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A Review of Colorado EnviroScreen



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A Review of Colorado EnviroScreen

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Executive Summary

Colorado EnviroScreen is an interactive environmental justice mapping tool for Colorado. The Colorado EnviroScreen identifies disproportionately impacted communities (DIC) based on the definition in Colorado's Environmental Justice Act (HB21-1266) so that communities can directly benefit from money and resources, enhanced opportunities to participate in Air Quality and Control Commission (AQCC) rulemaking and permitting process and prioritize enforcement and compliance initiatives. Colorado EnviroScreen was created by a team from Colorado State University (CSU) and the Colorado Department of Public Health and Environment (CDPHE)¹. The first version of Colorado EnviroScreen launched June 28, 2022. The current version of the technical documentation was published in January 2023.²

CDPHE is proposing to use Colorado EnviroScreen to make consequential decisions related to permitting requirements, enforcement and compliance, grant funding allocation and other environmental justice actions. As with any newly developed tool, it is important to ensure the tool is functioning as expected, the data used by the tool and produced by the tool is appropriate for its intended use, and that the supporting documentation for the tool is reliable. In the process of using Colorado EnviroScreen, there were several concerns about the quality of the data that became immediately apparent which prompted an initial review of the tool.

This document describes the review that was conducted, the initial findings, and recommendations. The Colorado EnviroScreen data sources were reviewed by subject experts for accuracy, completeness, age of data, methodology, spatial resolution, and documentation consistency. Significant shortcomings were identified that compromise the ability to use the current version of the tool. It is recommended that the tool not be used for environmental justice screening evaluations or any decision making until a thorough, independent evaluation of the tool has been conducted and the identified issues are addressed.

Specifically, Colorado EnviroScreen was evaluated by subject matter experts to assess:

- Is the data the most current, complete, and accurate available?
- Is the spatial distribution consistent with the expected spatial patterns?
- Is the range of values reasonable and consistent with expectations?
- Is the methodology technically appropriate?

Review findings were classified into seven categories: *Inaccurate data, incorrect methodology, insufficient data, incomplete dataset, spatial limitations, outdated data* and *inconsistent documentation*. Thirty-five (35) datasets used in Colorado EnviroScreen were reviewed, each dataset is used by EnviroScreen to calculate the final EnviroScreen score. The findings indicate that twenty-three (23) of those indicators have questionable data, meaning that more than 65% of the datasets appear to be questionable.

The intent of this analysis is to identify initial concerns and share them with tool developers and other users so that agencies, communities, and other users can collaborate on tool

¹ CO EnviroScreen Frequently Asked Questions. Available at:

https://docs.google.com/document/d/1_GEjGbOd3CmXwZu09QJ9oO4ZI8hqXtFwZAAeTsNV5lQ/edit#heading=h.gq83r62bwok4

² EnviroScreen Technical Documentation. Available at: <u>https://drive.google.com/file/d/1aZfZnLeEPxvpFBILOFGpYGKLQbDxhMMF/view</u>

improvements. This initial assessment indicates that Colorado EnviroScreen has significant limitations in its current form that adversely affect the allocation of resources. An accurate and reliable environmental justice screening tool is in the best interest of all Colorado citizens.

Colorado EnviroScreen is inaccurate. To correct this as expeditiously as possible, it is recommended that CDPHE initiate an independent peer-review process to ensure that the data used in EnviroScreen is robust and accurate; solicit technical expertise related to the most current, accurate, highly resolved datasets available; and update any inaccurate methodologies to ensure indicators are represented adequately. Until issues with EnviroScreen are addressed, the tool should not be used to make any consequential decisions.

1. Introduction

Colorado EnviroScreen (EnviroScreen) is an interactive mapping tool created by the Colorado Department of Public Health and Environment (CDPHE) and Colorado State University (CSU). CDPHE intends to identify disproportionately impacted communities and prioritize environmental justice benefits for these communities using this tool. CDPHE is proposing to use Colorado EnviroScreen to make consequential decisions related to permitting requirements, enforcement and compliance, grant funding allocation and other environmental justice actions. Additional information and details on the use of EnviroScreen are provided in CDPHE documentation^{3,4,5}.

As with any newly developed tool, it is important to ensure the tool is functioning as expected, the data used by the tool and produced by the tool is appropriate for its intended use, and that the supporting documentation for the tool is reliable. In the process of using Colorado EnviroScreen, there were several concerns about the quality of the data that became immediately apparent which prompted an initial review of the tool.

This document describes the review that was conducted, the initial findings, and recommendations. The Colorado EnviroScreen data sources were reviewed by subject experts for accuracy, completeness, age of data, methodology, spatial resolution, and documentation consistency. The intent of this analysis is to identify initial concerns and share them with tool developers and other users so that agencies, communities, and other users can collaborate on tool improvements. An accurate and reliable environmental justice screening tool is in the best interest of all Colorado citizens.

Chapter 2 describes the methods used to review the EnviroScreen tool. Chapter 0 documents the results of this analysis, implications of findings for key indicators, and recommendations for improvement. Finally, Chapter 4 provides general recommendations to improve both the EnviroScreen tool as well as the process by which the tool is reviewed and approved.

³ CO EnviroScreen website. Accessed March 2023: <u>https://cdphe.colorado.gov/enviroscreen</u>

⁴ CO EnviroScreen Frequently Asked Questions. Accessed March 2023:

https://docs.google.com/document/d/1_GEjGbOd3CmXwZu09QJ9oO4ZI8hqXtFwZAAeTsNV5lQ/edit#heading=h.gq83r62bwok4

⁵ EnviroScreen Technical Documentation. Accessed March 2023: <u>https://drive.google.com/file/d/1aZfZneEPxvpFBILOFGpYGKLQbDxhMMF/view</u>

2. Review Methodology

This chapter describes the methodology that was followed to evaluate EnviroScreen datasets for each indicator. We started this evaluation by downloading the EnviroScreen dataset from CDPHE's web site. We recommend that CDPHE assigns numerical versions to the full dataset – version 0.0, version 1.0 or similar—and creates a record of relevant changes for future identification and reference. We imported and formatted the data into version 3.0.3 of ArcGIS Pro. We were careful to map each indicator with their original units instead of percentiles, because this facilitates review by an expert who would be familiar with expected ranges and spatial patterns associated with the indicator. Since each indicator has unique units of measure, we selected bin ranges individually for each indicator. This method makes geographic patterns and significant values are easier to identify. The full set of thirty-five (35) figures created for all EnviroScreen indicators can be found in Appendix A.

