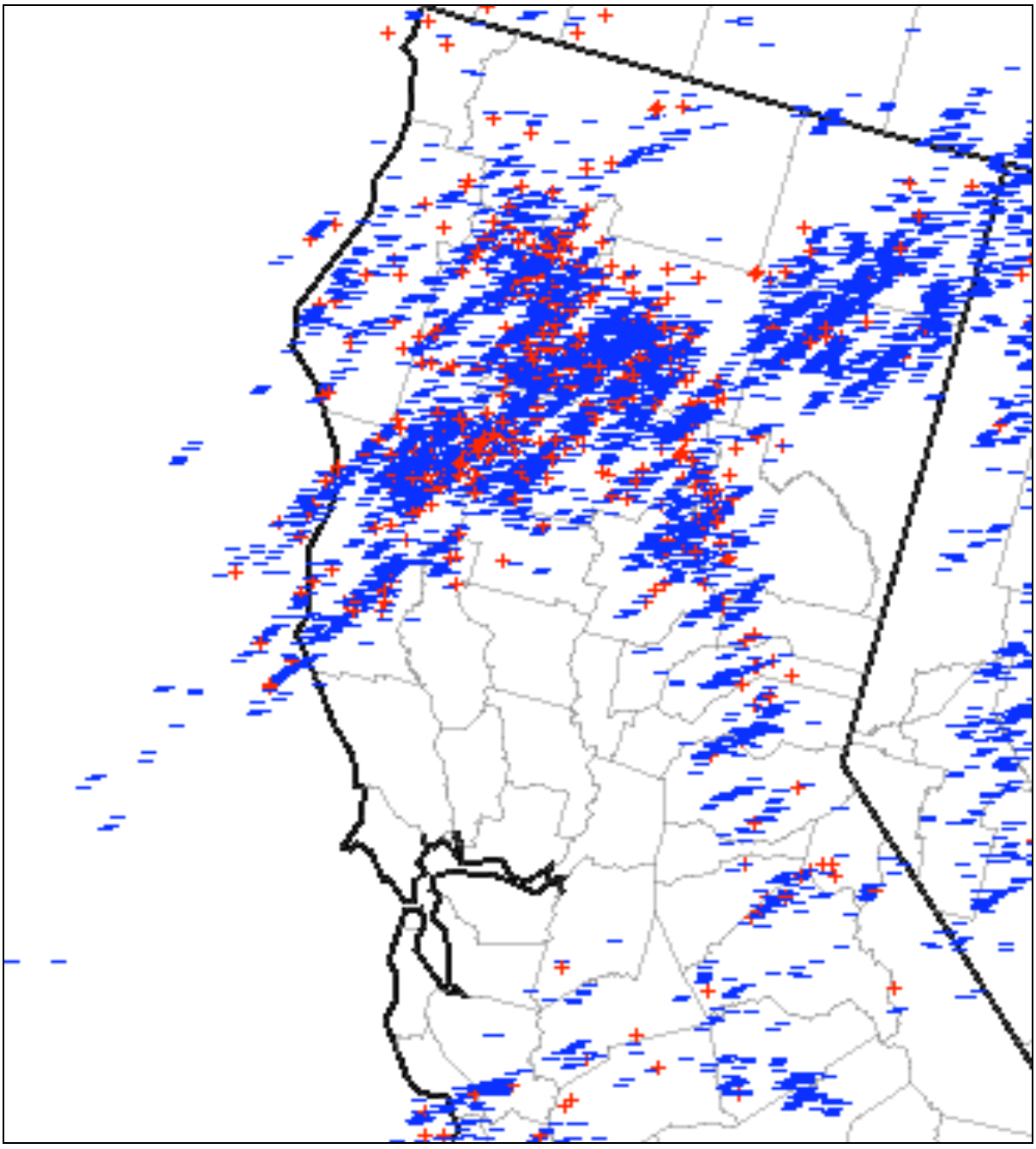
# SACRAMENTO FIRE WEATHER
# 2008 ANNUAL SUMMARY



