



The data consortium consists of Denver Regional Council of Governments members and regional partners with an interest in geospatial data and collaboration. The data consortium newsletter improves communication among local geographic information systems professionals and features updates from all levels of government as they relate to data and geospatial initiatives in our region. This newsletter is published quarterly.

A study of pedestrian infrastructure and vulnerable populations

Article submitted by Erik Braaten, University of Colorado Denver master's program graduate student. Erik can be reached at erik.braaten@ucdenver.edu.

Sidewalks and trails make up a vital component of a region's transportation network. The Denver region's combined pedestrian network encompasses over 7,300 miles of sidewalks and trails. The quality of the region's infrastructure is critical to quality of life and access to opportunity for the roughly 3 million residents of the region, but it may not be equitably serving all populations. Former Streetsblog national editor Angie Schmitt, in her 2020 book *Right of Way* that examines pedestrian deaths in the U.S., writes that, "people who have overlapping marginalized identities — an older black man who lives in a low-income neighborhood, for example — will be the most vulnerable."

This study of pedestrian infrastructure and vulnerable populations asked, "What is the current state of pedestrian infrastructure in the Denver region relative to vulnerable populations?" Insufficient pedestrian facilities were indicated by sidewalks with a width less than 5 feet and that were within 2 feet of the road (for example, lacking a buffer between the sidewalk and traffic). The following vulnerable populations were considered:

- Percent of individuals with a disability.
- Percent of individuals age 5-plus and classified as language challenged.
- Percent of minority individuals including Hispanic and Latino.

- Percent of total households with no vehicle available.
- Percent of people age 65-plus.
- Percent of total households below poverty.
- Percent of people age 5 to 7.

The study's author analyzed DRCOG's planimetric sidewalk data by running summary statistics for sidewalk width for sidewalks within 2 feet of the edge of pavement (for example, the road) across the seven vulnerable populations above the regional average. A walkshed of 3/4 mile representing a 15-minute walk (based on an average walking speed of 3 miles per hour) was generated for each census tract based on centroids created for each tract. The analysis found that walksheds created for census tracts with vulnerable populations above the regional average consistently had inferior sidewalk infrastructure compared to those at or below the regional average based on the metric described above.

