CENTRAL REGION TECHNICAL ATTACHMENT 93-27

IMPROVED SEVERE WEATHER DETECTION IN DATA SPARSE NORTHEAST
WYOMING DURING SUMMER SEVERE WEATHER SEASONS OF 1990-1992

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1.   Introduction

The Severe Local Storm season for Northeast Wyoming extends
from mid-April through September. The Casper National Weather
Service Office has warning responsibility for six counties.
Three of the six counties, Campbell, Crook, and Weston, encompass
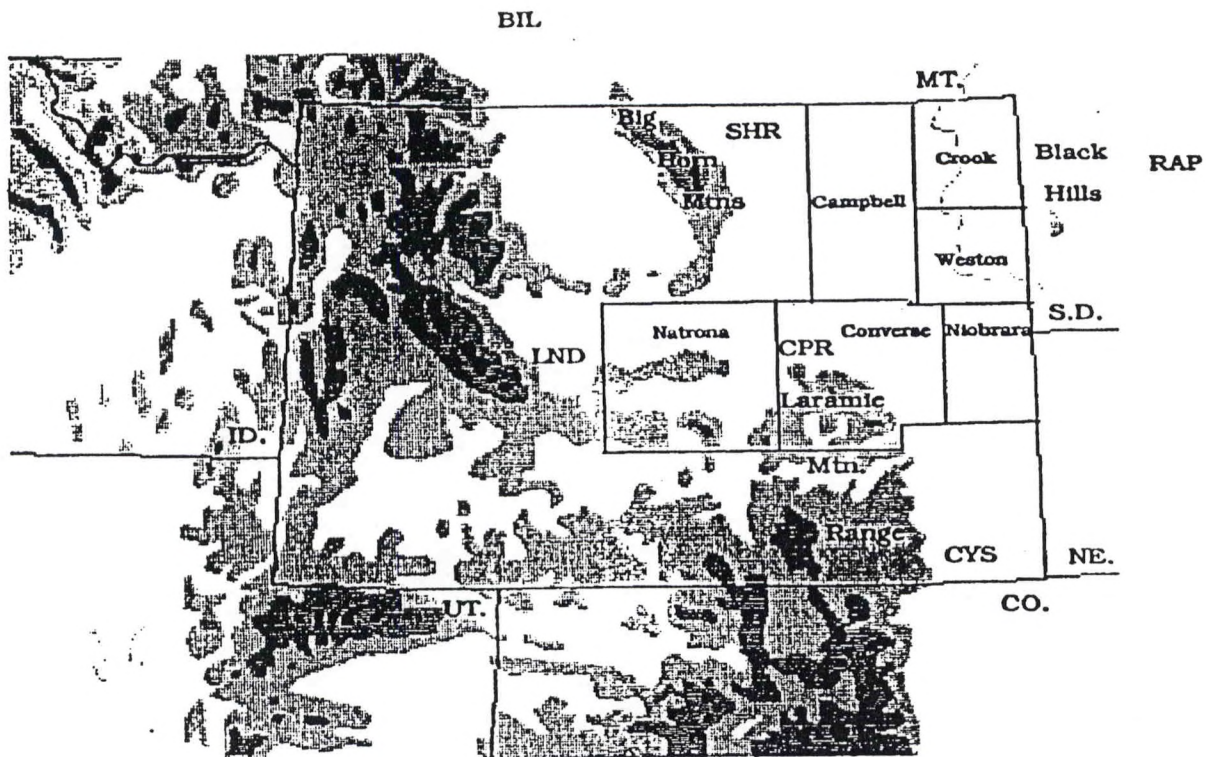the northeast quarter of the state (Figure 1).

Figure 1. WSO Casper County Warning Area.

The counties in Wyoming are large, but the population in each county is small. Population densities vary from 9.57 people to a low of .85 people per square mile. This creates a problem with severe weather detection in northeast Wyoming. Table 1 summarizes the population, area, and population density.

2. Topography and Weather Detection Equipment

The northeast quarter of Wyoming is surrounded by mountain ranges. To the west, lies the Big Horn Mountain Range. East of the area lie the Black Hills and to the south lies the Laramie Mountain Range (Figure 2).