Automated Lightning Detection
Friday, June 20 to Saturday June 21

# SACRAMENTO FIRE WEATHER ANNUAL SUMMARY - 2008

Three years of below normal rainfall and a remarkable outbreak of dry lightning June 21st lead to one of the worst wild land fire seasons in northern California history. Periods of wet weather in December, January and early February were followed by a very dry spring. Grasses cured earlier than usual while larger fuels were already running large moisture deficits. Extreme fuel conditions were in place when strong north winds began to develop in early June. A man made fire started on June 11th in Butte county exhibited extreme behavior reflective of the dangerous conditions. The Humboldt Fire grew to over 20,000 acres and prompted evacuations of the southern part of Paradise, Butte Valley and Butte Canyon. It destroyed 75 homes and claimed the life of a woman during the evacuation process. A firefighter was also killed in the line of duty. During this same time, fires larger than 1,000 acres sprang up in the Mendocino National Forest, Amador County and Tehama County. Strong high pressure dominated northern California the week of June 16th. Temperatures soared to over 105 degrees in the valleys and a light offshore flow kept humidity in the 15% to 30% range at night. An unusually strong low pressure disturbance approached this hot and dry atmosphere the evening of June 20th.

This disturbance moved into California with the perfect combination of instability and dynamics to create a historic outbreak of dry thunderstorms. The short wave was driven by a jet streak of 75 kts, which is unusually strong for the latter part of June. The jet provided strong dynamics as a large area of diffluence developed ahead of the short wave. Upstream disturbances fed tropical moisture into the strengthening wave, which was also tapping into colder air from the Gulf of Alaska. An area of thunderstorms developed off the coast the evening of the 20th and shifted inland.

As the jet streak rounded the base of the shortwave early on the 21st, the disturbance took on a "negative tilt". This occurs when a jet streak lifts the air in the base of a short wave, further cooling it and expending it southward. This slows the speed at which the bottom part of the short wave propagates while the jetstreak continues to move around the disturbance at the same speed. As the jet catches up to the area of strongest upper level divergence, the short wave 'tilts' back to the northwest as warmer air and pressure rises build in behind the jet. This resulted in a southeast flow aloft that was able to tap into deep tropical moisture off the Baja peninsula. Daytime heating further ignited this volatile mix the afternoon of June 21st. With regard to the occurrence of dry lightning, it was the perfect storm.

There were over 6,000 lightning strikes in northern California from the evening of June 20th through the morning of June 22nd. Lightning started 602 fires on the 21st and 309 more on the 22nd. The fires grew rapidly through spotting and torching. By June 25th 1156 new fires had been ignited. At the height of this event over 2,500 fires were blazing in northern California. Fires spread around the horn of mountains from the Mendocino NF to the Lassen, Plumas and Tahoe National Forests. The town of Paradise

was evacuated as the Canyon Complex backed into the area on the heels of the Humboldt and Ophir Fires. The Butte Lightning Complex burned almost 60,000 acres and destroyed nearly 200 homes in Butte County. Seven complexes grew to over 10,000 acres while eight other fires exceed 1,000 acres. Some of the larger complexes would burn into the month of August. Governor Schwarzenegger toured the damaged areas in early July and declared a state of emergency for Shasta, Plumas and Butte Counties.

Air quality deteriorated over the central valleys as a result of thick smoke from the wildfires. An onshore flow cleared things out a bit toward the end of June, but strong high pressure returned the week of July 7th as high temperatures rose above 105 degrees again. Heat and smoke prompted public health officials to issue air quality advisories through July 10th.

WFO Sacramento issued nearly 100 spot forecasts for the wildfires from June 21st through June 30th before IMETs could be deployed. In some instances up to 13 spot forecasts were issued on a single shift. There were 21 Red Flag Warnings issued for dry lightning in June. WFO Sacramento forecasters were kept extremely busy until well into July with coordination calls, media interviews and warning coordination.

Over 20,000 firefighting personnel were stationed in northern California at the height of the activity. Resource commitments totaled over $500,000,000 with an estimated $285,000,000 in the Sacramento County Warning Area (CWA) alone. Almost 300,000 acres burned in our CWA this summer with much of the land in National Forests. The national preparedness level for fire activity was raised to level 5 on July 1st, almost entirely due to the fires in northern California.

