



Service Assessment

Southern California Wildfires October 20 to November 3, 2003



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Silver Spring, Maryland



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July 2004

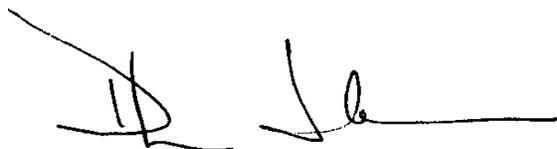
National Weather Service

Brigadier General (Retired) David L. Johnson, Assistant Administrator

Preface

Hot, dry offshore winds, known as Santa Ana Winds in southern California, coupled with long-term abnormally dry conditions across the area, set the stage for one of the more costly natural disasters in California history. During late October into early November 2003, fourteen wind driven wildfires swept across Southern California. These wildfires killed 22 people, destroyed 3,600 homes, charred nearly 740,000 acres of land, and caused more than \$2 billion in property damage. Casualties and property loss were highest in the San Diego metropolitan area. These losses were a result of the Cedar Fire moving into urban areas on Sunday, October 26, 2003.

Due to the magnitude of this event, we formed a service assessment team to examine the forecast and warning services provided to land managers, fire control personnel, emergency planners, media and the public. Service assessments provide a valuable contribution to ongoing efforts by the National Weather Service (NWS) to improve the quality, timeliness, and value of our products and services. Findings and recommendations from this assessment will improve techniques, products, services, and information provided to our partners and the American Public.

A handwritten signature in black ink, appearing to read 'DL Johnson', written over a horizontal line.

David L. Johnson
Assistant Administrator
for Weather Services

July 2004

Table of Contents

	<u>Page</u>
Preface.....	ii
Service Assessment Team.....	iv
Acronyms.....	v
Service Assessment Report.....	1
Executive Summary	1
Event Overview	3
Warning and Forecast Services	
A. Storm Prediction Center.....	6
B. Weather Forecast Office (WFO) San Diego, California.....	7
C. Weather Forecast Office (WFO) Los Angeles, California.....	13
D. Incident Meteorologists (IMETS).....	16
E. NWS Equipment Outage and Recovery	19
F. Media/Dissemination.....	22
Best Practices.....	26
Appendix A Map of Southern California County Warning and Forecast Areas.....	A-1
Appendix B Location Map of Wildfires.....	B-1
Appendix C Event Statistics	C-1
Appendix D WFO San Diego Chronological Product Highlights	D-1
Appendix E WFO Los Angeles Chronological Product Highlights	E-1
Appendix F Fire Regime Condition Class Map	F-1
Appendix G Southern California Media Demographics	G-1

Service Assessment Team

This Service Assessment Team was activated on November 6, 2003. The team assembled at the Weather Forecast Office (WFO) in San Diego, California on Tuesday, November 11, to begin their work. Team members visited WFOs San Diego and Los Angeles, California, various land management agencies, and media outlets. Numerous telephone interviews were conducted with emergency management officials, local, state, and federal government officials, broadcast media, and the public.

The team consisted of the following persons:

Greg Harmon	<i>Team Leader</i> , Meteorologist in Charge (MIC), WFO Sioux Falls, SD
John Dragomir	MIC, WFO Fairbanks, AK
Mike Vescio	MIC, WFO Pendleton, OR
Pat Vesper	Warning Coordination Meteorologist, WFO Midland, TX
Rusty Billingsley	NWS National Fire Weather Program Leader, Boise, ID
Heath Hockenberry	Assistant National Program Manager for Predictive Services, Bureau of Land Management (BLM), Boise, ID
Marilu Trainor	National Oceanic and Atmospheric Administration (NOAA), Public Affairs Specialist, NWS Western Region Headquarters, Salt Lake City, Utah

Other valuable contributors

Wayne Presnell	Office of Climate, Water and Weather Services (OCWWS), NWS, Silver Spring, MD
William Lerner	OCWWS, NWS, Silver Spring, MD

Acronyms

AFD	Area Forecast Discussion
AMRS	All Hazards Meteorological Response System
AWIPS	Advanced Weather Interactive Processing System
AWS	Automated Weather Source (Convergence Technologies)
BI	Burning Indices
CDF	California Department of Forestry
CDT	Central Daylight Time
CEM	Civil Emergency Message
CNRFC	California-Nevada River Forecast Center
COMET	Cooperative Program for Operational Meteorology, Education, and Training
CWA	County Warning Area
EM	Emergency Manager
ESA	Electronics Systems Analyst
F	Degrees Fahrenheit
FBAN	Fire Behavior Analyst
FFG	Flash Flood Guidance
FMO	Fuels Management Officer
FWF	Fire Weather Forecast
GACC	Geographic Area Coordination Center
HMT	Hydro-meteorological Technician
HWO	Hazardous Weather Outlook
IMET	Incident Meteorologist
MIC	Meteorologist in Charge
NCEP	National Centers for Environmental Prediction
NIFC	National Interagency Fire Center
NFDRS	National Fire Danger Rating System
NOAA	National Oceanic and Atmospheric Administration
NPW	Non-Precipitation Weather Watch/Advisory
NWR	NOAA Weather Radio
NWS	National Weather Service
NWSH	National Weather Service Headquarters
OCWWS	Office of Climate, Water, and Weather Services
PDT	Pacific Daylight Time
PST	Pacific Standard Time
RAWS	Remote Automated Weather Station
RFC	River Forecast Center
ROC	Radar Operations Center
ROMAN	Real-time Observations Monitoring and Analysis Network
SDM	Station Duty Manual
SPC	Storm Prediction Center
SPS	Special Weather Statement

UGC	Universal Generic Code
URL	Uniform Resource Locator
USDA	U.S. Department of Agriculture
WES	Weather Event Simulator
WFO	Weather Forecast Office
WSR-88D	Weather Surveillance Radar - 1988 Doppler
ZFP	Zone Forecast Product

Cover: Cedar Fire approaching the Scripps Ranch area October 26, 2003. Courtesy of John Gibbins of the San Diego *Union Tribune*.

Service Assessment Report

Executive Summary

Land management agencies and fire control personnel battled fourteen wind-driven wildfires across southern California in late October and early November 2003. These fires killed 22 people, destroyed 3,600 homes, blackened nearly 740,000 acres, and will end up as one of the more costly natural disasters in California history, according to then Governor Gray Davis.

We assessed the two southern California Weather Forecast Offices (WFOs) and services provided by the NWS Incident Meteorologists (IMETs) deployed to several of the wildfires. We also reviewed the performance of NOAA's National Centers for Environmental Prediction's (NCEP) Storm Prediction Center (SPC), which issues national Fire Weather Outlook products. The service assessment focused on the period October 20 through November 3, 2003. The assessment team found consistent, high quality products, services, and information were provided by the NWS during this time period.

Wildfires can leave large areas devoid of vegetation and vulnerable to producing large volumes of runoff leading to flash floods, floods, or mudslides. To accommodate the change in conditions after a wildfire, River Forecast Centers (RFC) often reassess their modeling procedures and work with the WFOs they service to understand the changes and better monitor the recovering areas. The team did not assess the California-Nevada RFC but felt some of their actions during the aftermath of these wildfires were noteworthy. A list of these actions can be seen in the Best Practices section on page 27.

The NWS dispatched seven IMETs directly to the southern California fires. IMETs are meteorologists who are specially trained to provide onsite weather support to fire fighting teams. The majority of IMETs serving the southern California wildfire made use of the ROMAN (Real-time Observations Monitoring and Analysis Network) system developed by the University of Utah and Bureau of Land Management to monitor surface weather observations. This system, with roots in the NWS funded project called MesoWest, helped IMETs to identify surface stations closest to the fires, and set alerts for critical weather parameter thresholds (**Best Practices 1**). The staffs at WFO San Diego and WFO Los Angeles provided critical services to the IMETs, as well as the various firefighting agencies, and emergency response personnel. Leading up to the wildfire emergency and throughout the event, the SPC issued one-day and two-day outlooks focused on critical fire danger. The two southern California WFOs issued Fire Weather Watches, Red Flag Warnings, and related high wind warnings and advisories well in advance of the wildfire conflagration. The combination of these NWS products resulted in excellent advance notification of a critical fire weather situation before the onset of the wildfire emergency. The assessment team interviewed a variety of NWS customers in southern California. Feedback was overwhelmingly positive toward the quality and reliability of products and services provided by the NWS prior to and during the wildfire crisis.

It must be noted WFOs San Diego and Los Angeles recently assumed full NWS fire weather forecast and warning responsibility for their respective County Warning Areas (CWA) (**Appendix A**). After a three year period of WFO staff training and customer awareness, this program transfer was completed on January 2, 2003. Prior to this time, fire weather services were provided by forecasters located at the interagency Southern California Geographic Area Coordination Center (GACC), located in Riverside, California. Despite some initial concerns, land managers are pleased with the fire weather products and services from the southern California WFOs, and were especially complimentary of these WFO services during this wildfire siege. WFOs San Diego and Los Angeles have created comprehensive Products and Services Guides. These guides are distributed to a variety of customers, including media, land managers, emergency planners, and general public (**Best Practices 2**). The U.S. Forest Service battalion chief at the Monte Vista Interagency Communications Center stated, "*WFO San Diego has bent over backwards to support our needs.*" Similar comments were made about WFO Los Angeles.

A four-year period of abnormally dry weather across southern California, combined with a week-long stretch of 100 F + maximum temperatures, very low relative humidity, and record low fuel moisture in the vegetation throughout the area, set the stage for a potential wildfire outbreak. As high pressure strengthened over the Great Basin on October 24, winds blowing from inland desert areas became established. These offshore winds, known as Santa Ana winds in southern California, reached peak intensity on Sunday, October 26. It was on this day the Cedar Fire raced into heavily populated areas on the north side of San Diego, destroying homes and closing freeways. The Cedar Fire became the largest and most deadly of the southern California fires, consuming more than 270,000 acres and causing 14 deaths.

This late October Santa Ana wind episode, considered moderate by historical standards, was forecast well in advance. A consistent message was provided by NWS forecasters and meteorologists located at the interagency Southern California GACC. Five days prior to the onset of down-slope winds on Sunday, October 19, fire control agencies, emergency planners, and the public were made aware of potential Santa Ana wind conditions and high fire danger for the following weekend.

The wildfires burned several NWS facilities in the San Diego area, including communication links to the WFO San Diego WSR-88D and a NOAA Weather Radio (NWR) transmitter. Portions of the upper air facility, located within urban San Diego, were either severely damaged or destroyed by the Cedar Fire. NWS electronics and equipment experts from WFO San Diego and a variety of other NWS offices teamed to return these critical systems back to service within a week of the fire storm, a remarkable accomplishment.

A Pacific storm brought valley rain and mountain snow to southern California on October 31, 2003. Additional precipitation and cooler temperatures in early November allowed firefighters to gain the upper hand on the fire situation, with mop up and resource demobilization continuing into mid-November.

