

UNIT VIII--KEEPING CURRENT WITH THE WEATHER

This unit is on keeping current with the weather. After you have read the instructions to students on page 1 of your workbook, please read and study the unit objectives on page 2. When you have finished, return to the text.

Because fire behavior processes are so dependent on elements of weather, this course puts strong emphasis on weather and its changeability. Fire managers recognize this fact and have grown very dependent on weather forecasts and other means of keeping current with the elements of weather and fire danger. Fire management organizations have special needs for weather forecasting services. Under item A, list the following: Planning daily fire management activities, planning effective control actions on fires, and determining potential hazards due to fire. These will be discussed in more detail later.

As a result of these needs, special forecasting services have long been tailored for use by resource management agencies. Fire weather offices of the National Weather Service usually have responsibility for, and provide, these forecasting services. Types of forecasts prepared are general fire weather forecasts, red flag warnings, smoke management forecasts, spot weather forecasts, and mobile weather unit forecasts. In certain portions of the United States, some of these forecasting services are provided by other Federal or state offices. However, the forecasts are very similar. This unit will discuss the usual types of forecasts and forecasting services available to resource managers and fire managers.

Now, please do question 1; then return to the text.

If your answers to items 2 and 4 are yes, then you are already familiar with special forecasting services and will have little trouble with this unit. If your answers are no, you should check on local services for your area.

Figure 1 on page 4 illustrates fire weather districts and district offices of the National Weather Service. Note that the district boundaries do not always follow state boundaries. Also note the legend in the lower right-hand side of the chart, and the symbols for the various services. Most weather districts in the West have mobile unit services at their locations. These mobile units are available for dispatch to any requesting agency within their districts and can go outside of their boundaries if necessary. We will discuss the special services of the mobile units in more detail later in this unit.

Now go to page 5. We will first discuss those forecasts that are provided on a regular basis to agencies during designated times of the year, such as the normal fire season months. Here are three forecasts that fit into that category. Under item B, list number 1 as general fire weather. The purpose of this forecast is for planning daily fire management activities, including daily manning levels, prevention programs, and initial attack readiness for wildfires. The general fire weather forecast is sent out each midafternoon with possible updates the following morning.

The second is red flag warning. The purpose of this forecast is to alert fire managers of critical or rapidly changing fire weather conditions that will increase fire danger in a significant way. This forecast is issued rather infrequently, perhaps once or a few times during a fire season.

The third is smoke management. This forecast advises fire managers of atmospheric conditions for the next 36 hours that will affect the dispersal of pollutants from fire. It is usually issued each morning by many fire weather offices during times of the year when smoke is a problem. We will give you examples of each of these forecasts.

Before we look closer at each of the three forecasts, please do question 2. It asks, "When are each of these forecasts issued?" (PAUSE)

Here are the answers for question 2: The general fire weather forecast is issued during midafternoons, daily. An update of that forecast is issued the following morning. Red flag warnings are issued very infrequently, and only as needed. Smoke management forecasts are issued during mornings, daily. We have not given you exact times for these forecasts as they can vary by areas.

On page 6 is illustrated a general fire weather forecast. Notice that there are three general parts to the forecast--the weather discussion, the zone forecasts for tonight and tomorrow, and the extended outlook for the following 2 days.

As you can see, zone forecasts make up the bulk of the general forecast. Each state of any size is divided into several weather zones. A zone encompasses an area that normally has similar weather characteristics. Each of the numbered weather zones has at least one fire weather station that provides the forecaster weather observations each day. Notice that the predicted temperature, relative humidity, and wind are not given here, but are rather the expected changes over today's readings. These change values are applied to today's local fire weather observations to give tomorrow's predicted weather elements.

Why is this format used in the forecast you may ask? Well, one of the principal purposes of this forecast is to provide input into the National Fire Danger Rating System. The zone forecast elements as shown are also put into a computer, which processes the data and calculates fire danger indices and components. We'll discuss this data processing and fire weather information system a little later.