There were 18 fires over 1000 acres in the Sacramento CWA last summer:

| FIRE | SIZE (acres) | EST. $ TO CONTAIN |
|---|---|---|
| | | |
| SHU Lightning Complex | 86,500 | $ 55.4 MILLION |
| Butte Lightning Complex | 59,440 | $ 85 MILLION |
| Canyon Complex | 37,831 | $ 45.5 MILLION |
| Humboldt Fire | 23,000 | $ 13.5 MILLION |
| TGU Lightning Complex | 22,907 | $ 2.14 MILLION |
| American River Complex | 20,541 | $ 24 MILLION |
| Cub Complex | 19,718 | $ 20.6 MILLION |
| Walker Fire | 14,500 | $ 3.29 MILLION |
| Peterson Complex | 7,842 | $ 2.65 MILLION |

| | | |
|---|---|---|
| Whiskey Fire | 7,700 | $ 6.35 MILLION |
| Rich Fire | 6,517 | $ 10.6 MILLION |
| Jackson Fire | 6,400 | N/A |
| Whiskeytown Complex | 6,240 | $ 8.4 MILLION |
| Yuba River Complex | 4,254 | $ 7.4 MILLION |
| "Wild" Fire | 4,089 | $ 1.2 MILLION |
| North Mountain Fire | 2,889 | N/A |
| Mill Complex | 2,100 | N/A |
| Ophir Fire | 1,600 | N/A |

The eight largest fires together cost over $245,000,000 to contain. The **SHU Lightning Complex** east of Redding began as a complex of 158 fires that merged into seven. It destroyed six residences and 16 outbuildings and resulted in 51 injuries. The complex threatened Shingletown and Burney, forcing several evacuations. Highway 299 had to be closed. The fire was not fully contained until July 23rd.

The **Butte Lightning Complex** started as 31 individual fires that merged into nine about 25 miles north of Yuba City. The complex destroyed 196 residences and 11 outbuildings. It threatened the communities of Concow, Magalia, Jonesville, Butte Meadows and Jarbo Gap, forcing evacuations and road closures. A man who refused to evacuate in Concow lost his life in the fire and 71 people suffered injuries. The fire was not fully contained until July 30th.

**The Canyon Complex** 15 miles northeast of Paradise occurred in very steep and hard to access terrain in the Plumas NF. The Quincy area was doused in heavy smoke for weeks and several people suffered smoke inhalation problems. This was a complex of 50 or so fires that merged into eight. The complex experienced wind driven runs and torching and forced the evacuation of Paradise. Highway 70 had to be closed as well. The fire was not fully contained until August 7th.

The **Humboldt Fire** was a man made fire ignited on June 11th in Butte County. It destroyed 75 homes and forced the evacuation of the southern end of Paradise, Butte Valley and Butte Canyon Creek. A fire fighter died from a non-traumatic brain hemorrhage while fighting this fire. A woman also suffered a heart attack during the evacuation process. Five fire fighters suffered injuries. The fire destroyed 23,000 acres before it was contained June 20th.

The **TGU Lightning Complex** was a complex of seven fires that merged into three in Tehama County. It threatened several residences, destroyed three buildings and forced the closure of some back roads. It was fully contained on July 5th.

The **American River Complex** was a complex of three fires about 11 miles northeast

of Foresthill. The complex experienced a rapid rate of spread and crowning with slope driven runs. It destroyed a commercial building and three residences. One fire fighter suffered injuries in a helicopter accident fighting this fire. The fire contributed to extremely poor air quality the Sacramento valley in late June and early July. The fire threatened power lines, cultural resources, watershed and private in holdings before it was fully contained on July 31st.

The **Cub Complex** 16 miles southwest of Chester, CA threatened structures and forced evacuations in Jonesville. The fire poured thick smoke into Chester and forced the closure of highway 32 for several days. The complex of seven fires in the Lassen NF was in steep terrain and was not contained until July 22nd. It forced the closure of recreation trails in the Lassen NF for several weeks.

The **Walker Fire** 10 miles northeast of Clearlake Oaks, CA experienced rapid rates of spread with long range spotting and active torching. It threatened several residences and closed roads. This fire was started by a vehicle driving in the area whose undercarriage struck a rock. Eight fire fighters suffered minor injuries fighting this fire, which was fully contained June 30th.