Event Overview

Antecedent conditions across southern California leading up to the firestorms were favorable for the development and rapid spread of wildfires. Fuel moisture in wildland vegetation throughout the area was extremely low due to a prolonged period of dry conditions. San Diego was in the midst of a record dry period with the last measurable rain occurring at Lindbergh Airfield on April 22, 2003. Similar conditions were experienced in the Los Angeles area. The downtown Los Angeles reporting station had not received measurable rain since June 10, 2003. Record heat also began impacting the area in the days leading up to the wildfire outbreak, with a week of 100 F + maximum temperatures in mid-October. Downtown Los Angeles recorded a high temperature of 97 F as late as October 21.

The first major fire in southern California, the Grand Prix-Padua Fire, began on Tuesday, October 21, in San Bernardino County (for fire locations see **Appendix B**). This fire burned nearly 60,000 acres in San Bernardino County and more than 10,000 acres in Los Angeles County, destroying 135 homes. Other fire starts occurred between October 21 and October 24 with light winds and low, daytime relative humidity.

High pressure began to build southward from the Pacific Northwest to the Great Basin region on Friday, October 24. In response to the building high, an easterly, offshore pressure gradient became established over southern California. This contributed to the onset of a moderate Santa Ana wind episode, initially at the mountain canyon and pass level on October 24 and early October 25, before spreading to the lower elevations on October 25 through the afternoon of October 27. The Santa Ana wind condition reached peak intensity during the midday hours on Sunday, October 26.

The largest and deadliest fire, the Cedar Fire, started Saturday afternoon, October 25, at approximately 5:37 p.m. PDT, east of Ramona, 35 miles northeast of downtown San Diego. This fire was accidentally set by a flare from a lost hiker. Increasing Santa Ana winds, with gusts locally exceeding 60 mph, and minimum relative humidity of less than 10 percent, combined with the very dry fuels to create extreme fire behavior and rapid fire spread. Between midnight and 10 a.m. on Sunday, October 26, the Cedar Fire expanded 30 miles to the west and south, spreading into heavily populated areas on the north side of San Diego. There were thirteen fatalities during this phase of the fire, with more than 2,000 residential structures destroyed. The Cedar Fire claimed its last victim, a firefighter, on Thursday, October 30. Particularly hard hit was the Scripps Ranch community where more than 150 homes were completely destroyed.

Other major fires ignited and raged uncontrolled on October 25 and October 26. The Simi Fire grew to more than 100,000 acres before containment. The Old Fire burned more than 90,000 acres, destroyed 990 homes and killed six people. The Paradise Fire burned 57,000 acres, and destroyed more than 200 residences, killing two people (**Appendices B and C**).

By late Monday, October 27, the large scale weather pattern began to change. The easterly pressure gradient relaxed and the Santa Ana winds diminished. On Tuesday, October 28, an onshore flow became established across southern California. Despite the associated cooling trend and recovering relative humidity, strong westerly winds caused the fires to spread eastward up the mountain slopes.

A Pacific storm brought valley rain and mountain snow to southern California on Friday, October 31. Additional precipitation and more seasonable early November temperatures allowed firefighters to gain the upper hand on the wildfire situation. In total, this event was the second deadliest fire disaster in California history with 22 killed and 225 injured (East Bay Hills Fire, October 1991; 25 dead, 150 injured). Nearly 740,000 acres of forest and urban area burned, most of which occurred in just a few days. The cost to fight these fires is estimated at \$121 million dollars, with structural losses well in excess of \$2 billion dollars. More than 3,600 residences, 36 commercial buildings, and 1,169 outbuildings were destroyed, exceeding the damage caused by the East Bay Hills Fire of October, 1991.

WFOs San Diego and Los Angeles began highlighting the potential for a Santa Ana wind event several days prior to the onset of strong winds. Fire Weather Watches, Red Flag Warnings, High Wind Warnings, and Wind Advisories were issued with long lead times. Both offices issued Special Weather Statements (SPS) on Friday, October 24, emphasizing the strong wind potential. The long lead time allowed land management and emergency management officials to allocate resources and plan for the extreme fire weather conditions.

Fact: Antecedent conditions across southern California leading up to the firestorms were favorable for the development and rapid spread of wildfires. Fuel moisture in wildland vegetation throughout the area was extremely low due to a prolonged period of dry conditions.

Fact: The largest and deadliest fire, the Cedar Fire, started Saturday afternoon, October 25, at 5:37 p.m. PDT, east of Ramona, 35 miles northeast of downtown San Diego. This fire was accidentally set by a flare from a lost hiker.

Fact: The Santa Ana wind conditions reached peak intensity during the midday hours on Sunday, October 26.

Fact: This event was the second deadliest fire disaster in California history with 22 killed and 225 injured (East Bay Hills Fire, October 1991; 25 dead.)

Fact: WFOs San Diego and Los Angeles began highlighting the potential for a Santa Ana wind event several days prior to the onset of strong winds.

Warning and Forecast Services

A. Storm Prediction Center

Overview

SPC issues Day 1 and Day 2 Fire Weather Outlooks for areas where high to extreme fire danger exists and meteorological conditions favor either the development or spread of wildfires. Critical Fire Weather Areas are issued when relative humidity values are expected to be less than 15 percent and sustained winds are forecast to exceed 20 mph. Extremely Critical Fire Weather Areas are delineated with the same humidity criteria but for sustained wind speeds of 30 mph or greater. SPC also issues Critical Area forecasts for dry lightning, when numerous cloud to ground lightning strikes are anticipated, but little or no measurable rainfall is expected.

The SPC's Fire Weather Outlooks for the late October Santa Ana wind event were accurate and consistent with the Fire Weather Forecasts (FWF) issued from WFOs Los Angeles and San Diego.

SPC began to focus on southern California in the Day 2 Outlook issued at 3:16 a.m. CDT Thursday, October 23. Although an outlook area was not issued, the discussion highlighted the anticipated development of nightly down-slope winds with poor overnight relative humidity recovery for late Friday into Saturday morning. The Day 1 Outlook issued on Friday, October 24 at 4:09 a.m. CDT incorporated portions of southern California, including the Los Angeles area and locations just north of San Diego, in a "Critical Area" forecast. The text of the discussion included the wording,

"Moderate Santa Ana winds will continue/increase late today as high pressure builds into the Great Basin. Down-slope northeast winds 15-25 mph with 30 mph gusts possible will be strongest in favored areas adjacent to canyons and passes."

The Day 2 outlook issued at 5:27 a.m. CDT Friday, October 24, valid for Saturday maintained a Critical Fire Weather Area for southern California and extended the threat into the San Diego vicinity.

During the weekend of October 25 and 26, the SPC continued to focus on the critical fire weather conditions setting up over southern California. "Critical Areas" were indicated each day in the Fire Weather Outlooks, with the Day 1 Outlook text on Saturday, October 25, stating,

"Culmination of down-slope winds will likely arrive later Tonight/early Sunday given marked increase of mid level wind speeds amidst nearly unidirectional flow."

On Sunday, October 26, the day the Cedar firestorm raced into the urban San Diego area, "Critical Areas" were again indicated across the entire threat region (**Figure 2**). The Day 1 Outlook included the discussion,

“Northeast winds of 25-35 mph are expected to peak this morning with localized gusts in excess of 50 mph possible...record or near record warmth, steep atmospheric lapse rates, and extremely dry air-mass/fuels will foster critical fire conditions and erratic fire behaviors.”

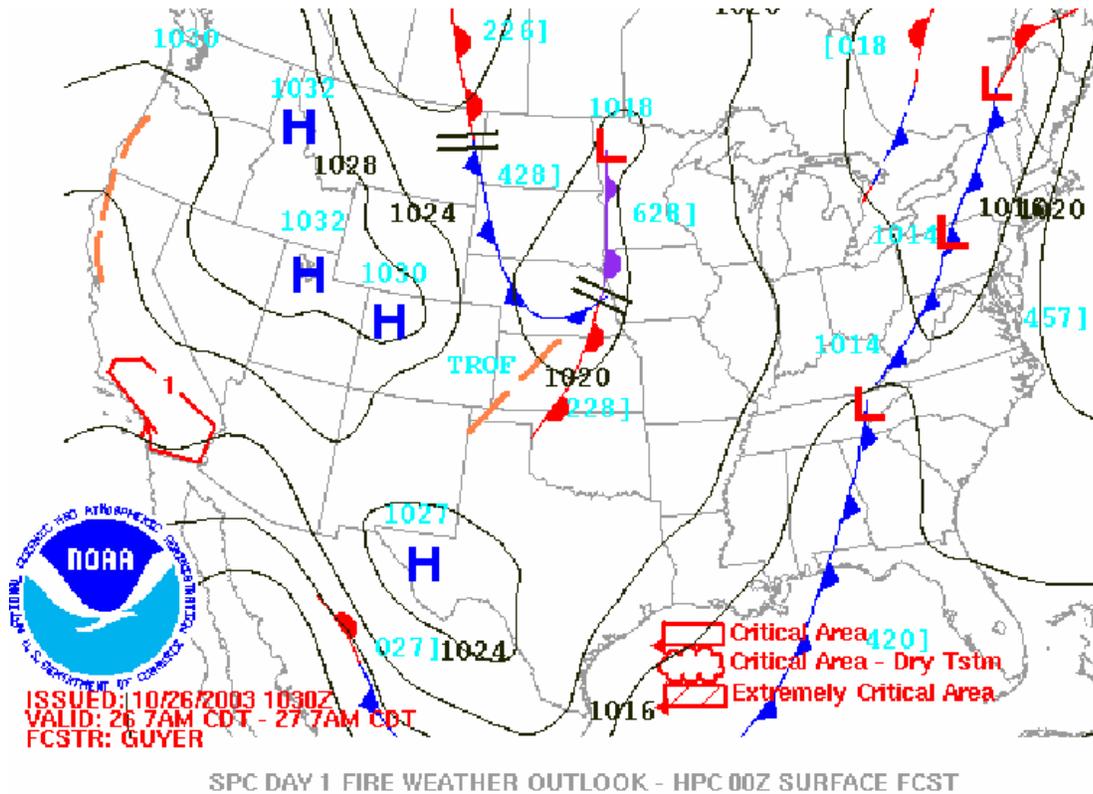


Figure 2. SPC Day 1 Fire Weather Outlook issued at 2:30 a.m. PST Sunday October 26, 2003, valid for the period 4 a.m. PST October 26 through 4 a.m. PST October 27. Note the "Critical Area" depicted for much of southern California. (SPC, NOAA).

Fact: The SPC’s Fire Weather Outlooks for the late October Santa Ana wind event were accurate and consistent with the Fire Weather Forecasts (FWF) issued from WFOs Los Angeles and San Diego.