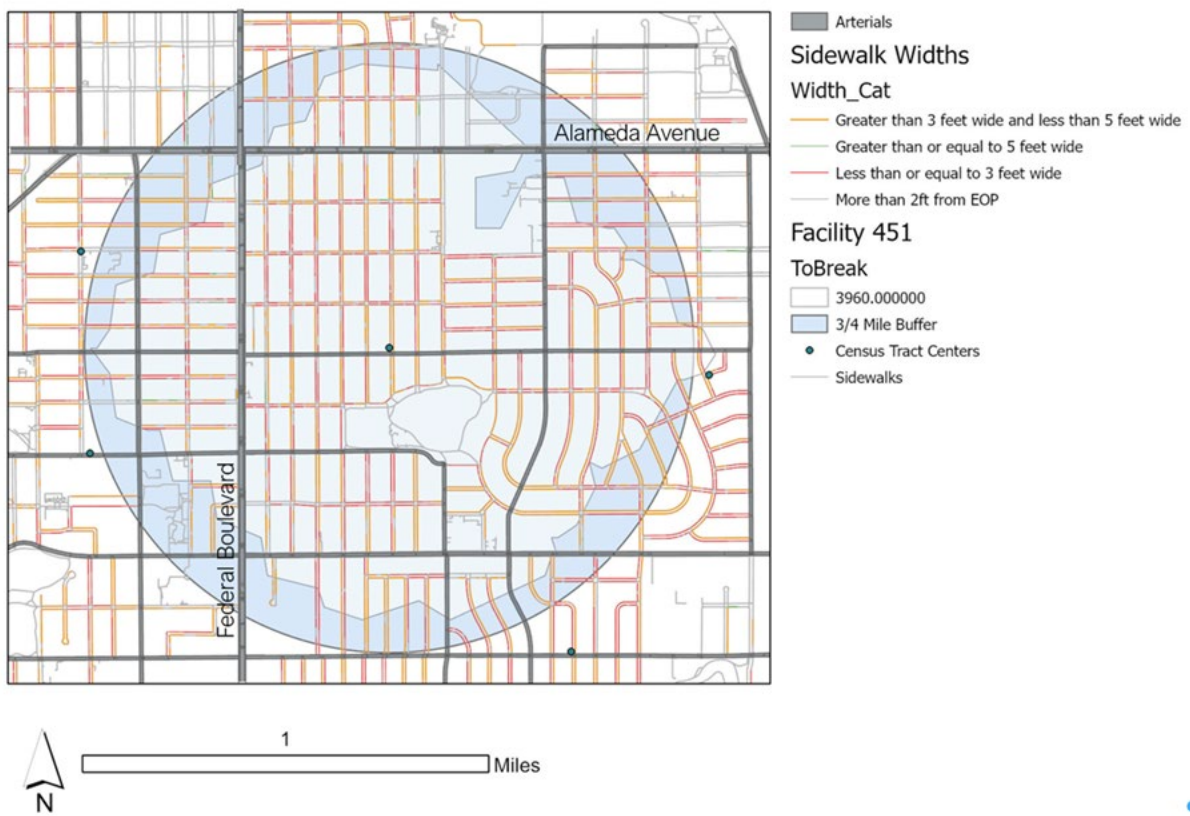
More than Regional Average	Sidewalk within 2 feet of EOP			Sidewalk more than 2 feet from EOP	Total	Percent Walkshed within 3/4 mi buffer
	3 Feet or less wide	Between 3 and 5 feet wide	5 Feet or greater wide			
Percent of Persons with a Disability	10	19	1	73		40
Percent of Persons 5 and Over Classified as Language Challenged	10	18	1	73		41
Percent of Minority Persons Including Hispanic and Latino	10	17	1	77		40
Percent of Total Households with No Vehicle Available	9	15	1	77		45
Percent of People (Males and Females) Aged 65 and Over	9	18	1	76		36
Percent of Total Households Below Poverty	10	16	1	75		42
Percent of People (Males and Females) Aged 5 to 17	7	15	1	81		35
Combined Vulnerable Census Tract Walksheds	9	17	1	76	103	40
At or below Regional Average						
Percent of Persons with a Disability	5	12	1	86		35
Percent of Persons 5 and Over Classified as Language Challenged	6	14	1	83		36
Percent of Minority Persons Including Hispanic and Latino	6	14	1	82		36
Percent of Total Households with No Vehicle Available	6	15	1	82		33
Percent of People (Males and Females) Aged 65 and Over	6	13	1	83		39
Percent of Total Households Below Poverty	6	14	1	83		35
Percent of People (Males and Females) Aged 5 to 17	7	15	1	80		40
Combined Non-Vulnerable Census Tract Walksheds	6	14	1	83	104	36

Figure 1: Summed totals surpass 100% due to rounding, but numbers across categories are consistent.

On average, 24% of sidewalks in walksheds affecting vulnerable populations were located within 2 feet of the road compared to 17% in walksheds where vulnerable populations were not above the regional average. The discrepancy appears to be mostly accounted for in higher percentages of sidewalks that are not only within 2 feet of the road but that are also 3 feet wide or less.

Planners could leverage similar analysis throughout the metro area to identify insufficient walksheds that affect vulnerable populations. An example walkshed is shown below.

Sidewalk within 2 feet of EOP		
3 Feet or less wide	Between 3 and 5 feet wide	5 Feet or greater wide
33	32	1
Sidewalk more than 2 feet from EOP		Percent Walkshed in 3/4 mi buffer
Total		
34	100	72



Using the DRCOG 2018 pilot land use land cover data to predict urban air temperature in the Denver metro area

Article submitted by Peter C. Ibsen, Ph.D. at the U.S. Geological Survey, Geosciences and Environmental Change Science Center, Denver. Peter can be reached at pibsen@usgs.gov.