IMETs from all over the country converged on Sacramento's warning area as the fires took hold in late June and early July. A heat wave prompted the issuance of more Red Flag Warnings on July 7th as temperatures rose above 110 in the northern Sacramento valley. Smoke filled skies and a light offshore flow kept overnight lows very warm with low humidity. A stronger onshore developed the following week, allowing firefighters to gain the upper hand on several fires.

Weak low pressure just off the California coast tended to shunt the desert southwest ridge off to the east for much of the remainder of July into the middle of August. This brought a nice onshore flow, below normal temperatures and reduced fire danger. There were no more Red Flag Warnings issued until the last week of August, when a series of north wind events developed. These continued into early September. The number of prescribed burns experienced a typical seasonal increase from mid September through early October. A strong cold front containing the first wetting rains of the year prompted the issuance of more Red Flag Warnings October 8th through the 13th. WFO Sacramento ended fire season on November 3rd as most forests completed their transition to 'low season' operations.

## RED FLAG WARNING VERIFICATION FOR 2008

Sacramento fire weather forecasters issued 117 Fire Weather Watches and 184 Red Flag Warnings in 2008. Statistically, a Red Flag Warning or Fire Weather Watch issued for any single zone counts as a separate watch / warning. These totals were well above those for 2007 and 2006. WFO Sacramento did an excellent job issuing Fire

Weather Watches in advance of anticipated Red Flag conditions. We were the only office in northern California to have a Fire Weather Watch out for the dry lightning outbreak of June 21st. We were also the first WFO to issue a Red Flag Warning for this event.

| MONTH | FIRE WX WATCHES | RED FLAG WARNINGS | |
|---|---|---|---|
| | | Wind / Low RH | Dry Lightning |
| May | 23 | 17 | 0 |
| June | 55 | 27 | 21 |
| July | 9 | 32 | 0 |
| August | 20 | 48 | 0 |
| September | 0 | 9 | 0 |
| October | 10 | 30 | 0 |

Red Flag Warning verification can be subjective, especially with regard to dry lightning. To verify as a correct warning for winds and RH, we refer to the matrix agreed upon by the California Wildfire Coordinating Group (CWCG):

The wind event should be expected to last for at least 8 hours to qualify for a red flag warning.

**W** indicates that the forecaster should consider a warning.

| Relative Humidity | Sustained Wind 6-11 mph | Sustained Wind 12-20 mph | Sustained Wind 21-29 mph | Sustained Wind 30+ mph |
|---|---|---|---|---|
| Daytime Minimum RH 29-42% and/or Nighttime Maximum RH 60-80% | | | | W |
| Daytime Minimum RH 19-28% and/or Nighttime Maximum RH 46-60% | | | W | W |
| Daytime Minimum RH 9-18% and/or Nighttime Maximum RH 31-45% | | W | W | W |
| Daytime Minimum RH < 9% and/or Nighttime Maximum RH < 31% | W | W | W | W |

In 2008, our POD (probability of detection) for synoptic scale (wind / RH) Red Flag Warnings increased to .976, compared to .830 in 2007. The CSI (critical success index) also increased to .832 from .714 and our FAR (false alarm ratio) decreased to .151 from .167. We believe this is partly because we did not issue as many Red Flag Warnings for the Burney Basin this year, where verification is highly dependent on a single sensor. We also did an excellent job issuing fire weather watches in anticipation of persistent Red Flag conditions. It can be seen in the table below that for synoptic scale Fire Weather Watches we verified 53 of the 90 issued in 2008. However, this supports the correct use of the Fire Weather Watch product. The watch is our way of communicating uncertainty in the timing and duration of Red Flag events. Additionally, a Fire Weather Watch issued for a certain period will only verify if Red Flag conditions occur within the exact time frame of the watch. Forecasters are to be commended for improving Red Flag Warning verification statistics for winds and RH during such an active summer.

Our dry lightning Red Flag verification scores were lower than those of 2007. The POD dropped to .588 from .880 while CSI decreased to .420 from .601. FAR also rose to .521 from .333. We did an excellent job on the June 21 lightning superstorm. There was one missed event during that outbreak; otherwise we verified 6 of the 6 Red Flag Warnings issued on June 21st. Our dry lightning verification scores dropped with a second series of Red Flag Warnings issued for dry lighting June 27-29. Fire Weather Watches were issued for both events and we did a good job leaving these in place when there was forecast uncertainty.

