Dust Transport Regimes and Public Health Implications at the Great Salt Lake

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Abstract

The desiccation (evaporation) of Utah's Great Salt Lake exposes fine, metal-rich sediments that pose respiratory health risks when mobilized by wind. In recent years, this has become an increasingly important issue. The Great Salt Lake's shrinking exposes toxic, metal-rich sediments that wind can carry into nearby communities, posing a public-health crisis by exacerbating asthma, COPD and other respiratory illnesses. Pinpointing the most active dust-source areas is therefore vital to directing mitigation efforts and protecting vulnerable populations. By combining remote sensing, atmospheric modeling, and public-health data, I pinpoint the lakebed areas most prone to harmful dust emissions and assess their correlation to health impacts to downwind population centers. I derived a Dry Bare Soil Index and two other spectral reflectance indices from Landsat 8–9 imagery, calibrating thresholds to map dust-prone polygons. Wind speed and wind direction measurements at 100m, 500m, and 1,000m elevations were aggregated into a master dataset and interpolated through Empirical Bayesian Kriging 3D to create continuous voxel layers. These layers with census tract asthma and COPD rates in ArcGIS Pro to evaluate spatial correlations. The analysis identifies roughly 1300 mi^2 (3350 km^2), of exposed lakebed as a dominant likely dust source. Voxel modeling shows northwesterly winds frequently approaching and regularly exceeding 8 m/s nearby the dust region. Overlaying health data reveals that populations downwind exhibit notably higher asthma and COPD prevalence than upwind areas. These findings confirm that a small fraction of the lakebed drives most harmful dust emissions and that prevailing wind regimes deliver those emissions to densely populated corridors. The clear spatial correlation between modeled transport pathways and elevated respiratory rates emphasizes the public-health significance of targeted dust-suppression measures. Future work should involve integration with field validation PI-SWERL measurements, incorporation of seasonal or daily wind-voxel time series, and refined spectral thresholds to reduce uncertainty and guide mitigation strategies.

Introduction

Wind-blown dust from desiccating (evaporating) saline lakes is a growing environmental hazard. Globally, playas that formed after large lakes receded now release fine particulate matter rich in salts, toxic metals, and microbial contaminants. Saline terminal lakes are shrinking on every inhabited continent, and their newly exposed playas now rank among the most aggressive natural sources of atmospheric dust. These sediments are typically alkaline, highly erodible and enriched in trace metals, so their mobilization threatens respiratory health, water security, and regional economies. Utah's Great Salt Lake (GSL) is a prominent case. Surface withdrawals and twenty-five years of persistent drought have lowered the lake to its historic minimum, unveiling more than 800 mi^2 (≈2 070 km^2) of lakebed that is intermittently entrained by strong synoptic winds (see Fig. 1). (Utah Department of Environmental Quality, 2025)

Chemical and toxicological studies leave little doubt that the exposed substrate is hazardous. Sediments contain elevated arsenic, lead, and other redox-active metals that enhance cellular oxidative stress (Jung et al., 2024). Laboratory assays (the testing of a metal or ore to determine its ingredients and quality) show that GSL dust exhibits among the highest particle-bound reactive oxygen species measured for natural aerosols, a demonstration for its capacity to damage pulmonary tissue (Attah et al., 2024). Mouse instillation experiments confirm that inhalation of the same material provokes neutrophilic inflammation and cytokine release, indicating a robust pro-inflammatory response (Cowley et al., 2025). These findings reinforce evidence from recent dust events that closed interstate highways, degraded winter snowpack albedo, and triggered local air-quality advisories (Stefanich, 2024).

Spatially, dust generation is not uniform. Field surveys identify a small subset of "hotspot" polygons, seen in Fig. 2, mainly in the Farmington and Bear River bays, that produce a disproportionate share of PM_{10} emissions when fragile surface crusts are disturbed (Williams, n.d.). Systematic Portable In-Situ Wind ERosion Lab (PI-SWERL) surveys of more than four thousand stations show that only about nine per cent of the desiccated surface lacks a protective salt crust, yet this small fraction accounts for a majority of the lake's potential PM_{10} emissions (Perry et al., 1999).

Hydrologically, the three river deltas that feed these bays deliver fresh loads of fine sediment each spring, continuously refreshing the erodible surface. Prevailing northwesterly winds then gain a long fetch across the dry mudflats before encountering the Wasatch Front. Therefore, plumes generated in these hotspots carry higher dust concentrations to densely populated corridors than emissions from the lake's western basins.

Fine-grained sediments of the Great Salt Lake lakebed are inherently enriched in trace metals through entirely natural geologic and hydrologic processes. As mountain streams and rivers drain the surrounding Basin and Range uplifts, they transport weathered material, rich in arsenic, lead, cadmium, and other redox-active elements, into the terminal basin. There, repeated cycles of flooding and evaporation concentrate these metals in the fine lacustrine clay and silt fractions. Mineralogical analyses of benthic sediments collected after the lake's historic low water level (around 2016) show arsenic and lead concentrations to be two to three times higher than regional levels. These naturally occurring metal-laden particles form the substrate of desiccated playas that, when disturbed, release toxic dust plumes laden with harmful contaminants. (Jung et al., 2024)

Because the hotspots lie as close as three miles from residential neighborhoods, they represent a significant public-health and regulatory concern. Additionally, prevailing winds, originating from the northwest, are very capable of transporting dust from deposits on the exposed lake bed. Subsequent sections of this report therefore prioritize the precise delineation of these areas, quantify their emission potential, and display observed wind regimes in order to view possible dust plume transportation. Long-range transport studies demonstrate that fine anthropogenic aerosols can traverse hundreds of miles (Perry et al., 1999), so even modest mischaracterization of source strength or wind trajectory can bias risk assessments.

Furthermore, Salt Lake City residents contend with some of the worst particulate pollution in the nation. The region has never met federal attainment for annual or 24-hour $PM_{2.5}$ standards and ranked seventh worst for daily particle pollution among 217 metropolitan areas across the nation (IQAir, 2025). Additional geographic and seasonal conditions enhance this issue. Winter temperature inversions trap vehicle, industrial and dust emissions in the valley for up to a week at a time, driving daily $PM_{2.5}$ peaks above 150 $\mu g/m^3$, which is more than five times typical summer levels, and prompting frequent air-quality advisories (Utah Department of Environmental Quality, 2024). These high-pollutant episodes coincide with spikes in emergency-department visits for asthma and COPD, especially among children and older adults. This highlights the need to address both local emission sources through dust-prone region mapping and prevailing winds over the exposed Great Salt Lake lakebed.

Remote sensing offers the spatial coverage needed to map dust-prone substrates across the exposed lakebed. Temporally, it is also possible to map how this dust-prone region has changed over time in response to global trends.. By applying targeted band-ratio algorithms such as the Dry Bare Soil Index and clay mineral indices in the shortwave infrared region, it is possible to distinguish areas with elevated clay and iron oxide content that correlate with laboratory-measured dust hotspots (Kamh et al., 2022). These indices can even be cross-referenced against grab-sample geochemistry to refine threshold values that delineate persistent dust-emitting areas. When these soil classification maps polygons are integrated with continuous three-dimensional wind visualizations (and other 2D methods), it is possible to gain an understanding of how wind transports dust to densely-populated urban centers.

Objectives

1. Derive a Dry Bare Soil Index (DBSI), among other spectral indices, from Landsat 8–9 imagery and calibrate threshold values against surface grab samples to delineate regions of possible harmful dust deposits.

2. Create continuous atmospheric voxels for wind speed and direction by interpolating data points at 100m, 500m, and 1,000m using an interpolation method with over 1,500 locations throughout the study region.

3. Symbolize and visualize 3D voxels in a scene, with 2D layers of possible harmful dust deposits, water level, and municipal boundaries, allowing for better understanding of dust transport to the population center of the Wasatch Front.

4. Overlay prevailing wind direction information, dust spot polygons, and municipalities with U.S. Census tract rate samplings of asthma and chronic obstructive pulmonary disease (COPD).

Spatial Analysis Question

Where on the exposed Great Salt Lake lakebed exhibit the highest potential for harmful dust emissions and how do the prevailing annual winds across the region influence how dust is transported to population centers, thereby correlating with spatial distribution of asthma and COPD prevalence?

Identifying the areas of the exposed Great Salt Lake lakebed with the highest potential for harmful dust emissions is fundamental to targeting mitigation efforts where they will be most effective. The newly exposed lakebed spans over 800 square miles of fine-grained, metal-rich sediments that laboratory assays have shown to generate reactive oxygen species and provoke robust inflammatory responses upon inhalation (Attah et al., 2024; Cowley et al., 2025). I aim to isolate a region where crust disruption leads to higher concentrations of harmful dust and areas that are more likely to be disturbed by wind. It is important to understand that not the entire exposed lakebed is susceptible to housing harmful dust deposits. Therefore, highlighting a comparatively more precise region allows land managers and policymakers to prioritize dust-suppression tactics.

Equally critical is understanding how prevailing annual wind regimes redistribute dust plumes toward population centers and influence respiratory health outcomes. As of mid-2025, the American Lung Association has granted Salt Lake City a failing grade for particle pollution in air. Prevailing northwesterly winds traverse long fetches across the desiccated mudflats before reaching the Wasatch Front, carrying dust plumes into densely inhabited corridors just miles from the shoreline (Gill et al., 2019). Interpolating and visualizing census-tract data on asthma and COPD prevalence and overlaying them with prevailing wind models illustrates the spatial correlation between predicted transport pathways and elevated disease rates.

Methodology

There are two main things that I must have to create a proper visualization of dust movement regimes across the Great Salt Lake region. The first is wind data (speed and direction) and the second is where harmful dust deposits are located. Acquiring and aggregating this data is an important step. Additionally, interpolation in the wind data is key, as vector data points are not helpful when trying to view a continuous, dynamic, and three-dimensional atmosphere. With the original format of the wind data (over 1,500 CSV files, one for each sample point), it is must be reorganized and aggregated into a compatible format for ArcGIS Pro to interpret. All CSV files must be combined into a single master dataset to produce a point feature class suitable for interpolation. This aggregation can be accomplished using a Python script.