The figures generated directly from EnviroScreen data were provided to subject matter experts who assessed the following:

- Is the data the most current, complete, and accurate available?
- Is the spatial distribution consistent with the expected spatial patterns?
- Is the range of values reasonable and consistent with expectations?
- Is the methodology technically appropriate?

Findings from subject matter experts were classified using the seven categories shown in Table 1. Our findings in Chapter 0 are organized following this categorization and, when possible, specific recommendations were provided to improve the quality of the dataset.

Table 1. Data concerns categories and description

Data Concern	Description
Inaccurate Data	Datasets are not representative of actual or known conditions
Incorrect Methodology	Calculations produce inaccurate results
Insufficient Data	Period of data is too short to provide reliable information
Incomplete Dataset	Datasets have gaps and discontinuities
Spatial Limitations	Some datasets need higher/better spatial resolution to be useful
Outdated Data	Datasets are old and more current information is available
Inconsistent Documentation	Discrepancies in metadata and technical guide creates confusion and distrust

3. Findings

This chapter documents our findings and concerns with several EnviroScreen datasets. For any indicator classified as questionable, we describe the problems with the indicator based on the categories listed in Table 1 and, when possible, recommendations for improvement. Our findings in this chapter are organized using EnviroScreen's definitions for the component scores in this order: environmental exposures, environmental effects, climate vulnerability, sensitive populations and demographics.

3.1 Environmental Exposures

The environmental exposures score combines nine indicators. In this section we only present the six indicators identified by subject matter experts as questionable.

3.1.1 Ozone

We found the ozone dataset questionable for the following reasons:

<u>Inaccurate Data</u>: This dataset is inconsistent with the elevated ozone concentrations along the Denver Metro/North Front Range Nonattainment area (Figure 1). It is well documented that daily maximum 8-hour average ozone concentrations across monitors in the Denver Metro have exceeded 71 ppb over the last three years, with instances well over 90 ppb⁶. In contrast, the ozone concentrations dataset used in EnviroScreen Figure 1 below has two critical deficiencies when compared to observations: the ozone concentrations are unrealistically low over the entire state, and their spatial distribution does not accurately reflect known high concentrations along the Front Range. CDPHE is aware of limitations with this dataset because it tries to justify its use in the EnviroScreen FAQ⁷.

Outdated Data: Ozone concentrations in dataset are from 2017.

<u>Inconsistent Documentation</u>: This dataset is described in the "Indicator" data table that can be downloaded from the tool website and in EnviroScreen Technical Documentation. The indicator data table specifies that the data is from 2012, but the EnviroScreen Technical Documentation states data is from 2017.

<u>Recommendation</u>: We recommend updating this dataset with the Colorado ozone State Implemented Plan (SIP) modeling which has a higher spatial resolution. This would mitigate some deficiencies described above and represent ozone exposures more accurately along the Front Range. We also recommend a review of available documentation to improve consistency and reliability.

 ⁶ Regional Air Quality Council 8hr ozone summary. Accessed March 2023: <u>https://raqc.org/current-8-hour-ozone-summary/</u>
 ⁷ CO EnviroScreen Frequently Asked Ouestions. Accessed March 2023:

https://docs.google.com/document/d/1_GEjGbOd3CmXwZu09QJ9oO4ZI8hqXtFwZAAeTsNV5lQ/edit



Figure 1. Map of CO EnviroScreen Ozone with the Ozone Non-Attainment Boundary

3.1.2 Air toxics emissions

We found the air toxics dataset questionable for the following reasons:

<u>Inaccurate Data</u>: Air toxic emissions are based on Air Pollution Emission Notices (APEN). APEN do not represent Colorado air toxic emissions accurately. For example, reported APEN are potential maximum emissions, are not updated annually, and have minimum reporting thresholds (i.e., are potentially incomplete). In addition to this concern, based on EnviroScreen technical support documentation, there are Hazardous Air Pollutants (HAPs) that are not considered in this assessment. Specifically, mercury is mentioned but not used, there are no polycyclic aromatic hydrocarbons (PAHs), heavy metals like cadmium or lead, and it is unclear how "coke oven emissions" correspond to a specific hazardous pollutant.

<u>Incorrect Methodology and Spatial Limitations</u>: The calculation method ("distance-weighted" method) produces inaccurate results that have more to do with the size of the area analyzed than the underlying data. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.



Figure 2. Map of CO EnviroScreen Air Toxics Emissions

<u>Implications</u>: This "distance-weighted" method is used in many indicators and not just the air toxic emissions dataset. Any indicator using this method will have high results for census block groups with a larger area. For example, the location with the highest air toxics score in Colorado is Pawnee Buttes Grasslands (Figure 2), which is inconsistent with the expected spatial distribution of Colorado's air toxic emissions sources. This means that small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).

<u>Recommendations</u>: Consider replacing air toxic emissions with a risk-based approach like the Air Toxics Screening Assessment (AirToxScreen⁸)that takes into account concentration levels rather than rely on inaccurate and incomplete air toxic emissions from APENs. At a minimum, the air toxic emissions need to include other air toxic emissions such as mercury, PAHs, and heavy metals like cadmium or lead. Releases of these compounds are reported to EPA as part of required Toxic Release Inventory reporting and are publicly available data. When applying a

⁸ Air Toxics Screening Assessment. Accessed March 2023: https://www.epa.gov/AirToxScreen

distance-weighted approach the values need to be normalized by the size of the area analyzed (i.e., county area, census tract area, census block group area).

3.1.3 Drinking water regulations

We found the air toxics dataset questionable for the following reasons:

<u>Spatial Limitations</u>: Data water quality (Figure 3) cannot be evaluated for census block groups because it is only available at the county level (larger spatial scale than census block groups).

CDPHE public outreach report stated that "Stakeholders who participated in Phase 1 engagement consistently ranked drinking water quality as a high-priority indicator, which led the project team to invest significant time in developing a unique dataset to include in EnviroScreen as there was no existing statewide dataset on this topic." As a result, the tool developer dedicated a lot of time developing the drinking water regulations indicator.



Figure 3. Map of Co EnviroScreen Drinking Water Regulations

<u>Implications</u>: Although spatial data for individual water systems is not available, normalizing data across the population (e.g., at the county level) can result in incorrect identification of a drinking water quality problem for an entire county that only impacts a small area (or vice versa). Further, aggregating data by county may not be representative of drinking water violations from

repeat violators or large polluters within certain census blocks, while others may not have any violations at all.