In figure 3 on page 7, we have a forecast that updates the forecast in figure 2. The update was issued the following morning at 0930. The update is usually much shorter, as it gives only the changes or refinements made on yesterday's forecast. This information is not used for fire danger ratings, but rather as an additional planning tool for fire managers.

We should discuss the zone weather forecast a bit more. On the bottom of page 7, we describe this forecast as a portion of the general fire weather forecast. It is issued on a regular basis during the normal fire season specifically to fit the requirements of fire management needs such as time, areas, and weather elements. The forecast zones or areas are determined based on a combination of administrative and climatological information, and usually are nearly the size of an individual

forest or district. They are numbered for convenience in reference. You notice that the zone forecasts in figures 2 and 3 are coded. To understand exactly what each of the elements mean, it is necessary to refer to the coding key in figure 4 on page 8. The principal weather elements are state of the weather, temperature, relative humidity, wind, precipitation duration, lightning activity level, and fuel moisture.

Since we've gone through the forecasts rather rapidly, you should take more time to read and study them. To help you become better acquainted with the general fire weather forecasts, the first exercise on page 9 has been prepared. Read the instructions; then do the exercise. When you have finished, return to the text.

Although we did not name it earlier, we mentioned a data processing and information system available to fire managers. This system is called AFFIRMS. AFFIRMS is an acronym for Admistrative and Forest Fire Information Retrieval and Management System. It is a user-oriented, interactive computer program that permits entry of fire weather observations and forecasts, performs computations of fire danger indices, and provides other services. This system is used on a National basis and requires that fire management offices have a computer terminal connected to a central computer via the telephone system.

There are several services that AFFIRMS provides to fire managers. These functions are diagrammed in figure 5 on page 10. On the input side, participating agencies take weather observations daily at fire weather stations and enter these into AFFIRMS. The National Weather Service retrieves these observations and, together with other forecasting aids, prepares general weather forecasts for each fire weather district. These forecasts go into the computer. Other uses to which AFFIRMS is put are administrative and fire status reports from various agency offices, and other special administrative reports related to fire weather and fire danger.

On the output side of AFFIRMS, any office that has a computer terminal can access the following items from any place in the United States: the fire weather station observations; fire situation reports for some areas; the daily fire weather forecast and forecast updates; and the National Fire Danger Rating System indices and components that have been calculated by the computer for today and the predicted indices and components for tomorrow. The weather information is archived; that is, put into permanent data storage for possible use later.

Several kinds of forecasts are entered into the AFFIRMS. One is the red flag warning, which is issued by the fire weather forecasting offices to specific areas only when one or more of the following situations occur: There is general dry lightning activity; the first lightning activity is foreseen after an extremely dry period; the fire danger is high to extreme, and the approach of a cold front will result in gusty and changeable winds of 20 miles per hour or more; and the forecaster foresees a change in weather that would result in a sufficient increase in fire danger to warrant a revised special forecast at times other than those of regular forecast. The red flag warning may be issued any time of day or night, or it may be issued as a part of the general fire weather forecasts. Remember that red flag warnings are issued very infrequently. Some years, red flag warnings may not be issued at all, while other years they might come out several times during the season.

In figure 6, we have an example of a red flag warning which you will want to come back to and study later.

Another forecast that users obtain through the AFFIRMS is the smoke management forecast. See page 11. The purpose of this forecast is to advise fire managers of the atmospheric conditions for the next 36 hours that will affect the dispersal of pollutants from fire.

Fire managers are most concerned about smoke dispersal in higher populated areas where people's activities might be affected by poor visibility or air pollution. There may not be much a fire manager can do about smoke from a wildfire, but he can usually plan prescribed fires to take place when smoke dispersal conditions are most favorable.