The wind data points are used to model potential dust movement. I imported annual wind speed and direction at three altitudes (100m, 500m, and 1,000m), regularly sampled throughout the study area. I interpolated those measurements using Empirical Bayesian Kriging 3D into two separate (speed and direction) three-dimensional layers, which are then converted to voxel layers for visualization and interpretation.

The next major step in understanding dust movement is to identify where deposits could be located. Using Landsat 8 OLI L2 spectral bands, I created rasters that reveal certain surface characteristics. In this case, I am using three calculated rasters form Landsat 8 – Clay Minerals (bands 6 and 7), Ferrous Minerals (bands 5 and 6), and DBSI (bands 3, 4, 5, and 6). These rasters are clipped to the exposed lakebed boundary. Finally, their values are multiplied (raster calculator) and classified to highlight possible deposits of harmful dust.

Wind speed of about 8m/s (30kmh, 17mph) or faster can pick up and carry dust, sand, and other particulate matter. I symbolized my wind speed voxel layer, to highlight where in my 3D atmosphere approaches 8m/s or is met/exceeded. For wind direction, since the direction of municipalities are all positioned within a 180-300° degree window southeast of the GSL, I symbolized the wind direction voxel to only highlight values that had an average wind direction within this range.

Both voxel layers, wind speed and wind direction, benefit from voxel exaggeration. Since the study region covers a significant area and the atmospheric focus height is only 100-1,000m, it can be difficult to view the voxels, as they appear like a thin layer. Expanding this layer, allows for easier viewing and interpretation.

The symbology of these layers, especially the 3D voxel layers, is extremely important. Incorrect or misleading symbology, can drastically change the final understanding of dust transport across the GSL and into the Wasatch Front. To minimize the risk of interpretational bias occurring, I experimented heavily with symbology data filters, transparency, color ramps, and other tools. Additionally, I queried several uninformed viewers throughout the process, to cross-validate symbology.

To assess public-health implications of prolonged and frequent dust exposure, I acquired census-tract asthma and COPD prevalence rates from the Centers for Disease Control and Prevention (CDC). I imported the tract-level rate polygons into ArcGIS Pro and used the Areal Interpolation tool. ensuring to use the right parameters for the appropriate data field, to create a continuous contour feature class. To effectively display the distribution and its correlation with the GSL dust regime, I symbolized the contours for both COPD and asthma to be better visible in contrast with the other layers.

Results

The Dry Bare Soil Index and clay and ferrous mineral indices delineated an area with high dust-emission potential on the exposed lakebed. These polygons cover nearly 1,300

mi^2 (3,350 km^2), representing a significant portion of the exposed lakebed, which is about 1,900 mi^2 (4,900 km^2). The highest values, indicating highest possibility of harmful dust deposits, occur in Farmington Bay and Bear River Bay, with smaller concentrations in the northwest arm of the lake bed.

Empirical Bayesian Kriging 3D interpolation of wind measurements at 100m, 500m and 1,000m elevations produced continuous voxel layers for speed and direction (see Fig. 5). Average annual wind speeds exceed 8 m/s across significant portions of the voxel volume (see Fig. 6). Additionally, nearly the entire wind voxel showcases wind approaching the 8 m/s threshold (6.5 – 8 m/s). As seen in Fig. 7, the average annual wind direction 3D voxel, when limited to display directional values of only 180 to 360° (the direction that leads to the Wasatch Front), showed extreme clustering of values directly over the exposed lakebed and dust-prone region.

Census-tract asthma and COPD prevalence rates were overlaid with wind direction, exposed lakebed, and dust-prone area in order to assess possible spatial relationships. There is visually a definite correlation between being downwind (southeast) of the dust-prone area and lakebed with higher rates of both respiratory diseases than nearby regions (seen in Figs. 3-4). Summary statistics show that tracts in the Wasatch front (downwind from the lake), experience abnormally high asthma rates compared to nearby areas. Up to 14% (average of 11.16% across the study region) prevalence is seen for asthma. COPD sees a similar trend, with a study region average of 4.7% prevalence, while seeing many tracts reaching and surpassing 8%.

My analysis identifies a smaller area of the lakebed as the dominant source of harmful particulate emissions. It demonstrates how prevailing wind regimes transport those emissions into the adjacent southeastern population centers and establishes a clear spatial relationship between modeled annual trends and respiratory disease prevalence.

Discussion

The analysis successfully answered my spatial question by identifying the lakebed areas with the highest potential for harmful dust emissions and demonstrating how prevailing annual winds transport that dust into downwind population centers, specifically the Wasatch Front. Wind voxel modeling and visualization confirmed that northwesterly flow regularly carries dust plumes into the Wasatch Front corridor. Highlighting a directional window that is capable of carrying particulate matter to the southeast clearly showcases that prevailing winds can easily pick up matter off the dust-prone area. Overlaying health outcome data revealed a strong spatial correlation between being downwind of the dust-prone area and elevated asthma and COPD rates (compared to nearby regions). Together, these findings validate my approach to linking sediment characteristics, atmospheric transport, and public health indicators.

All four objectives were met. I derived and calibrated the Dry Bare Soil Index and spectrally based mineral indices to map dust emitting substrates. I interpolated wind data into three dimensional voxels covering the entire study region from ground level up to 1,000m. I visualized a 2D dust deposit layer and 3D wind layers in an integrated scene. Finally, I integrated dust source and wind transport layers with census tract health data to quantify and map current respiratory disease rates. However, access to high resolution lidar of crust thickness or real time surface moisture sensors would have refined dust emission thresholds and reduced uncertainty in the hotspot classification. Looking at wind data on a temporal scale, possible on a day-by-day basis would have added helpful depth to the visualization and analysis.

Several significant findings and challenges emerged. First, the dust-prone region polygon may incorrectly estimate harmful dust deposits. It may overexaggerate or underestimate where deposits could be located. But from my research, it is far more likely that it is overexaggerating where harmful dust could be located. Second, voxel exaggeration proved essential for interpreting subtle vertical wind speed gradients but introduced potential visual confusion by significantly changing the scale of the atmosphere vertically. However, the location of data gradients within the voxel in relation to ground and 2D features remain intact and reliable. Third, the zonal statistical correlation between dust exceedance and disease prevalence underscores the public health relevance of this work, although causation cannot be inferred from spatial coincidence alone.

Uncertainty arises from several sources. My remote sensing calibration of dust emission thresholds relies on no real field samples, which may underrepresent spatial variability in crust composition. Interpolation error in Empirical Bayesian Kriging 3D affects the fidelity of wind field estimates. Finally, health data boundaries (census tracts) are coarse, especially further from the Wasatch Front. In order to "fill in the gaps", I performed an Areal Interpolation via the Geostatistical Wizard, using the 'Total Population' field give meaning to the rate of asthma and COPD.

Future work will begin with on-site validation of the dust-prone polygons using PI-SWERL measurements to establish precise emission thresholds under field conditions. I could then refine the spectral-index classifications by cross-referencing remote-sensing against an expanded set of ground-truth grab samples, improving the accuracy of hotspot delineation. Focusing on certain metals in samples could also provide for further analysis. Finally, it would be helpful to move beyond annual wind averages by incorporating seasonal wind-voxel time series and possibly even on a day-by-day basis, in an animation form. This could capture intra-annual shifts in wind regimes and yield more realistic dust transport visualizations, leading to a more granular and detailed understanding of the phenomena at play.

Conclusion

This analysis brings into clear sight the spatial interaction between sediment characteristics, atmospheric forces, and public health outcomes surrounding the dust epidemic of the Great Salt Lake. By isolating the DBSI and other mineral-index–derived polygons (Fig. 2) and demonstrating that northwesterly flows frequently approach and regularly exceed the 8 m/s threshold across these dust-prone areas (Figs. 5–6), I have created a robust and reliable remote-sensing based understanding of harmful dust transport in the region. The integration of 3D wind voxels (Figs. 5-7) with census-tract asthma and COPD contours (Figs. 3–4) further confirms that populations lying downwind, along the Wasatch Front, experience disproportionately elevated respiratory disease rates.

Beyond affirming my primary research question, the findings carry clear implications for land management and public health policy. Targeted dust-suppression measures, such as surface stabilization, crust restoration, or vegetation barriers, should be prioritized in hotspots, confirmed by field samples, where emission potential is highest. In a broader context, my analysis emphasizes the ability to couple remote-sensing techniques with atmospheric modeling to issue more nuanced risk assessments than those based on annual averages or point-source inventories alone.

At the same time, it is vital to understand the limitations inherent in my approach. The reliance on spectrally inferred thresholds without field-validated PI-SWERL measurements introduces uncertainty into the hotspot delineation. Empirical Bayesian Kriging 3D, while powerful, smooths out fine-scale wind heterogeneity, potentially obscuring short-duration gust events critical for dust entrainment. Although this is like not seen at the annual temporal scale anyway. And although census-tract rates offer the best publicly available health data, they mask intra-tract variability and cannot establish causation.

Looking ahead, the path forward is clear. Ground-truthing with expanded PI-SWERL sampling will sharpen spectral reflectance thresholds. Incorporating seasonal and daily wind-voxel time series into dynamic visualizations promises not only to capture episodic dust events but also to inform proactive public-health interventions. Ultimately, by layering finer-scale environmental monitoring onto the geospatial and atmospheric framework established here, I can move from broad maps to actionable strategies, guiding both mitigation efforts on the lakebed and adaptive health advisories in the Wasatch Front communities most at risk.