B. WFO San Diego, California

Overview

WFO San Diego provided excellent lead time to the Santa Ana wind event in both their FWF and public forecast products. They first mentioned the potential for a Santa Ana wind

event in their Area Forecast Discussion (AFD) issued at 2:00 p.m. PDT Sunday October 19, five days prior to the onset of the down-slope winds. The text of the discussion stated, “*Strong offshore flow developing Friday through the weekend.*” The FWF, issued later at 2:30 p.m. PDT included the wording, “*moderate offshore flow with very low humidities will be possible next weekend.*” These early messages generated an immediate response as the media picked up on the Santa Ana wind potential, and land managers took note. The Incident Commander on the Grand Prix Fire stated that the long lead time on the Santa Ana wind forecasts “... *caused us (land and fire management agencies) to increase our staffing and be more vigilant.*” Subsequent AFDs and FWFs issued Monday, October 20, through Wednesday, October 23, mentioned the potential for a Santa Ana wind event for late in the week through the weekend.

At 9:00 a.m. PDT Thursday, October 23, a Fire Weather Watch was issued for much of the WFO San Diego CWA for Saturday through Sunday afternoon, “*for sustained relative humidities less than 10 percent...and for northeast winds 25 to 35 mph and gusty.*” The watch was upgraded to a Red Flag Warning at 9:00 a.m. PDT Friday, October 24, valid through Monday afternoon, October 27, covering the peak of the wildfire activity. The warning included all of the mountains, inland valleys, and Orange County and was issued for, “*sustained relative humidities less than 10 percent and for northeast winds of 25 to 35 mph with gusts to 45 mph.*” The Red Flag Warning was updated four times from the initial issuance Friday morning until Monday morning, October 27. Maximum wind gusts were increased to 50 to 60 mph in the Red Flag Statements issued on Saturday and Sunday. While the Red Flag Warning may have been issued somewhat early for some locations, overall, wind and humidity forecasts correlated very well with observed data, especially over the weekend when conditions were most critical. At 4:00 p.m. PST Monday, October 27, the Red Flag Warning expired. In southern California, a Red Flag event occurs when high to extreme fire danger exists due to dry fuels, and dry lightning or strong dry winds and low humidity are observed. Sustained winds greater than 25 mph for at least 8 hours and relative humidity less than 15 percent for much of that time are needed to verify a Red Flag Warning. The Red Flag Warnings were supported by appropriate wind advisories in the public forecast products.

On Wednesday, October 29, at 9:00 a.m. PST, a new Red Flag Warning was issued for strong onshore winds and low relative humidity downwind of the wildfires. This warning caused confusion because many people in southern California, including some fire fighters and the media, only associate Red Flag Warnings with strong northeast Santa Ana, or offshore winds for southern California (**Finding 1**). Also, San Diego County air pollution meteorologists felt the wind speeds in the Wednesday afternoon FWF were not representative of observed conditions that evening, yet the FWF product was not updated. Routine FWFs are issued twice daily during the fire season, and are not typically updated after the 3:30 p.m. local issuance time. FWFs are available to the public from many WFO web sites (**Finding 2**).

The first public forecast product to indicate a threat for a Santa Ana wind event was the Hazardous Weather Outlook (HWO) issued at 6:00 a.m. PDT Thursday, October 23. The extended forecast portion of the product valid Friday through the following Wednesday indicated, “*Possible fire weather danger due to strong winds and low humidity.*” The public

Zone Forecast Product (ZFP) issued at 1:31 a.m. PDT Friday, October 24, called for wind gusts of 40 to 60 mph in most areas away from the coast for Saturday through Sunday.

Wind Advisories were posted at 2:30 p.m. PDT on Friday, October 24, valid through 2:00 p.m. PDT Saturday for much of the San Diego CWA. At 9:30 p.m. PDT Friday, a High Wind Watch was issued for portions of the area while the Wind Advisory was extended until 2 p.m. PST Sunday. At 2:00 p.m. Saturday, the High Wind Watch was upgraded to a High Wind Warning through 9:00 p.m. Sunday evening, with the Wind Advisory extended at that time for locations outside the warning area.

An SPS was issued by WFO San Diego at 11:30 a.m. on Friday, October 24, to alert the public to the increasing potential for strong Santa Ana winds, especially for Saturday and Sunday. The statement headline read, “*fire danger and strong winds increasing through Sunday...near record heat to continue.*” The text of the product also included the statement, “*fire danger is high and will be increasing as warm temperatures and low humidities continue...and winds increase.*” Follow-up SPSs were not issued regarding the anticipated critical weather situation prior to or during the firestorms (**See Recommendation 3**).

At the height of the Cedar firestorm, WFO San Diego issued, on their initiative, a Civil Emergency Message (CEM) to raise public awareness to the severity of the unfolding disaster, declaring a “*fire emergency across northern San Diego County.*” The first paragraph of the message stated “*a serious and potentially life-threatening fire situation continues across northern and eastern portions of the San Diego metro area this afternoon.*” (**Finding 3**).

Ten Spot Forecasts were issued from WFO San Diego from Tuesday, October 21 through Thursday, October 30, in support of fire suppression efforts. On Monday, October 27, a request for a Spot Forecast via email was received by WFO San Diego at 2:31 a.m. PST for the Mountain Fire, but the request went unfilled until 6:55 a.m. PST. At least one follow-up call was made to WFO San Diego by land management officials inquiring about the completion of the Spot request. The Battalion Chief at the Riverside California Department of Forestry (CDF) indicated the Spot Forecast information was needed in a more timely manner (**Finding 4**).

WFO San Diego benefited greatly from additional wind information from Automated Weather Source (AWS) Convergence Technologies WeatherNet weather stations located across southern California. These additional observations, normally located at schools, allowed WFO San Diego forecasters to more effectively monitor Santa Ana wind conditions during the event (**Best Practices 3**).

WFO San Diego does not conduct routine formal staff weather discussions. However, as the fire danger threat increased, “significant event briefings,” involving the operational staff and office management, were held around 11 a.m. on Wednesday, October 22 and again on Friday, October 24. These special briefings helped elevate the situational awareness of the staff to the increasing wildfire potential for the coming weekend (**Best Practices 4**).

During the height of the wildfire crisis on Sunday, October 26, WFO San Diego was staffed with three forecasters, an HMT, and the MIC. The MIC was called at approximately 9:30 a.m., and arrived at the office around 10:30 a.m. With an increased emphasis on maintaining critical information flow during extreme wildfire episodes in urban areas (**recommendation 3**), this staffing level may prove insufficient for future events (**Finding 5**).

Overall, the land management and emergency service organizations are satisfied with the services provided by WFO San Diego, and all of the individuals interviewed indicated a good working relationship with the office. A Special Projects Officer for the San Diego Fire Department said of this event, “... *the information was so correct and accurate and in our business we cannot ask for more than that.*” The Battalion Chief of the Cleveland National Forest indicated that this event “... *took no one by surprise. It was well forecasted.*” The Deputy Fuel management Officer (FMO) from the Cleveland National Forest said, (there is) “... *good interagency coordination on weather information.*”

WFO San Diego Fire Weather Training

WFO San Diego began preparing to assume fire weather forecast responsibility in 1999. All forecasters completed the S290 “Intermediate Wildland Fire Behavior” course as a first step. Office staff also routinely compiled practice Fire Weather and Spot Forecasts from 1999 until forecast responsibility was transferred to the WFO from the Southern California GACC in January 2003. When a new forecaster arrives in San Diego, they are required to successfully complete S290 and on-the-job training. This training includes familiarization with the office’s Fire Weather Station Duty Manual (SDM), completing a fire weather case study on the Weather Event Simulator (WES), and working several fire weather training shifts under the direct supervision of a Senior Forecaster. The office routinely conducts off season fire weather seminars to help the staff prepare for the upcoming fire season.

WFO San Diego Warning Coordination and Outreach

WFO San Diego maintains an effective warning coordination and public awareness program. They have hosted a number of workshops for their partners in emergency management and the media.

During the workshops held in the fall of 2002 and 2003, emergency planners, fire personnel, law enforcement, and the media were provided a WFO “San Diego Products and Resources Guide.” This guide contains important information about wildfires and proclaims weather as, “*one of the most significant factors in determining the severity of wild land fires.*” The guide reinforces the value of NWS fire weather products and services stating, “*An accurate weather forecast can mean life or death to a fire fighter and is also critical in protecting forest and range lands as well as the increasing number of homes built in remote areas.*” A summary of the office Fire Weather Program and a list of Fire Weather Definitions are contained in the guide.

WFO San Diego maintains a network of approximately 650 volunteer weather spotters who provide critical real-time weather information to the office through an online spotter report log, with reports then automatically alarmed on the office Advanced Weather Interactive Processing System (AWIPS). WFO San Diego maintains a good relationship with the amateur radio community and uses amateur radio packet software to acquire weather observation data for the office.

During the last fiscal year, WFO San Diego conducted numerous weather safety presentations for schools, civic clubs, service organizations, and conducted numerous office tours, including some involving local public officials. Overall, WFO San Diego's coordination and public awareness outreach were effective prior to the October 2003 southern California wildfire crisis.

Fact: WFO San Diego provided excellent lead time to the Santa Ana wind event in both their FWF and ZFP.

Fact: An SPS was issued by WFO San Diego at 11:30 a.m. Friday October 24 to alert the public to the increasing potential for strong Santa Ana winds, especially for Saturday and Sunday.

Fact: At the height of the Cedar firestorm, WFO San Diego issued, on their initiative, a CEM to raise public awareness to the severity of the unfolding disaster.

Fact: The land management and emergency service organizations are satisfied with the services provided by WFO San Diego, and all of the individuals interviewed indicated a good working relationship with the office.

Finding 1: On Wednesday, October 29 at 9:00 a.m. PST, a new Red Flag Warning was issued for strong onshore winds and low relative humidity downwind of the wildfires. This warning caused confusion because many people in southern California, including some fire fighters and the media, only associate red flag events with strong northeast Santa Ana, or offshore winds for southern California.

Recommendation 1a: In partnership with Southern California land management agencies, and the Southern California GACC meteorologists, WFOs San Diego and Los Angeles should review Red Flag Warning criteria to ensure the proper customer response for southern California.

Recommendation 1b: WFOs San Diego and Los Angeles should then provide outreach and educational opportunities to the local media and public to ensure Red Flag Warning criteria are well understood.

Recommendation 1c: All WFOs should review their Red Flag Warning criteria with their land management agencies prior to the start of the next fire season to ensure the criteria meet customer needs.

Finding 2: Routine FWFs are issued twice daily during the fire season, and are not typically updated after the 3:30 p.m. local issuance time. FWFs are available to the public from many WFO web sites.

Recommendation 2: FWFs should be updated when observational and/or short term model guidance suggests the current forecast is or will be substantially in error. This is especially important in critical fire situations.

