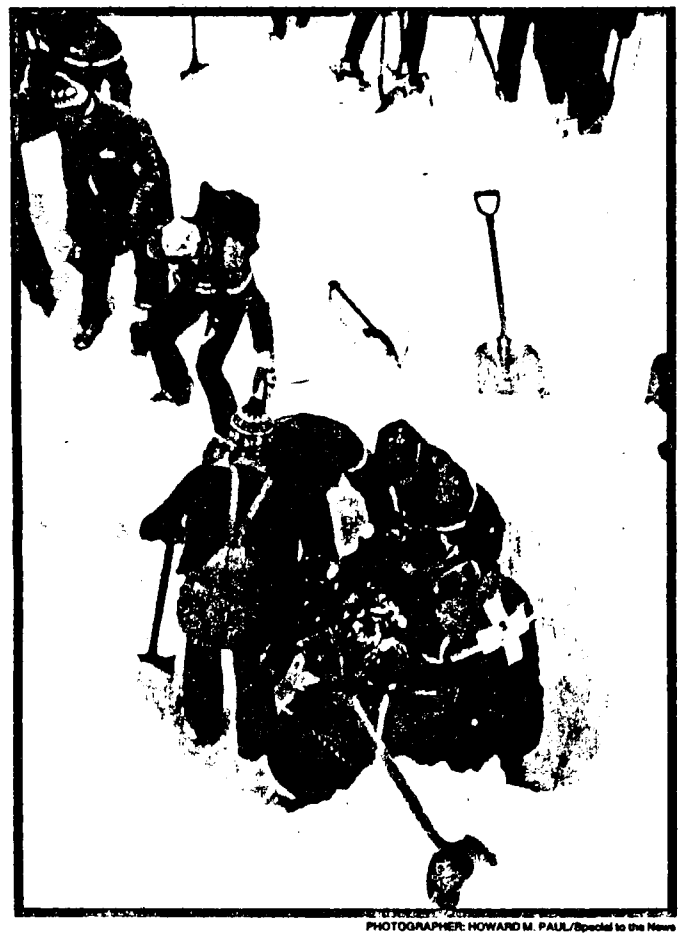
Steep slopes that face away from prevailing winds — on the leeward side — are especially prone to avalanches. When the snowpack can no longer absorb the stress of a weakening bond, the snow cracks and slides downhill. The final overload of the tenuous bond is the trigger — anything from an unwary back-country skier to new, wind-deposited snow. Slides are most likely during or immediately after a storm.

Though resort employees are closely patrolling their boundaries — and ticketing those who venture outside — the vast majority of the back country remains open to all, totally unregulated.

But Delbert Ewoldt, sheriff of Summit County — home to four ski resorts — said his officers will strictly enforce laws that prohibit the access of national forests through a closed ski-area boundary.

"If you violate the Skier Safety Act, you'll wind up in jail," Ewoldt said. "And there's something else: In Summit County, you may very well be charged for recovering (victims or trapped skiers). There's a time when People have to be a little more responsible.

"Local governments can only go so far in protecting somebody from their own stupidity."



PHOTOGRAPHER: HOWARD M. PAUL/Special to the News

Ski patrol removes body of snowmobiler killed on Shrine Pass in 1987.

AVALANCHE FACTS

How to recognize avalanche areas:

- Beware of steep slopes with angles of 30 degrees or more.
- Snow in north-facing slopes is more likely to slide in mid-winter, while south-facing slopes are more dangerous during the spring and on warm days.
- Avoid slopes where the wind tends to pile up snow.
- Smooth, open bowls, slopes and gullies are natural avalanche paths. Travel across the top of the ridge rather than across the face of the slope.

If you must traverse an area likely to be avalanche-prone, take several precautionary steps:

- Cross one at a time and wait until each skier is safe.
- Remove ski poles and straps from your wrists, loosen pack straps and ski bindings so you can jettison equipment quickly.
- Watch for cracks in the snow and listen for a hollow sound that indicates the snow is de-stabilizing.