Exposure to extreme heat can drastically increase health risks for urban residents, including increasing mortality rates during heat waves and even exacerbating serious mental health conditions (see footnotes 1 and 2). This heat risk is generally not equally distributed. Furthermore, regional climate shifts may increase urban heat as well as the inequities of heat risk, implying the need to develop city-specific resilience strategies (see Footnote 3). Addressing the inequity of urban heat can start with understanding how microscale urban land uses modify daytime and nighttime air temperature. During the day, radiative heat is captured, stored and reradiated by urban land covers. Heat transfer properties, however, differ among land covers. Using a network of air temperature sensors, deployed over Denver's urban core across a gradient of urban land covers (see Footnote 4) (Figure 1A), and regional air temperature and relative humidity at Denver International Airport as a reference, we can estimate the relative influences of land cover on air temperature with the high-resolution data. Previously, most available land cover data are available at a resolution of 30 square meters. At that scale, measuring the influence of tree canopy, turf or impervious surface on microclimate is not possible. However, with DRCOG's 1 square meter 2018 pilot land use data, in addition to identifying the influence of land cover types on microclimate, we can also use

computational models to predict microclimate air temperature over the entire Denver metro area for any given regional-scale air temperature and humidity (Figure 1B). We are fine tuning our models to provide data that can inform urban planners on the effect of specific land covers on urban heat. With citywide microclimate air temperature, city managers can have a better understanding of exactly where the urban heat is the biggest issue, while also quantifying how much urban tree cover, turf and greenspace contribute to mitigating those temperatures.

Figure 1:

