Elements of the National Weather Service Fire Weather Forecast

By Casey Sullivan, National Weather Service, Chicago

Today's Presentation Begins at 12 pm CST, 1 pm EST

Please Take Our One Question Survey

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Casey Sullivan

Meteorologist/Forecaster

National Weather Service

Chicago/Romeoville

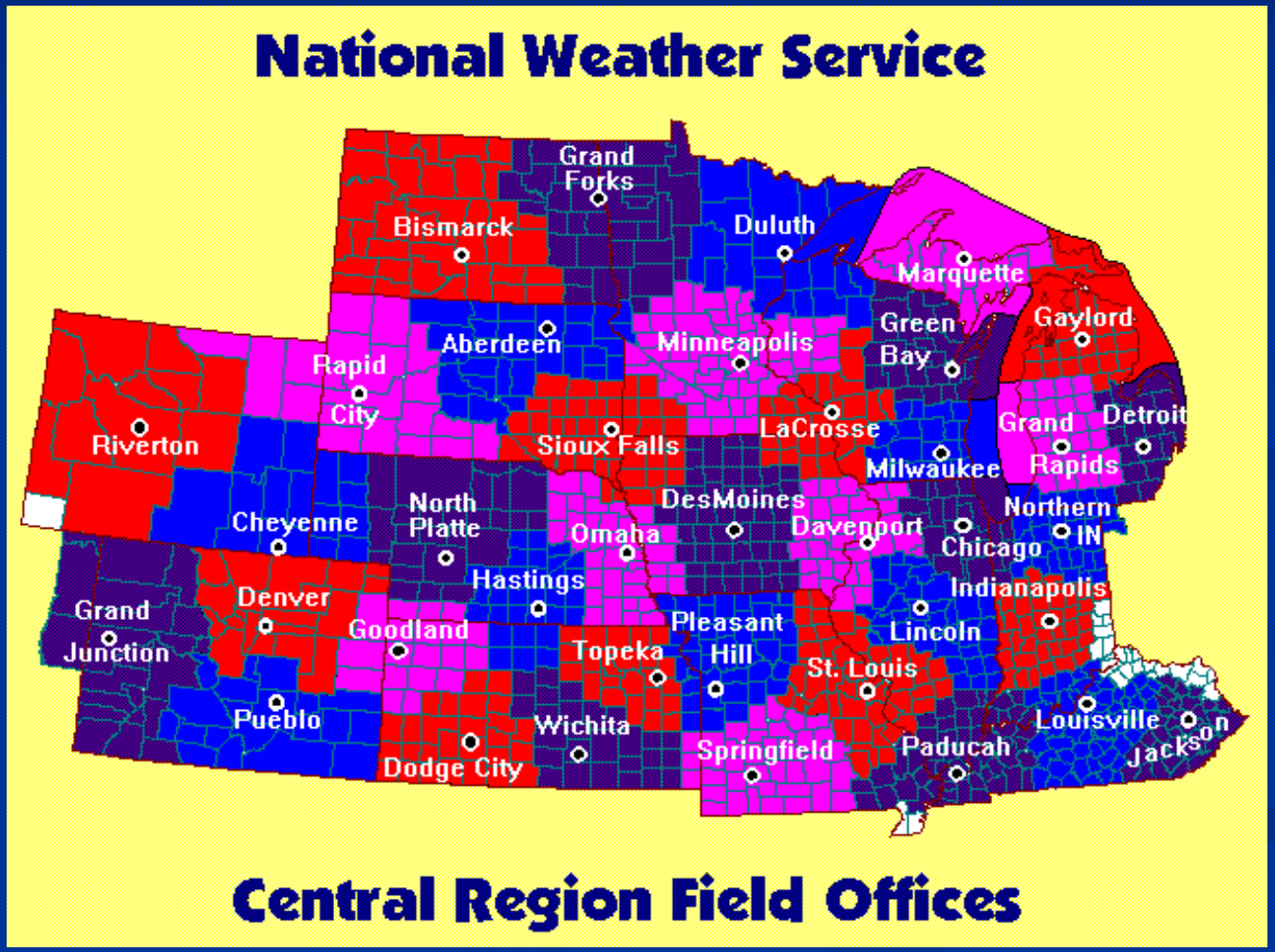
National Weather Service

- Federal Agency
  - NOAA (National Oceanic & Atmospheric Administration)
  - DOC (Department of Commerce)
- Mission, protection of life and property
- 122 offices staffed 24/7/365
- Approximately 25 staff per office
  - 10 forecasters work rotating shifts

