

# Fire's DANGER zone

Fire plumes rise thousands of feet, towering over the landscape, sending firefighters in retreating while unpredictable tornadoes of flame slice through the forest

Graphics and reporting by DERRIK QUENZER/THEOREGONIAN

## WHERE PLUMES DEVELOP

The Florence fire this summer produced at least 25 fire plumes, which swallowed up thousands of acres. Conditions that lead to plume-dominated fires include dense dry fuel on the ground, strong dry winds and heat. When energy produced by the wind-whipped fire exceeds the power of the wind, a convection column – or plume – begins to build. Plume-dominated fires move erratically and can sprint over thousands of acres.



## ANATOMY OF A FIRE PLUME

### ATMOSPHERE

The fire's intense heat builds a towering, mushroom-shaped thunderhead that can rise as high as 35,000 feet and create its own cloud cap.

### WEATHER

A few raindrops, called virga, may actually fall from the fire plume but evaporate before reaching the ground. Lightning may strike. Rain is created when air at the top of the plume cools so rapidly that the water vapor released by the burning forest condenses into droplets.

### CYCLE

Hot, buoyant and expanding air rises higher and higher. Denser and cooler air rushes in to replace it, quickly heating and rising as well. The cycle of a plume's formation and collapse can take three hours. Plume formation typically begins around noon, and three plume cycles is not uncommon on a hot summer afternoon depending on temperature and the fuel available.

### SPIRALING

Plumes spiral, tornado-like, at up to 100 mph at the base, with smaller columns sometimes spinning on the edges.

### FLAMES

Flames from the ground never rise higher than 200 feet inside the plume. The higher flames sometimes seen come from trapped gas, but even those flames never climb higher than 327 feet.

### GASES

Combustion gases within the column ignite trees quickly and toss flaming embers and burning pine cones to be spewed out by the column up to 1/4 mile away.

### MONITORING

When fires become plume-dominated, firefighters fall back to safety zones because the plumes' movements cannot be predicted. Reconnaissance helicopters remain in the air to monitor the blaze. Observers fly the fire's perimeter, tracking the fire's direction and growth.

### MOVEMENT

A plume's base can spread to a mile wide and can tear across 10 miles of forest in an hour, but generally moves from one to three miles in an hour.

## WHEN PLUMES COLLAPSE

1. A plume weakens when fuel is exhausted, the temperature drops or a cloud on top shades the fire ground below.

2. The upward energy diminishes.

3. Cold air falls down the outside of the column.

4. Rapidly-descending downdrafts collapse the column, spitting fire in every direction.

5. Embers are flung from the force of the downdraft up to two miles from the collapsed plume.