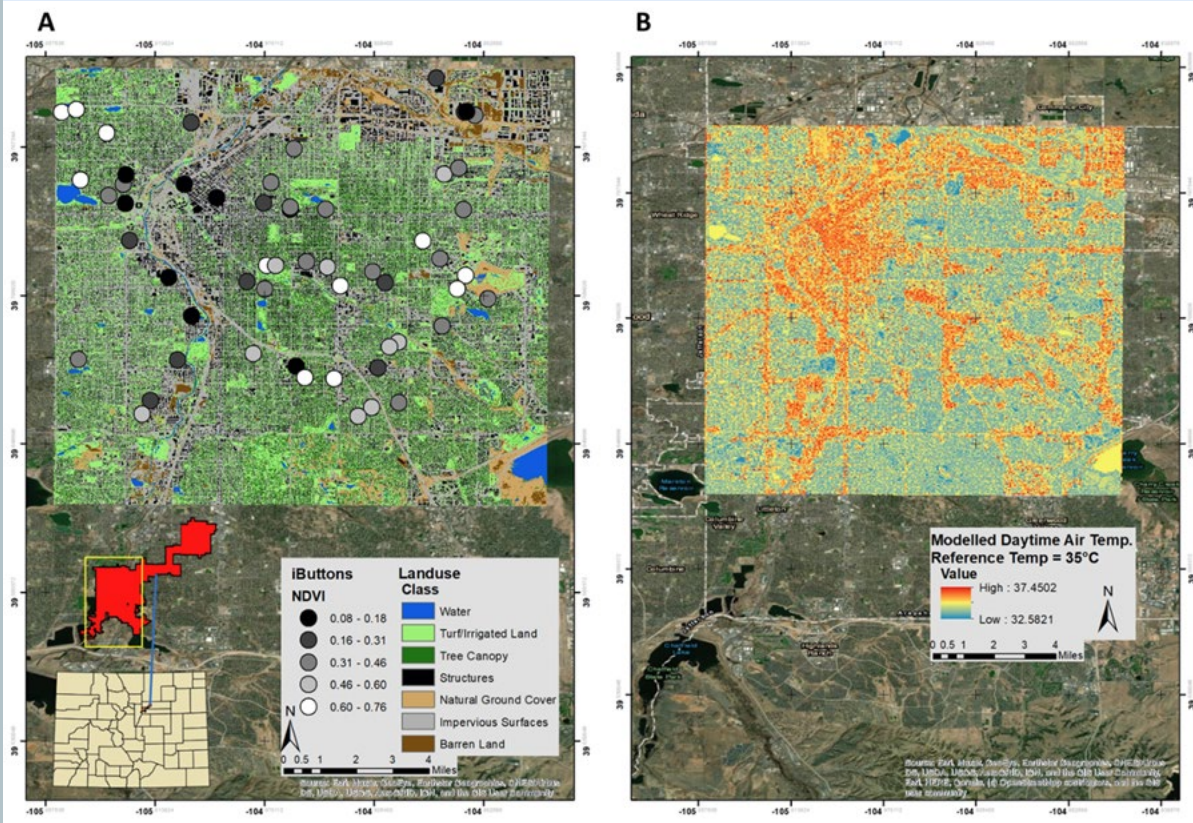


Figure 1A: DRCOG land use land cover imagery (section 12), overlaid with the microclimate sensor locations, stratified against urban greenness. 1B: Modeled daytime air temperature over the DRCOG land use land cover section 12 extent. The random forest model used Denver International Airport temperature at 30 degrees Celsius as a reference.

Footnotes:

1. Mullins, J. T. & White, C. Temperature and mental health: Evidence from the spectrum of mental health outcomes. *J. Health Econ.* 68, 102240 (2019).
2. Hondula, D. M., Balling, R. C., Vanos, J. K. & Georgescu, M. Rising temperatures, human health, and the role of adaptation. *Curr. Clim. Chang. Reports* 1, 144–154 (2015).
3. Ossola, A. & Lin, B. B. Making nature-based solutions climate-ready for the 50 °C world. *Environ. Sci. Policy* 123, 151–159 (2021).
4. Ibsen, P. C. et al. Greater aridity increases the magnitude of urban nighttime vegetation-derived air cooling. *Environ. Res. Lett.* 16, 034011 (2021).

marijuana locations

Article submitted by Joey Peña. Joey can be reached at 720.865.2781
or joey.pena@denvergov.org.

In Denver's regulated marijuana industry, location matters — especially to a city agency trying to keep marijuana out of the hands of kids.

To limit youth exposure to marijuana outlets, the City and County of Denver requires certain marijuana businesses to be 1,000 feet from specific locations, dubbed "sensitive uses." Sensitive uses include schools, childcare facilities, drug and alcohol treatment facilities, city recreation centers and outdoor pools and other marijuana businesses of the same type (store-to-store, for example).

Numerous public health, youth-serving and community organizations have expressed strong support for Denver's proximity requirements, and public health data supports the approach. For example:

- Children and young adults who are exposed to marijuana outlets with prominent signage tend to engage in more frequent use and often have greater expectations of marijuana's positive benefits ([Shih et al](#)).
- A 2020 study found an association between the density of licensed marijuana outlets with young adults' marijuana use, heavy use and intentions to use. The density of unlicensed outlets was associated with young adults' heavy marijuana use and symptoms of cannabis use disorder. ([Pedersen et al](#))
- Research on the tobacco and alcohol industries also supports proximity requirements and limiting outlet density. ([Finan et al](#); [Gwon et al](#); [Freisthler and Gruenewald](#); [Chen, Grube, and Gruenewald](#); and [Popova et al](#))

The city's goals for restricting outlet density and proximity to sensitive uses can present a challenge for city employees, who use the city's geographic information systems to determine whether an application for a new marijuana business is in compliance with proximity requirements.

Staff also use the systems to do preliminary, nonbinding proximity checks for new business owners to help them determine whether a location will comply with the proximity requirements. The service can save a new business owner time and capital during their search for a viable location.

To complete a proximity review, staff rely heavily on the 3-inch resolution imagery and planimetric data provided by DRCOG through contracts with The Sanborn Map Company and Kucera International, Inc.

City and County of Denver staff consider the data among the best available, and believe it would be difficult to capture better than 3-inch resolution imagery. The quality of the data helps the city provide more accurate proximity measurements during its quality control review of applications. The data also provides staff with building identification numbers, which are critical in analysis of a location.

In short, the data provided by DRCOG helps the city honor its commitment to its youth by limiting marijuana outlet density, which, in turn, limits youth exposure to marijuana commercialization and thus reduces the potential for negative health outcomes. It also helps the city provide a service to new marijuana business owners in search of a location.

New regional bike and pedestrian count dataset and web map

Article submitted by Jenny Wallace, GISP, GIS program manager at DRCOG. Jenny can be reached at 303-480-6754 or jwallace@drcog.org.