National Weather Service

- County Warning Area (CWA)
  - All forecasts, watches, warnings, advisories
  - River forecasts
  - Aviation
  - Marine
  - Fire Weather
  - NOAA All Hazards Weather Radio

www.weather.gov/*city*



NWS Fire Weather Program

- Fire Weather Program Manager at each office
  - Liaison between their fire/land managers/agencies and their offices
  - Coordinates changes, provides information and training and is the point of contact
  - Additional training, experience and education
  - Conducts outreach & training at meetings, symposiums or webinars

NWS Fire Weather Program

- Incident Meteorologist (IMET)
  - Trained and certified to provide on-site weather support during wildfires
  - Dispatched to the wildfire command center
  - Often, but not always, the fire weather program manager
  - Scattered across the country, but most western NWS offices have at least one IMET

NWS Fire Weather Program

- **Important to build a relationship/partnership with your local NWS office and fire weather program manager**
- Invite NWS forecasters to attend prescribed burns
- Invite fire weather program managers to present at or attend meetings & symposiums
- Ask for a tour of your local NWS office
- Sit down with the forecasters and learn about the forecast process

NWS Fire Weather Forecasts

- Vary by Office
  - Time of year
  - Detailed out to 36 or 48 hours
  - Available parameters
  - Units (knots or mph?)
  - Ventilation scale/ranges
  - Red flag criteria

