The Probabilistic Winter Storm Severity Index (WSSI-P) Users Guide

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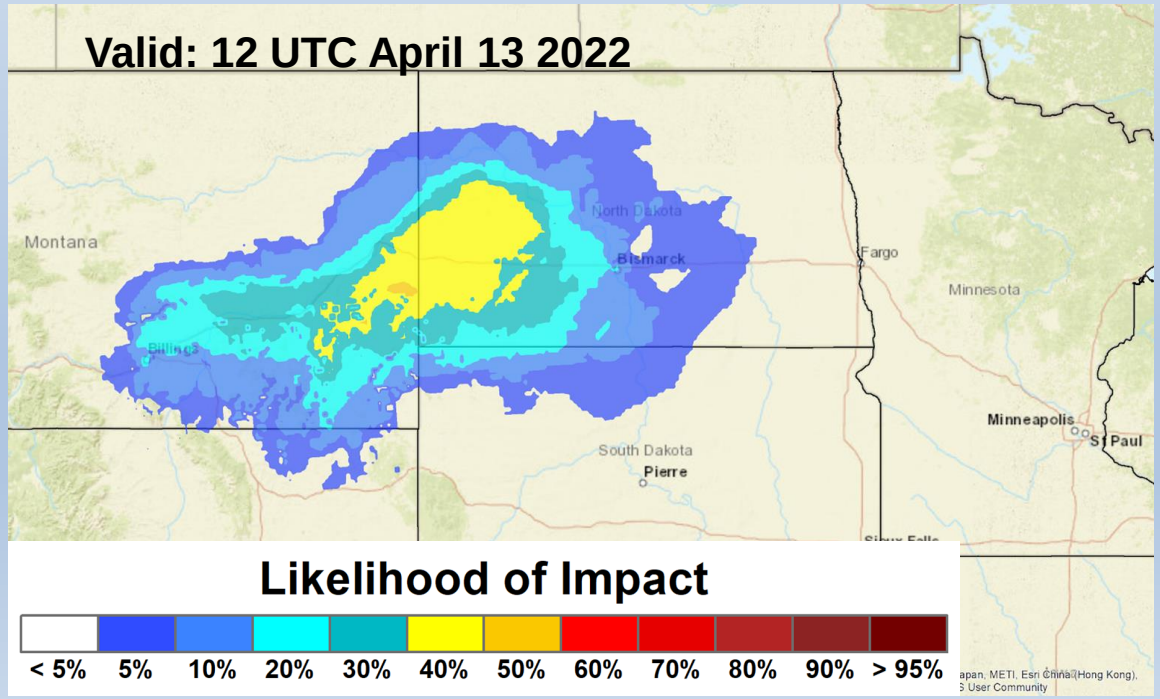
What The Probabilistic Winter Storm Severity/Impact Index Is

The Probabilistic Winter Storm Severity Index (WSSI-P) is a numerical weather prediction ensemble driven tool designed to help maintain situational awareness and to help communicate a general level of potential societal impacts and their spatial distribution for winter weather.



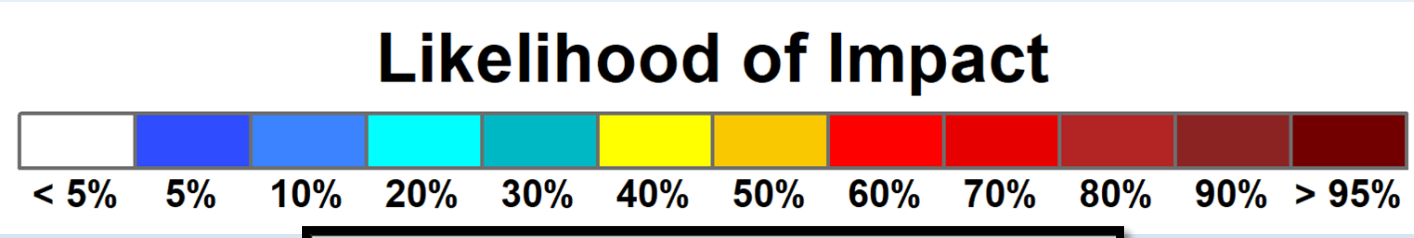
What The Probabilistic Winter Storm Severity/Impact Index Is NOT

- It is **NOT** a specific forecast for specific impacts.
  - For example, a depiction of “moderate” severity does not mean schools will need to close.
- It is **NOT** meant to be the sole source of information about a Winter Storm. It should always be used in context with other NWS forecast and warning information.
- The WSSI-P does **NOT** account for conditions that have occurred prior to the time the product was issued. It only uses forecast information. Therefore during an ongoing winter weather situation, the WSSI-P may not be representative of the entire event.