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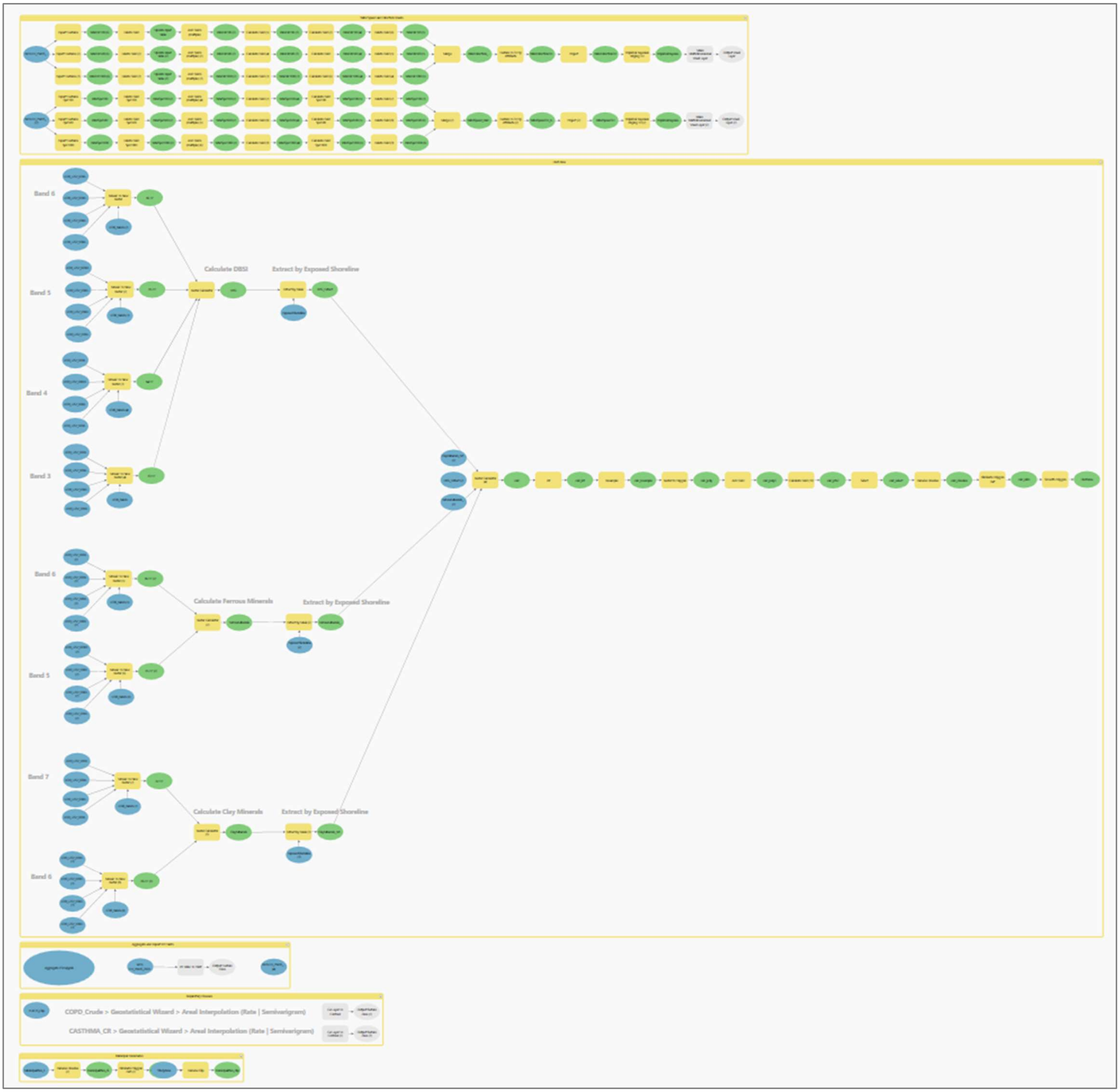
Metadata Table

Layer Name	Type	Date Created	Scale/Res	PCS	GCS (datum)	Creator of Data	Useful Attributes	Data Quality Issues	Method of Creation	Relevance to Analysis
DEM_10m	Raster DEM	4-29-25	10m	NAD 1983 UTM Zone 12N	NAD 1983	USGS	-	Some subtle DEM stitching artifacts.	Download then clip using simple polygon.	General appearance, flow direction analysis.
Study Area	Polygon	4-30-25	-	NAD 1983 UTM Zone 12N	NAD 1983	Jeffrey Varga	-	-	Hand drawn, snapped to edges of interpolated raster.	Used to clip and trim data, as well as referencing my study area.
Water Level	Polygon	5-3-22	-	NAD 1983 UTM Zone 12N	NAD 1983	UGRC, UGS, DNR FFSL	-	Data is 9 years old. The water level is likely different.	-	Simply shows water level as of 2016.
WindSpeed3D	NetCDF Import as Voxel	5-14-25	0.0001m	NAD 1983 UTM Zone 12N NAD 1983	NAD 1983	National Renewable Energy Laboratory (NREL) Jeffrey Varga	-	-	3D interpolation from a grid of wind samples at various altitudes. Then converted to a voxel layer.	Visualization of wind speed that is capable of dust transport.
WindDirection3D	NetCDF Import as Voxel	5-14-25	0.0001m	NAD 1983 UTM Zone 12N NAD 1983	NAD 1983	National Renewable Energy Laboratory (NREL) Jeffrey Varga	-	-	3D interpolation from a grid of wind samples at various altitudes. Then converted to a voxel layer.	Visualization of prevailing winds in areas of potential harmful dust deposits.
Dust Area	Polygon	5-15-25	-	NAD 1983 UTM Zone 12N	NAD 1983	Jeffrey Varga	-	Imprecise method of creation. May not cover all dust spots, or may overestimate.	Computed from various spectral indices (ferrous minerals, clay minerals, and DBSI) of surface reflectance.	Provides a mostly accurate area coverage of where harmful dust deposits are on and around the exposed lakebed.
Municipal Boundaries	Polygon	5-16-25	-	NAD 1983 UTM Zone 12N	NAD 1983	UGRC	-	Some gaps in the continuous polygons, likely from merging smaller features together	Ran a simple Eliminate Polygon Parts tool to close gaps.	Shows areas where the majority of the population at risk to dust inhalation reside. This feature simply serves as a general display of where inhabited areas are. Therefore, it is appropriate to slightly modify the data for easier viewing.
Locations	Point	5-26-25	-	NAD 1983 UTM Zone 12N	NAD 1983	AGRC	POPULATION	-	-	Used for labeling major cities in the Wasatch Front.
PLACES	Polygon					Centers for Disease Control and Prevention	CASTHMA_Cr COPD_Crdue TotalPopul	Some gaps in the data due aggregated by census tract.	-	Used to create contour features for asthma and COPD rates throughout the region.
Asthma_Contour	Contour	5-24-25	-	NAD 1983 UTM Zone 12N	NAD 1983	CDC Jeffrey Varga	-	Interpolation may make results misleading.	Clipped to extent. Areal Interpolation (Rate, TotalPopul), semivariogram function.	Display the distribution of asthma rate and its correlation with the GSL dust regime.
COPD_Contour	Contour	5-24-25	-	NAD 1983 UTM Zone 12N	NAD 1983	CDC Jeffrey Varga	-	Interpolation may make results misleading.	Clipped to extent. Areal Interpolation (Rate, TotalPopul), semivariogram function.	Display the distribution of COPD rate and its correlation with the GSL dust regime.