If you are caught in an avalanche:

- Throw off your poles, pack and skis.
- Attempt to "swim" in the snow and stay on the surface, arching your back and keeping your head up so the snow hits you in the chest and forces you up.
- Wrap your arms around your face. As soon as you feel yourself stop, push out and away away to create an airspace and remove pressure from your chest.
- Don't panic. Some avalanche victims have been able to dig themselves out. But since avalanche victims often become disoriented while tumbling through the snow, first spit to determine which way is up.

Local numbers for recorded daily reports by the Colorado Avalanche Information Center:

Denver/Boulder: 236-9435; Fort Collins: 482-0457; Colorado Springs: 520-0020; Summit County: 668-0600; Durango: 247-8187; Vail: 827-5687; Aspen: 920-1664.

Michael Romano is a *Rocky Mountain News* staff writer

Fort Collins, Colorado A Gannett Newspaper

FRIDAY
December 1, 1989

FORT COLLINS COLORADOAN

Avalanche

Unstable snowpack cause for concern in state high country

By J. LEWANDOWSKI
The Coloradoan

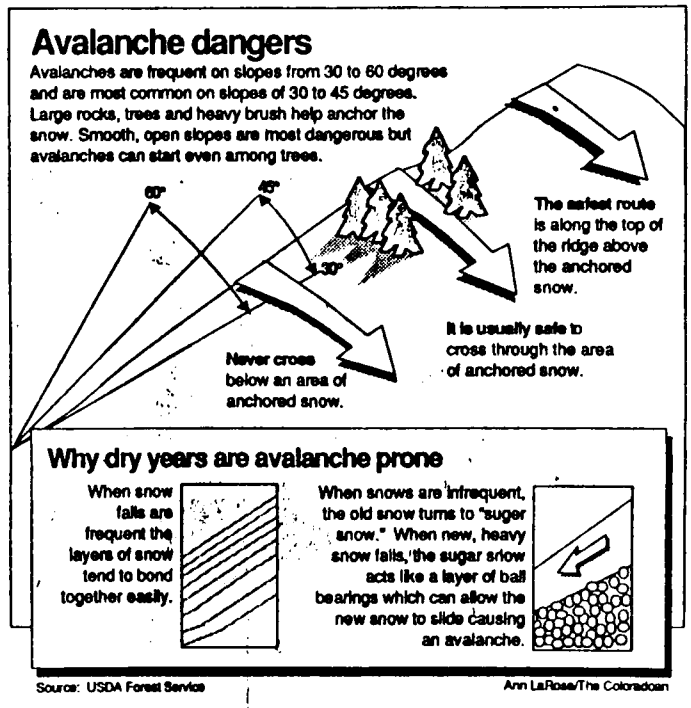
Avalanche danger will be severe in Colorado's mountains and throughout the West this winter due to unstable early winter snowpack, the director of the Colorado Avalanche Information Center said Thursday.

Snowfall has been sporadic this season and the initial layers of snow might not be able to hold the heavier snows that are sure to come as the winter progresses, said Knox Williams, director of the Colorado Avalanche Information Center.

"We're going to have a pretty bad avalanche situation this winter," Williams said. "We need a layer of snow that bonds well with others on top of it. But right now we have poor conditions because we have a weak bottom layer."

During the last three years 20 people have died in avalanches while skiing and snowmobiling in Colorado. In 1987 a

See AVALANCHE, Page A12



Avalanche

Continued from Page A1

record 11 people were killed; five people died in 1988; and four died in 1989.

The Colorado Avalanche Information Center operates a recorded telephone message service. Back country travelers can call to get current weather and snow conditions. The message is updated every day.

The danger will be acute this year because the consistency of the first layers of snow has changed since falling.

As snow gets old it changes from a powdery texture to a consistency that resembles sugar. The cold air temperature is responsible for the change.

Ideally, snow builds up gradually throughout the winter which keeps the temperature of the layers consistent. That allows one layer to bond to the next.

However, conditions have been less than ideal this winter, Williams said.

The layers of snow have developed the sugar consistency and new layers cannot bond well as they fall. Simply stated, the "sugar snow" layer becomes similar to tiny ball bearings. As the weight on top grows the new layers can slide and cause an avalanche.

Sometimes the weight of a skier or snowmobile can trigger the reaction, Williams said.