Motivation – To Better Depict Aspects of Winter Storms

- Current NWS Procedures:
  - Winter weather Watches/Warnings/Advisories are raised based primarily on “yes/no” thresholds of accumulation and generally at the level of individual counties.
- Reality of Winter Weather:
  - Severity/impacts from winter weather are due to more than just amounts (one 5” snowstorm is not like the next 5” snowstorm) Great variation in weather conditions frequently occur with individual counties.

WSSI-P Impact Scale



Potential Winter Storm Impacts	
	Minor Impacts **Expect a few inconveniences to daily life.** • Winter driving conditions. **Use caution while driving.**
	Moderate Impacts **Expect disruptions to daily life.** • Hazardous driving conditions. **Use extra caution while driving.** • Closures and disruptions to infrastructure may occur.
	Major Impacts **Expect considerable disruptions to daily life.** • Dangerous or impossible driving conditions. **Avoid travel if possible.** • Widespread closures and disruptions to infrastructure may occur.
	Extreme Impacts **Expect substantial disruptions to daily life.** • Extremely dangerous or impossible driving conditions. **Travel is not advised.** • Extensive and widespread closures and disruptions to infrastructure may occur. • Life-saving actions may be needed.

WSSI-P Components

Overall Winter Storm Impacts

PURPOSE: This component is designed to highlight the maximum impact from any of the WSSI-P components. It's meant to quickly convey where, and how intense, the greatest threat from the storm is.

Snow Rate Index

PURPOSE: This component is designed to highlight areas in which impacts, especially transportation, could become overwhelmed due to the rate snow is accumulating.

Snow Amount Index

PURPOSE: This component is designed to highlight areas in which impacts, could become overwhelmed due to the total amount of snow.

Prior to making calculations based upon the amount of snow, climatology based factors are determined. Climatology is an important aspect to the level of impacts a winter storm brings. Those areas of the country less accustomed to snowfall will be less prepared to deal with snow, resulting in higher level of impacts compared to the same amount of snow in a snowier part of the country. For example 6 inches over snow would result in moderate impacts across Kansas City, MO but would result in Major impacts for Atlanta, GA.

WSSI-P Components

Blowing Snow Index

***PURPOSE*:** This component highlights areas where blowing/drifting snow is expected to occur and result in transportation related problems. In general, the blowing snow significantly increases as the SLR and winds both increase. Prior blowing snow research indicates that in general it takes just under 20 mph of wind to start to move snow around.

Ice Accumulation Index

***PURPOSE*:** This component was developed to account for the combined effects of ice accumulation and wind which can produce widespread tree damage, transportation shutdowns and utility problems.

Snow Load Index

PURPOSE: This component is to highlight areas where the weight of the snow could result in damage to trees and powerlines. In general, the lower the snow-liquid ratio (SLR) is and the greater the total snow accumulation, the higher the index.