<u>Recommendation</u>: Since spatial data identifying public water system (PWS) boundaries is limited, CDPHE data should be cross checked with the USEPA general Safe Drinking Water Act (SWDA) system. Reported violations typically include an area or address that can be used to geographically locate the violation and provide improved quality of data and spatial accuracy. CDPHE should obtain and incorporate better drinking water quality data in EnviroScreen since communities were highly concerned about this indicator.

3.1.4 Lead exposure risk

We found the lead exposure dataset questionable for the following reasons:

Incomplete Datasets and Inaccurate Data: This data source relies exclusively on lead-based paint estimates, which are insufficient to capture risk because there are other pathways for lead exposure including lead water pipes. In addition to the data source being incomplete, the data does not represent the risk of lead-based paint. Housing construction dates are not always indicative of lead risk in more affluent communities (where renovations or abatement activities are more likely to occur). Construction dates are not always indicative of potential lead paint and lead pipe risk. For example, historic homes located in central Denver (Washington Park)⁹ are often the subject of multiple renovations, which often include removal and/or abatement of lead paint and leaded water lines. EPA's data does not account for neighborhoods (like those in central Denver) that have gone through multiple renovations. Additionally, municipalities may have lead abatement initiatives ongoing like lead pipe/service removal initiatives, and these initiatives do not appear to be included in the current data. For example, Denver Water's lead reduction program¹⁰ has replaced lead with copper in more than 15,000 service lines in the first three years of the program¹¹.

<u>Inconsistent Documentation</u>: Downloadable metadata lists the data source from 2014-2018, whereas the technical guide lists the data source from 2015-2019.

<u>Recommendation</u>: Consider using age of home data alongside poverty data to represent older homes that may not have gone through renovations or lead abatements. This approach was used successfully by the Washington State Department of Health¹². Utilizing poverty data could be more representative of homes that have not undergone renovations or abatements. The data can be supplemented with information from municipalities that have undertaken lead abatement programs. We also recommend updating this indicator with recent data to ensure the documentation is accurate and self-consistent.

- https://www.5280.com/neighborhood/washington-park/
- https://blog.usajrealty.com/neighborhood-focus-washington-park-denver/
- 10

¹¹ News Article. Accessed March 2023: <u>https://www.denverwater.org/tap/more-15000-lead-service-lines-have-been-</u>

⁹ Washington Park Neighborhood. Accessed March 2023 https://www.housedigest.com/996419/the-best-neighborhoods-in-denver-to-buy-a-home/

Denver Water's Lead Reduction Program. Accessed March 2023: <u>https://www.denverwater.org/your-water/water-quality/lead</u>

replaced#:~:text=Denver%20Water's%20Lead%20Reduction%20Program%20is%20fast%2Dtracking%20the%20replacement,direct%20cost% 20to%20the%20customer.

¹²

Washington Tracking Network. Lead Exposure Risk. Accessed March 2023: https://fortress.wa.gov/doh/wtn/WTNIBL/

3.1.5 Other air pollutants

We found the other air pollutants dataset questionable for the following reasons:

<u>Inaccurate Data</u>: APEN overstate the levels of other air pollutant emissions. APEN are potential maximum emissions, are not updated annually, and have minimum reporting thresholds, which make them potentially incomplete.

<u>Incorrect Methodology and Spatial Limitations</u>: The calculation method ("distance-weighted" method) produces inaccurate results that have more to do with the size of the area analyzed than the underlying data. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.

<u>Implications</u>: This "distance-weighted" method is used in many indicators. Any indicator using this method will have high results for census block groups with a larger area. For example, see Figure 4 where the locations with the highest scores are in rural areas which is inconsistent with the expected spatial distribution of Colorado's air emissions sources. This means that small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).



Figure 4. Map of CO EnviroScreen Data for Other Air Pollutants

<u>Recommendations</u>: When applying a distance-weighted approach the values need to be normalized by the size of the area analyzed (i.e., county area, census tract area, census block group area).

3.1.6 Fine particle pollution

We found the fine particle pollution dataset questionable for the following reasons:

Outdated data: The indicator uses a five-year-old dataset (2017)

<u>Spatial Limitations</u>: This dataset has a significant limitation because is not representative of the fine particle pollution exposures people may experience in Colorado. EnviroScreen relies on a downscaling fusion model dataset provided by EPA¹³ that for fine scales "are not expected to represent actual fine-scale atmospheric concentration gradients, except possibly where multiple monitors are present in the grid cell". This limitation applies to geographically smaller census block groups as they are in the "fine scale" range. However, since the fine pollution monitoring

¹³EPA Bayesian Space-time Downscaling Fusion Model (Downscaler) - Derived Estimates of Air Quality for 2017 https://ofmpub.epa.gov/rsig/rsigserver?data/FAQSD/docs/2017_DS_Annual_Report.pdf network is sparse over the entire state, the downscaling fusion model is unlikely to represent reasonable exposures to most people in the state.

<u>Inconsistent Documentation</u>: There are discrepancies between the description of downloadable metadata (2012) and the technical documentation (2017).

<u>Recommendation:</u> There are alternative datasets, like the Colorado ozone SIP modeling, with higher spatial resolution that could replace the current dataset. Although, the SIP modeling was performed for ozone, other atmospheric pollutants and fine particle pollution can be derived from this modeling. This would mitigate those deficiencies described above and would represent fine particle pollution exposures more accurately along the Front Range. We also recommend updating this indicator with recent data and ensuring the documentation is accurate and consistent.

3.2 Environmental Effects

The environmental effects score combines the information of seven indicators. In this section we only present the review of the six indicators identified as questionable. We note that all six environmental effects indicators used a "distance-weighted" methodology that produces inaccurate results that have more to do with the size of the area analyzed rather than the underlying data because this method will lead to systematically higher values for those census block groups that have a larger area.

3.2.1 Proximity to hazardous waste facilities

We found the proximity to hazardous waste facilities dataset questionable for the following reasons:

<u>Inaccurate Data</u>: The inclusion of both Large Quantity Generators (LQGs) and Treatment, Storage and Disposal Facilities (TSDFs) has the potential to overestimate the impact/density of waste generation activities. LQGs are heavily regulated and the identification of a LQG site is not indicative of mismanagement of waste, environmental contamination, or that a site has significant air emissions or wastewater discharges.

<u>Inaccurate Data</u>: When comparing EnviroScreen data that used LQG/TSDF data alongside Resource Conservation and Recovery Act (RCRA) info and TSDF, the data appears comparable; however, there are limitations from including LQGs, as LQGs alone are not indicative of mismanagement of waste or contamination.

<u>Incorrect Methodology</u>: The calculation method produces inaccurate results that have more to do with the size of the area analyzed rather than the underlying data. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.