Avalanche conditions heightened this week following a major storm in the north and central mountains that dumped up to 30 inches of snow. The new snow is sitting on top of an unstable layer. Also, because there is no precipitation in the forecast, the new snow is already changing and taking on the consistency of sugar and will soon form another unstable layer, Williams explained.

"The two feet we had will grow weaker by the day," Williams said.

Observers for the avalanche center reported about 50 avalanches since Sunday. Considering that the snowpack is relatively low, that is a large number of slides, Williams said.

"Snow cover is shallow and air temperatures are cold. That leads to a weakening of the snow," Williams said. "That tells us what the situation is going to be for the next snow."

Reports to the avalanche center come from ski patrols, road crews and people who are regularly in the back country. They report on weather conditions, temperatures, wind speeds and snow. The center's three forecasters use that information to develop the daily report.

Extra caution is advised for back country travelers throughout the winter, Williams said.

Unfortunately for skiers, the best slopes for skiing also are the most avalanche prone, Williams said. The pitch of the most avalanche prone slopes is 30-45 degrees.

"It's going to be pretty shakey throughout the winter. It could be a dangerous winter in the back country," Williams said.

Booklets on avalanche safety are available at the U.S. Forest Service office at 240 W. Prospect St. Williams will present a workshop on avalanche safety at 7 p.m. Tuesday, Dec. 5 at The Mountain Shop, 632 S. Mason St.

The Avalanche Information Center number is 482-0457.

Slides Pose Backwoods Peril

by Christopher H. Cessna
Steamboat Lake Ranger

Imagine what it would be like to look up and see tons of snow traveling straight for you at up to 100 miles an hour. Now imagine being buried in snow so tightly packed that you can't move even a finger.

Most people, even hardcore backcountry winter travelers, haven't thought about an avalanche in these sobering terms. The topic, however, is as serious as death. There have been 105 avalanche-related deaths in Colorado since 1950, according to Knox Williams, director of the Colorado Avalanche Information Center.

"We have the dubious distinction of being the leading state in avalanche deaths," Williams said, adding that Colorado has had twice the number of avalanche fatalities as Washington, which ranks second in the grim statistic.

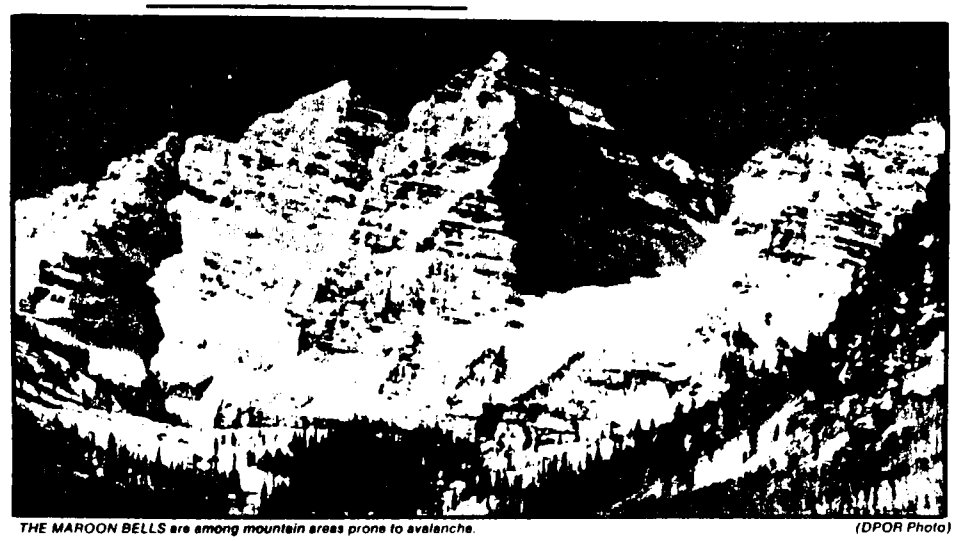
Learning how, when and where avalanches occur and following a few common-sense guidelines for avoiding them can greatly reduce your chances of being caught in one.