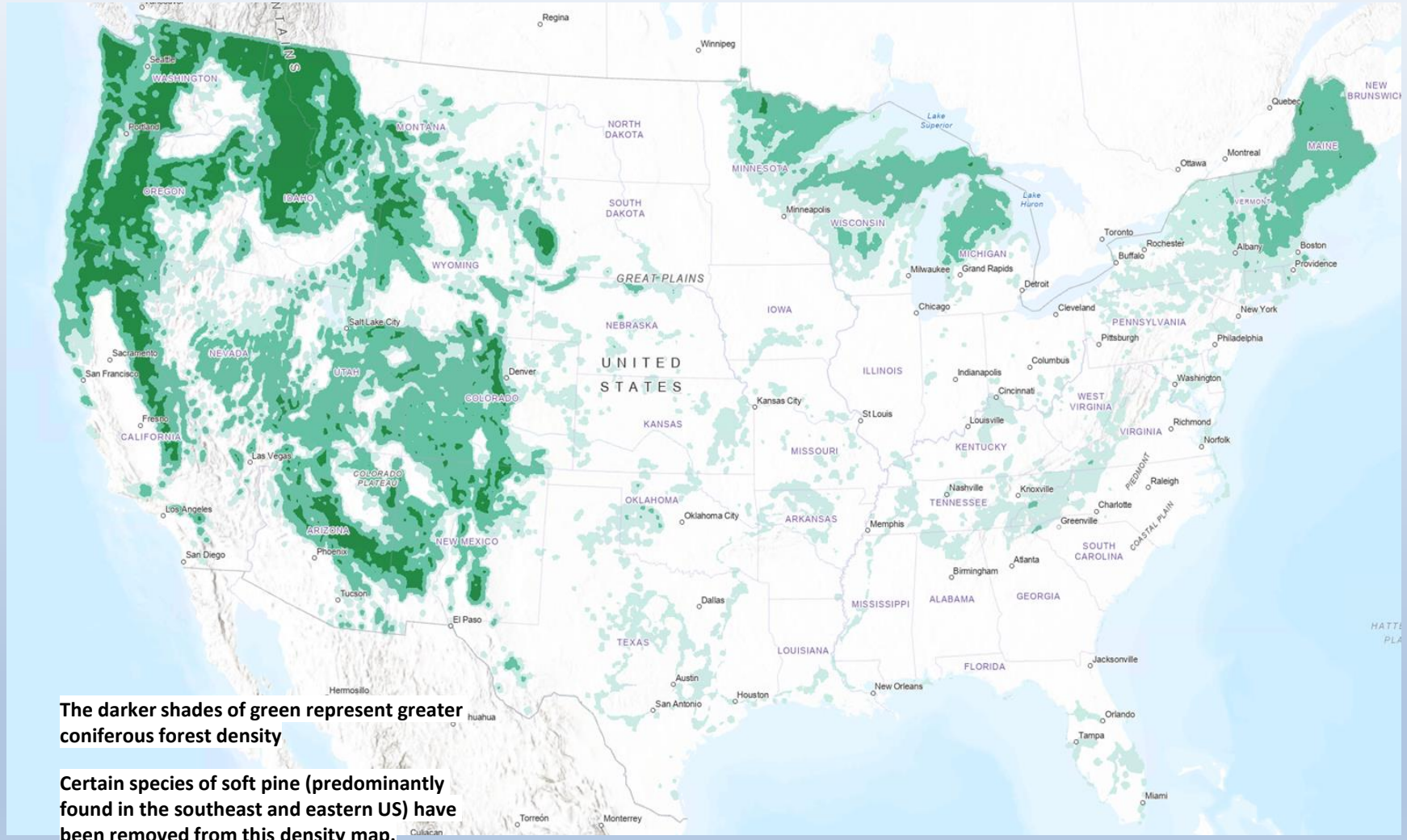
NWS has implemented the WSSI to provide the public with a tool that attempts to convey the complexities and hazards associated with winter storms as they relate to potential societal impacts. NWS acknowledges contributions to the field of ice impact forecast graphics made by Sidney Sperry (Oklahoma Association of Electric Cooperatives) and Steven Piltz (NWS) in the development of the "Sperry-Piltz Ice Accumulation Index" or SPIA® Index.

Using Non-Meteorological with Meteorological Data

The WSSI-P uses non-meteorological data along with meteorological data to help forecast impacts

- Urban areas
  - Used in the Ice Accumulation Index and Snow Amount Index
  - They give a 25% increase to impact
  - Defined from US Census Bureau
- Land Use / Coverage
  - Decreases impacts for areas with greater obstructions to wind (e.g. forests, high density commercial/residential areas) compared to areas without obstructions (e.g. cropland, grassland)
  - Used in the Blowing Snow Index
- Forest Density
  - Density reclassified into weighting factors that reduce impacts of snow load
  - Used in the Snow Load Index
- American Society of Civil Engineers (ASCE) snow and ice load data
  - Normalized data used in Snow load and Ice accumulation components
- Enhanced Vegetation Index (satellite data)
  - Used to determine where dense vegetation is for snow load component
  - Where values indicate dense leafy vegetation the snow load algorithm impacts are adjusted upwards for leaves

