Kansas Wildland Firefighter

Lesson 2 – Fire Behavior Basics

Eight Parts of a Fire

1. Point of origin – the precise location where an ignition source came into contact with combustible material.

2. Head of a fire – the side of the fire with the fastest rate of spread.

3. Flank of a fire – the part of a fires perimeter that is roughly parallel to the main direction of spread.

Eight Parts of a Fire (cont.)

4. Rear of fire – the portion of fire spreading directly into the wind or downhill also called the heel.

5. Fingers of a fire – long narrow extensions of a fire projecting from the main body.

6. Pockets – unburned indentations in the fire edge formed by fingers.

Eight Parts of a Fire (cont.)

7. Island – unburned area inside the fire.

8. Spot fire – fire ignited outside the main body of the fire by a firebrand.

Photo: Kari Greer

Parts of a Fire

- Head of a Fire: (side with the fastest rate of spread)

Photo: NIFC

Parts of a Fire

- Flank of a Fire: (parallel to the main direction of spread)

Photo: NWCG

Parts of a Fire

- Heel of a Fire: (spreading downhill)

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Parts of a Fire

- Fingers of a Fire: (long, narrow extension)

Photo: NWCG

Parts of a Fire

- Spot Fire: (ignited outside the main body)

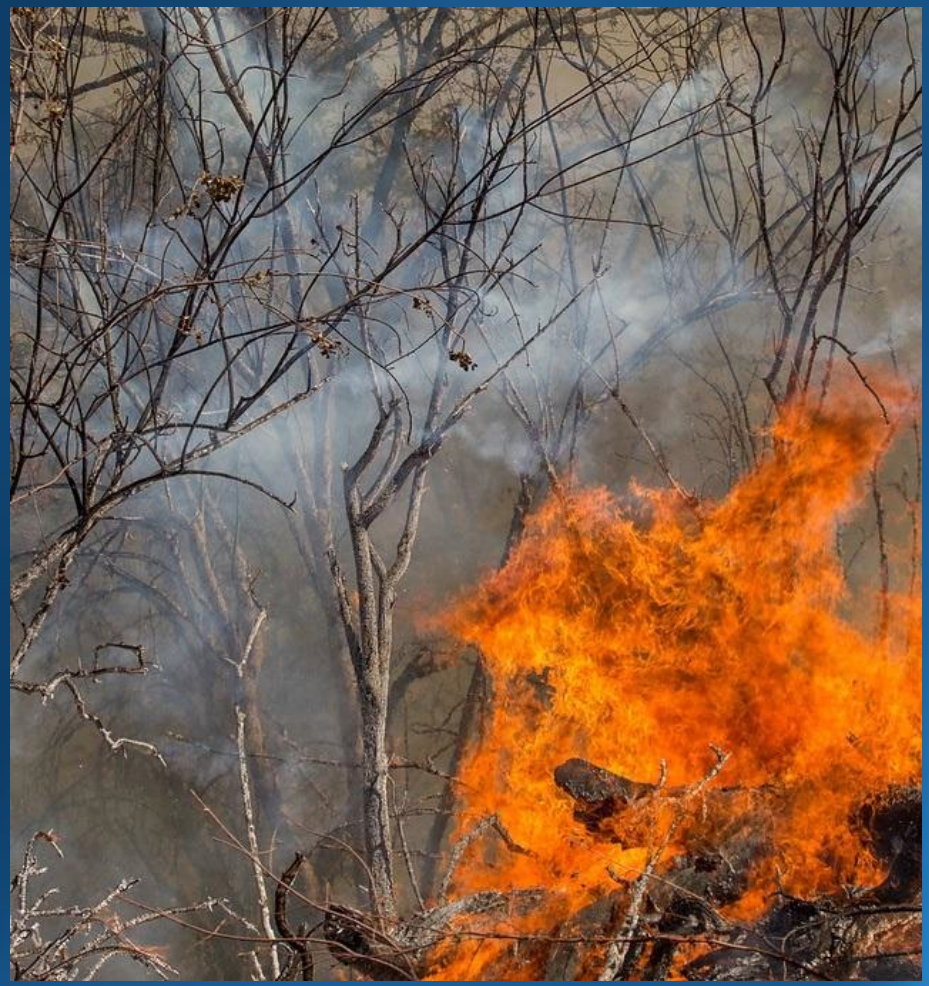


Photo: Kari Greer

Fire Behavior Terms

- Smoldering
  - No flame and barely spreading
- Creeping
  - Low flame and spreading slowly
- Running
  - Spreading rapidly
- Torching
  - Tree foliage burning from the bottom up
- Backing fire
  - Low intensity fire with slow spread rate

Fire Triangle

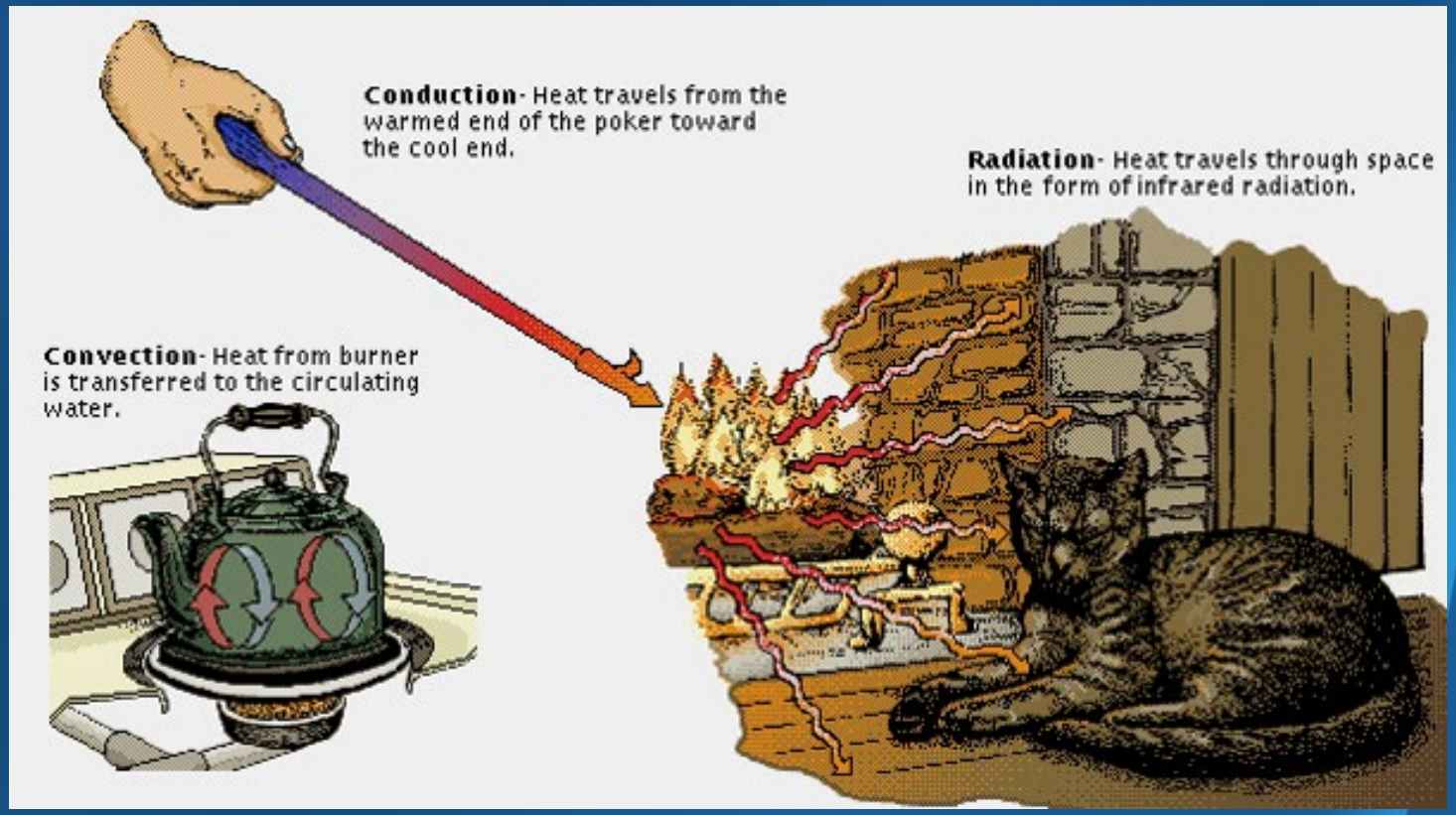
- Three elements necessary for a fire to successfully burn.
  1. Heat to start and continue the combustion process
  2. Fuel to burn
  3. Air to supply oxygen for the flame