TABLE 1
Population Density by County

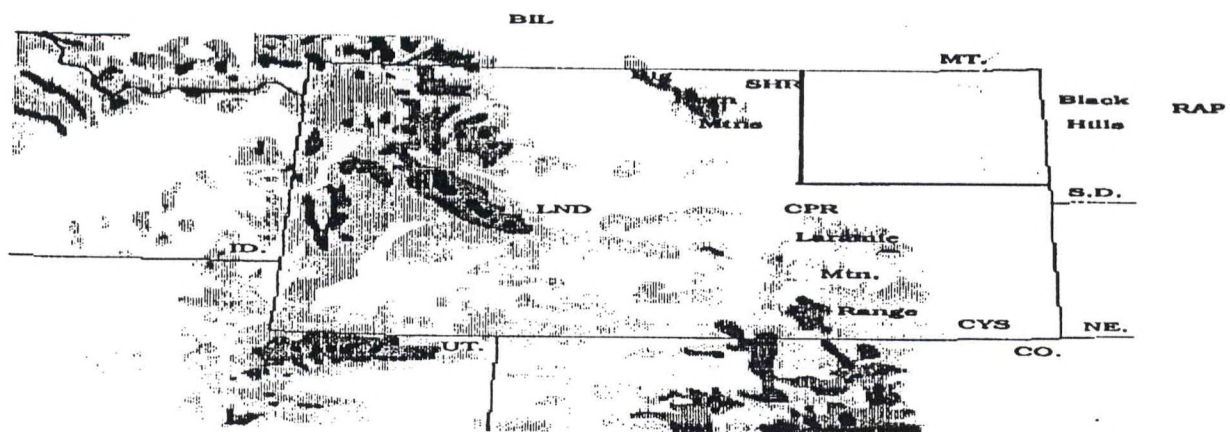| County	Population	Area (sq. mi.)	Population Density
Natrona	61,226	6,400	9.57 people/sq.mi.
Campbell	29,370	5,500	5.34 people/sq.mi.
Weston	6,518	2,750	2.37 people/sq.mi.
Converse	11,128	4,829	2.30 people/sq.mi.
Crook	5,294	3,300	1.60 people/sq.mi.
Niobrar	2,499	2,925	0.85 people/sq.m

Figure 2. Mountain ranges surrounding northeast Wyoming

National Weather Service radar sites available to the Casper office for severe weather detection in Northeast Wyoming are Alliance, Nebraska (which has a WSR-57 radar); Cheyenne, Wyoming; and Billings, Montana (which have a WSR-74C radar). The Weather Service Office (WSO) in Casper also uses, on occasion, FAA enroute radar located in Wyoming at Lusk, Lovell, and Rock Springs. The availability of radar information in northeast Wyoming is another major problem with the detection of potentially dangerous weather. Figure 3 illustrates the basic 125 nm radar coverage from the three NWS radars and the 100 nm radius for the three FAA radars.
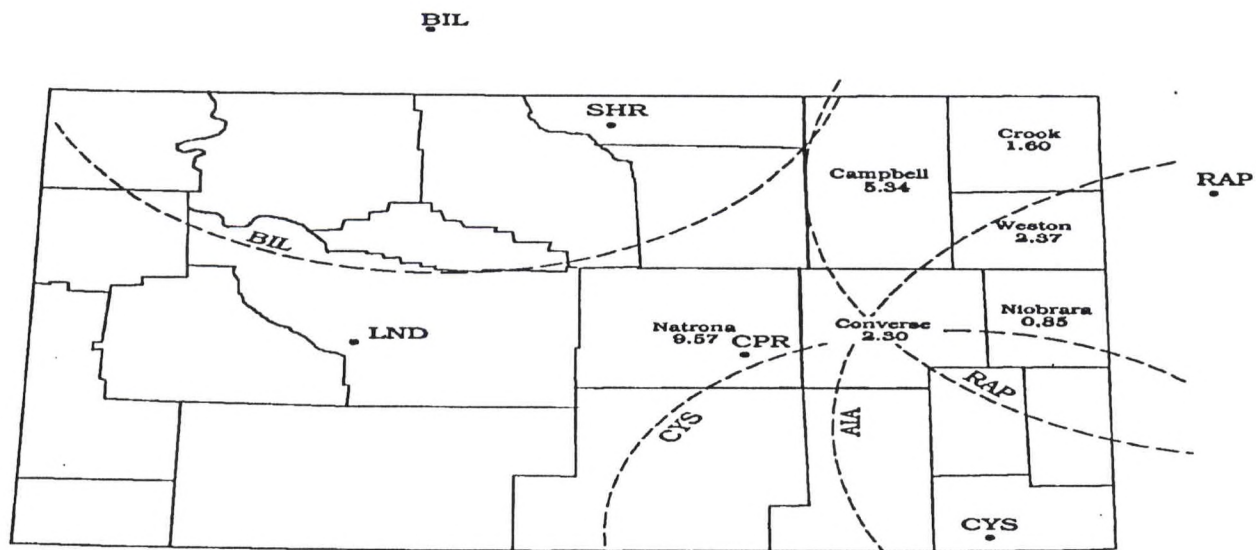

Figure 3. Radar coverage and county population densities.
       --- NWS 125 mi radius
       ... FAA 100 mi radius

3.   Data and Analysis

When thunderstorms develop or move into the northeast quarter of the state, detailed radar detection is limited. Mountain ranges hamper the radars' ability to accurately detect the strength of the thunderstorm (Figure 3.1). The radars often show thunderstorms as a Digital Video Integral Processor (DVIP) level one or two after elevating the radar's antenna to avoid terrain contamination. This can be misleading to the observer or forecaster who cannot say for sure whether the storm being tracked is in fact a DVIP level-1 storm or a DVIP level-5 storm where the radar is only ''painting'' the top of the storm.