Figure 7 presents two typical smoke management forecasts issued in the Northwest. These could come from various parts of the country and in different formats. There are several things to note about these forecasts. First, they are issued in the morning and describe atmospheric conditions such as stability and transport wind at various altitudes for today and tomorrow.

Second, the forecasts are issued during various times of the year and not exclusively during fire seasons. This is because prescribed burning is frequently done during off-fire season months.

Third, these forecasts may be issued from offices other than the National Weather Service. The top example shows a forecast issued from a Forest Service meteorology office in Portland. In California, some State and County agencies are involved in preparing these forecasts. Please come back and read these forecasts in more detail later.

Until now, we have discussed forecasts prepared for specific zones or larger areas within a fire weather district. Although these forecasts are adequate for Fire Danger Rating purposes, they may not supply enough information for other fire management activities. See question 3; mark your choice or choices.

In question 3, you should have marked all the choices, since these are all reasons why a general forecast may not be adequate for specific ongoing fire situations. What does the fire manager do then? Well, he asks for more help by requesting special forecasting services. The next part of this unit, starting on page 12, describes special forecasting services available. The first is commonly referred to as the spot weather forecast. This is a special forecast issued to fit the time, topography, and weather of a specific fire. These forecasts are issued upon request of the user agency and are more detailed, timely, and specific than the zone forecasts. Remember that the spot weather forecast must be requested each time that it is provided. When should this forecast be requested? Most fire managers recognize that one or more of these conditions will make it advisable to obtain a special spot weather forecast: The general fire weather forecast does not seem to fit your situation; indicators suggest possible blowup conditions; control is not expected for a considerable time; red flag warnings are posted for the zone which includes the fire area; there is, or has been, erratic fire behavior; and the fire is in, or moving into, fast burning, moderate to heavy fuels. We should note here that spot forecasts are also used in the planning and execution of prescribed fires, aerial spraying projects, and other resource management activities.

To obtain good spot weather forecasts there are four essential steps to be taken. In item C, list the following:

1. Take and record representative weather observations on the fire,
2. complete part I of the Weather Service request form,
3. transmit data from form to forecasting office, and
4. provide forecaster feedback on accuracy of forecast.

The last step is not required by the forecaster, and it will not help the first forecast that you receive, but it certainly can help the forecaster improve on subsequent spot forecasts for the fire. As a result, we insist that step 4 is essential to getting the best forecast.

On page 13, figure 8 is the Weather Service form that you should use. The request form has three parts. You will initially complete part I and transmit this data to the forecasting office. To help you become better acquainted with the information requested by the forecasting office, we would like you to complete part I of the form as we provide the information.

In block 1 at the top left, enter Summit Mountain Fire. Control agency is National Forestry Department. Request is made at 1310 hours on August 18. The location is: Section 12, Township 4 North, Range 6 West. The fire is in the Deep Creek drainage on a southeast exposure. The size of the fire is 85 acres. Elevation at the top is 3,800 feet; the bottom, 3,650 feet. The fire is in a pine thinning area with slash, and is not crowning.

Observations have been taken near the fire perimeter at 3,700 feet elevation. The observation time was 1245. Winds at eye level were southwest 6. Dry bulb was 860, wet bulb 620. The relative humidity and dew point could be determined in the field from psychrometric tables. However, it is not necessary that you provide them. The forecaster will do this. Under remarks, note stage 2 cumulus 15 miles to west. The forecast is to be sent to the fire camp, via radio, attention the Fire Boss.

When the forecast is received in fire camp by radio, it is recorded under part II, and part III is also completed. If the forecast should arrive in hard copy, it will be on the same form with parts I and II completed. These forecasts are usually provided within 30 to 40 minutes of the time the forecaster receives the request.

Why do you suppose fire weather forecasters request weather observations from the fire? Normally forecasts are made for large areas and are based on weather observation stations scattered throughout the United States and this part of the world. By giving the forecaster accurate data taken at the fire, he can better adapt the broader scale forecast to that specific area. The last portion of this unit is devoted to taking weather observations on fires.