Coniferous Forest Density

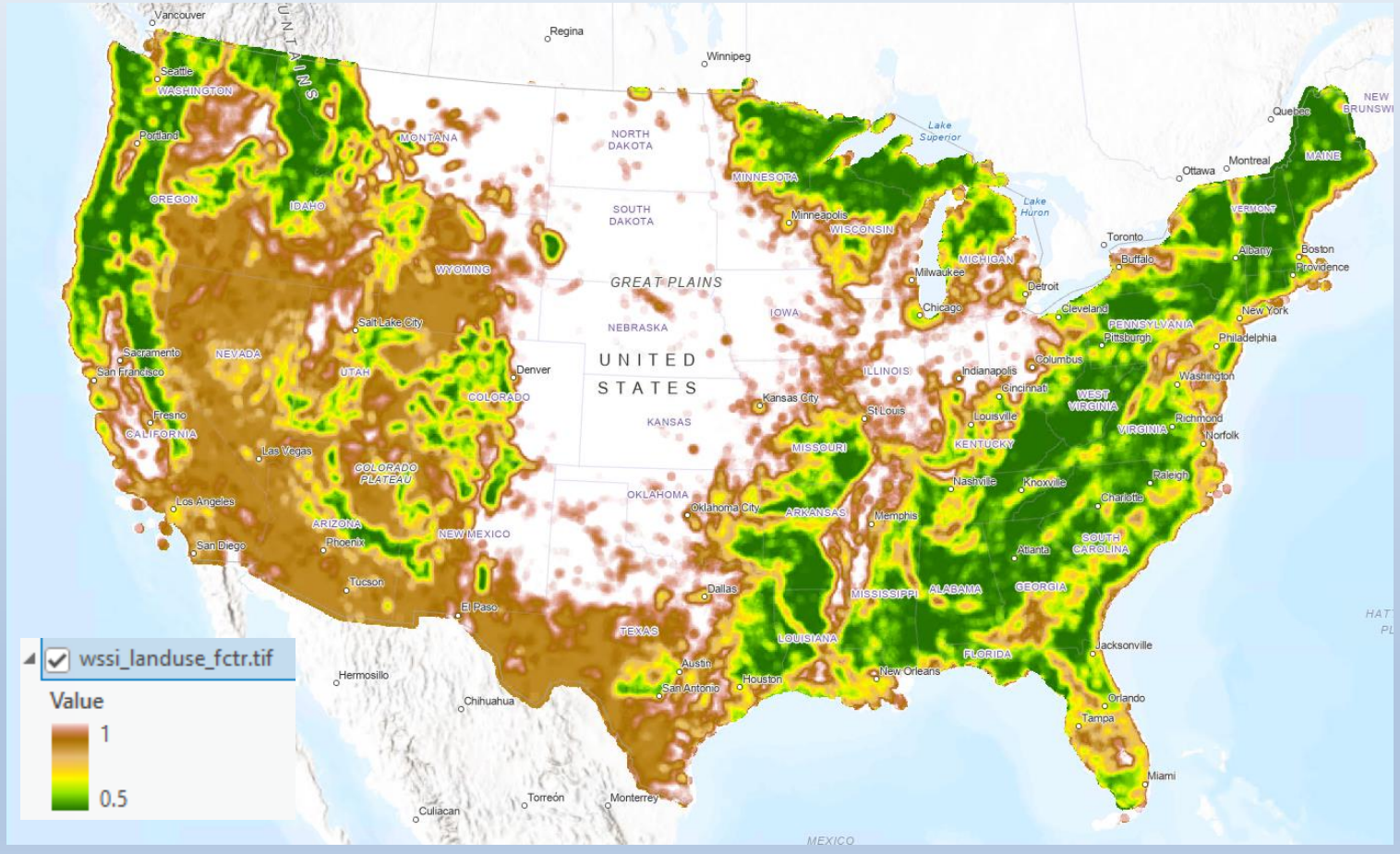


The darker shades of green represent greater coniferous forest density

Certain species of soft pine (predominantly found in the southeast and