Finding 3: At the height of the Cedar firestorm, WFO San Diego issued, on their initiative, a CEM to raise public awareness to the severity of the unfolding disaster.

Recommendation 3: Emergency statements should be issued in coordination with fire management officials when rapidly spreading wildfires are encroaching upon a major metropolitan area. However, WFOs should use the SPS as the primary vehicle for conveying such information, unless directed by a government agency to issue a CEM. Updated SPSs should be issued as new and credible information becomes available from fire management personnel. The Short Term Forecast should be used to update weather conditions within the threatened area.

Finding 4: On Monday, October 27, a request via e-mail for a Spot Forecast was received by WFO San Diego at 2:31 a.m. PST for the Mountain Fire, but the request went unfilled until 6:55 a.m. PST. The Battalion Chief at the Riverside CDF indicated the Spot Forecast information was needed in a more timely manner.

Recommendation 4: WFOs with Fire Weather responsibility should coordinate with fire control agencies to ensure Spot Forecast turnaround times defined in Annual Operating Plans meet customer needs, especially during critical wildfire events and fire start initial attack.

Finding 5: During the height of the wildfire crisis on Sunday, October 26, WFO San Diego was staffed with three forecasters, an HMT, and the MIC. With an increased emphasis on maintaining critical information flow during extreme wildfire episodes in urban areas, this staffing level may prove insufficient for future events.

Recommendation 5: Regional Directors should augment WFO operational staffing during critical weather events, including major wildfires impacting urban areas, to ensure timely delivery of routine products, emergency services, and enhanced information flow into and out of the office. This staffing level should be in place before the onset of the critical event if at all possible.

C. WFO Los Angeles, California

Overview

WFO Los Angeles also recognized the Santa Ana wind potential and communicated this information well in advance of the wildfire outbreak. The WFO Los Angeles forecasters routinely run a set of locally developed applications that allow forecasters to conveniently view RAWS observations in a meteogram plot on AWIPS (**Best Practices 5**). The first mention of possible Santa Ana winds occurred on Tuesday, October 21. The afternoon FWF that day contained the headline, “*possible Santa Ana winds this weekend.*” This was three days prior to the onset of the event and was a key product in alerting the fire community of a potentially hazardous situation. Subsequent Fire Weather Forecasts headlined the possibility of Santa Ana winds so a consistent message was communicated.

Public forecast products also conveyed a consistent message. Forecasters introduced, “*locally breezy*” and, “*breezy below passes and canyons*” wording in the Friday through Sunday periods of their ZFP as early as Wednesday, October 22. The early morning HWO of October 22 also brought attention to, “*northeast winds 20 to 30 mph with locally stronger gusts possible through and below passes and canyons*” valid during the same period.

On Thursday, October 23, at 9:50 a.m. PDT, a Fire Weather Watch was issued after coordination with appropriate fire management agencies. The watch was valid for Friday through Sunday and focused on strong Santa Ana winds with gusts over 40 mph accompanied by single digit relative humidity. The watch area included mountains and valleys of Santa Barbara, Ventura, and Los Angeles Counties. Lead times on this watch ranged from 28 to 32 hours depending on the area. This provided excellent advance notice to local emergency management and fire control agencies.

The Fire Weather Watch was upgraded to a Red Flag Warning on Thursday, October 23 at 3:30 p.m. PDT, providing more than 20 hours lead time before the onset of Red Flag conditions. A total of six Red Flag Warnings, and 13 fire weather Spot Forecasts were issued by WFO Los Angeles for this event. While WFO Los Angeles provided a quality service during this event, a review of issued products revealed the Red Flag Warning was not headlined in several Spot Forecast products where a Red Flag Warning existed. Also, public and fire weather Universal Generic Code (UGC) zone numbers were used interchangeably in the Red Flag Warning products (**Finding 6**). During this event, single digit humidity and winds gusting over 35 mph were observed on Saturday morning, October 25. Winds continued to increase through Sunday morning, October 26, the height of the strong winds, with gusts from 35 to 68 mph observed.

All Red Flag Warnings were allowed to expire Monday afternoon, October 27, as Santa Ana wind conditions transitioned to an onshore flow, eventually bringing increased humidity and cooler temperatures to the region. Despite the cooling trend and recovering humidity, gusty onshore winds were forecast to peak on Wednesday, October 28, through Thursday, October 29

depending on the location. The strong onshore winds produced a continued threat of critical fire weather across the forecast area, and this was adequately reflected in issued products.

The 2003 fire weather season was the first full season the WFO Los Angeles provided fire weather services to customers in their CWA. Interviews with the Los Angeles County Fire Weather Coordinator, the Ventura County Program Administrator of Emergency Services, and the Ventura County Fire Department indicated WFO Los Angeles products and services are routinely used to make fire suppression resource decisions. The Los Angeles County Fire Weather Coordinator praised the office's forecasts, stating, "*I thought they were great synoptics, right on, and the BI's (burning indices) trended well.*" Customer interviews also revealed the AFD is a well liked and frequently used product. It frequently conveys additional meteorological information and forecaster reasoning not routinely found in other NWS products.

WFO Los Angeles recognized the potential for hazardous fire weather conditions early, coordinated this information with agencies in a timely manner, communicated a consistent forecast over time and between products, and managed the extra work load very well. The fire weather community indicated sufficient lead time was received to activate local emergency plans.

WFO Los Angeles Fire Weather Training

WFO Los Angeles implemented a detailed five-phase plan as the office began preparing to assume fire weather forecast responsibility in May 2000. As a part of this plan, practice FWF products were routinely made available for review by WFO Hanford, CA and the Southern California GACC. In January 2003, forecast responsibility was officially transferred to WFO Los Angeles from the Southern California GACC. All forecast staff completed fire weather training per NWS Instruction 10-401 prior to the 2003 fire weather season. This training consisted of the S290 course "Intermediate Wildland Fire Behavior" and the COMET (Cooperative Program for Operational Meteorology, Education, and Training) Computer Based Learning module "Fire Weather Wildland Fire Behavior." The office elevated its fire weather service potential through the implementation of an aggressive local training effort. Forecasters were required to complete the following: an exercise using the web-based NWS Spot Forecast Request procedure; two WES exercises pertaining to "Santa Ana" wind events and dry lightning; and training related to Remote Automated Weather Stations (RAWS) and the National Fire Danger Rating System, used by many land management agencies. This training also included familiarization with the office's SDM section on fire weather. New WFO Los Angeles forecasters complete a proficiency program for each of the forecast desks, including fire weather, prior to assuming operational forecaster responsibility.

WFO Los Angeles Warning Coordination and Outreach

WFO Los Angeles maintains an effective warning coordination and public outreach program. The office actively participates in workshops with their partners in emergency services and the media. Office tours are conducted upon request. WFO Los Angeles is around 50 miles from the primary Los Angeles-based media. While this distance does not deter the WFO staff

from visiting media partners in the Los Angeles market, it does result in about half of all scheduled television station visits to the WFO being cancelled (**Finding 7**).

During the week preceding the October wildfire outbreak, WFO Los Angeles was promoting an office Open House scheduled for October 24 and 25. While promoting the Open House with radio and newspaper affiliates, the staff took the opportunity to speak of the near term fire weather threat regarding the dry and windy conditions forecast to occur over the weekend. More than 1,000 people toured the office during the Open House and all were provided an opportunity to learn about the immediate fire weather danger.

In the three months prior to the October wildfire outbreak, WFO Los Angeles conducted numerous coordination meetings with key fire weather customers. Presentations concerning the fire weather program included; demonstrations of the WFO Los Angeles fire weather website, spot forecast page, and website access of weather observations, Red Flag Warning criteria, data sharing programs, National Fire Danger Rating System (NFDRS), and local climatological effects.

Over the last year, presentations highlighting the fire weather threat across southern California were also provided at the Southern California Edison Risk and Resource Symposium, the Los Angeles County Communities at Risk Workshop, the Emergency Network of Los Angeles, the Santa Barbara County Storm Summit, and the Santa Barbara County Emergency Services Coordinator's Meeting. The office also conducted a series of coordination meetings with 10 major TV stations and eight radio stations, focusing on local fire weather threats, and other weather issues important to the area.

Fire control representatives indicated this pre-season outreach helped foster a positive relationship with WFO Los Angeles. The Program Administrator of the Ventura County Office of Emergency Services stated, "*I have an excellent relationship with this (WFO Los Angeles) office.*" Overall, WFO Los Angeles achieved a significant level of customer coordination and public outreach prior to the October 2003 southern California wildfire crisis.

Fact: WFO Los Angeles recognized the Santa Ana wind potential and communicated this information well in advance of the wildfire outbreak.

Fact: On Thursday, October 23 at 9:50 a.m. PDT, a Fire Weather Watch was issued after coordination with appropriate fire management agencies.

Fact: The Fire Weather Watch was upgraded to a Red Flag Warning on Thursday, October 23, at 3:30 p.m. PDT, providing more than 20 hours lead time before the onset of Red Flag conditions.

Fact: The WFO Los Angeles recognized the potential for hazardous fire weather conditions early, coordinated this information with agencies in a timely manner, communicated a consistent forecast over time and between products, and managed the extra work load very well.

Finding 6: While WFO Los Angeles provided a quality service during this event, a review of issued products revealed the Red Flag Warning was not headlined in several Spot Forecast products where a Red Flag Warning existed. Also, public and fire weather UGC zone numbers were used interchangeably in the Red Flag Warning products.

Recommendation 6: WFOs should review NWS Instruction 10-401 to ensure spot and fire weather forecast formats are followed. Fire weather policy should provide clear guidance concerning proper use of UGC types in fire weather products.

Finding 7: WFO Los Angeles is around 50 miles from the primary Los Angeles-based media. While this distance does not deter the WFO staff from visiting media partners in the Los Angeles market, it does result in about half of all scheduled television station visits to the WFO being cancelled.

Recommendation 7: In all major metropolitan cities across the Nation where the WFO is located a significant distance from its major media partners, the NWS should explore the creation of media coordination studios located close to its media partners. Private partners could be a source of facilities for media coordination. This will allow WFOs to efficiently schedule and conduct multiple media interviews and meetings with media partners, increasing the visibility of the NWS and enhancing outreach opportunities.

D. Incident Meteorologists

Overview

NWS Incident Meteorologists (IMETs) are dispatched to wildfires upon request of federal and state land management agencies. The IMETs provide on-site weather services to the incident in support of firefighter safety and to supply meteorological input into fire behavior models for tactical and planning purposes.

The 2003 fire season marked the first year the NWS acquired full responsibility for all IMET services in California. In previous seasons, land management agency IMETs provided much of the service to California per a separate agreement between the NWS and the California agencies. During the southern California wildfires, the NWS dispatched seven IMETs to support six major wildfires from October 22 to November 11. Incidents supported include the Old, Grand Prix, Padua, Piru, Paradise, and Cedar Fires.