Red Flag Warnings for dry lightning can be a real forecast challenge with the occurrence of monsoonal thunderstorms that transition from 'dry' to 'wet' in a few hours. Documentation states that such occurrences are to be covered by highlighting statements and not Red Flag Warnings.

Statistically, POD is the ratio of warned events to total events. So if

A= the # of correct warnings
B= the number of incorrect warnings
C= the number of events not warned

Then POD = A / (A+C)

FAR is the ratio of warnings without an event to total warnings: B / (A+B)

CSI = A / (A+B+C)

## 2008 Red Flag Warnings

| | Synoptic Scale | Dry Thunderstorms | Total or Average |
|---|---|---|---|
| Number of Red Flag Warnings | 163 | 21 | 184 |
| Number of Correct Warnings | 134 | 10 | 144 |
| Number of Incorrect Warnings | 29 | 11 | 40 |
| Number of Events Not Warned | 4 | 3 | 7 |
| POD for Red Flag warnings | 97.6% | 58.8% | 95.4% |
| CSI for Red Flag warnings | 83.2% | 42.0% | 75.3% |
| FAR for Red Flag warnings | 15.1% | 52.0% | 21.7% |
| Red Flag warning Lead Times | 21.6 Hours | 7.1 hours | 19.9 Hours |

## 2008 Fire Weather Watches

| | Synoptic | Dry Thunderstorms | Total or Average |
|---|---|---|---|
| Number of Fire Weather Watches | 90 | 27 | 117 |
| Number of Watches Verified | 53 | 10 | 63 |
| Lead time of verified Watches | 27 hours | 7 hours | 22.38 Hours |

Our lead time for Red Flag Warnings decreased in 2008 largely due to the increase of dry lighting warnings. Note that our lead time for wind / RH events increased in 2008 to 21.6 hours and our lead time for Fire Weather *Watches* for wind / RH increased to 27 hours.

### SPOT FORECASTS ISSUED FOR THE YEAR 2008

WFO Sacramento issued 517 spot forecasts in 2008. This represents our highest total ever - and is an increase of 153 over 2007 (364) and 193 over 2006 (324). We were #3 in the nation in wildfire spots (302) and #7 in total spots (possibly #6 depending on the final count). The majority of our prescribed spot forecast requests continue to be federal. The monthly breakdown of our spot forecasts follows:

| Month | Rx Burns | Wildfire | WFU | HAZMAT | Other |
|---|---|---|---|---|---|
| | | | | | |
| JAN | 5 | 0 | 0 | 0 | 0 |
| FEB | 9 | 0 | 0 | 0 | 0 |
| MAR | 12 | 0 | 0 | 0 | 0 |
| APR | 35 | 5 | 0 | 0 | 0 |
| MAY | 34 | 16 | 0 | 0 | 0 |
| JUN | 16 | 107 | 0 | 0 | 0 |
| JUL | 0 | 74 | 0 | 0 | 0 |
| AUG | 6 | 49 | 0 | 1 | 0 |
| SEP | 15 | 44 | 0 | 0 | 0 |
| OCT | 43 | 3 | 5 | 0 | 0 |
| NOV | 23 | 4 | 0 | 0 | 0 |
| DEC | 11 | 0 | 0 | 0 | 0 |
| | | | | | |
| **TOTAL** | **209** | **302** | **5** | **1** | **0** |

We issued 93 spot forecasts for wildfires from June 21st through June 30th. The GACC continues to handle most WFU spot requests. We issued 68 spot forecasts for wildfires and 296 for prescribed burns, 195 (66%) of which came from the USFS. The decrease in prescribed burn spots to 209 (nearly 30% less than 2007) was largely driven by the forests in the wake of the June lightning outbreak. CAL-FIRE spot requests also dropped to 39 from 52.

| Spot Forecast Requests | 2008 | 2007 |
|---|---|---|
| | | |
| Wildfires (USFS) | 241 | 44 |
| Wildfires (CALFIRE) | 61 | 24 |
| Burns (USFS) | 140 | 195 |
| Burns (CALFIRE) | 39 | 52 |
| Burns (NPS) | 30 | 40 |
| WFU | 5 | 9 |
| HAZMAT (OES) | 1 | 0 |

WFO Sacramento had an average spot forecast completion time of 46.5 minutes in 2008. A good goal for 2009 would be to drop this to under 40 minutes. The lightning storm of 2008 sent us a tremendous number of spot requests simultaneously, probably resulting in an increase in turnaround time. The 181 wildfire spot requests in June and July came in almost entirely between June 22nd and July 6th.