An avalanche, or snowslide, is a mass of snow falling or sliding down a mountain. There are two kinds. One, a "loose snow" avalanche, forms when a few grains of snow tumble downhill, dislodging countless others on the way. The other, called a "slab" avalanche, occurs when a large, flat piece of snow breaks loose. Slab avalanches are more dangerous, because they usually carry more snow and cover a wider area.

Too much snow piled on a slope can cause an avalanche, but it's a little more complicated than that. The condition of snow, as well as the amount, plays a major role. Snow and ice crystal structure make the difference between a safe snowpack and a deceptive, unstable base. Time, temperature fluctuations and the additional weight of new snowfalls can transform the angular, interlocking crystals into a mountainside of nervous ball bearings.

Water vapor moving up through the snowpack can also bring about a dangerous change in the snow. When the ground is colder than the top of the snowpack, water molecules move toward the warmer layer. The result is a layer of "sugar" snow at the bottom, so called because it no longer sticks together. Instead, it shifts and slides like sugar.

Most avalanches occur during November, December and January because conditions are right for the creation of sugar snow. Periods of thaw also bring the threat of avalanche, and the danger of snowslides exists as long as there is snow in the mountains.



THE MAROON BELLS are among mountain areas prone to avalanche. *(DPOR Photo)*

The most important thing to keep in mind when looking for potential avalanche sites is terrain, specifically steep slopes. Avalanches usually occur on 25-50 degree slopes. Bear in mind that gentle slopes may be hit by avalanches flowing off steeper hillsides above.

Steep gullies and chutes that run straight downhill are natural corridors for the tons of crashing snow. These corridors are called avalanche paths. Never assume that staying in or behind a stand of trees will shield you from danger. Slides often travel through light to moderately dense forests, and major slides have been known to topple trees like bowling pins.

Survivor interviews have shown that most avalanches are triggered by one member in a party falling on or near a vulnerable spot in the "release zone," an area of unstable snow that breaks away and starts sliding, literally tearing away beneath the hapless traveler's feet.

The best advice is to steer clear of avalanche-prone terrain, especially slopes that face away from prevailing winds. They usually carry a heavier load of snow, and exposure to the wind keeps later snowfalls from sticking.

There are, however, safe paths for the experienced mountaineer who has no choice but to cross a potential release zone. Geologic structures such as ridges, outcrops and terraces can act as natural barriers. Ridge crests offer the safest routes and usually are above the lethal release zones and out of immediate danger.

Do your homework before you head for the winter high country. Begin studying the area's weather at least a week before you leave. If there's more than a foot of new snow, be careful. It takes a few days for large amounts of new snow to settle and bond. Pay attention to the area's temperature for at least a week as well. Continuous temperatures below 20 degrees Fahrenheit following a storm indicate the snow won't have had a chance to bond.

If you want to learn more about avalanches, try your local library. Mountaineering shops also carry winter safety literature and frequently offer avalanche awareness talks.

If you'd like to talk to the experts, including "Mr. Avalanche," Knox Williams, call the Colorado Avalanche Information Center at (303) 371-1080, or write to: Colorado Avalanche Information Center, 10230 Smith Road, Denver, CO 80239. The center, which is part of the Colorado Geological Survey, is staffed by four experienced avalanche forecasters who use information from 30 mountain observers to prepare daily avalanche hazard evaluations.

IF YOU ARE CAUGHT IN AN AVALANCHE:

1. Discard all equipment -- skis, poles, backpack, etc. Snowmobilers must get away from their machines.

2. Make swimming motions. Try to stay on top of the snow; work your way to the side of the avalanche if possible.

3. Before coming to a stop, try to clear an air space in front of your face with one hand while thrusting the other straight up. A few survivors were rescued only because searchers spotted their hand above the snow.

4. REMAIN CALM -- DON'T WASTE ENERGY AND OXYGEN.

IF YOU ARE THE SURVIVOR:

1. Mark the place where you last saw the victim.

2. Search directly downslope.

3. DO NOT DESERT THE VICTIM to go for help. After a half hour the buried victim has only a 50 percent chance of survival, and that percentage drops rapidly.