IMET Ordering and Dispatch

Lengthy delays in the ordering process occurred with two of the seven IMET dispatches. A delay of approximately two days occurred on the Cedar Fire and a one and a half day delay occurred on the Old Fire due to unfamiliarity with request procedures. These delays took place before the NWS received the IMET orders (**Finding 8**).

Once the NWS received an IMET order, the Staff Meteorologist to the National Interagency Fire Center (NIFC) and the WFOs did an excellent job of dispatching qualified forecasters to the southern California wildfires. The average time from receipt of IMET orders by the NWS to IMET arrival on-site was approximately 13 hours. This was well within the interagency goal of 24 hour forecaster arrival once the NWS receives an IMET request. The land management agencies have also expressed a desire for the closest available IMET resource. Three of the dispatched IMETs in this event were from California WFOs, and four were from WFOs in neighboring states. The average distance from the IMET's home office to the supported incident is approximately 300 miles, equivalent to the typical distance between forecast offices in the Western Region. Based on this evidence, the NWS did a good job of providing the closest IMET resource.

IMET Services

IMETs provided superior service during the southern California wildfire crisis. Favorable comments on the IMETs performance were received from every Incident Commander and Fire Behavior Analyst (FBAN) interviewed or surveyed. The Incident Commander on the Grand Prix fire said of the IMETs' performance, "*Timing was impeccable within an hour or so. The IMETs experience and expertise are going up. I'm pleased with how the program has come along.*"

Fire Behavior Analysts, with whom the IMETs work closely on-site, were polled to rate IMET services on the six major wildfires. Five FBANs returned the survey; and one sent email comments. Surveyed FBANs rated IMET services as very good to excellent, with an average rating of 4.6 on a scale of 1 to 5, with 5 being excellent.

Equipment and Data Acquisition

The year 2003 marked the first season for operational deployment of the NWS All Hazards Meteorological Response System (AMRS), a communications and meteorological display system for use on wildfires and other hazard incidents. All IMETs were trained on the set-up and use of the AMRS at the annual IMET Workshop at NIFC in the spring of 2003. The AMRS consists of two-way satellite internet connectivity, a laptop computer, and the FX-Net meteorological display software. FX-Net is a web-based tool with similar, but more limited capabilities of the forecast office AWIPS. FX-Net servers located at the NWS Western and Southern Region Headquarters supply the meteorological data.

Despite the challenges associated with remote operations, the new AMRS performed very well and was a significant improvement for on-site meteorological support. "*The two-way satellite AMRS and FX-Net are great additions! It makes our job 10 times easier and better!*" said Mark Stubblefield, IMET on the Paradise fire. All seven IMETs indicated little or no problems, and all were very happy with the improved system. Minor problems with short losses of Internet connectivity were not significant enough to affect on-site support.

Another aid in data acquisition was the Real-time Observation Monitoring and Analysis Network (ROMAN) system developed by the University of Utah. This web-based application delivers surface weather observations from numerous platforms across the Western United States using the MesoWest network. Four of the seven IMETs on the southern California wildfires found the ROMAN system quite helpful, and used the application to set alerts and/or monitor RAWS and other surface stations near the wildfires. According to IMET Frederic Bunnag on the Old Fire, *“I used ROMAN extensively. Excellent tool, especially the Weather Near Fire feature.”*

Conference Calls

During the wildfires, coordination conference calls were initiated each day at 8:30 a.m. by the Southern California GACC meteorologists, and included WFOs Los Angeles and San Diego, and the IMETs. IMETs dispatched to the fires from outside of the local forecast area were more likely to favor the utility of the coordination calls. These IMETs were less familiar with the local topography and weather regimes, and found the information from the GACC meteorologists and the local WFOs to be beneficial. Comments from local IMETs already familiar with the area were less supportive of the calls, but they still felt the calls had value.

The timing of the coordination calls were a concern to some IMETs. For the most part, the IMETs preferred the call a little later in the morning for various reasons. One reason is 8:30 a.m. is too close to their morning briefings. There is not enough time to look at extended guidance, or conflicts with planning meetings.

Fact: During the southern California wildfires, the NWS dispatched seven IMETs to support six major wildfires from October 22 to November 11.

Fact: IMETs provided superior service during the southern California wildfire crisis. Favorable comments on the IMETs performance were received from every Incident Commander and Fire Behavior Analyst interviewed or surveyed.

Finding 8: Lengthy delays in the ordering process occurred with two of the seven IMET dispatches. These delays took place before the NWS received the IMET orders.

Recommendation 8: The NWS needs to work with the land management agencies to ensure IMET ordering and dispatch instructions are consistent from the local to the national level. These consistent instructions need to be clearly documented in all land management mobilization guides, and included in NWS fire weather policy directives.

Fact: Once the NWS received an IMET order, the Staff Meteorologist to the NIFC and the WFOs did an excellent job of dispatching qualified forecasters to the southern California wildfires. The average time from receipt of IMET orders by the NWS to IMET arrival on-site was approximately 13 hours. This was well within the interagency goal of 24 hour forecaster arrival once the NWS receives an IMET request.

Fact: Surveyed FBANs rated IMET services as very good to excellent, with an average rating of 4.6 on scale of 1 to 5, with 5 being excellent.

Fact: Despite the challenges associated with remote operations, the new AMRS performed very well and was a significant improvement for on-site meteorological support. All seven IMETs indicated little or no problems, and all were very happy with the improved system.

Fact: During the wildfires, coordination conference calls were initiated each day at 8:30 a.m. by the Southern California GACC meteorologists, and included WFOs Los Angeles and San Diego, and the IMETs.

E. NWS Equipment Outage and Recovery

Overview

The wildfires burned several NWS facilities in the San Diego area, including communication links to WFO San Diego's WSR-88D and a NWR transmitter. Portions of the upper air facility, located within urban San Diego, were destroyed by the Cedar Fire.

The San Diego WSR-88D outage began around 9:00 a.m. PST on Sunday, October 26. Telecommunication and power lines to the radar site were destroyed as the Cedar Fire burned over the facility. While the immediate radar grounds were well maintained, dry fuels were in close proximity of the radar (**Finding 9**). An on-site inspection the next day determined the radar equipment had escaped significant damage. The WFO San Diego Electronics Systems Analyst (ESA) initiated action with the NWS Radar Operations Center (ROC) in Norman, Oklahoma. The plan called for a wireless solution to restore communications between the remote radar site and WFO San Diego. The ROC engineers completed installation of wireless equipment on Friday, October 31, but data delivery proved to be sporadic. After nearly two days of tireless troubleshooting, a reliable wireless connection was established on Sunday, November 2, and radar data began flowing again. The radar was being powered by the backup generator at that time. Commercial power was restored to the remote site on Friday, November 7. It was not until Monday, November 10, that new telecommunications lines were completed and the WSR-88D was returned to normal operation. The creative actions of the WFO ESA as well as NWS Western Region Headquarters and ROC personnel clearly enabled a return to service much sooner than would have otherwise occurred.

The Cedar Fire also heavily damaged the NWS upper air facility, located within urban San Diego. The office and storage trailers were completely destroyed, and the weather balloon inflation building severely damaged. Up to 20 tanks of compressed hydrogen, stored at the site, remained intact, but posed an explosion threat as the wildfire approached the facility. Aware of this hazard, the WFO San Diego ESA called the Incident Command Post of the Cedar Fire on Sunday, October 26, to alert fire fighting personnel to this potentially explosive situation. After the fire passed, clean up personnel were not allowed to enter the inflation building until the hydrogen tanks were inspected and removed by the vendor, again demonstrating excellent

“safety first” procedures by the WFO ESA. Environmental clean up at the upper air facility was achieved on Tuesday, October 28, in less than eight hours. In the meantime, a plan of action for the restoration of upper air services was jointly developed by personnel from WFO San Diego, the NWS Western Region Headquarters, and NWS National Headquarters. Generator power and temporary trailers were made available on Thursday, October 30 and a portable upper air system, the W9000 system, was installed and tested on Friday, October 31. The first balloon release occurred late that afternoon. All upper air contract personnel were trained on the new equipment and data transfer procedures, allowing for the first official release, using the W9000 system, on Saturday afternoon, November 1. A total of 13 upper air flights were missed.

Finally, the San Bernardino NWR was logged out on October 29. The reason for the system outage was determined to be a failed battery on the emergency power generator at the transmitter site (**Finding 10**). Battery replacement and generator check was achieved and the weather radio restored to full service on Monday, November 3. Electronics and equipment experts from WFO San Diego and a variety of other offices teamed to return these critical systems back to service within a week of the fire storm, judged to be a truly remarkable accomplishment by the assessment team.

Fact: The wildfires burned several NWS facilities in the San Diego area, including communication links to the WFO San Diego WSR-88D Doppler radar and a NWR transmitter. Portions of the upper air facility, located within urban San Diego, were destroyed by the Cedar Fire.

Fact: Telecommunication and power lines to the radar site were destroyed as the Cedar Fire burned over the facility.

Finding 9: While the immediate radar grounds were well maintained, dry fuels were in close proximity to the radar.

Recommendation 9: NWSH, the Regions and the ROC should work with land management agencies to identify high wildfire risk areas in proximity to WSR-88D sites. A starting point to identify the main risk areas may be the U.S. Department of Agriculture (USDA) Fire Lab’s Fire Regime Condition Classes (See Appendix F). In the identified high risk areas, the appropriate site maintenance organization (DOD, FAA, NWS) should remove dry fuels more frequently from the land it owns than for sites in non high risk areas.

Finding 10: The San Bernardino NWR was logged out on October 29. The reason for the system outage was determined to be a failed battery on the emergency power generator at the transmitter site.

Recommendation 10: Regions should reiterate and emphasize preventive maintenance requirements for NWR emergency power systems.



Picture 2. Destroyed office and storage trailers at Upper Air Facility. Courtesy of WFO San Diego.



Picture 3. Severely damaged inflation shelter at Upper Air Facility. Courtesy of WFO San Diego.



Picture 4. WFO San Diego's WSR-88D facility after the firestorm. Courtesy of WFO San Diego.

F. Media/Dissemination

Overview

During the wildfires, the public's primary source for attaining weather information was through the multiple English-speaking and foreign language media outlets operating throughout southern California. **Appendix G** provides a breakdown of the demographics and media coverage for the WFO San Diego and WFO Los Angeles CWAs.

National, regional and local media representatives from southern California confirmed their staffs were keenly aware of the extreme fire danger prior to the late October wildfire outbreak. News stories frequently touched on the threat. Stories ranged from drought information, to the decaying forest conditions caused by a beetle infestation, to the potential effects of hot fall temperatures and Santa Ana wind conditions across the area. The media conveyed safety information, urging residents to use caution while enjoying the outdoors, and suggested residents clear potential fire fuels from their property. Broadcast meteorologists regularly briefed station management and staff on the potential wildfire conditions, and were featured guests on local radio shows, where they were frequently asked about the wildfire threat.