Heat Transfer

- Heat can be transferred by three processes:
  1. Radiation (may dry surrounding fuels)
  2. Convection (hot gases and smoke column above the fire)
  3. Conduction (heat conducted from one fuel particle to another)

Heat Transfer

Radiation – Convection – Conduction



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The Fire Environment

1. Fuels
2. Topography
3. Weather

Photo: NIFC

Fuels

1. Grass
2. Shrub
3. Timber Litter
4. Logging Slash

Photos: Kari Greer

Fuels

- Grass field

Photo: NWCG

Fuels

- Timber Slash

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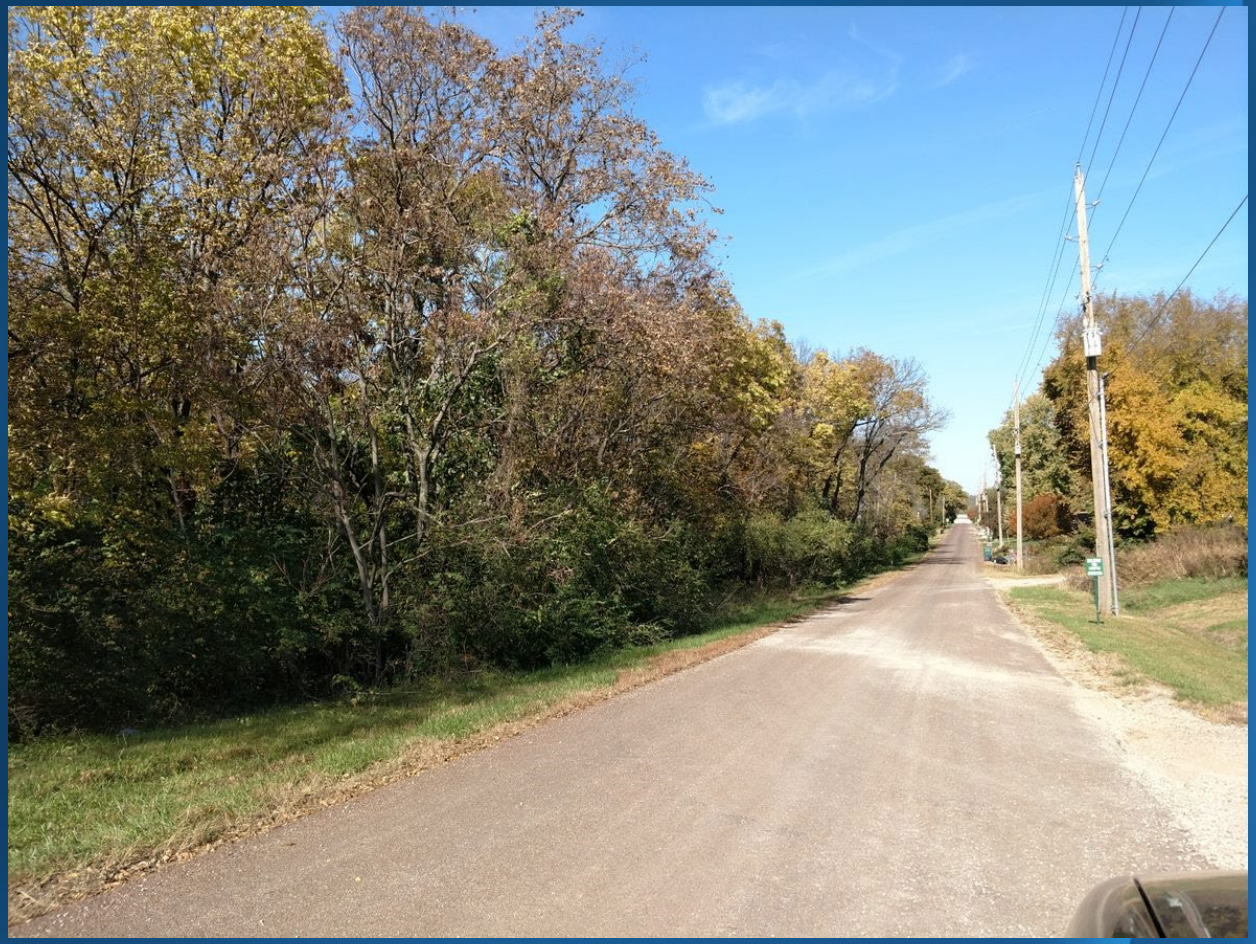
Timber Fuel