<u>Implications</u>: This "distance-weighted" method is used in many indicators. Any indicator using this method will have high results for census block groups with a larger area. This means that

small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).

<u>Recommendation</u>s: Using TSDF data only might provide a better indication of potential impacts from emissions, releases, etc. A better indication of potential impacts might use RCRA violations alongside TSDF. Finally, when applying a distance-weighted approach the values need to be normalized by the size of the area analyzed.

3.2.2 Proximity to mining locations

We found the proximity to mining locations dataset questionable for the following reasons:

<u>Incorrect Methodology</u>: The calculation method produces inaccurate results that have more to do with the size of the area analyzed rather than the underlying data (Figure 5). Any factor that uses the "distance-weighted" method will create values that are biased high for larger areas. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.

<u>Implications</u>: This "distance-weighted" method is used in many indicators. Any indicator using this method will have high results for census block groups with a larger area. This means that small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).

Proximity to an active mine alone has the potential to overestimate risk. The mining industry is heavily regulated, and the identification of a mining site is not indicative of mismanagement, environmental contamination, or that a site has significant risk. Including only active mines may underestimate the risk. The Colorado Oil and Gas Conservation Commission (COGCC) has addressed the issue of orphaned oil and gas wells and there are ongoing abandoned mine mitigation projects throughout the state.

<u>Recommendation</u>: When applying a distance-weighted approach the values need to be normalized by the size of the area analyzed.



Figure 5. Map of CO EnviroScreen Data for Proximity to Mining Locations Indicator

3.2.3 Proximity to National Priority List sites

We found the proximity to National Priority List (NPL) sites dataset questionable for the following reasons:

<u>Spatial limitations</u>: Limitations exist in mapping the actual affected area from an NPL site versus the proximity. Some NPL sites have a wide geographic range in the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database. However, operable units within the sites indicate where varying levels of contamination and/or remediation have occurred. Additionally, NPL sites include sites with varying types of contamination – groundwater, soil, soil vapor, sediment, surface water. Proximity to a particular site may not always indicate adverse impact based upon the type of media impacted.

<u>Incorrect Methodology</u>: The calculation method used for EnviroScreen produces inaccurate results that have more to do with the size of the area analyzed rather than the underlying data. Any factor that uses the "distance-weighted" method will create values that are biased high for larger areas. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in

large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.

<u>Implications</u>: This "distance-weighted" method is used in many indicators. Any indicator using this method will have high results for census block groups with a larger area. This means that small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).

<u>Recommendation</u>: A better dataset to use would be the 5-year reviews of each NPL listing which has accurate and available data of currently impacted areas. For example, the Denver Radium site consists of over 65 properties contaminated by radioactive residues derived from the processing of radium ore in the early 1900s. This site has been partially deleted from the National Priorities List of Superfund sites. While affected areas around the Denver Radium site have a large boundary in Denver, the cleanup and remediation of most of these locations has already occurred.

Another example is the Nelson Tunnel NPL site in Creede, Colorado. The entire Mineral County and census block groups within the county received the same rating despite the NPL listing only being in Creede and having specific operable units assigned to a smaller geographical location. When applying a distance-weighted approach the values need to be normalized by the size of the area analyzed.

3.2.4 Proximity to oil and gas

We found proximity to oil and gas dataset questionable for the following reasons:

<u>Incorrect Methodology</u>: The calculation method used in EnviroScreen produces inaccurate results that have more to do with the size of the area analyzed rather than the underlying data. Any factor that uses the "distance-weighted" method will create values that are biased high for larger areas. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.

<u>Implications</u>: This "distance-weighted" method is used in many indicators. Any indicator using this method will have high results for census block groups with a larger area. This means that small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).

<u>Recommendation</u>: The distance-weighted approach needs to be updated to ensure indicators are represented adequately.



Figure 6. Map of CO EnviroScreen Data for Proximity to Oil and Gas Indicator

3.2.5 Proximity to Risk Management Plan sites

The proximity to Risk Management Plan (RMP) sites dataset is questionable for the following reason:

<u>Incorrect Methodology</u>: The calculation method produces inaccurate results that have more to do with the size of the area analyzed rather than the underlying data. This is because the "distance-weighted" method is based on counts of facilities and is not normalized by area. As an example, if a facility dataset was uniformly distributed across the state with the same number of facilities per area, using the "distance-weighted" method would result in large census block groups having higher facility counts simply due to their size, while in actuality the areas would all have an equal density of sources.

<u>Implications</u>: This "distance-weighted" method is used in many indicators. Any indicator using this method will have high results for census block groups with a larger area. This means that small census block groups, such as those that typically occur in urban areas, will be biased low. The implications of this methodology error are significant because scores that are higher (i.e., "worse") in larger census block groups (low population rural areas) will divert resources away from smaller census block groups (higher population urban areas).

<u>Recommendation</u>: when applying a count-based approach the values need to be normalized by the size of the area analyzed.

3.2.6 Wastewater discharge indicator

We found the wastewater discharge indicator dataset (Figure 7) questionable for the following reasons:

<u>Inaccurate Data</u>: The water data is generated from EPA's Toxic Release Inventory (TRI) data, which is often inaccurate and over or understates actual impact to a local area. The use of TRI data may not identify all potential discharges to public waterways, as reporting requirements only impact certain facilities. With respect to EJ, using TRI only implies that if there is no TRI, that the water will not be impacted, conversely, living close to a TRI does not guarantee exposure.

The modeling uses the U.S. Environmental Protection Agency (EPA) Risk-Screening Environmental Indicators (RSEI) which uses simplified data. RSEI is designed to represent a worst-case scenario, so in many cases, additional investigation will indicate less potential for concern, such as, the water discharge is to a larger stream or river than modeled.

The RSEI model captures the potential release and exposure to certain toxic chemicals that may threaten human health and the environment by using TRI. A comparison of the EnviroScreen wastewater discharge indicator from the RSEI model to an Enforcement and Compliance History Online (ECHO) facility of NDPES permitted facilities, and an ECHO facility search of Clean Water Act (CWA) noncompliance's within the last 5 years shows there is some overlap of permitted facilities and facilities with CWA violations and what EnviroScreen calls "most burdened". However, the use of TRI data may not identify all potential discharges to public waterways, as reporting requirements only impact certain facilities and the modeling may represent "worst-case scenario" data.

<u>Inconsistent Documentation</u>: The downloadable metadata indicates data is from 2021, whereas the technical documentation indicates is from 2019.