eastern US) have been removed from this density map.

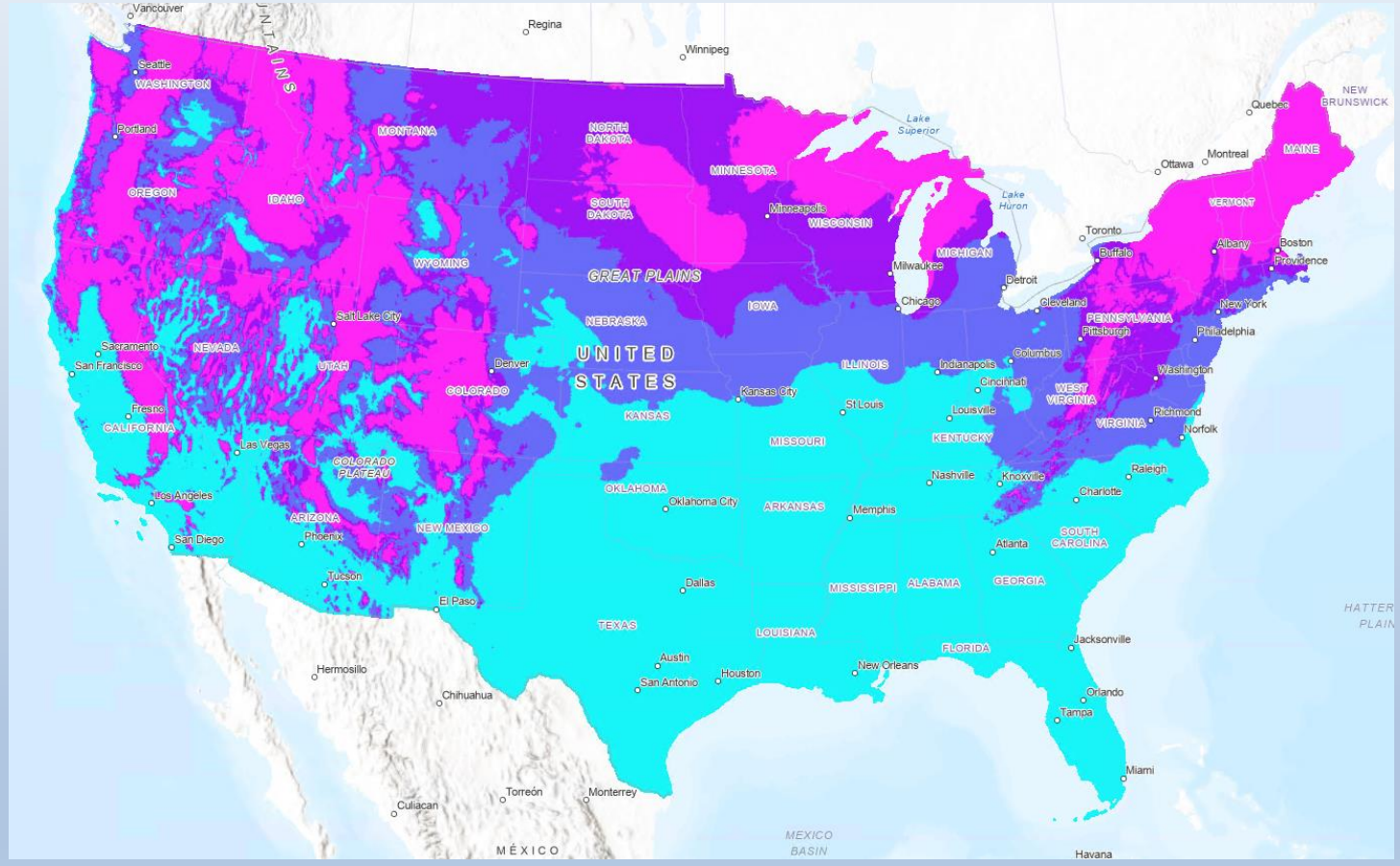
This density represents groups of trees. This does not, for example, represent individual trees planted in someone's yard