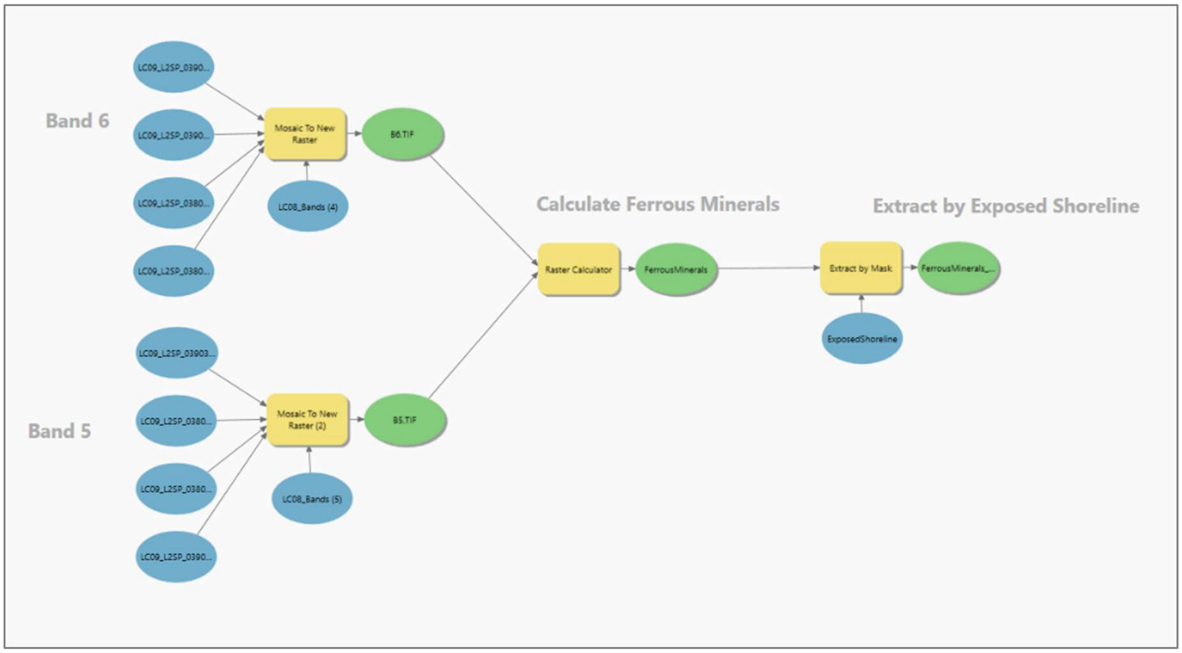
ModelBuilder Diagrams

Entire Method

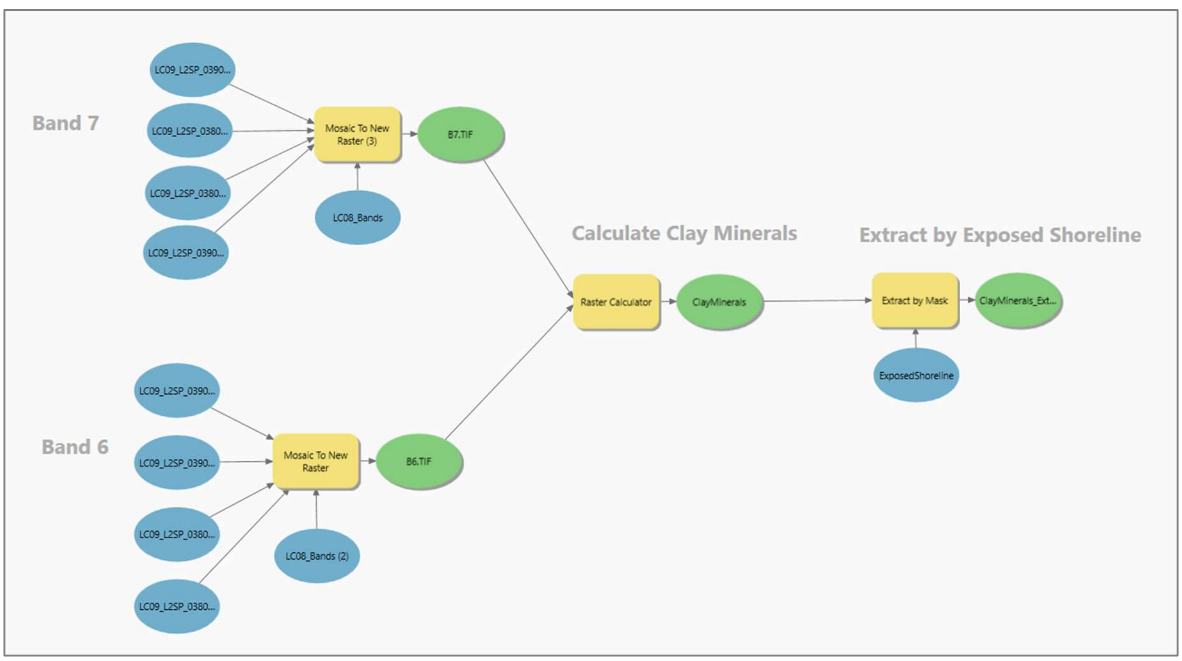
This excludes some intermediary tasks along the way. General workflow only. There is too much for ModelBuilder to handle.



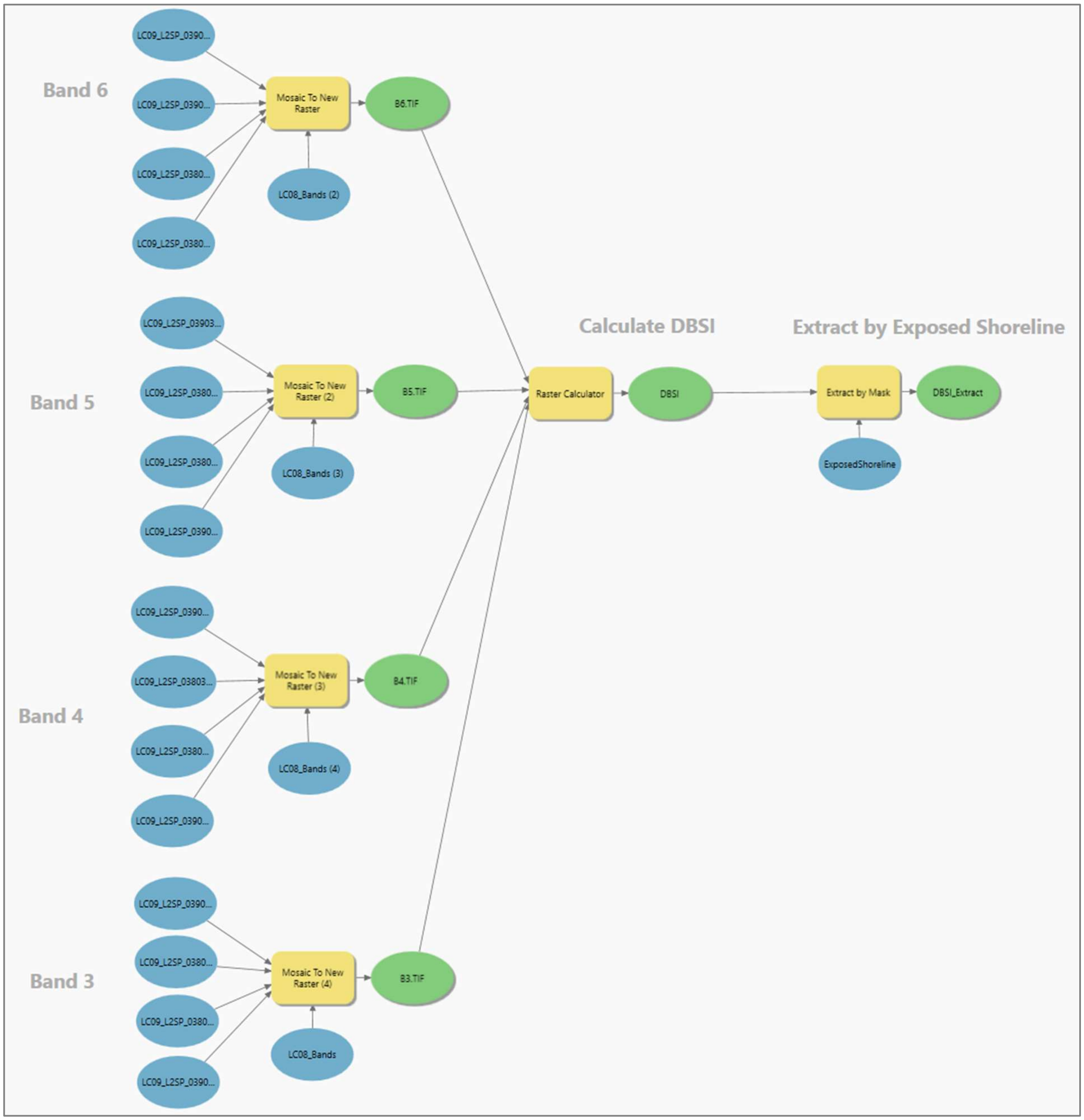
Calculate Ferrous Minerals Index



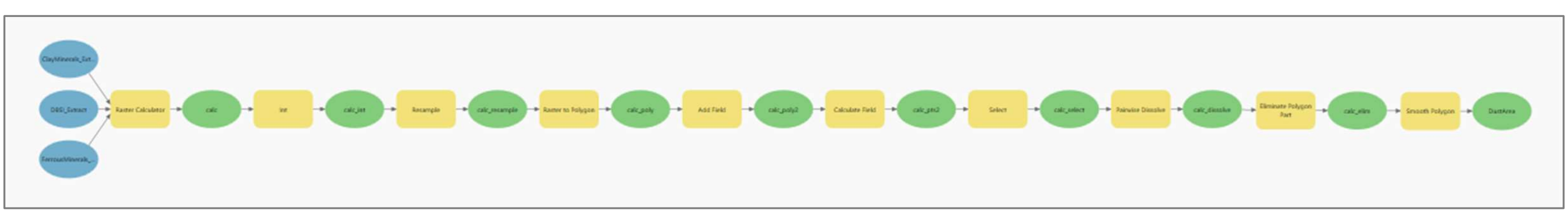
Calculate Clay Minerals Index



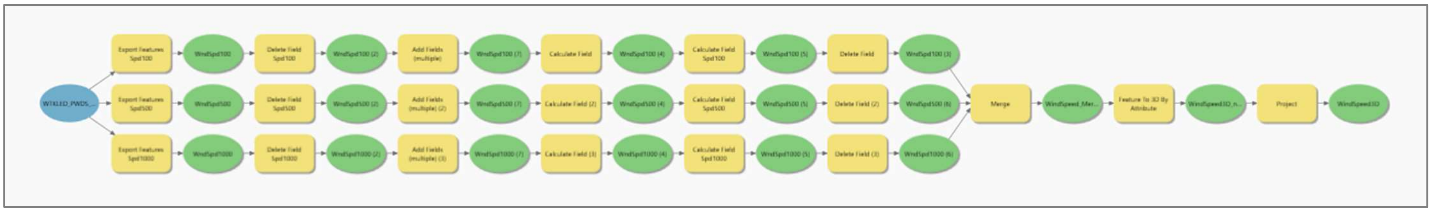
Calculate Dry Bare Soil Index (DBSI)



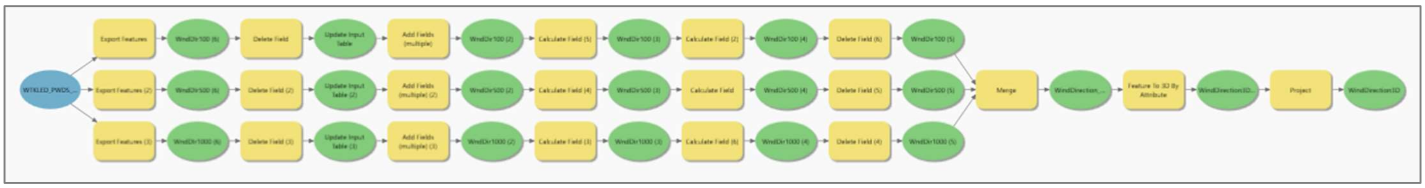
Calculate Dust-Prone area from Ferrous Minerals, Clay Minerals, and DBSI