<u>Recommendations</u>: Discharge data is specific to a particular site address, where the true impact would be the point of discharge, which may be some distance away from the site (particularly as it relates to storm water discharges). Use of discharge data reported under the National Pollutant Discharge Elimination System (NPDES) program (for direct dischargers only) would provide more accurate information. Impaired waterways would be a better indicator for wastewater impacts. We also recommend updating this indicator with recent data and ensure the documentation is accurate and consistent.



Figure 7. Map of CO EnviroScreen for Wastewater Discharge Indicator

3.3 Climate Vulnerability

The climate vulnerability score combines the information of four indicators, which we discuss in this section since all were identified as questionable. Overall, none of the datasets in this section evaluate climate vulnerability (susceptibility of the population to the impacts of the hazard). Rather, these indicators represent a measure of exposure. A population can be highly exposed but not highly vulnerable. Additionally, none of these indicators account for future climate change.

3.3.1 Drought

The indicator for drought is calculated as the sum of weekly total percent of an area experiencing severe, extreme, or exceptional drought between 2016 and 2020. In addition to the general issues with the climate indicators discussed above, we found the drought indicator questionable for the following reason:

<u>Insufficient Data</u>: Four years is not long enough to characterize long-term exposures to drought or other climate hazards. Typically, 20 or 30-year periods¹⁴ are used to minimize natural interannual variability in the climate system.

<u>Recommendation</u>: Examples of alternative datasets and/or approaches that would result in a more robust and reliable evaluation of exposure to drought are listed below. At minimum, the period of analysis should be expanded to align with these approaches.

- The FEMA National Risk Index¹⁵ uses the same weekly data from the U.S. Drought Monitor used in EnviroScreen but for the period 2000 to 2017 to evaluate the historical occurrence of drought. Then this historical drought occurrence is intersected with the agricultural value density of each census tract to characterize exposure.
- The CDC National Environmental Public Health (EPH) Tracking Network dataset used in EnviroScreen for extreme heat days provides county-level drought data for 1980-present.
- A recent NOAA funded study on state-level drought vulnerability uses the weekly U.S. Drought Monitor data for 2000 to 2019 as one exposure indicator of drought.
- World Resources Institute Aqueduct tool provides present-day drought risk (2000-2014) and baseline water stress classifications (1960-2014) at the hydrological sub-basin level as well as future projections.

3.3.2 Extreme heat days

The indicator for extreme heat is the average number of days between May and September during the period 2016 to 2020 in which daily high temperature exceeded the 90th percentile of historical daily high temperatures. In addition to the general issues with the climate indicators discussed above, we found the extreme heat indicator questionable for the following reason:

<u>Insufficient Data</u>: Four years is not long enough to characterize long-term exposures to extreme heat or other climate hazards. Typically, 20- or 30-year periods are used to minimize natural interannual variability in the climate system.

Recommendation:

Heat index¹⁶ is a better measure of population impacts from extreme heat than extreme heat days and should be used instead. Heat index data is available for the period 1979-2021 from the same CDC EPH dataset currently used in EnviroScreen. We recommended using this data for a longer period instead of the daily maximum temperature to better represent potential public health impacts. The NWS heat index classifications can be used to classify the heat index days (e.g., 125 °F or higher is 'extreme danger', 103-124°F is 'danger', etc.)

Alternative datasets or approaches include:

• The CDC EPH dataset also provides the projected difference in extreme heat days in the 2030s, 2050s and 2080s relative to a historical baseline at the county level that can be used for forward looking evaluations. This data is provided for both a moderate emissions

¹⁴ World Meteorological Organization Guidelines. Accessed March 2023: <u>https://library.wmo.int/doc_num.php?explnum_id=4166</u>

Intergovernmental Panel on Climate Change Global Warming definition. Accessed March 2023: <u>https://www.ipcc.ch/sr15/chapter/glossary/</u> ¹⁵ https://www.fema.gov/sites/default/files/documents/fema_national-risk-index_technical-documentation.pdf

¹⁶ National Weather Service Heat Index. Available at: <u>https://www.weather.gov/ama/heatindex</u>

scenario (RCP 4.5) and a high emissions scenario (RCP 8.5) using climate model projections developed for the 4th National Climate Assessment.

• First Street Foundation provides heat risk data at the census tract level free for noncommercial use for the period 2022 to 2052.¹⁷

3.3.3 Floodplains

The EnviroScreen indicator for flooding is the percentage of each geographic area where there is at least one percent chance of flooding annually. We identified the following limitations with the approach used to assess exposure to flooding:

<u>Incomplete Data Set</u>: The dataset used may not comprehensively cover Colorado. As stated on the data source website, "areas that correspond to the 100-year flood zone are not included [in the data source]".

<u>Inaccurate Data</u>: EnviroScreen uses the percent of the total census tracts that is within the floodplain, which would include both developed and undeveloped areas. This may result in a misrepresentation of relative exposure.

<u>Recommendation</u>: Use the percent of developed and agricultural areas that are within the floodplain as this would better represent actual exposure to people and property (see the FEMA National Risk Index approach for riverine flood exposure). The alternative datasets recommended below would have better coverage if large gaps in the floodplain layer used are identified.

Alternative datasets include:

- FEMA National Risk Index¹⁸
- First Street Foundation¹⁹ provides historical and future flood risk data at the census tract level for free for non-commercial use. Data is provided at various administrative levels (e.g., census tract, county, zip code).

3.3.4 Wildfire risk

The EnviroScreen technical documentation indicates that the wildfire risk score is calculated as the mean value of USDA Forest Service wildfire hazard potential dataset within each geographic area (i.e., county, census tract, census block group). This data set is appropriate for evaluating potential exposure to wildfire in the present-day and is widely used for this purpose. With that said, we note the following limitations of the data and approaches used in EnviroScreen:

<u>Spatial Limitations</u>: EnviroScreen currently uses the 270-m resolution version of the dataset. However, a higher resolution (i.e., 30 m) version was developed recently for the USDA Wildfire Risk to Communities dataset.²⁰

<u>Incorrect Methodology</u>: Using the mean wildfire hazard potential across each geographic area may misrepresent the relative risks for people and property, particularly if large areas are forested and undeveloped.

¹⁷ First Street Foundation Heat Risk dataset. Accessed March 2023: <u>https://aws.amazon.com/marketplace/pp/prodview-juylajmn3mixo?sr=0-</u> <u>4&ref_=beagle&applicationId=AWSMPContessa</u>

¹⁸ Federal Emergency Management Agency, National Risk Index. Available at: <u>https://hazards.fema.gov/nri/</u>

¹⁹ First Street Foundation. Available at: <u>https://firststreet.org/</u>

²⁰ United States Department of Agriculture, Wildfire Risk to Communities. Available at: <u>https://wildfirerisk.org/</u>

<u>Inconsistent Documentation</u>: The units used for wildfire are not listed in the definitions and the figure says to see the technical report for units.