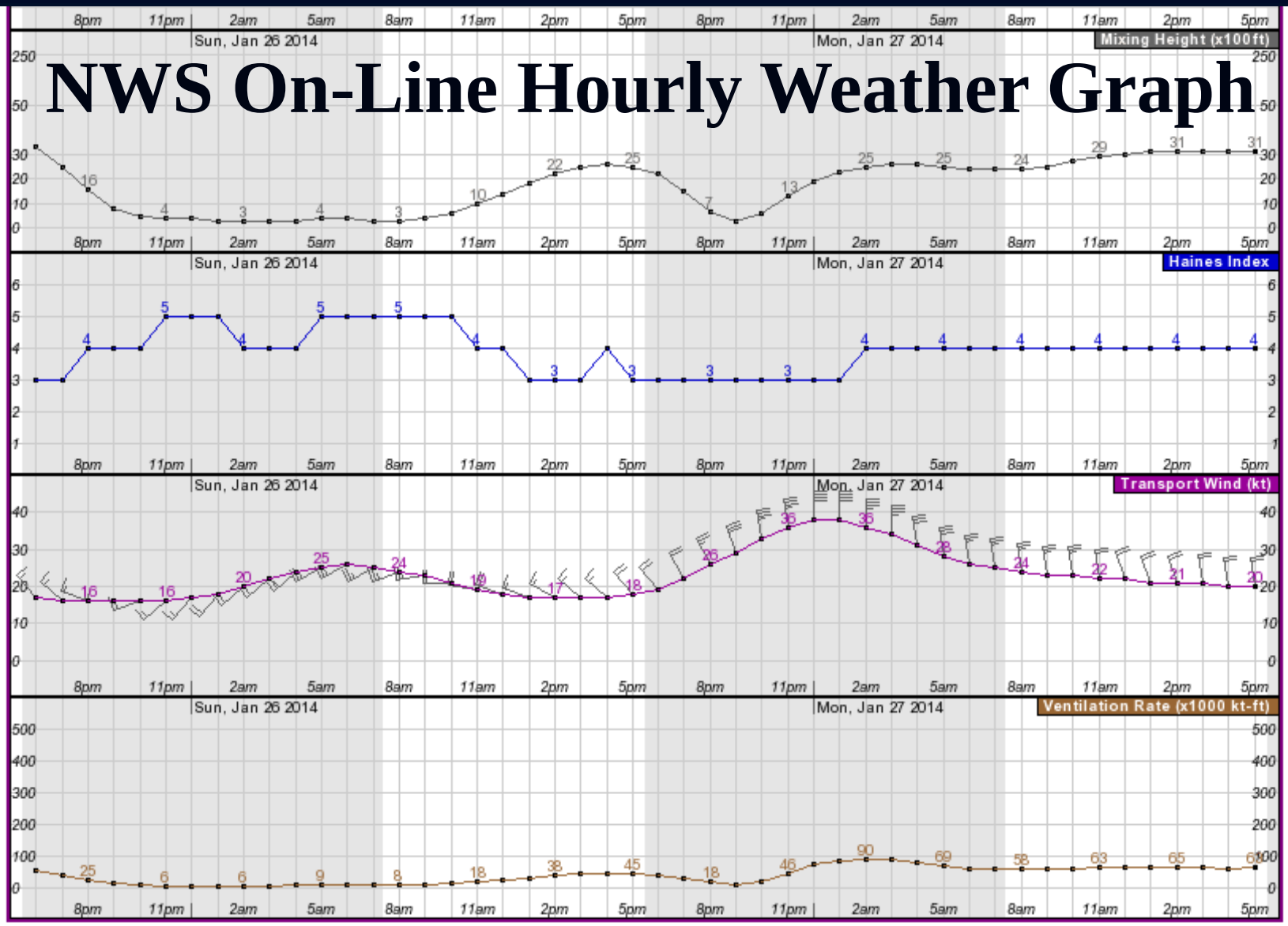
NWS Fire Weather Forecasts

- Routine Daily Forecasts
  - Usually issued twice a day in the early morning and mid/late afternoon
  - County based
  - Data is *averaged* over the entire county and over a 12 hour period
  - Contains a discussion at the top
  - Based off of data available in the hourly weather graphs

NWS Fire Weather Forecasts

- Hourly Weather Graphs
  - Routine fire weather forecast is based off this data
  - Provides hourly graphs out 36 to 48 hours for specific fire weather parameters (7 days for others)
  - Grid points are 2.5 km by 2.5 km
  - Much more detailed forecast
  - **Use hourly weather graphs for specific trend through the day!**

NWS On-Line Hourly Weather Graph



Sunday, January 26 at 3pm

Temperature: 54 °F Dewpoint: 30 °F Wind Chill: N/A Surface Wind: W 11mph
Sky Cover: 28% Precipitation Potential: 0% Relative Humidity: 40%
Thunder: <10% Rain: <10% Snow: <10% Freezing Rain: <10% Sleet: <10%
Mixing Height: 2500ft Haines Index: 3 Ventilation Rate: 43000kt-ft
Transport Wind: NW 17kt

NWS Fire Weather Forecasts

- Fire Weather Watch/Red Flag Warning
  - Issued when a combination of dry fuels and weather conditions create extreme fire danger and/or fire behavior
  - Watches issued 18 to 96 hours
  - Warnings issued up to 48 hours
- NWS forecasters need your input/feedback!
- **IMPORTANT: Criteria differ by NWS office/local user needs**

NWS Fire Weather Forecasts

- NWS Chicago/Romeoville Criteria
  - Sustained 20 foot winds of 20 mph or higher
  - Afternoon relative humidity less than 25%
  - 10 hour fuel moisture at 8% or less for one day

NWS Fire Weather Forecasts

- Spot Forecasts
  - Site Specific
  - User Requested
  - On-line
  - Prescribed Fire/Wildfire/Hazmat/SAR
  - For all federal agencies/whenever federal agencies are involved or when public safety is involved