- Typical rural Kansas timber fuel near roadway.



Fuel Size and Shape

- Light fuels
  - Diameter less than ½ inch
- Heavy fuels
  - Diameter greater than ½ inch

Photo: NWCG

Fuel Moisture

- Fuel Moisture is the amount of water in a fuel expressed as a percentage.
  - As fuel moisture increases, the amount of heat required for ignition also increases
  - Different fuels in the same area will have various moisture levels.

Fuel Load

- Fuel load is the quantity of fuels in the area.
  - Quantity of fuels available for combustion is most important
  - Temperature required to reach ignition varies by fuel size and shape
  - Horizontal Continuity is how fuel is arranged in a horizontal direction.

Fuel Arrangement

- Horizontal and vertical arrangements of fuel loads is a consideration.
  - Horizontal Continuity is how fuel is arranged in a horizontal direction.
  - Vertical Arrangement refers to the way fuels are arranged or spaced upward.

Fuel Examples

- Aerial fuels:
  - Includes tree branches, tree crowns, vines, and tall shrubs

Photo: Kari Greer

Fuel Examples

- Surface fuels:
  - Includes needles, leaves, duff, grass, small dead wood, down logs, stumps, large limbs and low shrubs
- Ground fuels:
  - Includes deep duff, tree roots, rotten buried logs and other organic material.

Topography

- Topography is the shape of the surface of the earth and position of its natural and manmade features.
- Convection and radiant heat are a consideration.

Topography

- Slope is the amount or degree of incline
  - The steeper the slope, the faster the fire burns uphill
  - Possibility of burning material rolling downhill