## INCIDENT METEOROLOGIST DISPATCHES FOR 2008

Sacramento fire weather participated in 5 IMET dispatches in 2008. IMET Mike Smith

was recognized for his 50th fire (Double Ace distinction) in August. IMET trainees Jason Clapp and Steve Goldstein continued to progress toward IMET certification. Each needs one more training fire to be certified and will hopefully achieve this in 2009. All incident support was in California last year with three fires in our CWA. IMETs from all over the country converged on our CWA when the fires broke out in June. Our interaction with IMETs gave us a new appreciation of how our products are used in the field. We began issuing the morning FWF at 5 AM so they would be on the web in time for their 6 AM briefings.

Total IMET dispatch days from WFO STO totaled 47 days. This is an increase from 34 in 2007 and 31 in 2006.

A breakdown of WFO STO IMET dispatches including incident name, dates dispatched and fire weather district of the incident is as follows:

| Incident Name | IMET | Dispatch Dates | Fire Weather District |
|---|---|---|---|
| | | | |
| Canyon Complex | Mike Smith | 6/24/08-7/4/08 | Sacramento |
| BTU Lightning Complex | Jason Clapp | 6/26/08-7/2/08 | Sacramento |
| Yolla Bolly Complex | Mike Smith | 7/23/08-8/6/08 | Eureka |
| Lime Complex | Steve Goldstein | 8/8/08-8/17/08 | Eureka |
| Elmore Incident | Mike Smith | 9/8/08-9/11/08 | Sacramento |

Number of days on Incidents

Mike Smith ..... ..... ..... 30
Steve Goldstein..... ..... 10
Jason Clapp ..... ..... ..... 7

Total Days of IMET support
from WFO Sacramento..... …….47

## FIRE WEATHER TRAINING ASSIGNMENTS IN 2008

Sacramento fire weather participated in 13 teaching assignments in 2008. Most of these were for the weather portion of the "Basic Fire Behavior" S-290 course. Mike Smith also taught three S-390 courses and one S-590 course. The 13 courses taught in 2008 represent a decrease from 17 in 2007 and 24 in 2006. WFO Sacramento continues to be a big help to state and local agencies that must comply with the S-290 wildland fire fighting course.

Special thanks go to Mike Smith, who shouldered a large teaching workload again last year. Jason Clapp is being currently being trained to assist with our teaching responsibilities. He will be teaching his first S-290 class in late January, 2009.

The courses taught, locations, agency served and instructors follow:

| Course Name | Location | Date | Agency Served | Instructor |
|---|---|---|---|---|
| Wldnd Fire Calc S-390 | Magalia | 1/9 | CALFIRE | Mike Smith |
| Basic Fire Behavior S-290 | McClellan | 1/14 | NPS | Mike Smith |
| Basic Fire Behavior S-290 | McClellan | 1/22 | Various | Mike Smith |
| Basic Fire Behavior S-290 | McClellan | 1/28 | Various | Mike Smith |
| Basic Fire Behavior S-290 | Murphys | 2/08 | Various | Mike Smith |
| Adv Fire Behavior S-590 | Tucson | 3/9 | Various | Mike Smith |
| Basic Fire Behavior S-290 | Vacaville | 3/24 | Various | Mike Smith |
| Basic Fire Behavior S-290 | Vallejo | 3/31 | Various | Mike Smith |
| Basic Fire Behavior S-290 | Sonora | 4/2 | USFS | Mike Smith |
| Basic Fire Behavior S-290 | Vallejo | 4/14 | Various | Mike Smith |
| Wldnd Fire Calc S-390 | McClellan | 4/29 | CALFIRE | Mike Smith |
| Wldnd Fire Calc S-390 | Ione | 11/17 | CALFIRE | Mike Smith |