4. Upon recovery, treat the victim for shock and suffocation.

For current information on mountain weather, snow and avalanche conditions call:

Denver/Boulder	(303) 236-9435
Fort Collins	(303) 482-0457
Colorado Springs	(719) 520-0020
Dillon	(303) 668-0600
Minturn	(303) 827-5687
Aspen	(303) 920-1664
Durango	(303) 247-8187
Road Conditions-	
Denver and west	(303) 639-1111
Interstate 25	(303) 639-1234

Avalanche: winter's 'White Death'

By Sara Ryan
Morning Summit Staff Writer

Traveling through the backcountry dominated by winter is a popular, exhilarating activity.

Every year, millions of people participate in backcountry and a myriad of other activities in Colorado's winter wonderland, even when the threat of avalanche is high.

If you are prepared and knowledgeable about avalanche safety, the wilderness experience will prove rewarding, although too many individuals are not "avalanche aware." An avalanche generally occurs in the backcountry, on large open slopes on high mountain sides, yet even smaller low elevation slopes such as gullies, road cuts and small openings in trees can also create an avalanche.

An avalanche may be triggered by many factors, such as new snow, wind-deposited snow, mechanical changes in the snowpack, an explosive or artillery fire, or an unwary backcountry skier, climber or snowmobiler.

Snow avalanches in Colorado kill more people annually than in any other state.

Last year the state reported 56 incidents of individuals caught in avalanches—killing four—and 11 of these incidents occurred in Summit County.

Due to its inherent terrain, weather, and snow pack conditions, Summit County is a high hazard avalanche area.

Due to the high avalanche risk rate, in 1973 the U.S. Forest Service implemented an avalanche warning program for Colorado, as an outgrowth of an existing avalanche research project.

The program evolved into a permanent administration, which is now known as the Colorado Avalanche Information Center (CAIC).

The center, managed by the Colorado Geological Survey, is housed in the National Weather Forecast Office in Denver.

It operates from November through April, seven days a week.

As the weather, snow cover, and avalanche conditions are always changing, the purpose of the center is to monitor these changes and provide the public with current information.

Contact with a network of 30 field sites around the state, provide the forecaster on duty with current data necessary to make daily snow stability evaluations, to issue and terminate avalanche warnings as warranted, and to report any effected persons.

The forecaster also keeps close contact with most ski areas, the highway department, the forest service, and the sheriff's department.

Warnings and information is then provided to the public via recorded telephone messages, the NOAA Colorado Weatherwire, the news media, and through educational avalanche awareness talks, seminars, literature and public announcements.

"The most important thing to realize about an avalanche is that, unlike other natural tragedies, you have to put yourself in the situation," Nick Logan, associate director of the center, said. "An avalanche can be avoided if you know what to look for."

The 24-hour recorded phone messages, updated twice daily, provide public contact for current mountain weather, snow and avalanche conditions on an everyday basis.

All mountain travelers and citizens are encouraged to call the hotline on a daily basis, in order to stay up-to-date with all changes in conditions.

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In addition to phone messages, avalanche seminars are another source of information for tourists, citizens and avalanche workers.

"The seminars teach people to recognize avoidable areas in order to exercise better judgment in the backcountry."Logan said.

Part of the center's service includes going to schools, and educating children in grades 5 and up about avalanche awareness.

The center also provides a forum for ski patrollers to discuss, understand, and solve avalanche-related problems, as well as providing useful forecasts for scheduling avalanche control, snowmaking, slope grooming and lift operations.

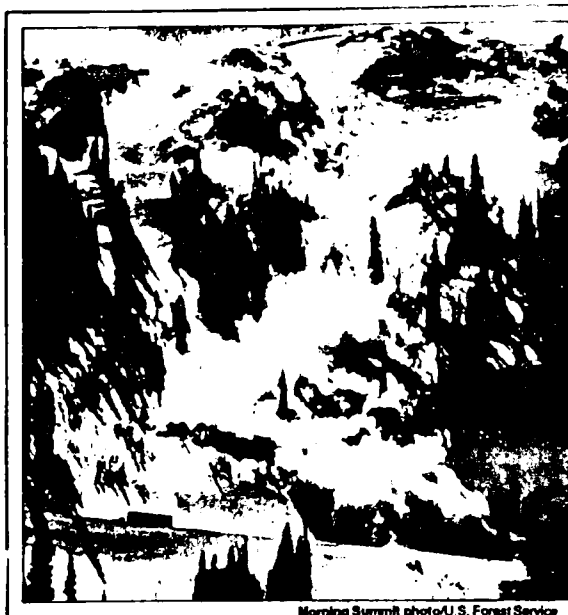
In the continental climate zone, an avalanche can occur any time, because the snowpack can lose strength over time, with or without snowfall.