<u>Recommendation</u>: Use the percent of developed lands in each geographic area that are classified as having high wildfire hazard potential instead of the mean value across all areas. At minimum, use the higher resolution USDA wildfire hazard potential dataset. Alternatively, consider using the USDA Risk to Potential Structures dataset listed below as it accounts for both wildfire intensity and likelihood and thus is more representative of risk.

Alternative datasets include:

- Risk to Potential Structures dataset of the USDA Wildfire Risk to Communities project.²¹
- First Street Foundation Wildfire Risk data²² at the census-tract (available for free for noncommercial use).

3.4 Sensitive Populations

The sensitive populations score combines the information of nine indicators. In this section we present the review of the life expectancy indicator, the only one identified as questionable.

3.4.1 Life expectancy

We found the life expectancy dataset questionable for the following reasons:

<u>Incomplete Dataset</u>: The dataset has several gaps that result in large areas and many census block groups which show no data (Figure 8).

Outdated Data: The dataset covers 2010-2015. More recent data is available.

Although Colorado ranks high in the U.S. for life expectancy, in June 2021, CDPHE released data that showed overall life expectancy in Colorado dropped by a full two years from 80.9 in 2019 to 78.9 in 2020 due to Covid19.

<u>Recommendation</u>: Use more complete and recent data available from CDC National Vital Statistics System²³. Update annually as new data becomes available.

²¹ Risk to Potential Structures dataset. Accessed March 2023: <u>https://www.arcgis.com/home/item.html?id=b67f6b56887f4bd595bc48ca59b4dd68</u>

²² First Street Foundation Wildfire Risk data. Accessed March 2023: <u>https://firststreet.org/risk-factor/fire-factor/</u>

²³ CDC National Vital Statistics System. Accessed March 2023: <u>https://www.cdc.gov/nchs/nvss/index.htm</u>



Figure 8. Map of CO EnviroScreen Life Expectancy Indicator

3.5 Demographics

The demographics score combines the information of six indicators. Our main concern with all of them is that they use outdated data and inconsistent data ranges.

<u>Outdated Data</u>: The data sets used for demographics are from a robust and reliable source – The American Community Survey, which uses census data, but the date ranges for the demographic indicators are not consistent and should therefore not be combined to determine the demographic score. Moreover, when a data set is outdated, the census block groups currently classified as DIC could potentially become non-DIC and vice versa.

<u>Inconsistent Documentation</u>: For housing cost burden and disability, the downloadable data states the data is from 2019, while the EnviroScreen Technical Documentation states that the data is from 2015-2019.

<u>Recommendation</u>: Update as soon as possible to the latest version of the census for all indicators and use the consistent data ranges. We also recommend updating this indicator with recent data and ensure the documentation is accurate and consistent.

3.6 Data Descriptions

We identified inconsistencies related to the data source for some indicators which leads to confusion. Descriptions for each Colorado EnviroScreen indicator are available for download at CDPHE website and are also provided in the technical support document; however, as summarized in Table 2 some of the report dates are inconsistent.

Indicator	Downloaded Description Date	Technical Guide Description Date
Ozone	2012	2017
Particles (PM _{2.5})	2012	2017
Lead Exposure	2014-2018	2015-2019
Traffic Proximity	2019	2017
Diesel PM	2017	2014
Wastewater Discharge	2021	2019
Disability	2019	2015-2019
Housing Cost Burden	2019	2015-2019

 Table 2.
 EnviroScreen Indicators with Inconsistent Documentation

3.7 EnviroScreen Review Summary

Table 3 provides a summary of the EnviroScreen review. The indicators and the descriptions from CDPHE website hosting EnviroScreen are listed with the data source and hyperlinks, whether or not the data has been flagged as questionable, and the reasons for concern.

Table 3. Summary of EnviroScreen Data Analysis

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
Environmenta	al Exposure Indicators				
Ozone	Maximum 8-hour average model predictions over the U.S. for ozone for any month in 2017	U.S. Environmental Protection Agency (EPA) Bayesian Space-time Downscaling Fusion Model (Downscaler)	https://ofmpub.ep a.gov/rsig/rsigserv er?data/FAQSD/do cs/2017 DS Annu al Report.pdf	yes	Inaccurate Data Outdated Data Inconsistent Documentation

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Air toxics emissions</i>	A distance-weighted measure of estimated air toxics emissions based on reported emissions from Air Pollution Emission Notices (APENs) filed by permitted entities, 2016- 2020	Colorado Department of Public Health and Environment (CDPHE) Colorado Air Pollutant Emissions Notice (APEN) dataset 2021	https://cdphe.colo rado.gov/apens- and-air%20%20- permits	yes	Inaccurate Data Incorrect Methodology Spatial limitations
<i>Diesel particulate matter (PM)</i>	Diesel particulate matter (PM) level in air, in micrograms per cubic meter (µg/m3) (2014)	EPA NATA, via EJScreen 2021 (data year 2014)	https://www.epa.g ov/nationalair- toxics- assessment/2014- nataassessment- results	no	n/a Inconsistent Documentation
<i>Drinking water regulations</i>	Population-weighted duration (in weeks) of resolved and unresolved health-based violations between 2010 and 2020 from active community public water systems	Colorado Department of Public Health and Environment (CDPHE) 2010- 2020	https://cdphe.colo rado.gov/dwinfo	yes	Spatial Limitations

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
Lead exposure risk	Percent of housing units built before 1960, as an indicator of potential lead paint exposure	Calculated based on Census/ACS data, retrieved 2019 (data years 2013- 2017) (data source for housing age is the U.S. Census Bureau American Community Survey (ACS) from 2015- 2019)	https://www.cens us.gov/progra%20 ms- surveys/acs/data/ summaryfile.html	yes	Incomplete Dataset Inaccurate Data Inconsistent Documentation
Noise	Estimated average daytime summer noise in decibels (dBA) between 2013-2015	National Park Service (NPS) sound map	https://www.nps.g ov/subjects/sound /soundmap.htm	no	n/a