On page 14 is an exercise on special spot weather forecasts. Please complete the exercise; then return to the text.

Now, do question 4 at the bottom of page 14; mark your choice or choices.

In question 4, you should have marked statements 1 and 3. Spot forecasts do not come automatically. You must request each one and provide current data with the request.

The spot forecast should be better than a general fire weather forecast but probably not as accurate as the next forecast that we will discuss. This is the mobile weather unit forecast. See page 15. The mobile weather unit is a special service available in the Western United States. The map on page 4 gives the locations of permanently based mobile units. These units can be dispatched with a qualified fire weather meteorologist and be on the road within 2 hours of receiving the request. A mobile unit contains weather observation equipment, radio communications equipment, including a facsimile machine and power supply, and other conveniences. The meteorologist is able to communicate directly with a regular National Weather Service forecast office to exchange forecasting data between office and field. In effect, the mobile unit becomes a miniature forecasting office at the fire.

In addition to the mobile units, several air portable units are now available. These tent-trailers provide essentially the same forecasting facilities as the mobiles. They can be hauled on large cargo aircraft, slung from helicopters, and moved to almost any location.

The forecasts produced by a mobile weather unit will be much more detailed than a spot forecast. On page 16, we have an example of a mobile unit forecast. As you read through the forecast, you will see how predictions are tailored to local terrain features. Accuracy is greatly improved, since a forecaster can verify his own forecasts and work to improve them.

Mobile unit forecasts can be prepared to meet any schedule desired on the fire. Usually there are two primary forecasts prepared each day to coincide with shift planning. Updates of these forecasts are always available as requested.

We have mentioned some of the advantages of having the mobile unit on a fire. Turn to page 17, and please list the following under item D:

1. Can get better weather observations at fire area,
2. can get forecasts better adapted to local terrain,
3. meteorologist works directly with plans section,
4. meteorologist can attend and participate in briefings,
5. meteorologist can help train and position weather observers, and
6. communications problems are reduced.

You will want to come back and review these advantages later, as you will be required to know them. Also, please take more time to read and study the mobile unit forecast example on page 16.

Before leaving this discussion of the mobile weather unit, please be advised that it can be requested for purposes other than wildfires. Resource managers often have mobile units on site for prescribed burns, aerial spraying projects, or natural disasters such as floods.

A primary use of weather forecasts and data collected on a fire is for fire behavior predictions. The plans section on a fire, or specifically the Fire Behavior Officer, is responsible for performing calculations to predict fire behavior.

When both a meteorologist and a Fire Behavior Officer are on a fire, their responsibilities are as follows: The meteorologist and weather observers work for the Fire Behavior Officer. The Fire Behavior Officer makes fire-line observations and notes fire behavior factors affecting the fire. The meteorologist prepares the most detailed weather forecast possible for the fire area. The Fire Behavior Officer then prepares his fire behavior forecast using all fire behavior and weather information available to him.

So here we have another forecast, called the fire behavior forecast. It is a forecast prepared for each shift by a Fire Behavior Officer to meet the planning needs of the fire overhead organization. It interprets fire calculations, describes expected fire behavior by areas of the fire, and identifies hazards due to fire for ground and aircraft activities.

On page 18 is an example of a fire behavior forecast. It includes a short weather summary followed by considerable detail on expected fire behavior by areas of the fire. It also identifies time periods when certain erratic fire behavior activities are expected and recommends precautions to be taken as a result of these. As you can see, a good fire behavior forecast is a valuable planning tool and places strong emphasis on safety. This forecast is usually distributed to overhead personnel at the beginning of each shift.

On page 19, exercise 3 requires that you compare the various forecasts that have been discussed in this unit. This is a good time to go back to read and study these forecasts. When you have finished the exercise, return to the text.

The last section of this unit is on monitoring the weather on a fire. Turn to page 20. There is much that a firefighter can do to monitor the weather if he has a belt weather kit and has learned a few basic skills. It's important that he know where, when, and how to take observations, either visually or with instruments.