3

WSO Casper does have MICROSWIS, which allows the observers in the office a visible and infrared picture of the storm. MICROSWIS is a computer program which allows the WSO to dial into the WSFO's SWIS (Satellite Weather Imagery System). Larger scale features, such as short waves, moisture channels, dry slots, and jets are also visible on the MICROSWIS. However, the access time involved is long. Satellite pictures take about six minutes to receive and new photos are available only once every hour. As a result, the most important and consistently reliable tool has proven to be the Severe Weather Spotter.
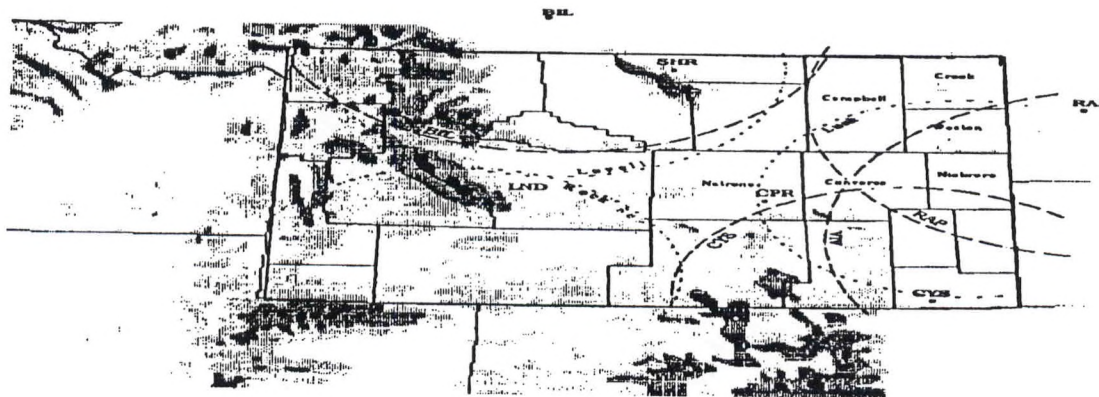

Figure 3.1   Radar coverage with mountain ranges superimposed.
--- NWS 125 mi radius
FAA 100 mi radius

With this in mind, the number of spotters was increased from roughly 50 in 1990, to over 500 by the 1992 severe weather season. Three years of severe weather data show the positive impact which spotters have played in WSO Casper's warning program. Table 2 clearly shows that as spotter involvement in severe weather detection was increased over the past three seasons, verification and timeliness of the issuance of warnings were significantly improved.

Mining is the major industry in Campbell County. WSO Casper met with upper-level management and the safety coordinator of a large mining company to explain that the outside operation of the mining company necessitated training the employees on severe weather spotting. Also, this would create an excellent spotter network because their operation ran 24-hours-a-day. WSO Casper trained over 250 people on severe weather spotting. Also, the management and staff of a major radio station in the area agreed to a real-time exchange of weather information.

A review of emergency operations in Crook county, conducted in Spring 1992, resulted in improved awareness and public education in severe weather detection. As a result, the city and county workers obtained new radios for use in severe weather reporting. For the first time, all workers in the county can now quickly relay storm information to the Sheriffs office. The severe weather reports are then relayed to the Casper WSO.

TABLE 2

Year	1	2	3	4	5	6	7
1990	7	2	5	1	6	4	2
1991	10	7	3	6	4	6	6
1992	3	2	1	2	1	1	3

Key: Column 1= Number of Warnings Issued
Column 2= Number of Warnings Issued from Spotters Reports
Column 3= Number of Warnings Issued from Other Means (Radar,etc.)
Column 4= Number of Warnings Issued before Severe Weather Happened
Column 5= Number of Warnings Issued as Severe Weather Was Happening
Column 6= Number of Warnings Where Watches were Issued Prior to Warning
Column 7= Number of Warnings that Verified

4.   Conclusion

Currently, radar coverage is poor in northeast Wyoming due to the topography of the area. Sparse population is also another problem. The data show that an increase in spotter training and networks has played a significantly effective role in the issuance and verification of severe weather warnings. No other tool, technological or electronic, that WSO Casper has at its disposal is as effective as a spotter in an active network.

5.   Acknowledgements

Craig Sanders, WSFO Cheyenne, Wyoming assisted me with the maps.

6.   References

Population Density: 1992 Rand McNally Atlas, 68th Edition