Prior to leaving for a wilderness excursion, be sure to call the hotline, and be certain that someone in your group has knowledge about safety precautions and recognizing terrain.

The wise backcounty traveler continually assesses and reevaluates all input, and doing so bases decisions.

For more information, attend the Avalanche Center Seminar on December 13, or send a self-addressed, stamped envelope to **Colorado Avalanche Information Center**, Colorado Department of Natural Resources, 10230 Smith Road, Denver, CO 80239

For current information update, call 668-0600 in Summit County, 236-9435 in Denver/Boulder, and 827-5687 in Vail.



Morning Summit photo/U.S. Forest Service

Observations to watch for:

- Old slide paths (avalanches usually run in the same places)
- Sounds and cracks around and shooting ahead of you
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Some basic notes about route selection:

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To send natural gas to Southern California...

Proposed pipeline seen as economic boost for Northwest Colorado

CRAIG, Colo. (AP) - A proposed gas pipeline linking northwestern Colorado with Southern California may ignite an economic revival in this depressed corner of the state.

"My guess is that pipeline will result in several hundred jobs in that area over time," said Ronald W. Cattany, assistant director of the Colorado Department of Natural Resources.

The proposed, $100 million TransColorado pipeline may stimulate production of coal-bed methane in the Piceance Basin and the revival of scores of shut-in wells in the area, officials said. Within a couple of years, the TransColorado could move up to 300 million cubic feet of natural gas per day to markets in Southern California.

Curt Dallinger, project manager for WestGas, a subsidiary of Public Service Co. of Colorado and one of three partners in the project, said filling the pipeline should not be a problem.

"There were in the neighborhood of over 200 shut-in wells when we started this project," said Dallinger. "That's just wells drilled and shut in, waiting for a market."

In addition to WestGas, partners are Rocky Mountain Natural Gas, a subsidiary of K N Energy Inc. of Lakewood, and Questar Pipeline Co., a subsidiary of Salt Lake City-based Questar Corp.

"This will be long-term," said Larry Hall, president of K N Energy, of the project. "This is a tremendous project for the Western Slope, which has suffered through some tough times."

...environmental impact statements will have to be prepared because the pipeline would cross four national forests and two BLM districts...

The pipeline is designed to run 300 miles south to near Ignacio. The starting point will be the middle of the Piceance Basin - a point nearly equidistant from Rangely, Meeker, Rifle and Grand Junction.

From Ignacio, the line will intersect with El Paso Natural Gas Co.'s existing pipeline leading west to California. A second California-bound line, Transwestern Pipeline Co., is just another 34 miles to the south, in New Mexico.

"The real benefit of the TransColorado is that it will intersect with one and possibly two interstate pipelines serving Southern California," said Frank Keller of Denver-based Barrett Resources Corp.

"The Piceance Basin is in need of pipelines. There is a big resource of natural gas in that area," said Keller.

Steve Schwochow of the Colorado School of Mines' Institute for Energy Resource Studies said a recent study sponsored by the Gas Research Institute said there was 84 trillion cubic feet of gas reserves in the Piceance Basin.

Total U.S. consumption of natural gas is about 18 trillion cubic feet annually.

"What percentage of that 84 trillion cubic feet is recoverable is harder to deal with," Schwochow added.

Barrett Resources has about 90 wells in the area producing 30 million cubic feet of gas per day. Another major oil company, Conoco Inc., has nearly 200 operating gas wells in the Douglas Creek Arch about 60 miles northwest of Grand Junction.

"Ultimately, that pipeline could be of some value to us," said Bill Brister, manager of Conoco's Casper, Wyo., division. "The more access we have to markets around the country, the better off we are."