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Other air pollutants</i>	A distance-weighted measure of estimated other air pollutant emissions based on reported emissions from Air Pollution Emission Notices (APENs) filed by permitted entities, 2016- 2020	Colorado Department of Public Health and Environment (CDPHE) Colorado Air Pollutant Emissions Notice (APEN) dataset 2021	https://ofmpub.epa .gov/rsig/rsigserver ?data/FAQSD/docs/ 2017 DS Annual Report.pdf	yes	Inaccurate Data Incorrect Methodology
Fine particle pollution	24-hour average particulate matter that is less than or equal to 2.5 micrometers in diameter (PM2.5) concentrations during 2017	U.S. Environmental Protection Agency (EPA) Bayesian Space-time Downscaling Fusion Model (Downscaler)	https://ofmpub.ep a.gov/rsig/rsigserv er?data/FAQSD/do cs/2017 DS Annu al Report.pdf	yes	Incomplete Dataset Spatial Limitations Inconsistent Documentation
Traffic proximity and volume	Count of vehicles average annual daily traffic (AADT) at major roads within 500 meters, divided by distance in meters (2019)	2019 HPMS data (U.S. Department of Transportation, 2019) – annual average daily traffic estimates	Not publicly available. Details on HPMS available at http://www.fhwa. dot.gov/policyinfor mation/hpms.cfm	no	n/a Inconsistent Documentation

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
Environmental	Effects			_	
<i>Impaired</i> <i>Streams and</i> <i>rivers</i>	The average impairment and assessment status of streams. The proportion of total stream length that is impaired across all evaluated stream segments weighted by the percentage of possible impairment for each segment. The proportion of unassessed stream segments is weighted by half to ensure known stream impairment contributes more heavily to the overall score.	303(d) Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division2000- 2020	https://cdphe.colo rado.gov/clean- water-gis-maps	no	n/a
Proximity to hazardous waste facilities	Count of hazardous waste facilities (treatment, storage, disposal facilities, and large quantity generators) within 5 kilometers (km), or nearest beyond 5 km, each divided by distance in km (2021)	Calculated from EPA RCRAInfo database, retrieved 04/2022	https://www.epa.g ov/hwpermitt ing/reference- documenthazardou s-waste- treatmentstorage- and-disposal- facilities	yes	Inaccurate Data Incorrect Methodology

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
Proximity to mining locations	A distance-weighted measure of the total number of active coal, hard rock, and construction materials mining permits within a given geographic area	Colorado Division of Reclamation, Mining and Safety 2022	<u>https://drms.color</u> <u>ado.gov/data-</u> <u>search</u>	yes	Incorrect Methodology
<i>Proximity to National Priorities List sites</i>	Count of proposed or listed NPL sites within 5 kilometers (km), or nearest one beyond 5 km, each divided by distance in km (2021)	Calculated from EPA CERCLIS database, retrieved 04/2022	http://cumulis.epa .gov/supercpa d/cursites/srchsite s.cfm	yes	Spatial Limitations Incorrect Methodology
Proximity to oil and gas	A distance-weighted measure of the total number of active oil and gas locations, active pits, tank batteries, wells, and spills and releases within a given geographic area.	Colorado Oil and Gas Conservation Commission 2016-2021	https://cogcc.stat e.co.us/data2.html #/downloads	yes	Inaccurate Data Incorrect Methodology

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Proximity to Risk Management Plan (RMP) sites</i>	Count of RMP facilities (facilities that are required to develop potential chemical accident management plans) within 5 kilometers (km), or nearest one beyond 5 km, each divided by distance in km (2021)	Calculated from EPA RMP database, retrieved 04/2022	<u>https://www.epa.q</u> ov/rmp/riskmanag <u>ement-plan-rmp-</u> ruleoverview	yes	Inaccurate Data Incorrect Methodology
Wastewater discharge indicator	Estimated toxic chemical concentrations in stream segments within 500 meters of a geographic boundary, divided by distance in kilometers (km) in 2019	Calculated from RSEI modeled toxicity- weighted stream concentrations, created 08/2021	<u>https://www.epa.g</u> <u>ov/rsei</u>	yes	Inaccurate Data Inconsistent Documentation

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern				
Climate Vulnerability									
Drought	Sum of weekly total percent of an area experiencing a severe, extreme, or exceptional drought (categories D2, D3, or D4). These levels of drought imply some level of voluntary or mandated water use restrictions and observable damage or loss of pasture and crops. Drought is measured between 2016-2020 at the county level.	U.S. Drought Monitor 2016- 2020	https://droughtmo nitor.unl.edu/Data .aspx	yes	Insufficient Data				
Extreme heat days	Average number of days between May and September from 2016 through 2020 in which daily high temperature exceeded the 90th percentile of historical daily high temperatures. Values are reported in Colorado EnviroScreen at the census tract level.	National Environmental Public Health Tracking Network via the U.S. Center for Disease Control (CDC) 2016-2020	<u>https://ephtrackin</u> g.cdc.gov/	yes	Insufficient Data				

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern			
Floodplains	Percentage of each geographic area where there is at least a one percent chance of flooding annually	Federal Emergency Management Agency (FEMA) (2016)	https://geo.colora do.edu/catalog/47 540- 5ca228ffd4326700 0b8c7448	yes	Incomplete Dataset			
Wildfire risk	Wildfire Hazard Potential for the United States, version 2020	U.S. Department of Agriculture (USDA), U.S. Forest Service (USFS)	https://www.fs.us da.gov/rds/archive /catalog/RDS- 2015-0047-3	yes	Spatial Limitations			
Sensitive Populations								
Asthma hospitalization rate	Age-adjusted asthma hospitalization rates per 10,000 people recorded at the census tract level between 2013-2017	Colorado Hospital Association's Hospital Discharge Dataset, published by Colorado Department of Public Health and Environment (CDPHE)	https://data- cdphe.opendata.ar cgis.com/datasets/ a176548521c546f Ob9be512197d7d8 f4 1/about	no	n/a			
Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern			
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<i>Cancer</i> prevalence	Individuals 18 years and older who have reported having cancer. Provided as a rate of individuals per 10,000 at the census tract Level.	Center for Disease Control and Prevention (CDC) 2015- 2019 via PLACES	https://chronicdat a.cdc.gov/500- Cities- Places/PLACES- Local-Data-for - Better-Health- Census-Tract- D/cwsq-ngmh	no	n/a			
<i>Diabetes prevalence</i>	Individuals 18 years and older who have reported ever having diabetes, excepting diabetes during pregnancy. Provided as a rate of individuals per 10,000 at the census tract Level.	Center for Disease Control and Prevention (CDC) 2015- 2019 via PLACES	https://chronicdat a.cdc.gov/500- <u>Cities-</u> Places/PLACES- Local-Data-for - Better-Health- Census-Tract- D/cwsq-ngmh	no	n/a			