Photo:
Kari Greer

Slope with Timber Fuel

- Typical Kansas slope with timber fuel

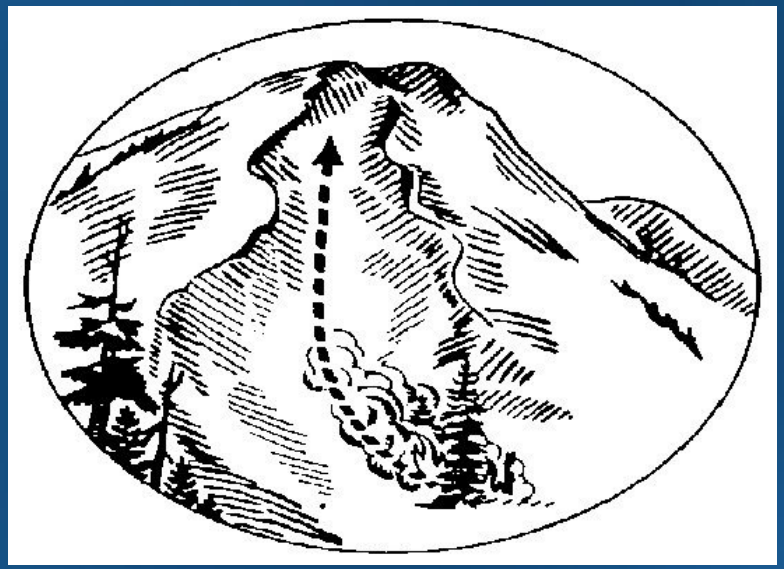
Topography Considerations

- Aspect
  - The direction a slope is facing in relation to the sun

Photo: NWCG

Topography Considerations

- Shape of the Country
  - Will influence the wind's speed and direction. Examples: Box canyons, Narrow canyons and Saddle landforms



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Topography Considerations

- Barriers
  - Any obstructions to the spread of fire, typically an area or strip lacking any flammable fuel.
  - Can be natural or man-made.

Natural Barrier Example

- River Barrier

Photo: NIFC

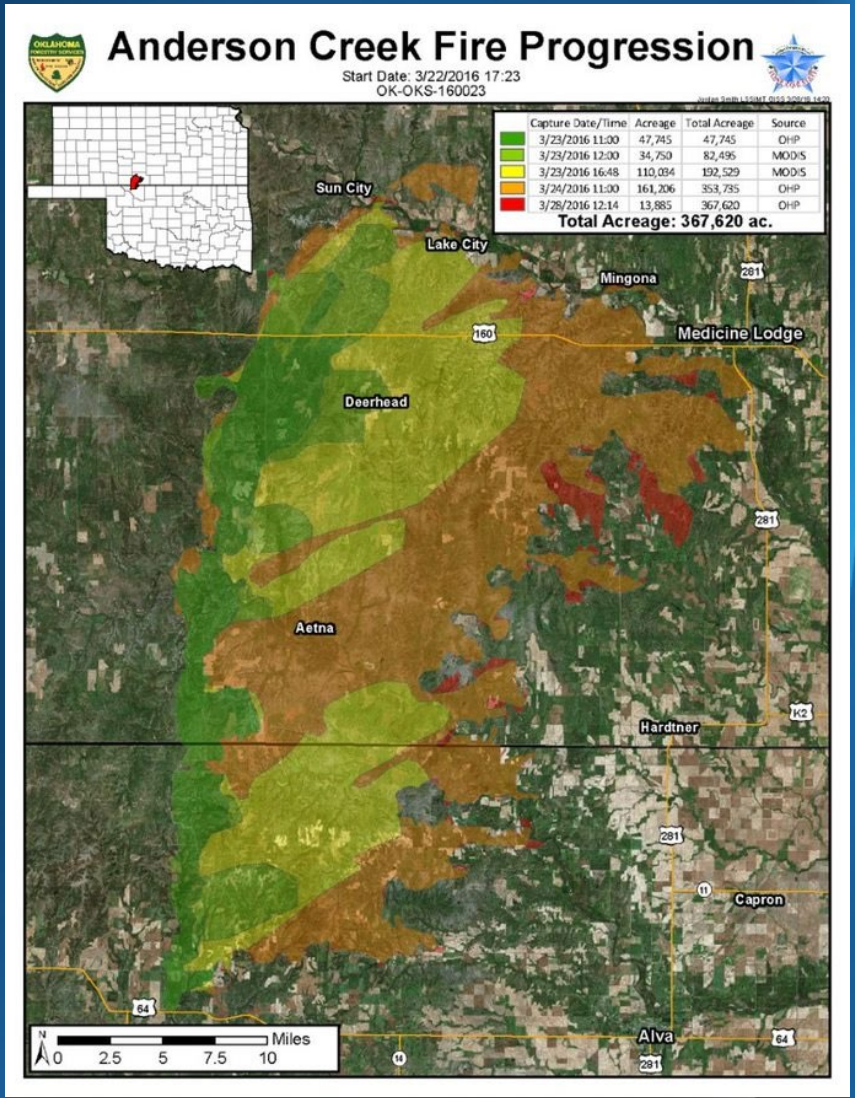
Man-Made Barrier Examples

- Roads, Interstate highway landscape, agricultural fields.