The media served by WFOs San Diego and Los Angeles stated they have good to excellent working relations with the NWS staffs. Their contact with the NWS ranged from daily calls to occasionally requesting information during severe weather. The majority of radio and television stations and numerous newspapers throughout the area used the WFO San Diego and Los Angeles websites as a primary way to access NWS weather information. Broadcast media said they incorporated critical weather information from these sites into their daily programming, and specifically mentioned the value of being able to access hourly graphical and tabular wind observation data, Fire Weather Watch, Red Flag Warning, ZFP and satellite imagery.

NWS website data greatly aided the media in their ability to relay critical real-time weather information and forecasts to the public during the wildfire outbreak. However, some media customers suggested the NWS should simplify the WFO web addresses as the current address string is too long, and difficult to remember (**Finding 11**). Media throughout the area commented on the graphical observation maps on the WFO San Diego homepage to be the easiest, most efficient way to monitor current wind information during the fires (**Best Practice 6**). Similar maps were not readily available from the WFO Los Angeles web site. However, in reference to the WFO Los Angeles website, a key KCBS Los Angeles correspondent said, "*all the weather information I needed was there.*" Similar support was voiced from the San Diego Union Tribune who stated, "*The wind was the weather story. We accessed the NWS (San Diego) website daily.*" The Chief Meteorologist on KUSI Channel 9 in San Diego added, "*The NWS has made huge advancements in recent years. They are leading the charge and setting the pace.*" Further he said, "*Automated observations on the San Diego graphical map were highly reliable. I used the data to compare wind trends.*" While NWS websites were heavily used, NWR was not widely used by local or national media as a weather source during the fires.

When the Cedar Fire began on October 25, San Diego TV and radio stations carried crawler messages and break-ins. By the next morning, all San Diego news stations curtailed most of their regular programming and featured reporters interviewing firefighters and victims in an effort to keep viewers and listeners abreast of the unfolding events. News coverage ranged from stations adding a few extra hours of programming to nearly wall-to-wall coverage for several days. Local newspapers devoted as much as 80 percent of their available space to stories about the wildfires, while several networks and other media organizations, including many international news organizations, increased their staff devoted to telling this story.

The California wildfires received constant media attention for more than two weeks. As events worsened, stories that began as local or regional news became national and international news, as networks brought in key personalities or feature writers to submit reports from southern California locations.

Overall, the response from the southern California media about the NWS performance of WFO San Diego and Los Angeles was overwhelmingly positive. KCBS in Los Angeles said, *“They (NWS) all do a great job.”* The meteorologist for FOX TV 11 in Los Angeles, said, *“The forecasters out of the San Diego and Los Angeles offices did an excellent job with forecasting and letting us know so we could disseminate accurate information to the public.”* The Science Editor for the Los Angeles Times said, *“The NWS did a great job with this event.”* NBC TV 7/39 in San Diego added, *“I was very pleased with the San Diego office and there is nothing I would have changed.”* Finally, the meteorologist from FOX TV 6 in San Diego concluded, *“As a result of NWS forecasts, we are able to tailor our products for the public.”* He went on to state, *“When the San Diego NWS issues a Red Flag Warning, I take notice and often build stories around it. We see it as good public service to educate our viewers. We use the information and get it out to the people.”* While the southern California media were pleased with the products and services provided by WFOs San Diego and Los Angeles, they did express a desire for additional methods of getting a “heads up” when new NWS products are issued during major events (**Finding 12**).

Fact: National, regional and local media representatives from southern California confirmed their staffs were keenly aware of the extreme fire danger prior to the late October wildfire outbreak.

Fact: The media served by WFOs San Diego and Los Angeles stated they have good to excellent working relations with the NWS staffs.

Finding 11: Some media customers suggested the NWS should simplify the WFO web addresses as the current address string is too long, and difficult to remember.

Recommendation 11: NWSH should explore the possibility of changing the Uniform Resource Locator (URL) for WFOs to a national standard incorporating the NWS “weather.gov” domain name and the WFO city name; e.g. <http://www.weather.gov/sandiego>.

Fact: While NWS websites were heavily used, NWR was not used by local or national media to access weather information during the fires.

Finding 12: While the southern California media were pleased with the products and services provided by WFOs San Diego and Los Angeles, they did express a desire for additional methods of getting a “heads up” when new NWS products are issued during major events.

Recommendation 12a: NWS offices are encouraged to coordinate with media partners and explore new methods of enhancing information flow during critical events. Instant messaging software, which can provide timely, ongoing communication with the media, should be used if possible.

Recommendation 12b: NWSH should explore adding date-time stamps to the headline legend of WFO homepages so customers can quickly see when the most current products were issued (Figure 4).

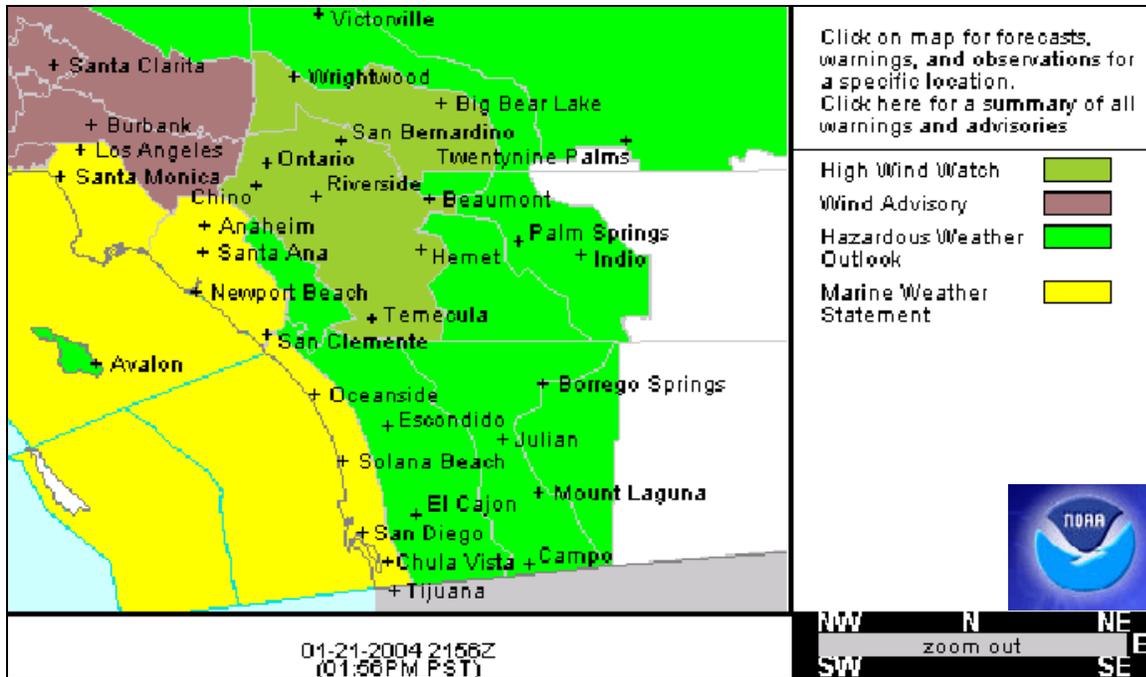


Figure 3. Current format of valid NWS web display of Watches, Warnings, and Advisories.

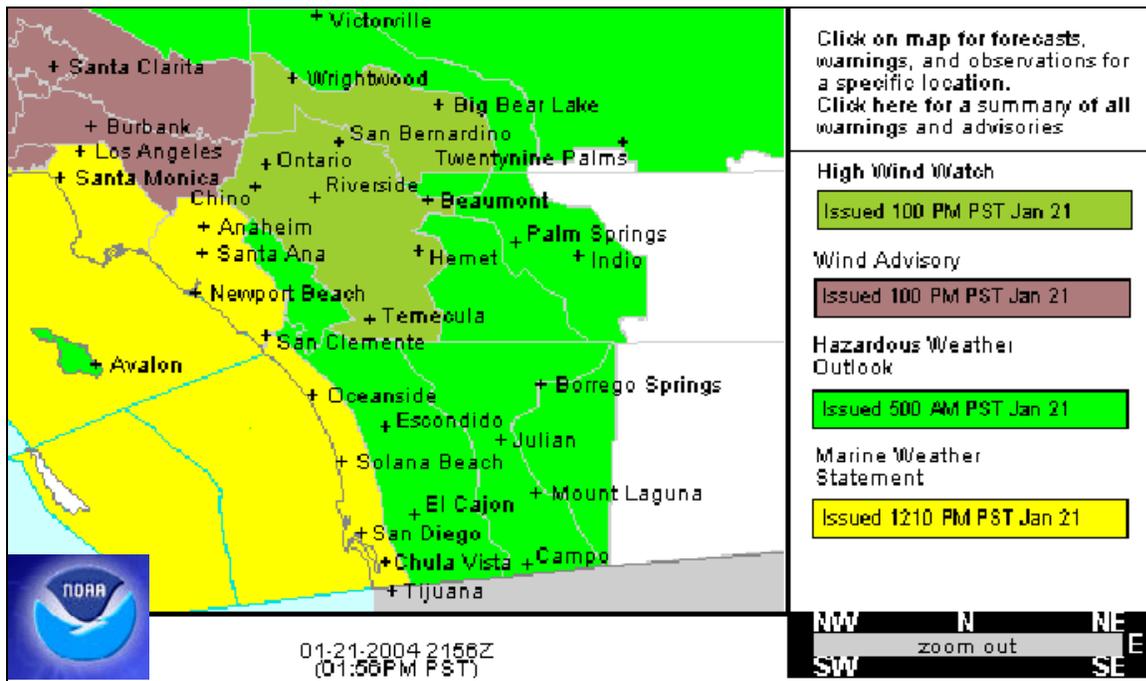


Figure 4. Proposed change to NWS Web display of Watches, Warnings and Advisories.

Best Practices

1. The majority of IMETs serving the southern California wildfire made use of the ROMAN (Real-time Observations Monitoring and Analysis Network) system developed by the University of Utah and Bureau of Land Management to monitor surface weather observations. This system, with roots in the NWS funded project called MesoWest, helped IMETs to identify surface stations closest to the fires, and set alerts for critical weather parameter thresholds.
2. WFOs San Diego and Los Angeles have created comprehensive Products and Services Guides. These guides are distributed to a variety of customers, including media, land managers, emergency planners, and general public.
3. WFO San Diego benefited greatly from additional wind information from local mesonets located across southern California. These additional observations, some located at schools, allowed WFO San Diego forecasters to more effectively monitor Santa Ana wind conditions during the event.
4. As the fire danger threat increased, WFO San Diego conducted “significant event briefings,” involving the operational staff and office management, were held around 11 a.m. on Wednesday, October 22, and again on Friday, October 24. These special briefings helped elevate the situational awareness of the staff to the increasing wildfire potential for the coming weekend.
5. The WFO Los Angeles forecasters routinely run a set of locally developed applications that allow forecasters to conveniently view RAWS observations in a meteogram plot on AWIPS.
6. Media throughout the area commented on the graphical observation maps on the WFO San Diego homepage to be the easiest, most efficient way to monitor current wind information during the fires.