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Heart disease in adults</i>	Age-adjusted predicted prevalence of coronary heart disease among individuals 18 years and older for all census tracts in Colorado. Based on measured values between 2014-2017 and reported as percent of population.	Behavioral Risk Factors Surveillance System (BRFSS), published by Colorado Department of Public Health and Environment (CDPHE) Open Data	https://data- cdphe.opendata.ar cgis.com/datasets/ CDPHE::heart- disease-in-adults- cdphe-community- level-estimates- census- tracts/about	no	n/a
<i>Life</i> <i>expectancy</i>	Estimated life expectancy in years recorded at the census tract level using data from 2010-2015	Colorado Department of Public Health and Environment (CDPHE) Vital Statistic Program 2010- 2015	https://data- cdphe.opendata.ar cgis.com/datasets/ CDPHE::colorado- life-expectancy- by-census-tract- published-by- naphsis-usaleep- 2010-2015/about	yes	Incomplete Dataset Outdated Data Inconsistent Documentation

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
Low birth weight	Average percentage of singleton births with low birth weight (<2,500 grams) between 2013- 2017	Colorado Department of Public Health and Environment (CDPHE) Vital Records Birth Dataset.	https://data- cdphe.opendata.ar cgis.com/datasets/ CDPHE::low- weight-birth-rate- census- tracts/about	no	n/a
<i>Mental health indicator</i>	Age-adjusted prevalence of number of people who had reported 14 days or more of not good mental health in the last 30 days. Based on the Behavioral Risk Factor Surveillance System (BRFSS).	Center for Disease Control and Prevention (CDC) 2015- 2019 via PLACES	https://chronicdat a.cdc.gov/500- Cities- Places/PLACES- Local-Data-for - Better-Health- Census-Tract- D/cwsq-ngmh	no	n/a
Population over 64	Percent of people in a census block group over the age of 64	ACS 2016-2020	https://www.cens us.gov/newsroom/ press- kits/2021/acs-5- year.html	no	n/a
Population under 5	Percent of people in a census block group under the age of five	ACS 2016-2020	https://www.cens us.gov/newsroom/ press- kits/2021/acs-5- year.html	no	n/a

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
Demographic	S				
Housing cost burdened	The percent of households within an area that spend more than 30% of household income on housing	American Community Survey (ACS) 2015-2019 Gross Rent as a percentage of household income in the past 12 months, Mortgage status by selected monthly owner costs as a percentage of household income in the past 12 months	https://data.censu s.gov/cedsci/table ?q=B25091&tid=A CSDT5Y2019.B250 91	yes	Outdated Data Inconsistent Documentation

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Percent disability</i>	Percent of people who report one or more of these six disability types: hearing difficulty, vision difficulty, cognitive difficulty, ambulatory difficulty, self-care difficulty, and independent living difficulty	American Community Survey (ACS) 2015-2019	https://data.censu s.gov/cedsci/map? g=percent%20dis ability&tid=ACSST 5Y2019.S1810&cid =S1810 C01 001 E&vintage=2019&l aver=VT 2019 04 0 00 PP D1&mod e=thematic	yes	Outdated Data Inconsistent Documentation
Percent less than high school education	Percent of people age 25 or older in a census block group whose level of educational attainment is less than a high school diploma	ACS 2016-2020	https://www2.cen sus.gov/programs- surveys/acs/summ ary_file/2020/prot otype/5YRData/	yes	Outdated Data

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Percent linguistic isolation</i>	Percent of people in a block group living in linguistically isolated households. A household in which all members age 14 years and over speak a non-English language and also speak English less than "very well" (have difficulty with speaking English) is considered linguistically isolated by the U.S. Census Bureau.	ACS 2016-2020	https://www2.cen sus.gov/programs- surveys/acs/summ ary_file/2020/prot otype/5YRData/	yes	Outdated Data
Percent low income	The percent of a census block group's population living in households where the household income is less than or equal to twice the federal poverty level	ACS 2016-2020	https://www2.cen sus.gov/programs- surveys/acs/summ ary_file/2020/prot otype/5YRData/	yes	Outdated Data

Indicator Name	Indicator Description	Data Source	Link	Is Data Questionable? (yes/no)	Reasons For Concern
<i>Percent</i> <i>people of</i> <i>color</i>	The percent of individuals in a block group who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino. That is, all people other than non-Hispanic, white-alone individuals. The word "alone" in this case indicates that the person is of a single race, not multiracial.	ACS 2016-2020	https://www2.cen sus.gov/programs- surveys/acs/summ ary_file/2020/prot otype/5YRData/	yes	Outdated Data

4. Summary and Recommendations

We reviewed thirty-five (35) datasets, each representing an indicator used by EnviroScreen. Our review shows that twenty-three (23) of those indicators used data of questionable quality.

Importantly, Colorado EnviroScreen's technical documentation clearly lists limitations and proper use of the tool; however, the tool is being used in a manner that is inconsistent with the stated abilities of the tool. Specifically, by proposing to use Colorado EnviroScreen to make decisions about resource allocation, participation opportunities, emissions cuts and monitoring, or enforcement, CDPHE will be using Colorado EnviroScreen in a way that does not appear to be supported by the tool developers. Further, these decisions are consequential and will have social, financial, and legal implications that are particularly concerning given the questionable quality of data and methodologies used by the tool.

This review shows that EnviroScreen has significant deficiencies and limitations that make the tool unreliable for the intended purposes. While specific recommendations for each indicator identified as a concern are provided in Chapter 3, the following is a list of general tool development recommendations for CDPHE's consideration:

- Initiate a thorough and independent peer-review process to ensure that the data used in EnviroScreen is robust and accurate, verify the tool calculations, review the applied methodologies, including whether the datasets are comprehensive, and advise on the appropriate weighting applied to the indicators in the calculation of the final score.
- Regularly solicit technical expertise related to the most current, accurate, highly resolved datasets available.
 - When possible, use datasets available at a higher spatial resolution than what is currently implemented. This will provide meaningful information, especially for indicators where the public has voiced concerns.
 - Update the methodology that uses the "distance weighted" approach in EnviroScreen to ensure indicators are represented adequately.
- Establish quality assurance and quality controls procedures to ensure consistency of data descriptions across all platforms and documentation.
- Create a systematic record and access to archived versions of the technical documentation and release notes. Provide detailed logs for all updates and modifications to datasets and versions of EnviroScreen.
- Create an open and transparent process of experts to review and approve the tool and any changes to the tool to improve public trust and defensibility of decisions based on the tool.

Appendix A

EnviroScreen Maps



















> 85








































80% - 100%









80% - 100%