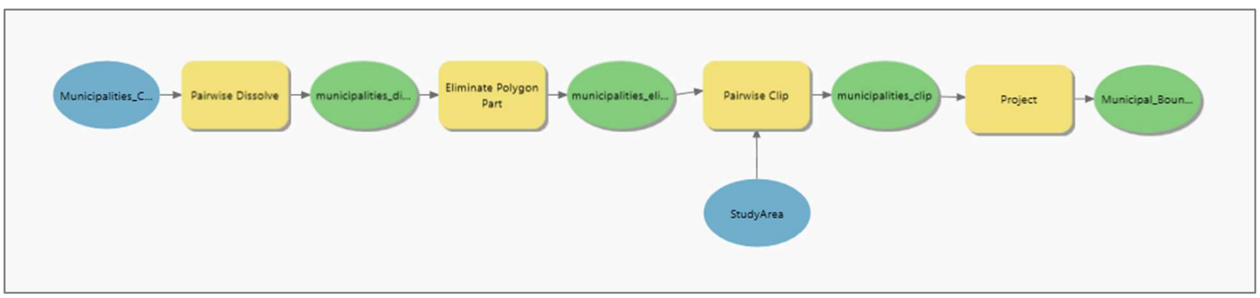
Wind data points to wind speed voxel



Wind data points to wind direction voxel



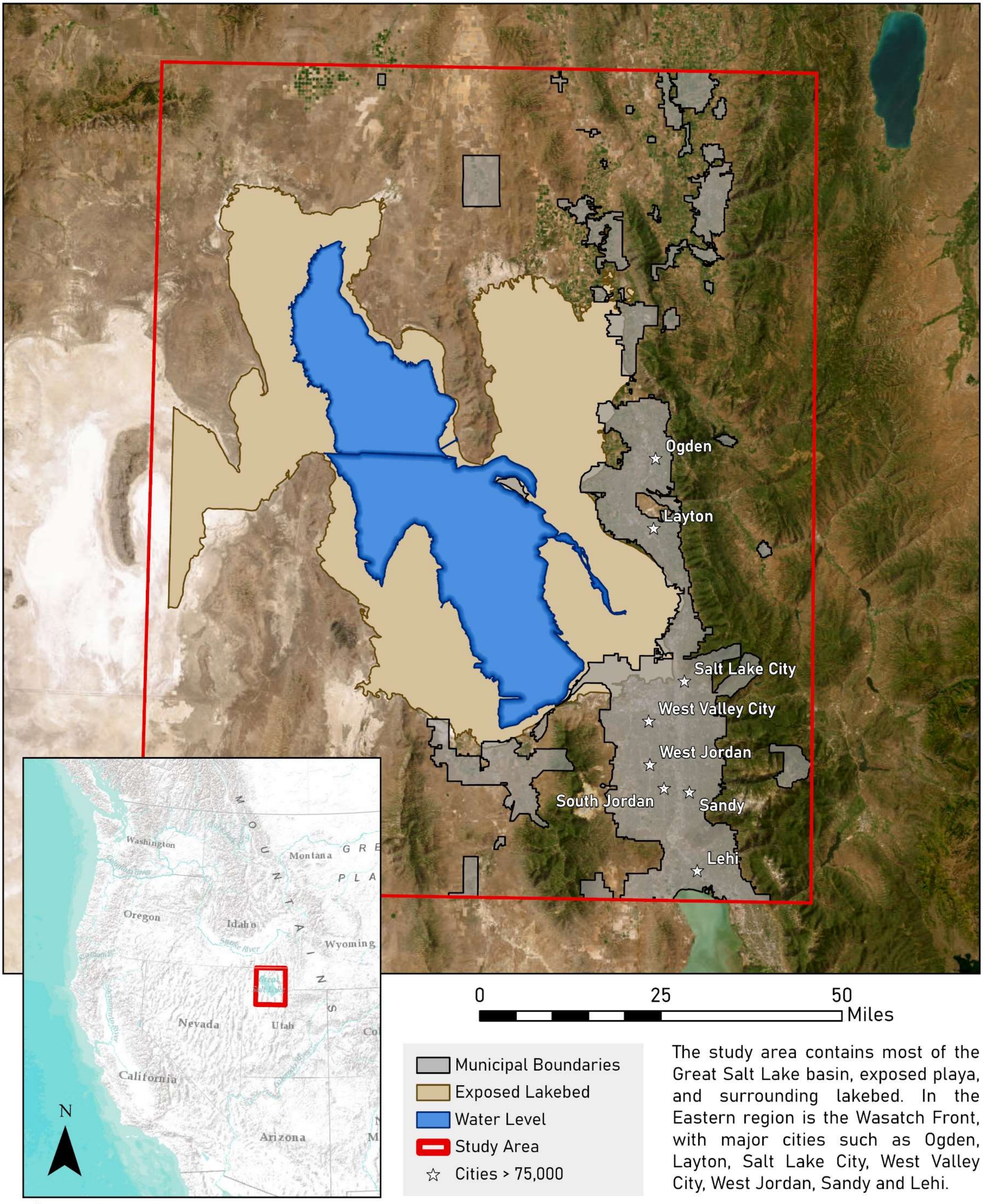
Clean-up and improve municipal boundaries polygon



Maps

Fig. 1

GSL Dust Transport Study Area

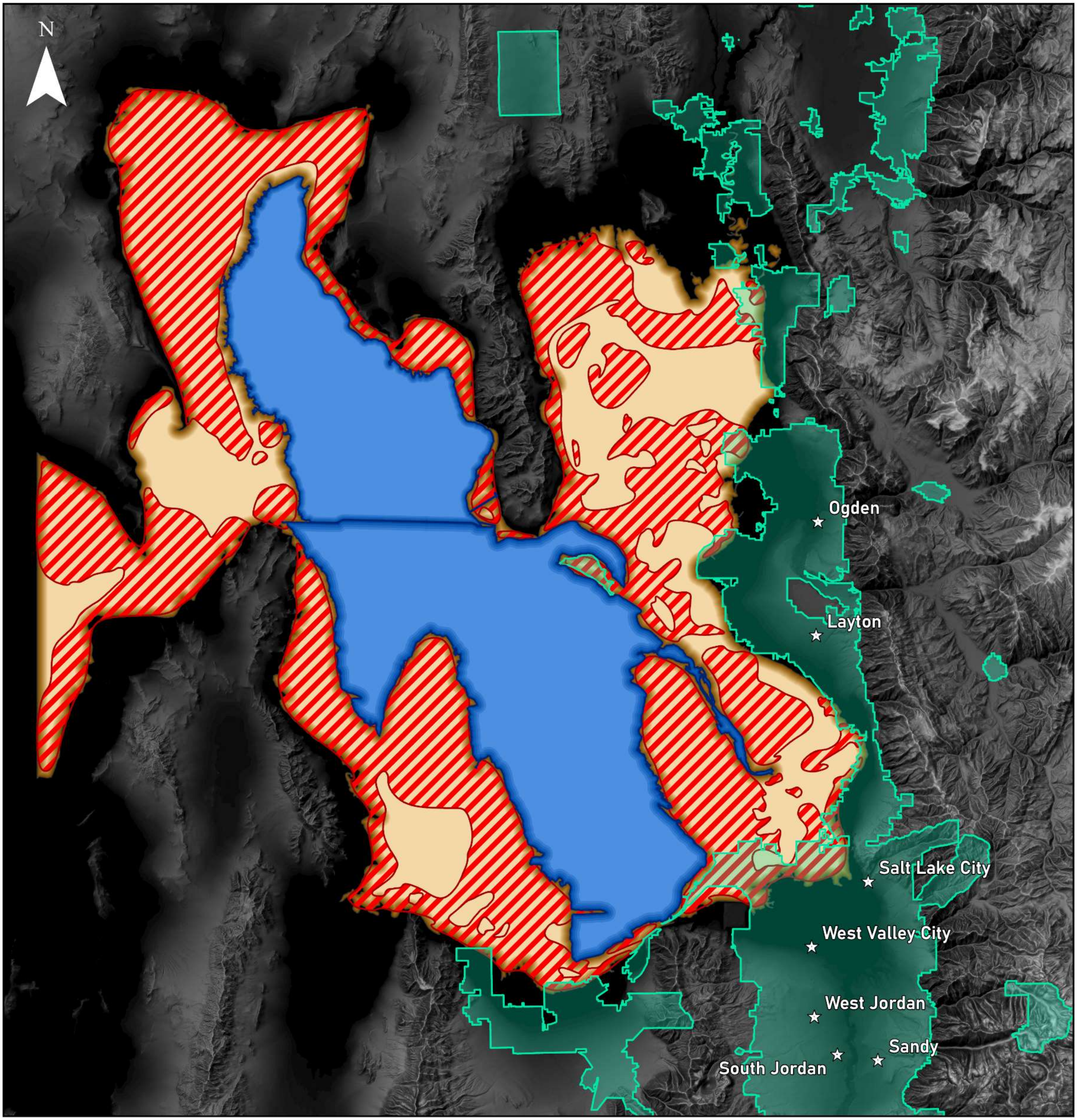


The study area contains most of the Great Salt Lake basin, exposed playa, and surrounding lakebed. In the Eastern region is the Wasatch Front, with major cities such as Ogden, Layton, Salt Lake City, West Valley City, West Jordan, Sandy and Lehi.

Jeffrey Varga - May 26, 2025 - Source: UGRC

Fig. 2

Dust Area Overview



Water Level
Municipal Boundaries
Dust Area
Exposed Lakebed
☆ Cities >75,000

0 25 50 Miles

As water levels have fallen, these formerly submerged flats (shown in tan) have become exposed and are now susceptible to wind transportation. The hatched red zones around the Great Salt Lake represent areas of exposed lakebed where harmful dust hotspots are likely to occur. The map also overlays municipal boundaries, indicating that cities like Ogden, Salt Lake City, and Sandy lie close to or downwind of these dust source areas.