Best Practices

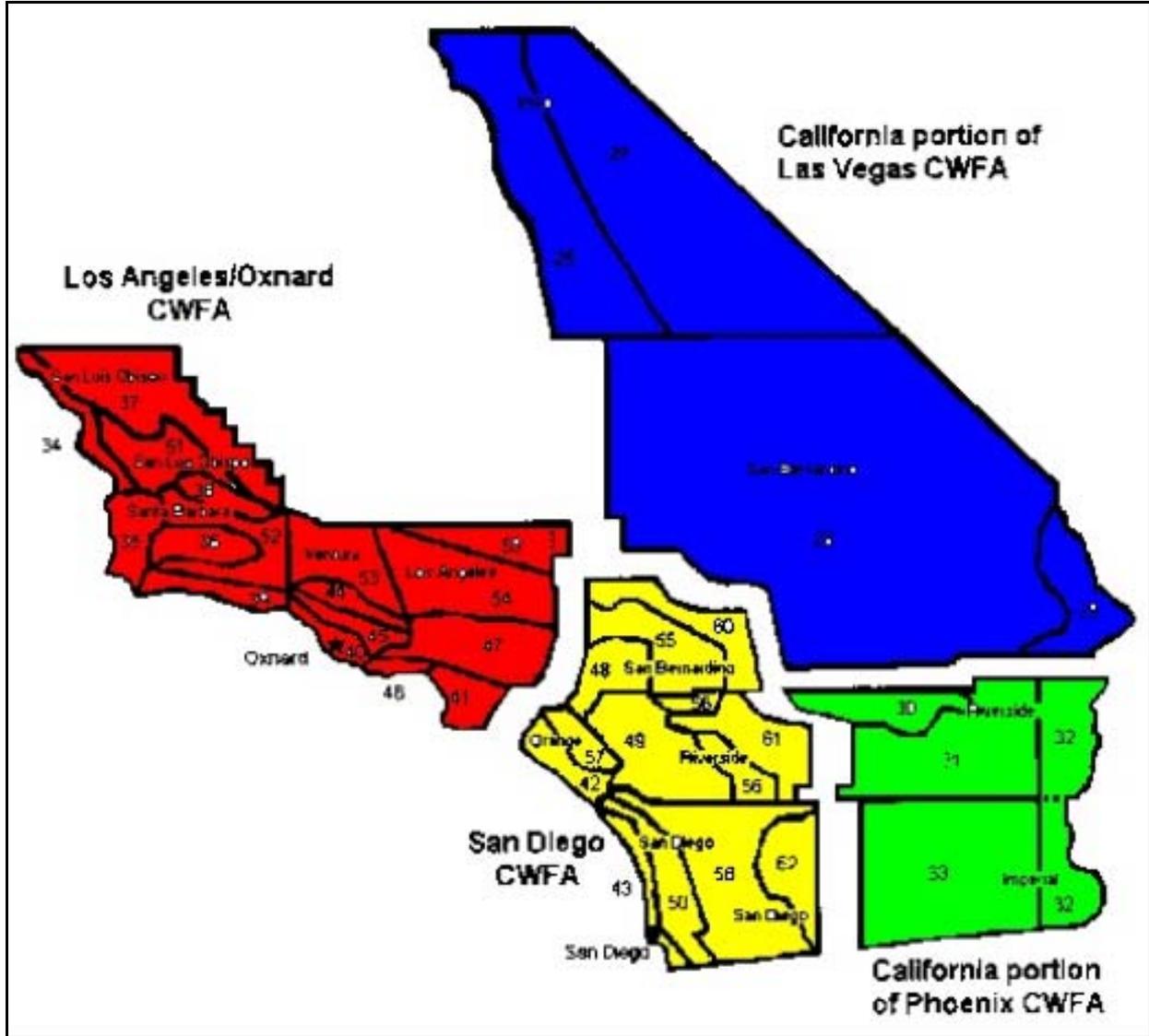
California-Nevada River Forecast Center

The following are some of the actions taken by the California-Nevada River Forecast Center (CNRFC) in the aftermath of the southern California wildfires of October 20 - November 3, 2003.

- 1.** Before the wildfires were completely out, the CNRFC had developed an alternative watershed model configuration to address the affects of the burn on the drainage below San Vicente and El Capitan reservoirs. They were then able to run multiple models to assess which gave the best representation of the situation.
- 2.** CNRFC lowered their Flash Flood Guidance (FFG) for the burn areas.
- 3.** WFO San Diego hosted a meeting shortly after the event where a CNRFC hydrologist gave WFO San Diego staff and a group of their partners an overview of CNRFC fire-adjusted operations, products, and services.
- 4.** CNRFC developed a web site which collects the specific hydro-meteorological information for southern California to help state and local officials monitoring the burn area to find information quickly and easily. This web site features graphics with precipitation observations and forecast estimates and FFG with the burn areas clearly delineated. The site is at: <http://www.wrh.noaa.gov/cnrfc/srncaburn.html>

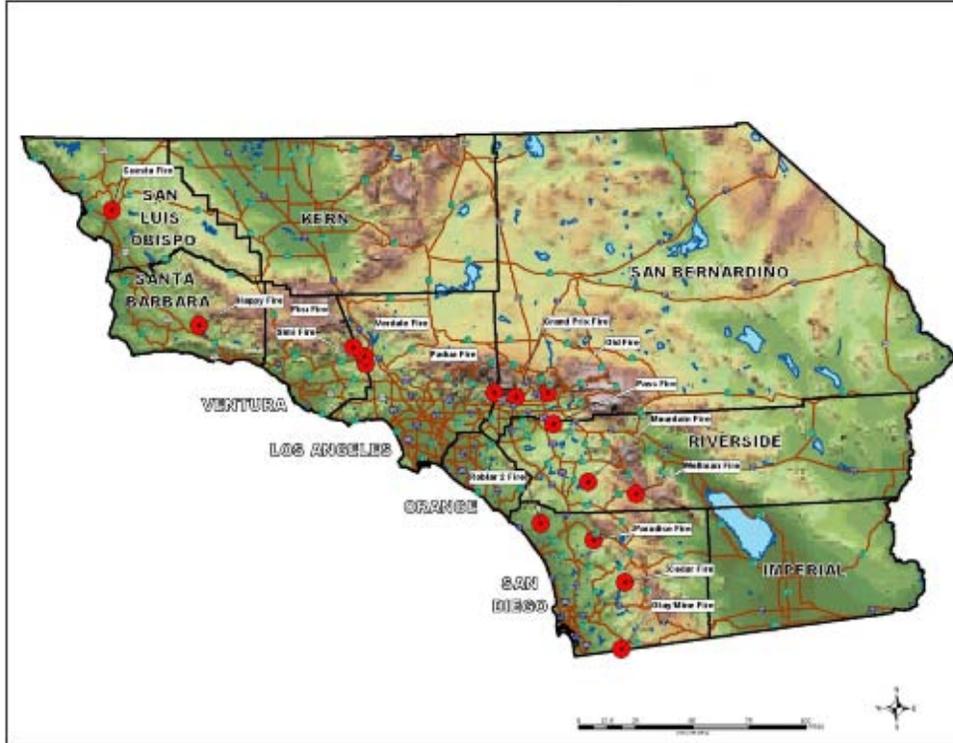
Appendix A

Southern California County Warning and Forecast Areas



Appendix B

Location Map of Wildfires



Location of southern California wildfires, indicated by red circles, during October 2003. Courtesy of Tom Rolinski, Bureau of Land Management.

Appendix C

Event Statistics

START DATE												
	NAME	COUNTY WARNING AREA	TIME FIRST REPORTED	ACRES	DATE CONTAINED	DECLARED CONTROLLED	STRUCTURE LOSS – RESIDENTIAL	STRUCTURE LOSS – COMMERCIAL	STRUCTURE LOSS –	FATALITIES	INJURIES	• CAUSE
10/21	ROBLAR 2	San Diego	1201	8,592	N/A		0	0	0	0	8	UI
10/21	PADUA	Los Angeles	1359	10,446	11/2		0	0	0	0	0	H
10/21	GRAND PRIX	Los Angeles	1422	59,448	11/8	11/12	135	1	60	0	35	H
10/21	PASS	San Diego	1611	2,387	10/23	10/24	5	0	21	0	3	H
10/23	PIRU	Los Angeles	1330	63,991	11/14		1	1	6	0	0	UI
10/24	VERDALE	Los Angeles	1307	8,650	10/28	10/29		0	1	0	0	UI
10/24	HAPPY	Los Angeles	1505	250	10/25	10/27	0	0	0	0	0	UI
10/25	OLD	San Diego	0917	91,281	11/5		993	10	0	6	12	H
10/25	SIMI	Los Angeles	1450	108,204	11/2	11/11	22	0	278	0	21	UI
10/25	CEDAR	San Diego	1737	273,246	11/4		2,232	22	566	14	113	H
10/26	PARADISE	San Diego	0130	56,700	11/6		221	2	192	2	24	H
10/26	MOUNTAIN	San Diego	1145	10,331	10/29	11/2	21	0	40	0	7	UI
10/26	OTAY (MINE)	San Diego	1300	45,971	10/28	10/30	1	0	5	0	1	UI
10/26	WELLMAN	San Diego	1305	100	10/27	10/28	0	0	0	0	1	UI
	TOTAL			739,597			3,631	36	1,169	22	225	

*H = Human caused, UI = Under Investigation as of 11/14/03

Appendix D

WFO San Diego Chronological Product Highlights

Valid Time (local)	Product Type	Remarks
2:00 p.m. Sun 10/19/03	AFD	“Strong offshore flow developing Friday through the weekend.”
2:30 p.m. Sun 10/19/03	ZFP	“Breezy” wording added to forecast for Friday through Sunday.
2:30 p.m. Sun 10/19/03	FWF	“Moderate offshore flow with very low humidity will be possible next weekend.”
3:30 a.m. Tue 10/21/03	AFD	“1040 mb surface high will build into the Great Basin for moderate to strong offshore flow Friday night into Saturday.”
9:00 a.m. Thu 10/23/03	Red Flag Warning	Fire Weather Watch Saturday through Sunday afternoon “for sustained relative humidity less than 10 percent...and for northeast winds 25 to 35 mph and gusty.”
2:30 p.m. Thu 10/23/03	AFD	“Will probably have local advisory to strengthen winds Saturday a.m.”
9:10 p.m. Thu 10/23/03	AFD	“Red Flag Warning will likely be issued tomorrow morning.”
1:31 p.m. Fri 10/24/03	ZFP	Wind gusts of 40-60 mph in forecast for Saturday and Sunday except for San Diego County coastal zone.
6:00 a.m. Fri 10/24/03	HWO	“Fire Weather Watch...for very low humidity and for Santa Ana winds...Saturday and Sunday.”
9:00 a.m. Fri 10/24/03	Red Flag Warning	Red Flag Warning through Monday afternoon “for sustained relative humidity less than 10 percent... and for northeast winds from 25 to 35 mph with gusts to 45 mph.”
11:30 a.m. Fri 10/24/03	SPS	Headline- “Fire danger and strong winds increasing through Sunday.”