Fire Weather Elements

- Surface Winds
- Mixing Heights
- Transport Winds
- Ventilation Rate/Dispersion
- Haines Index
- NWS Forecasts

Surface Winds

- Several different heights
  - Mid Flame
  - Eye Level
  - 20 Foot
  - 10 Meter (~33 feet)

Surface Winds

- In meteorology, the surface wind is defined as a 10 meter wind
- If the forecast(s) doesn't specifically state the forecast height, assume the forecast is for 10 meters
- NWS forecasts are for 10 meters, except when *specified* for 20 foot in fire weather forecasts

Surface Winds

- NWS Chicago/Romeoville uses a standard 20% reduction or “rule of thumb”
  - 10 meter wind is 10 mph, 20 foot wind is 8 mph
  - Strong cold air advection could be less, 15%
  - Strong warm air advection, could be more, 25%

Mixing Heights

- The height to which smoke will rise before spreading out (inversion = mixing height)
- Layer of stable air where temperatures warm with increasing height
- Acts as a lid, severely limiting amount of vertical motion

Mixing Heights

- Expressed in FT AGL (feet above ground level)
- Peaks in early/mid afternoon
- Typically will be very low at night, usually less than 1000 ft, sometimes at the surface, due to surface cooling
- 1700 Feet
  - Minimum height most users want before burning
  - Depends on location, size, fuel type, etc., of burn site

Mixing Heights

- Generally, an easy parameter to forecast, in terms of data availability
  - Multiple computer forecast models
  - Multiple forecasts levels & heights
  - Hourly forecast data available from some models
- Forecast accuracy dependent on many factors
  - Cloud cover and temperatures

Transport Winds

- ***Average*** wind speed and ***average*** direction in the mixed layer
- The mixed layer is the surface to the mixing height
  - Depth changes as mixing height changes
- Example, the mixing height is 2000 feet, and the transport winds are South at 15 mph. This means that the ***average*** wind speed between the surface and 2,000 feet is 15 mph FROM the south

Ventilation Rate/Dispersion

- Multiplication of the ***mixing height*** in feet and the ***transport winds*** in knots
  - Units differ based on user needs
- The larger the number, usually the better the ventilation
  - Strong surface winds can prevent smoke column from rising sufficiently above surrounding areas

Ventilation Rate/Dispersion

- IMPORTANT, descriptors are determined by the users! Forecasters only provide/create the numbers. Range/descriptors below used by Chicago area fire/land managers
  - Poor, < 40,000 knot feet
  - Fair, 40,000 to 60,000 knot feet
  - Good, 60,000 to 100,000 knot feet
  - Very Good, 100,000 to 150,000 knot feet
  - Excellent, > 150,000 knot feet