Fig. 3

Asthma Rate by Population

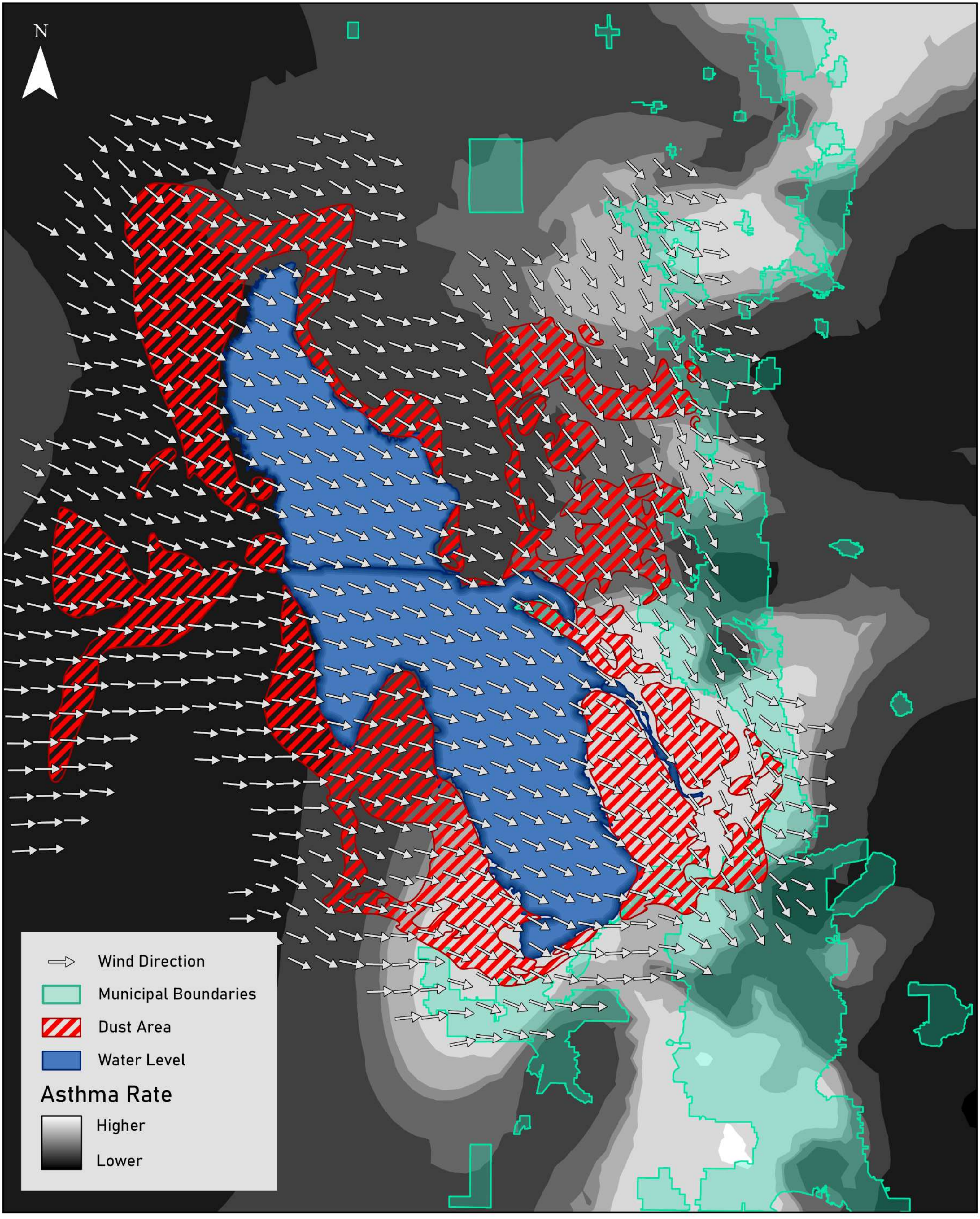


Fig. 4

COPD Rate by Population

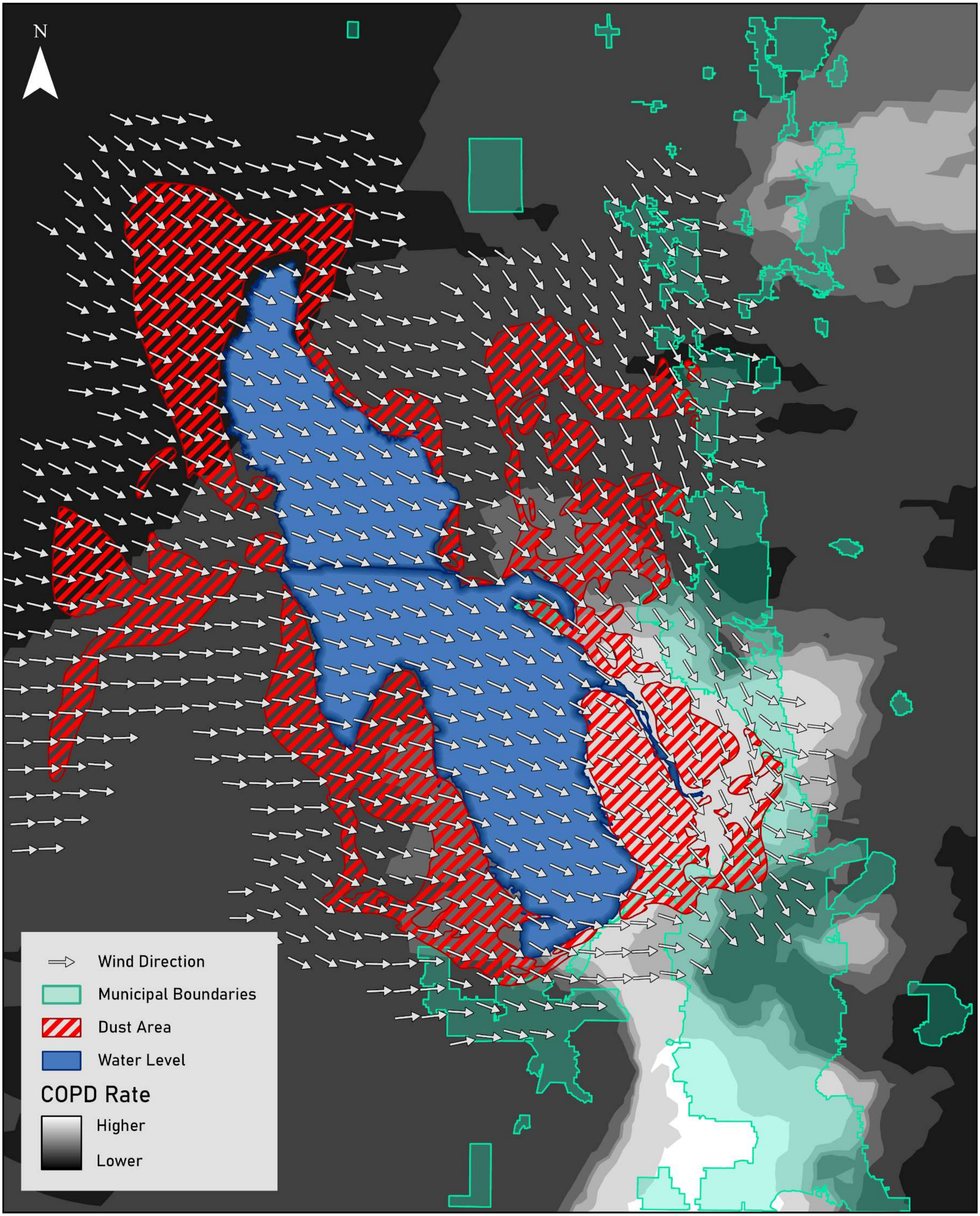
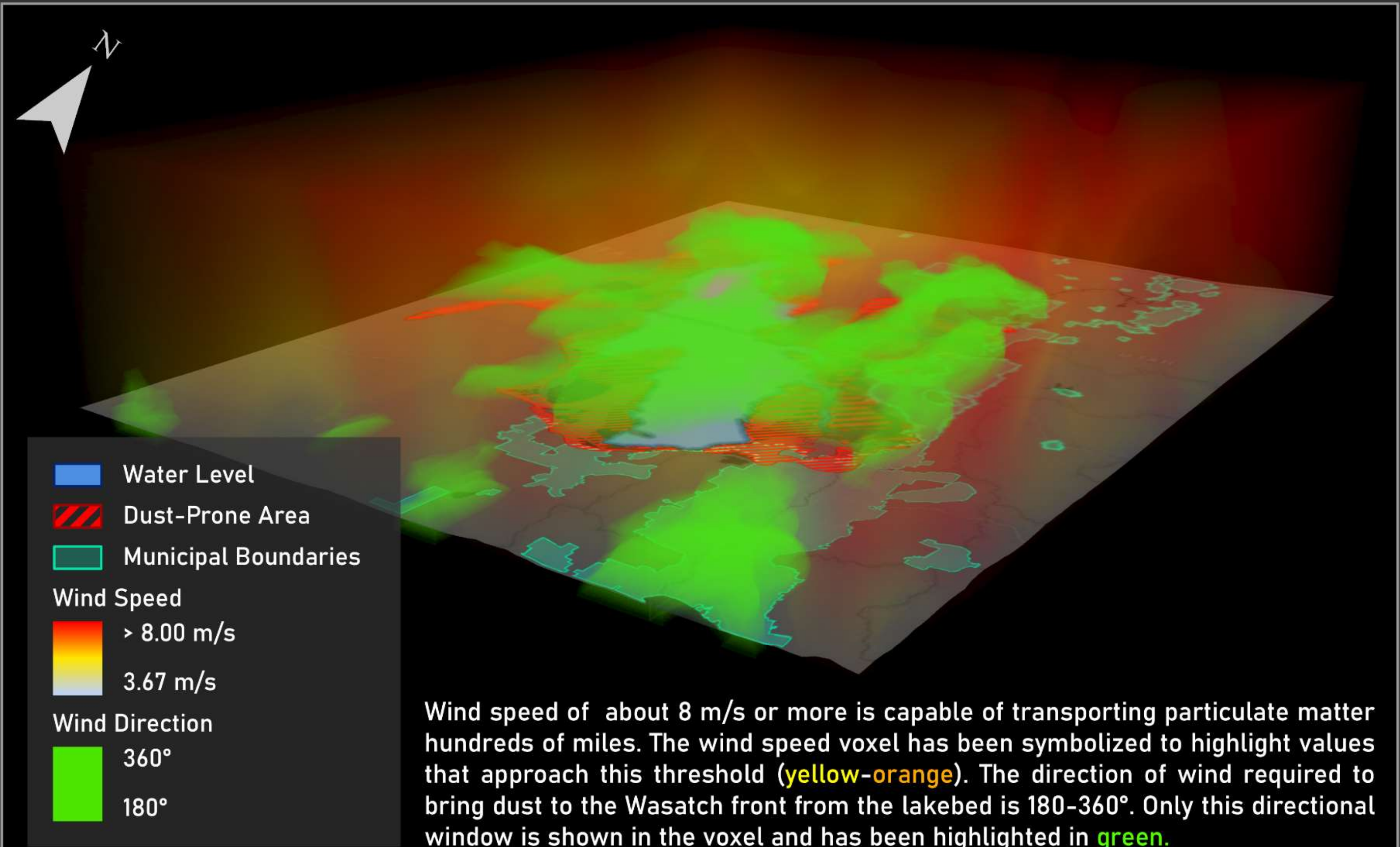


Fig. 5 Wind Speed and Direction Voxels



Wind speed of about 8 m/s or more is capable of transporting particulate matter hundreds of miles. The wind speed voxel has been symbolized to highlight values that approach this threshold (yellow-orange). The direction of wind required to bring dust to the Wasatch front from the lakebed is 180-360°. Only this directional window is shown in the voxel and has been highlighted in green.