Photos: NWCG

Fire Progression Example

- Anderson Creek, Oklahoma fire – March, 2016:
- Day 1: Dark Green, Light Green
- Day 2: Brown
- Day 3: Red



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Weather

- Considered a key part of the fire environ-ment

Photo: NIFC

Weather

- Weather is one of three components of the fire environment
- Basic principles and concepts relating to wildland fire behavior include:
  - Temperature (higher air temperatures drive off moisture making them easier to ignite)
  - Relative Humidity (amount of moisture in the air divided by the amount the air could hold)

Weather

- Weather is one of three components of the fire environment
- Basic principles and concepts relating to wildland fire behavior include (cont.):
  - When temperature increases, the relative humidity decreases
  - When temperature decreases, the relative humidity increases
- Constantly changing and difficult to predict.

Weather and Wind

- Can be the most important factor influencing a wildland fire.
  - Increases the supply of oxygen to the fire
  - Determines the direction of fire spread
  - Increases drying of available fuels
  - Dries and preheats fuels ahead of the fire

Weather Fronts

- Cold fronts
  - Boundary line between a cooler air mass which is replacing a warmer air mass

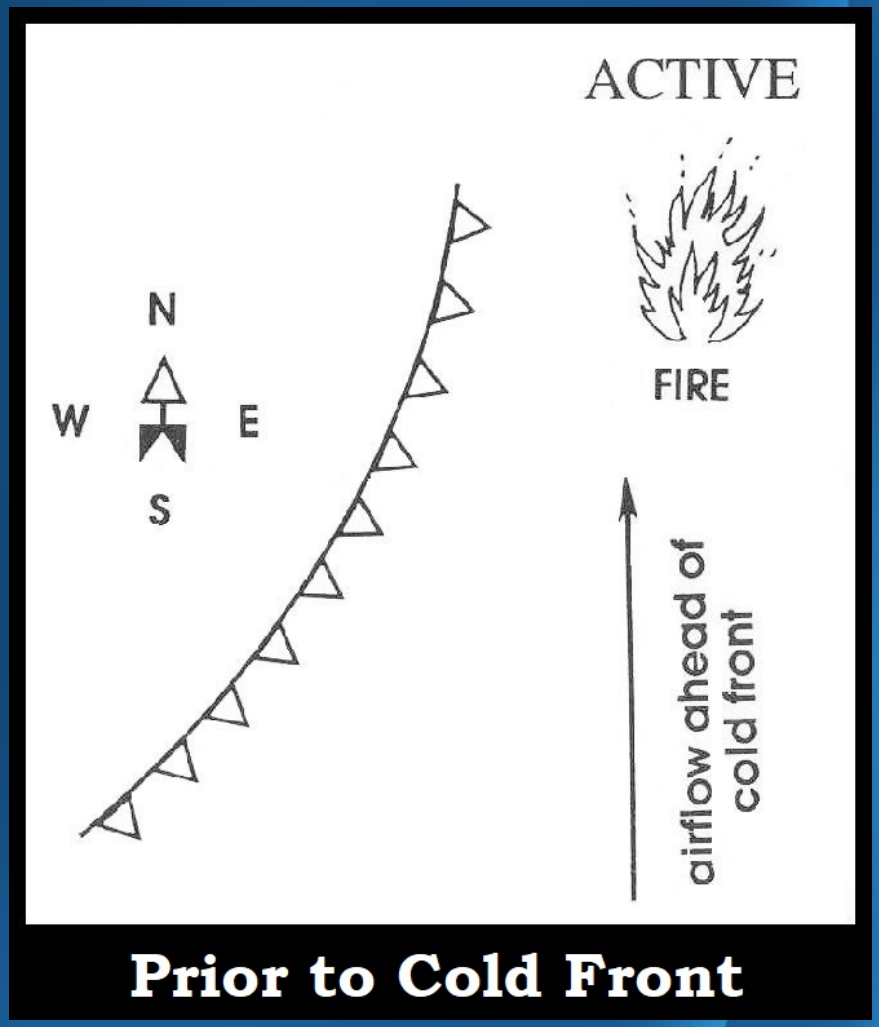
Photo: NIFC

Weather Fronts

- Cold fronts
  - Look for a line of cumulus clouds approaching from the west or northwest
  - A large dust cloud can precede the arrival of a cold front