2:30 p.m. Fri 10/24/03	AFD	“Strong pressure gradients Saturday will tighten up even more Sunday...more fully including San Diego County.”
2:30 p.m. Fri 10/24/03	NPW	“Wind advisory until 2 p.m. Saturday” for portions of Orange, San Diego, Riverside, and San Bernardino Counties, “A High Wind Warning may be needed Saturday night and Sunday.”
9:30 p.m. Fri 10/24/03	NPW	High Wind Watch for Saturday night through Sunday for the Orange County coastal areas, San Bernardino and Riverside County valleys, and the Santa Ana mountains and foothills. Wind Advisory until 2 p.m. Sunday “for portions of Orange, San Diego, Riverside, and San Bernardino Counties.
3:00 a.m. Sat 10/25/03	AFD	“Very low humidity will be widespread.”
10:45 a.m. Sat 10/25/03	Red Flag Warning	Red Flag Warning through Monday afternoon for “strong northeast winds that will gradually increase to 25 to 35 mph and gust up to 50 to 60 mph.” “In addition...sustained relative humidity will be less than 10 percent.”
2:00 p.m. Sat 10/25/03	NPW	High Wind Watch upgraded to a High Wind Warning until 9 p.m. Sunday, Wind Advisory extended until 9 p.m. Sunday.
2:30 p.m. Sat 10/25/03	AFD	“Fire danger will be extreme with this event.”
8:20 a.m. Sun 10/26/03	Red Flag Warning	Red Flag Warning remains in effect through Monday afternoon. “Northeast winds will be at their peak levels this morning and through about 1 p.m.”
8:30 a.m. Sun 10/26/03	NPW	High Wind Warning and Wind Advisory continue through 9 p.m. tonight.
2:00 p.m. Sun 10/26/03	CEM	“Fire emergency across northern San Diego County”
2:00 p.m. Sun 10/26/03	NPW	High wind warning canceled, wind advisory extended through 2 p.m. Monday.
8:25 p.m. Sun 10/26/03	NPW	Wind Advisory through 2 p.m. Monday for mountains, inland valleys, and Orange County coastal areas.

12:00 p.m. Mon 10/27/03	NPW	“Wind Advisory Cancelled at 12 p.m. today”
4:00 p.m. Mon 10/27/03	Red Flag Warning	“The Red Flag Warning for the area has expired as of 4 p.m.”
2:30 p.m. Wed 10/29/03	Red Flag Warning	Red Flag Warning San Bernardino, Riverside, San Diego County mountains for “Strong gusty winds and low relative humidity downwind of wildfires this evening through Thursday...”
6:00 a.m. Thu 10/30/03	Red Flag Warning	“Red Flag Warning Cancelled”

Appendix E

WFO Los Angeles Chronological Product Highlights

Valid Time (PDT/PST)	Product Type	Remarks
3:00 p.m. Tue 10/21/03	FWF	"Santa Ana winds possible this weekend"
9:30 a.m. Wed 10/22/03	FWF	"Santa Ana winds possible this weekend"
2:30 p.m. Wed 10/22/03	ZFP	"Locally breezy" wording added Friday through Monday in many zones.
3:30 p.m. Wed 10/22/03	FWF	"Santa Ana winds possible this weekend"
6:00 a.m. Thu 10/23/03	HWO	"Northeast winds 20 to 30 mph, locally stronger gusts Friday through Sunday"..."combination of gusty winds and extremely low humidity will create dangerous fire weather conditions".
9:50 a.m. Thu 10/23/03	Fire Weather Watch	Friday through Sunday below and through the passes and canyons of the mountains and valleys of Los Angeles, Ventura, and Santa Barbara counties.
3:30 p.m. Thu 10/23/03	FWF	Tonight through Friday...below and through the passes and canyons of the mountains of San Luis Obispo and Santa Barbara counties., as well as the Santa Ynez Valley. Friday through Sunday...below and through the canyons of the mountains and valleys of the Los Angeles and Ventura Counties northeast winds 25 to 35 mph, local gusts to 40 mph. Single digit humidity expected.
3:45 p.m. Thu 10/23/03	Red Flag Warning	Upgraded FWW added zone 251 of the Santa Ynez Valley.
6:00 a.m. Fri 10/24/03	HWO	Highlighted "gusty northeast winds and very low humidity"
9:10 a.m. Fri 10/24/03	Red Flag Warning	Extended through Monday afternoon and added zones 237, 238, 239, 240, and 241

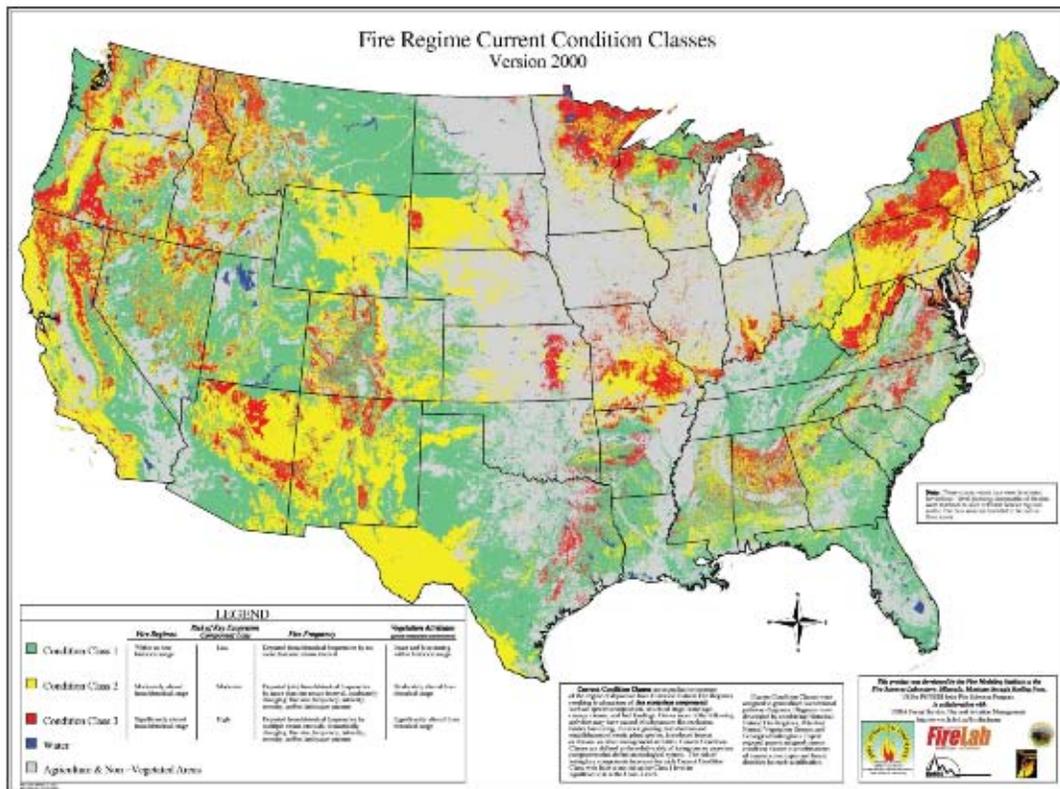
2:30 p.m. Fri 10/24/03	NPW	Wind Advisory issued for Los Angeles and Ventura Counties.
3:20 p.m. Fri 10/24/03	Red Flag Warning	Extended and added zone 259.
6:00 a.m. Sat 10/25/03	HWO	Highlighted gusty northeast winds...highlighted Red Flag Warning and Wind Advisories.
9:15 a.m. Sat 10/25/03	NPW	Additional zones included in the Wind Advisory.
12:30 p.m. Sat 10/25/03	NPW	Additional zones included in the Wind Advisory.
3:15 a.m. Sun 10/26/03	NPW	Additional zone included in the Wind Advisory.
3:54 a.m. Sun 10/26/03	FWS	VERDALE/SIMI - Requested time 1:38 a.m.
9:30 a.m. Sun 10/26/03	Red Flag Warning	Today through Monday afternoon...Los Angeles County, Ventura County and Santa Barbara Mountains. Cancelled for Santa Barbara County South Coast, Antelope Valley, San Luis Obispo County
3:30 p.m. Sun 10/26/03	Red Flag Warning	Continued...local wind gusts 40 to 60 mph...otherwise no changes.
2:30 a.m. Mon 10/27/03	NPW	Cancelled Wind Advisories for Los Angeles and Ventura Counties.
6:00 a.m. Mon 10/27/03	HWO	Mentioned winds will be on the decrease in the afternoon.
9:30 a.m. Mon 10/27/03	NPW	Remaining Wind Advisories cancelled.
9:30 a.m. Mon 10/27/03	Red Flag Warning	Extended through the afternoon.
5:30 p.m. Mon 10/27/03	Red Flag Warning	Expired...

Appendix F

Fire Regime Condition Class Map

Areas shaded in yellow are Condition Class 2 indicating a moderate risk of losing key ecosystem components to wildfire.

Areas shaded in red are Condition Class 3 indicating fire regimes significantly altered from their historical range and the risk of losing key ecosystem components is high.



Appendix G

Southern California Media Demographics

Demographics	WFO Los Angeles	WFO San Diego
County Warning Areas (see maps)	Counties: Los Angeles, Orange ⁶ , San Luis Obispo, Santa Barbara and Ventura.	Counties: Riverside, Orange ⁶ , San Diego and San Bernardino.
Population ¹	Approx. 12.3 million	Approx. 4 million
Households ¹	Approx. 7.5 million	Approx. 2.5 million
TV Market Ranking ²	2	26
TV Stations within CWA ³	25	19
Radio Market Ranking ⁴	2	17
Radio Stations within CWA ³	80	50
Daily Newspapers within CWA ⁵	18	9
Weekly Newspapers within CWA ⁵	75	83
Total Media Outlets	198	161

Notes:

- 1. Information from the California Secretary of State, Bureau of Vital Statistics.**
- 2. Obtained from Nielsen Ratings.**
- 3. Information provided by the California Broadcasters Association, Sacramento, CA.**
- 4. Obtained from Arbitron.**
- 5. Newspaper demographics compiled from Gebbie Press Media information.**
- 6. Media from Orange County serves audiences within the County Warning Areas of WFO Los Angeles and WFO San Diego**