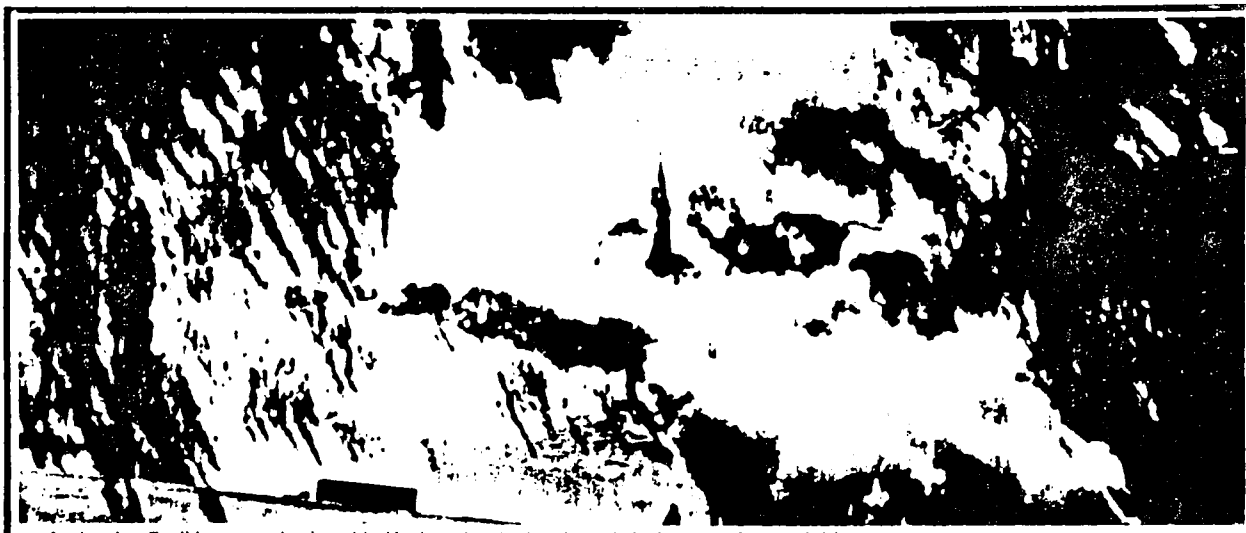
The expected natural gas boom concerns coal producers in the area. They do not want to see gas companies start drilling on coal lease properties for which federal agencies have granted oil and gas leases.

"We are prevented by law from approaching the wellhead and casing with our blasting and mining operations," said Wayne Sowards of Trapper Mining Inc. of Craig.

He said the Colorado Oil and Gas Conservation Commission is holding meetings to iron out potential conflicts between coal and gas producers.

Chuck Finch of the Bureau of Land Management's Montrose office said environmental impact statements will have to be prepared because the pipeline would cross four national forests and two BLM districts.

"There is an incredible amount of work to do," he said. "We're a long ways from putting any pipe in the ground."



Avalanches like this one are best avoided by knowing the terrain and staying away from unstable snow cover.

AVALANCHE!

Story by: Sara Ryan

Avalanche knowledge crucial

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THE Avalanche REVIEW

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Winter Operations:

Improving the Hasty Search in Backcountry Avalanche Rescue

By Dale Atkins

In any mountain rescue operation, be it search, high angle rock, river or avalanche, the actions taken by the rescuers in the first few minutes after reaching the site has a large impact on the success of the operation. This is especially true for the hasty search phase in avalanche rescue. The hasty search is the action taken at the avalanche site prior to establishing organized probe lines. When conducting the hasty search any incorrect decisions which are made regarding equipment or procedures and/or hazards which are not adequately identified can compromise the success of the operation. Time is wasted, wrong areas are searched; potentially having a major effect upon the victim's survivability and/or the rescuers' safety. To reduce that loss of time, improve the efficiency and effectiveness of backcountry avalanche SAR, and aid in making those critical decisions within those first few minutes, a hasty search flowchart is presented.