Weather Fronts

- Cold fronts (cont.)
  - Look for a shift in winds from the south or southeast, to the southwest with an increase in velocity



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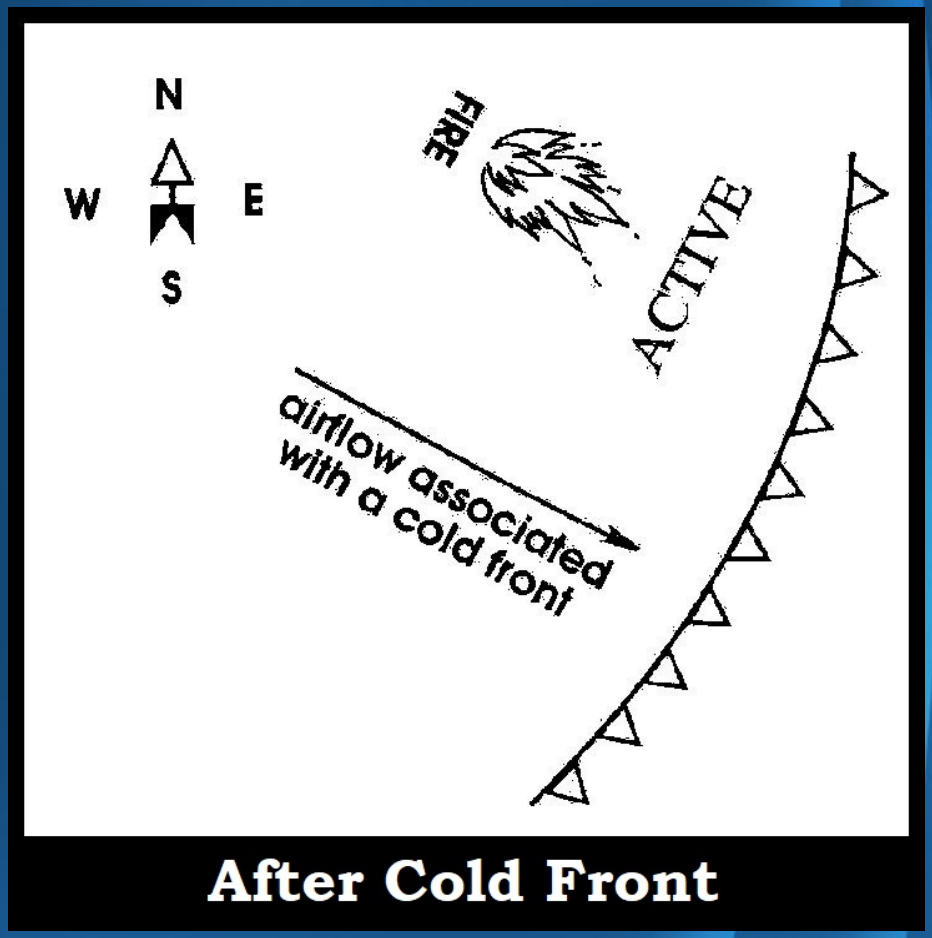
Weather Fronts

- Cold fronts (cont.)
  - Winds are strong, erratic and gusty as the front reaches your location
  - Winds will shift in a clockwise direction
  - Winds will continue to shift as the front passes