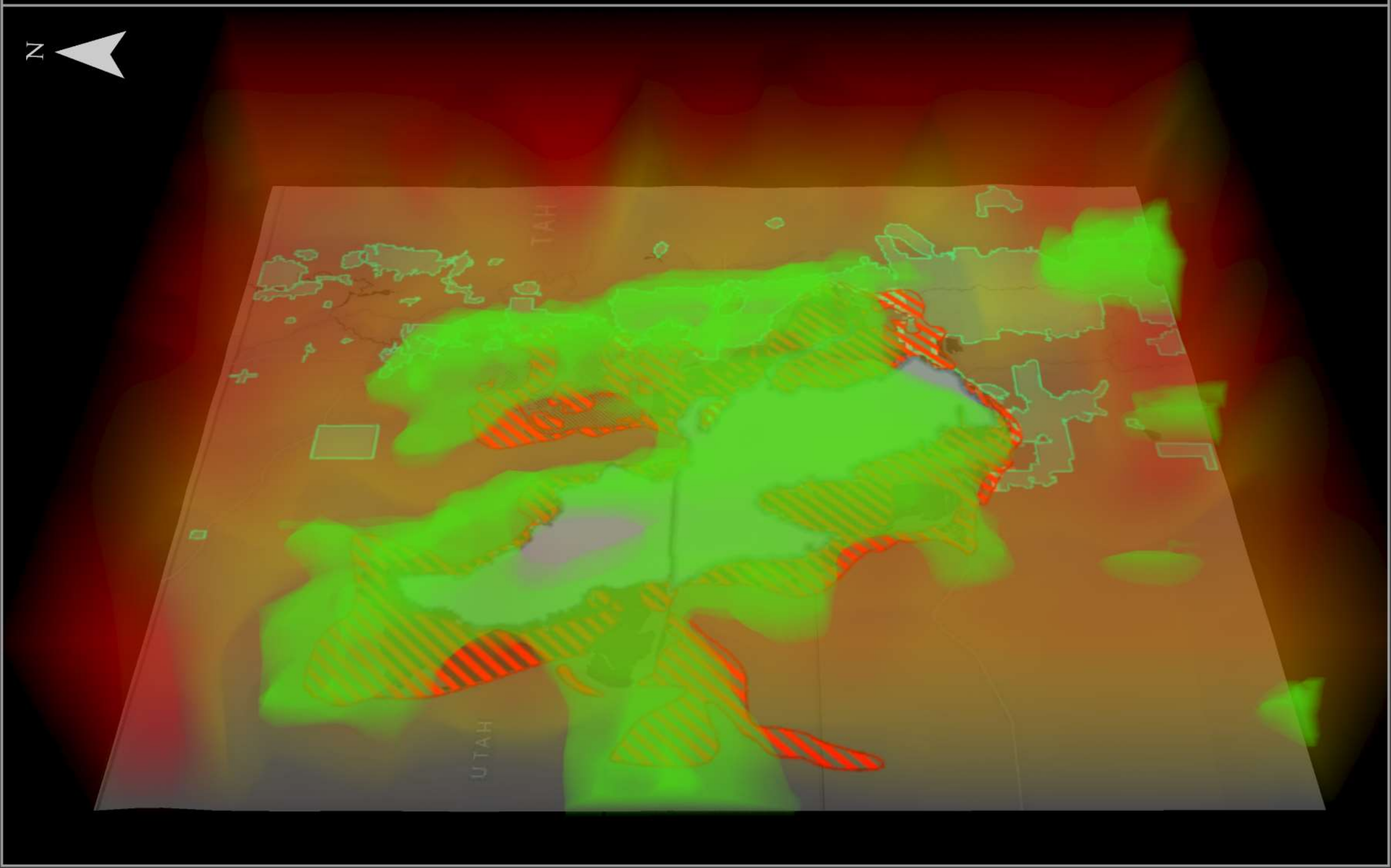
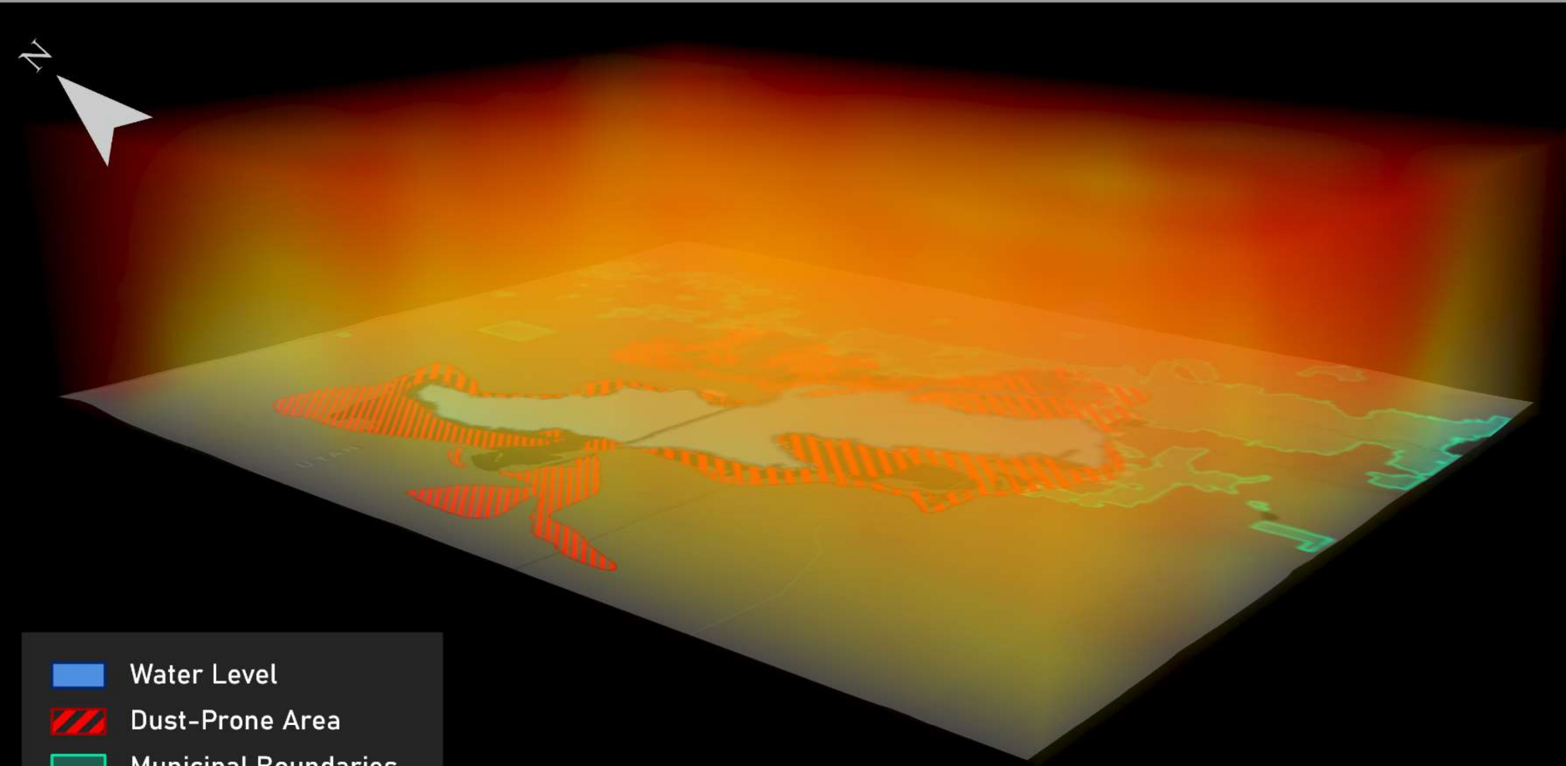


Fig. 6

Wind Speed Voxel



Wind speed of about 8 m/s is capable of transporting particulate matter hundreds of miles. The wind speed voxel has been symbolized to highlight values that approach this threshold (yellow-orange). Nearly the entire study region is covered in wind that is near the threshold for dust transport. The average wind speed across the entire voxel is roughly 6.5 m/s.