Time is the enemy in SAR work, especially for the buried avalanche victim. A mistake in where to search may cost the victim his or her life. Identifying the likely burial areas is one of the purposes of the hasty search. The buried victim in the backcountry faces a long delay before notification, the arrival of rescuers, and recovery, compared to victims near developed ski areas (Table 1). Survival of a buried victim decreases sharply with time. At 30 minutes, more victims will be found dead that alive. But, victims can survive many hours under the snow. The longest live recovery in North America is 25.5 hours, and people have survived for days when trapped in structures. No rescue group should abandon the search prematurely; all victims should be given the benefit that they might be found alive—sometimes they are.

Backcountry Avalanche Rescue

The hasty search is conducted in the same manner for both developed areas and backcountry rescues. Upon reaching the accident site the hasty search leader is confronted with the same variables that the rescue leader is grappling with back at the roadhead (Table 2). The many variables can act alone or interact with each other to present both solutions and problems to the avalanche rescue puzzle. The hasty search leader must recognize the variables involved at the accident site and make decisions on how best to use the available personnel and equipment to find the victims or to establish where to start looking for them. This in the face of the given hazards and weather.

The right mix of variables, the number of trained and equipped personnel and favorable weather may lead to a successful operation. Conversely, poor weather alone, no matter how well trained and equipped the rescuers are, may shut down an operation. The number of clues found improves the chances of success in an operation even if the avalanche is quite large, but the lack of clues even in small slides will undermine effectiveness.

The Hasty Search Team

In winter backcountry SAR operations, especially avalanche rescue, the luxury of reaching the scene quickly is not possible. At times, helicopter support may be available, but even the most reliable helicopter operators may be grounded for a number of reasons. The hasty search team, 3-10 people, is the first to reach the site. The team members should be well practiced in what needs to be done. The leader should be an experienced SAR manager, as his or her decisions will affect the rest of the operation, regarding what resources are needed and what areas need to be searched.

TIME ELAPSED BEFORE: (hours)	All Rescues	Developed Areas	Backcountry
Sounding of the alarm	3.5	0.75	5.25
Arrival of rescuers at accident	6.25	1.25	10
Discovery of victim	20.5	2.5	38

Table 1. Time elapsed after an accident for the recovery of the victim. Source: Knox Williams, 1977.

To get the hasty team to the accident site, rescuers and their equipment should be in good physical condition. Team members' abilities and over-snow travel capabilities should be similar. Snowshoers do not mix with skiers; skiers using wax will not be able to climb with skiers using skins. As access to the site becomes more difficult, the physical conditioning, abilities, and equipment differences become more apparent.

A significant difference between backcountry and developed area rescues is the personal equipment carried by the rescuers in the hasty team and other first responding field teams. In the formal three-stage rescue plan of developed areas this is known an Stage 1. When an accident happens in or close to a developed area, there is usually no need to take in personal bivouac gear. In the backcountry, minimal bivouac gear should always be carried. Not doing so invites problems. In fifteen years of mountain rescue work I have, all too often, been on the only team to get to an accident site. Weather or mechanical problems ground the helicopter; technical terrain, equipment problems, or an injured rescuer have kept support teams from reaching the site. Having the bivouac gear will allow you to take care of yourself and the victim, until medical and evacuation

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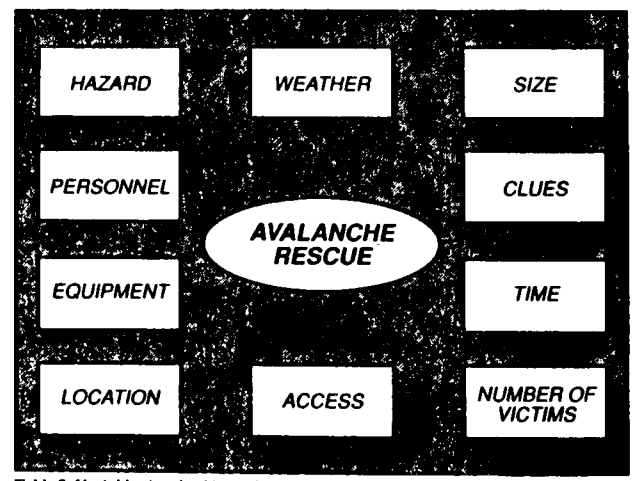

Table 2. Variables involved in avalanche rescue.