First of all, when? The two most important times are during periods when the weather has stabilized for the extreme; that is, the warmest and driest period and the coldest and wettest period. In inland areas, this is usually about 0600 in the morning and 1700 in the afternoon.

You will want observations more often, however. The frequency might be once every hour, but during periods when you expect changes in the weather, they might be more frequent.

Where should they be taken? The best locations are near the fire in areas representative of fireline conditions, but not inside the burn. Why not inside the burn? Well, the burn area can modify weather elements and would not be representative of those conditions under which the fire will burn.

How many locations? On a small fire, one location might be adequate. On large fires with varied terrain and dangerous topography and/or fuel conditions, take observations at each problem area. Also select locations with good visibility for weather watches to monitor changing weather conditions.

Now do question 5; mark your choice or choices.

In question 5, you should have marked all the choices. These are all good reasons for taking weather observations on a fire.

See item E on the next page. We want to discuss some of the important weather processes that can and should be monitored visually. Please list the following: Thunderstorm buildups, approaching cold fronts, inversion layers, air stability and instability, wind shifts, and cloud cover.

When we have strong concerns that one of these weather processes could change the weather for the worse and create serious control and safety problems, it is usually wise to set up a security weather watch. In a security weather watch, one or more observers are posted at strategic locations in the proximity of the fire to detect and warn fire personnel of pending critical weather changes that might significantly affect the fire.

Figure 12 illustrates a security weather watch. Oftentimes, regular fire lookouts can be used for this purpose, or you may need to locate a person on a good vantage point to observe changing weather processes. Several factors are important here. The weather watch must be able to detect wind shifts or increased winds before they affect the fire and provide adequate warning time to fire personnel. This can mean placing the observer between the fire and the wind source at a considerable distance from the fire. In the case of approaching cold fronts, watchers have been located up to 20 miles to the west of a fire. Then, of course, the watcher must be able to communicate rapidly with fire personnel.

On page 22, see question 6; mark your choice or choices.

In question 6, you should have marked number 3. Valley winds typically change in daytime from downvalley to upvalley and reverse at night, but these are usually slow or gradual changes. However, some of the other processes listed could influence valley winds. The other five processes listed have been responsible for serious fire control and safety problems.

Finally, we wish to discuss the belt weather kit, which is a standard item on many fires. This small, compact unit, which can be strapped to your belt, contains all the weather instruments and miscellaneous items needed to take a basic weather observation. The two primary instruments to accomplish the job are the windspeed meter and the sling psychrometer. Other items are the psychrometric tables for determining relative humidity, a small bottle of distilled water, a pencil, a recording pad, and a compass.

On pages 23 and 24 are instructions on how to use the instruments, observations to be taken, and standards of accuracy for taking the observations. If you have a belt weather kit available to you, we suggest you remove the items from the kit and inspect them carefully. Read through the instructions; then go outdoors and take various observations using the kit. If you have any problems or questions, find someone who is familiar with the belt weather kit. When you have finished, return to the text.

On page 25, see question 7; complete the four items.

Here are the standards for accuracy for the four kinds of observations in question 7: Dry bulb temperature, plus or minus 1 degree; wet bulb temperature, plus or minus 1 degree; windspeed, plus or minus 2 miles per hour; and wind direction, to nearest cardinal point. There are eight cardinal points.

The recording sheet for fire weather observations shown in figure 14 is an item provided in the belt weather kit. How do the observation columns compare with those on the special forecast request form on page 13? The observation sheet is designed to provide the same data. Remember, that it is important to record all observations you take on fires. This can be useful information even after the fire is over.

This concludes the unit on keeping current with the weather. We hope that you will be more observant of weather processes in the field and will use weather data to good advantage on wildfires or prescription fires.

We suggest you go back to the unit objectives on page 2 and prepare for the unit test.