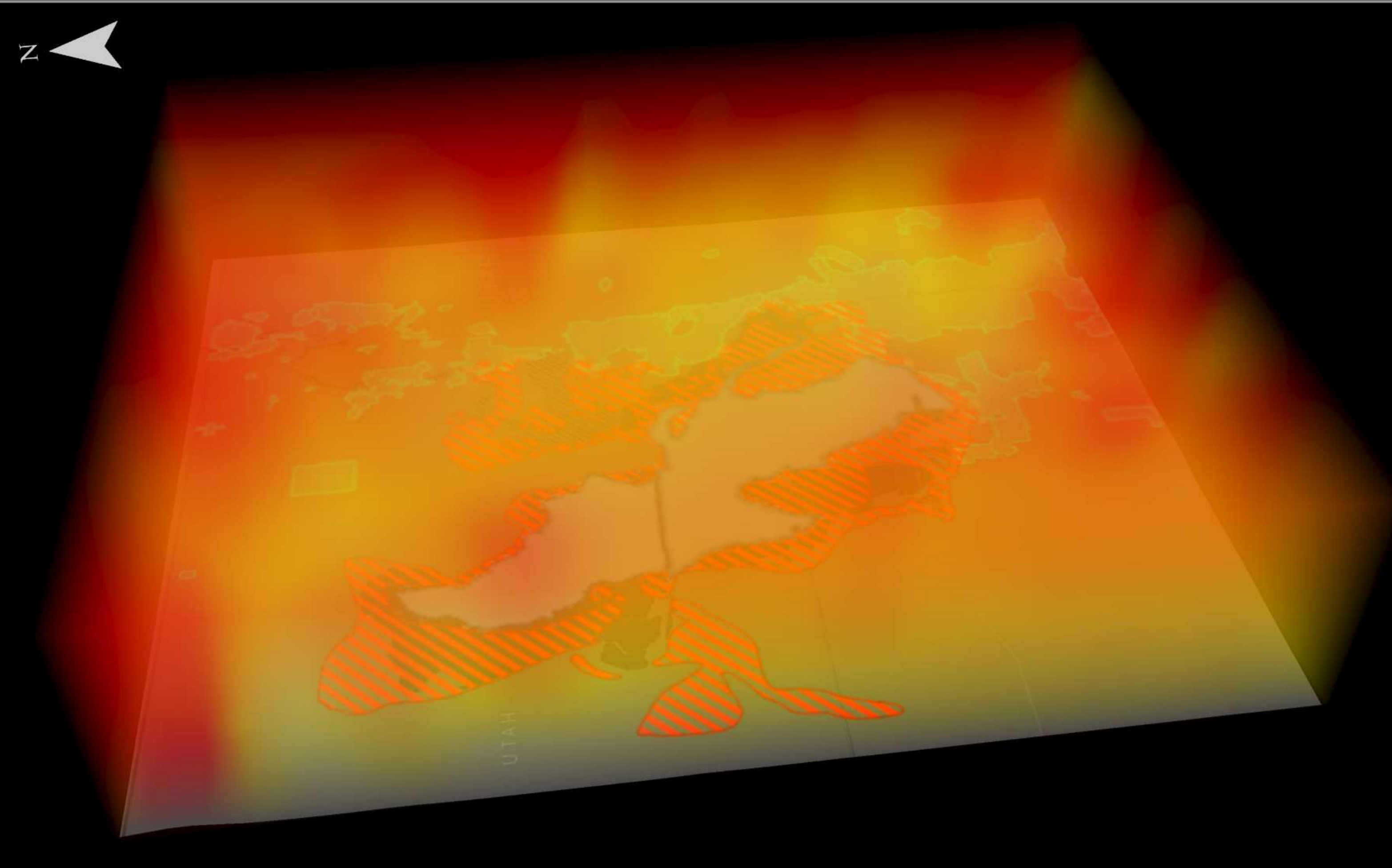
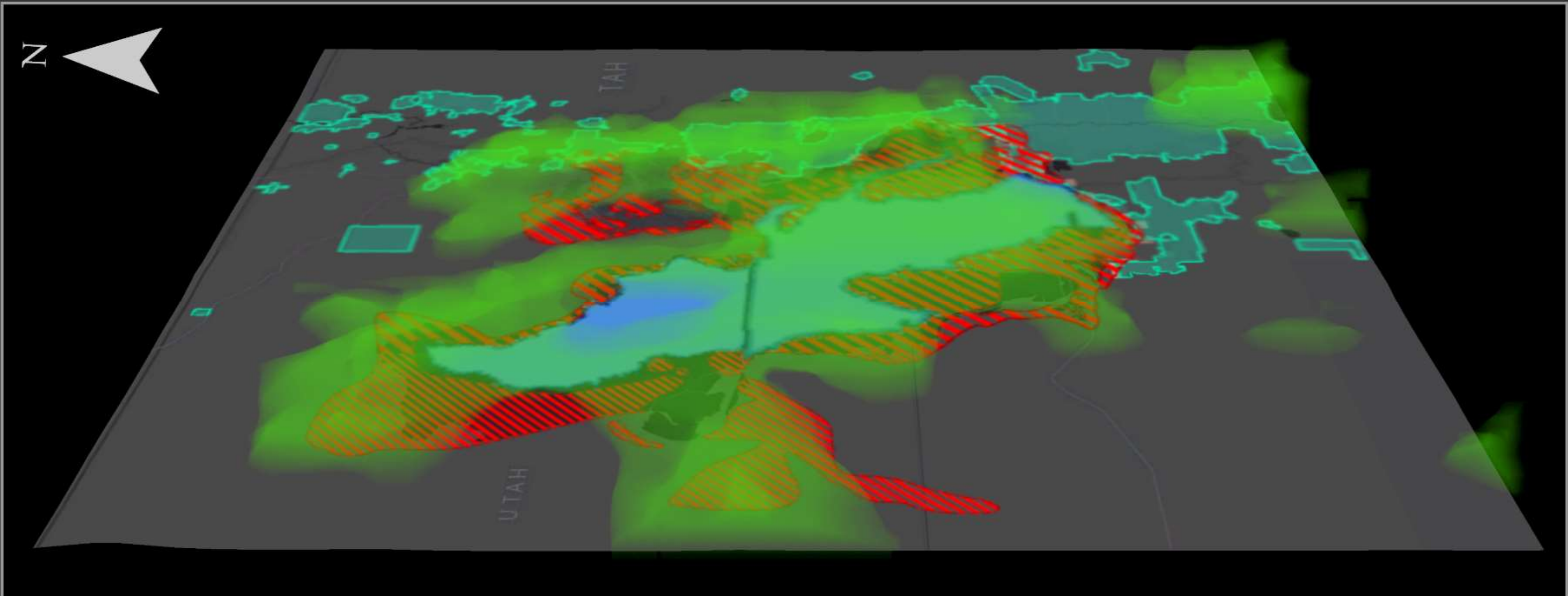
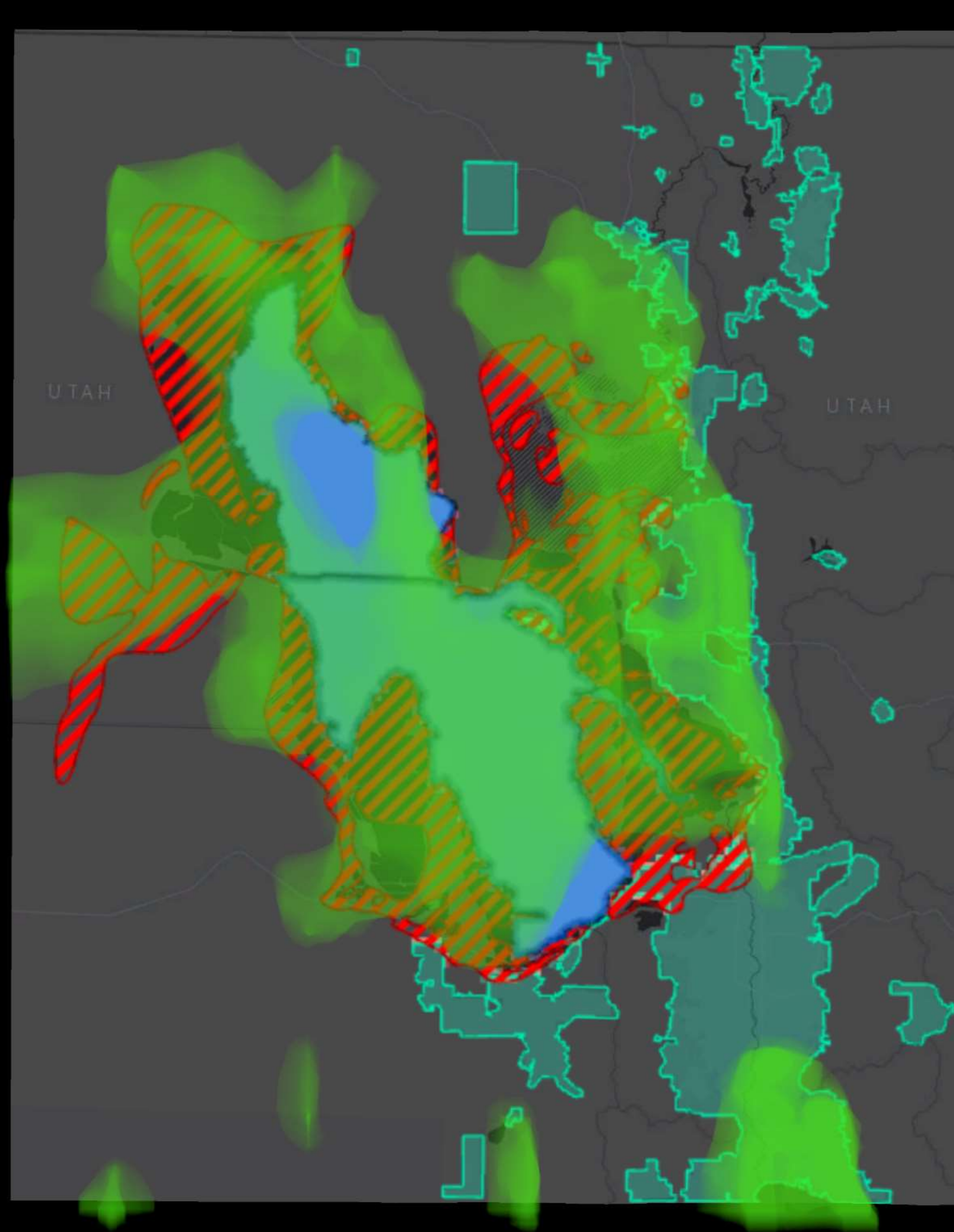


Fig. 7

Wind Direction Voxel





Water Level
Dust-Prone Area
Municipal Boundaries
Wind Direction
360°
180°

The Great Salt Lake and nearby region experiences continuous and robust prevailing winds, enabling particulate matter from the exposed lakebed to be consistently transported throughout the year. Due to the lake being northwest of the Wasatch Front, winds that blow in a predominantly southeasterly direction are likely to carry particulate matter to populations. Therefore, a degree window of 180-360° is highlighted and shown in green. The highlighted 180-360° directional window lies directly above the dust-prone area year-round.