New Land Use Factor



Values near 1 indicate no reduction from Land Use. Dark green is a 50% reduction. This is applied to the Blowing Snow and Ground Blizzard components

ASCE Snow Load Factoring

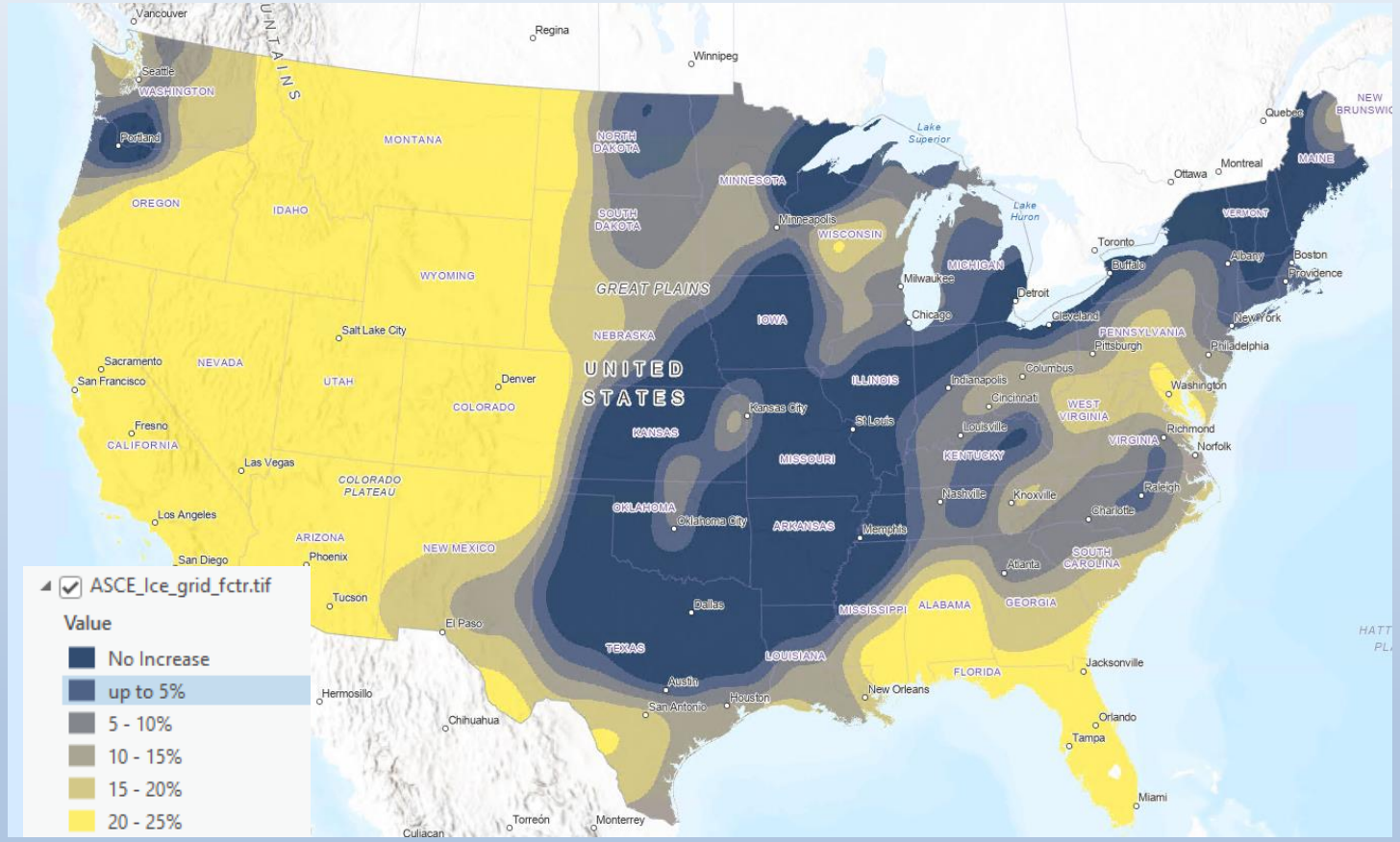


Based on 50-year Mean Recurrence Intervals of Snow Load Data

Pink = More resilient (higher thresholds)

Light Blue = Less resilient (lower thresholds

ASCE Ice Amount Factoring



Based on 250-year Mean Recurrence Intervals of Ice Accumulation Data

Blue = No adjustment to ice amount

Yellow = Artificially increase ice amount (to increase impacts)

WSSI-P Element Generation

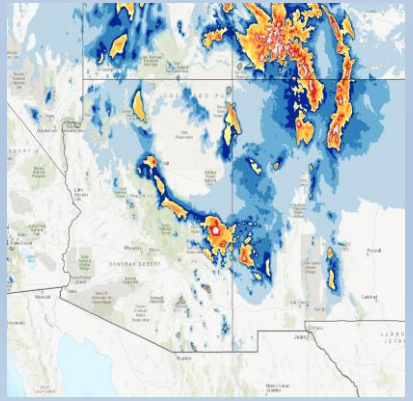
The WSSI-P uses meteorological data along with non-meteorological data to calculate forecast impacts

Model Data → WSSI Algorithms → WSSI Output

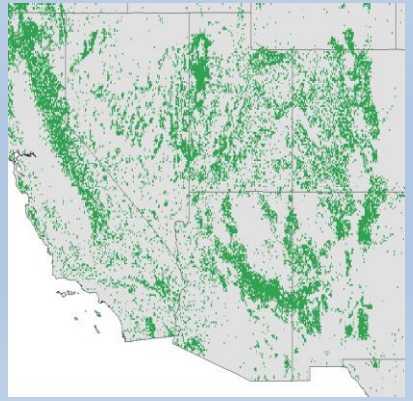
6h QPF/Snow/Ice
6h Wind Gust
6h Temperature

Forest Classification for snow load
(Evergreen or deciduous)
Land use mask for blowing snow and blizzard
Urban mask for snow/ice amount impact