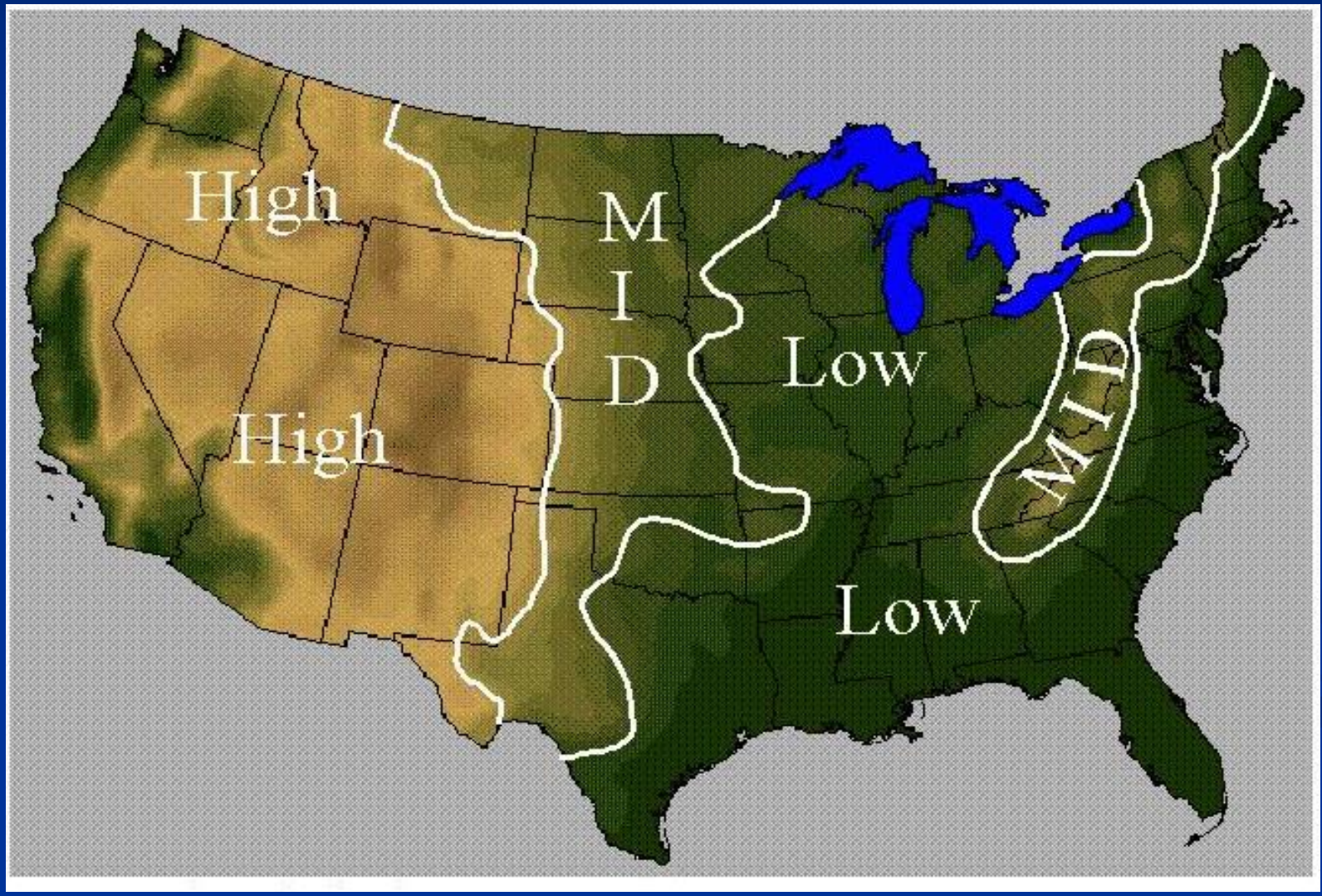
Ventilation Rate/Dispersion

- NWS text (FWF) forecasts typically display highest number or “Vent Rate Max” for a 12 hour period
- Important to remember this “Max” may only last a few hours (when mixing heights are at their peak in the afternoon)
- **Use hourly weather graphs for specific ventilation trends through the day!**

Haines Index

- Numerical value (2 to 6) used to describe atmospheric stability
  - High values (5 & 6), dry & unstable air
  - Low values (2 & 3), moist & stable air
- Uses temperatures and dewpoints at specific pressure surfaces aloft (lower atmosphere)
- Good indicator of extreme fire behavior for large fires/wildfires

Haines Index-3 Elevations



Haines Index

- Does not include any wind data
- Solely based on forecast information, similar to mixing heights/transport winds, difficult to verify/observe
- Changes primarily based on computer forecast model changes

Thank you

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Thank you!

Please take our one question concluding survey here:

Next Webinar:

March 27, 2014 at 2:00 PM Eastern (1:00 PM Central)

Characterizing Wildlife Communities of Fire-Dependent Ecosystems of the Northern Lake States and Exchanging Research, Inventory, and Monitoring Knowledge and Ideas

R. Gregory Corace, III (US Fish and Wildlife Service-Seney National Wildlife Refuge)

with

Lindsey M. Shartell (MN Department of Natural Resources)

Dawn S. Marsh (US Fish and Wildlife Service-Seney National Wildlife Refuge)

Thank you!

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