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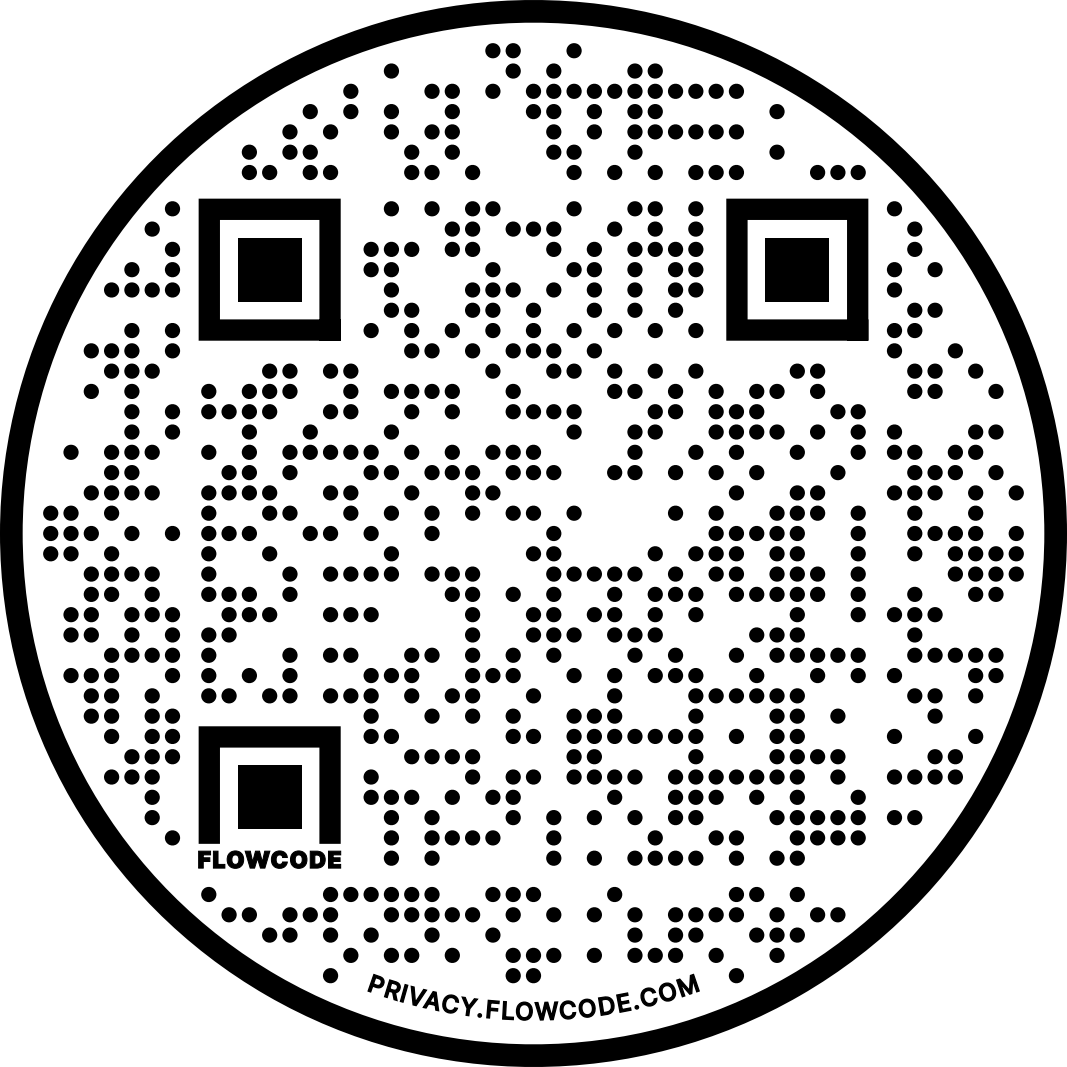
Weather Fronts

- Thunderstorms
  - Produced by cumulonimbus clouds
  - Accompanied by thunder and lighting
  - Usually associated with a cold front
  - Strong wind gusts and heavy rain
  - Usually short in duration
  - Look for tall, building cumulus clouds
  - Look for clouds with a cauliflower appearance and/or a dark flat base

Questions?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