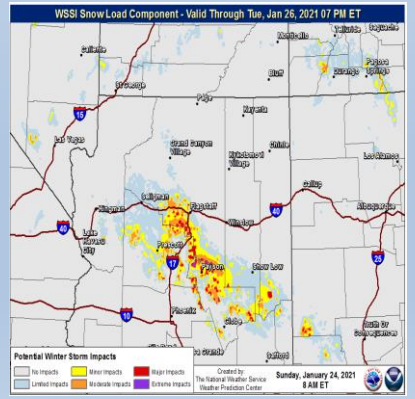
Model Snow and QPF Forecast



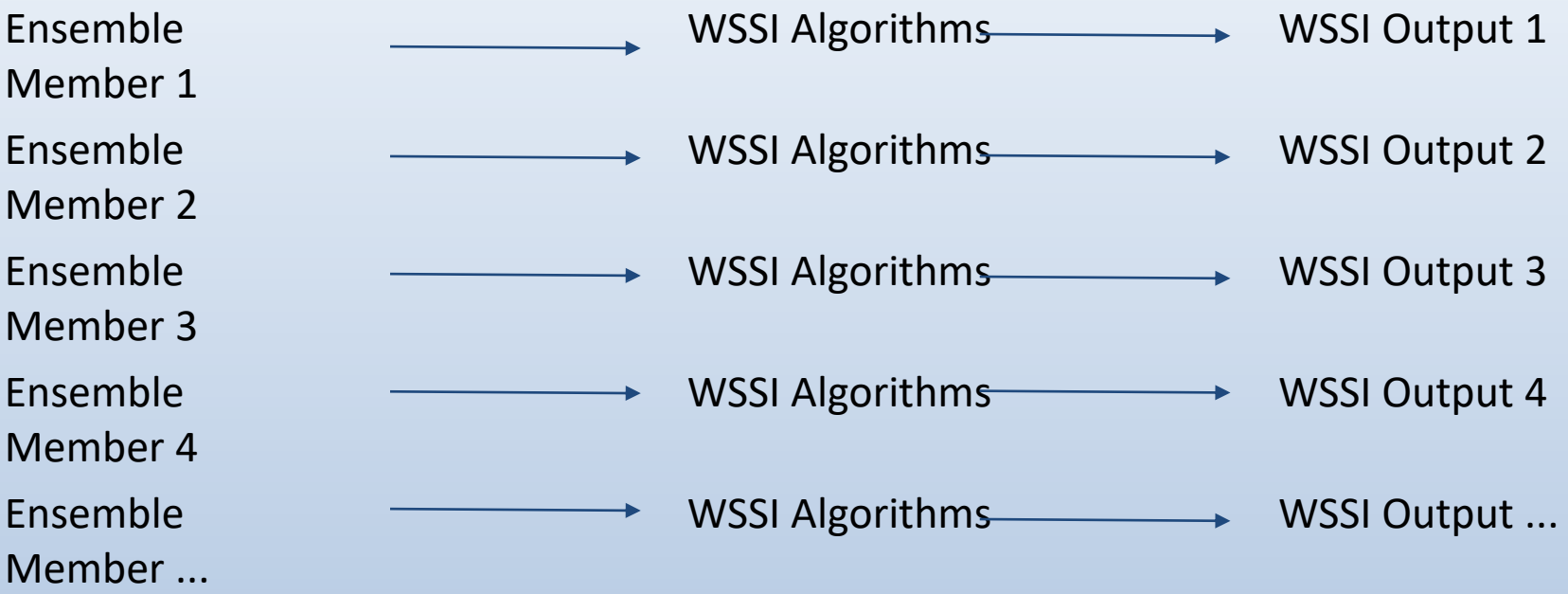
WSSI Evergreen Mask



WSSI Snow Load



Experimental Probabilistic WSSI Generation

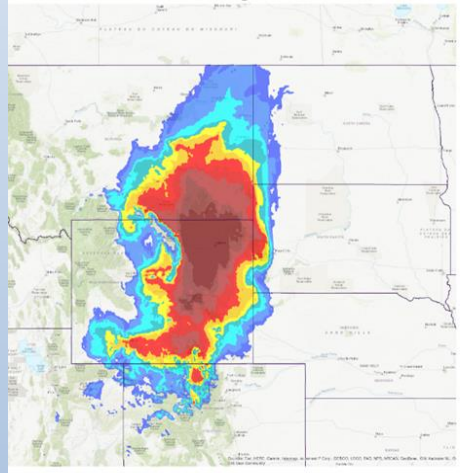


- **Run centrally at WPC. 60 meteorologically consistent scenarios run through the WSSI algorithms, which provide a distribution of WSSI-P values.**
  - **The 60 members are the same as the model membership of the WPC super Ensemble (WSE) used in the WPC Probabilistic Winter Precipitation Guidance**
- **Resultant WSSI-P probabilities reflect # of scenarios forecasting given impact out of total membership.**

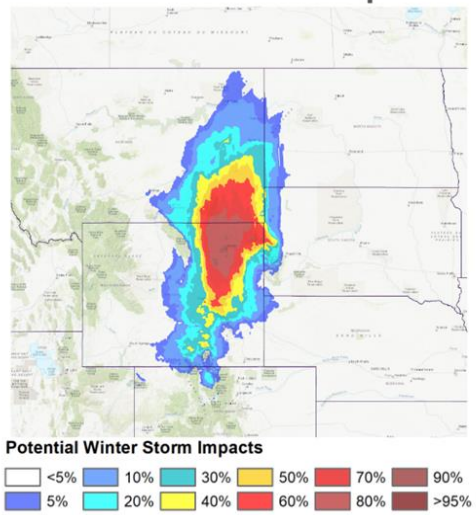
Probabilistic WSSI Output

Depicts probability of reaching an impact level for winter hazards using the WSSI impact thresholds

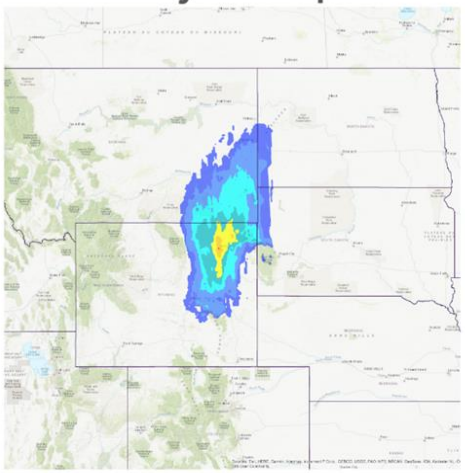
Minor Impact



Moderate Impact



Major Impact



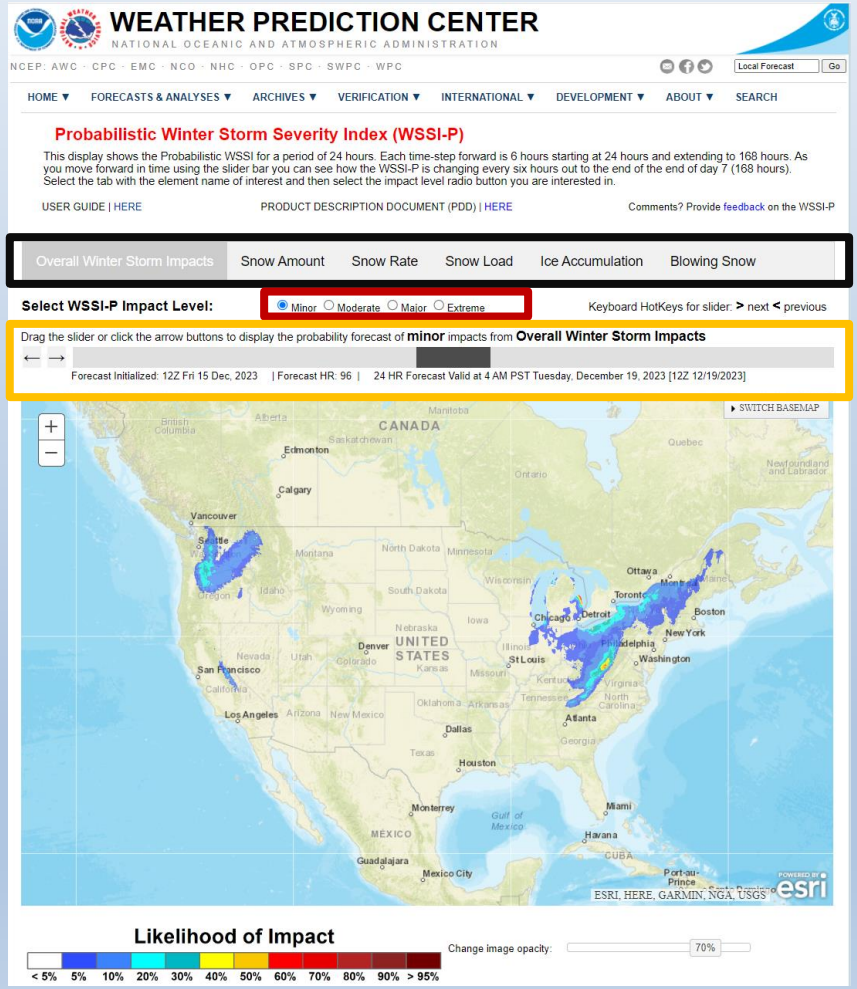
Higher probabilities of minor provide a good envelop of impacts for a the storm.

High probabilities of moderate impacts show where there is likely going to be disruptions to daily life.

The highest probabilities of major (or extreme) depict were the most severe impacts are likeliest to occur.

WSSI-P Webpage

- The PWSSI web page has several interactive mechanisms that work together to produce the image overlay on the web map.
- Each image depicts a likelihood of impact, ranging from 5% to >95%, for a component and impact level.
- The default option shown when the page loads is the likelihood of for Moderate impacts from the Overall Winter Storm Impacts
- Click a component's tab to view the impact forecast for each component or the Overall Winter Storm Impacts to view the combined greatest threat
- Component options are: Overall Winter Storm Impacts, Snow Amount, Snow Rate, Snow Load, Ice Accumulation Blowing Snow
- Select a WSSI Impact Type radio button for the level of impact
- Impact types: Minor, Moderate, Major, Extreme
- The slider bar controls the forecast time.
- To advance or retreat the slider you can: drag the dark gray slider click the arrow buttons, or use the > to go forward in time or the < key to go back in time.



Summary

- The WSSI-P tool is designed to help maintain situational awareness and to help communicate a general level of potential societal impacts and their spatial distribution for winter weather.

- This tool uses both meteorological and non-meteorological data to forecast impacts for Snow Amount, Snow Load, Ice Accumulation, Blowing Snow, and a Summary graphic, which is a composite of the maximum impact from any of the other components.

- Probabilities are generated from the WPC Super Ensemble.
  - All 60 member forecast WSSI impacts
    - Components and Summary
  - Probabilities are an unweighted result of number of members forecasting a given scenario

Contact Information

- Questions or Comments? Please Reach out to:
- NWS WSSI Project Lead:
  - Jim Nelson (james.a.nelson@noaa.gov)
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- WSSI Lead Scientist and Developer
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