DRCOG staff have compiled a regional bicycle and pedestrian count dataset that will contribute to the overall picture of multimodal transportation across the Denver region. The data is now available on the [Regional Data Catalog](#). Bicycle and pedestrian count data will be used in implementing the [Metro Vision Regional Transportation Plan](#) and [Active Transportation Plan](#).

Local bicycle and pedestrian counts are collected from local governments by DRCOG staff, standardized and aggregated into a regional bike and pedestrian count dataset. Bicycle counts may be from on-road or off-road facilities and include both manual and automated counts (both short-duration counts and permanent).

A special thanks to the jurisdictions and stakeholders that worked with the DRCOG team to provide data, including Boulder County, Clear Creek County, City and County of Denver, City of Lakewood and City of Littleton. Other data sources include the Colorado Department of Transportation and DRCOG. DRCOG will request local data during its annual data collection effort to update the bicycle and pedestrian count dataset. More information on the dataset schema and format can be found [here](#).

Check out [the newest web map](#) showing the bicycle and pedestrian count data!

[Web map](#)

DRCOG data acquisition updates

Article submitted by Ashley Summers, GISP, PMP, information systems manager at DRCOG. Ashley can be reached at 303-480-6746 or asummers@drcog.org.

Denver Regional Aerial Photography Project 2022

Previous project partners received quotes in mid-April for participation in the upcoming

imagery project. DRCOG will request commitments in the fall in the form of a signed letter of intent that outlines the products and services that the partner wishes to purchase.

In addition to the traditional imagery offering, DRCOG staff are also offering a Nearmap subscription. The Nearmap subscription offers more frequently updated imagery that can be used as a supplement to the primary imagery deliverable, which is produced once every two years.

If you are not a project partner and would like to be, reach out to me at asummers@drcog.org. Read more about DRCOG's [imagery projects](#) on the [website](#).

Regional Lidar Project 2020

DRCOG received [a grant from the U.S. Geological Survey](#) in December 2019 to collect quality level 2 lidar in 5,000 square miles of the region and derive contours in most of the metro area. Flights to collect the data and data processing tasks to produce the point cloud are complete. Thorough quality control undertaken by the U.S. Geological Survey began in June and is expected to complete in August. DRCOG staff expect deliveries in the fall and winter. The data will be in the public domain and made available for download through DRCOG's Regional Data Catalog.

For more information, visit the [website](#).

Do you have an interesting use case for lidar data? Tell us about it by emailing me at asummers@drcog.org.

Planimetric Data Project 2020

The Planimetric Data Project began in February and deliveries began in June. Partners in Group 1 are reviewing their deliverables now. Group 2 is on schedule for delivery in August. There are seven deliveries total. The public will have access to the data in the first quarter of 2022 via the DRCOG Regional Data Catalog.

DRCOG staff are collecting building roofprints, edges of pavement, parking, sidewalks and ramps, trails, driveways, and impervious surfaces throughout the metro area. [Check out the map](#).

If you are not a project partner and would like to be, reach out to me at asummers@drcog.org. Read more about DRCOG's [planimetric data projects](#) on the [website](#) and [download datasets](#) from past projects.

Regional Land Cover Project 2020

DRCOG was awarded a Colorado Water Plan Grant from the Colorado Water Conservation Board in March, which supplies a 50% match to local contributions for the project. The project kicked off in June with a presentation from Sanborn and the University of Vermont regarding the ["interpretation key,"](#) an illustrated guide to the classification schema DRCOG staff use.

The product will be a 9-class, 1-meter resolution land cover dataset that covers the 6,000

square mile Denver region. Deliverables are expected in the first quarter of 2022 and will be made publicly available on DRCOG's Regional Data Catalog.

If you are not a project partner and would like to be, reach out to me at asummers@drcog.org. You can stay apprised of project happenings on the [website](#).

Engage with us

- This quarterly newsletter reaches more than 400 people, has a higher-than-average open rate, and is written by professionals like you. It is the perfect place to show off your projects, highlight your great work and contribute ideas to the GIS community in the Denver region. Newsletter release dates are the 15th of January, April, July and October (or the next business day afterward). Please contact Ashley Summers at 303-480-6746 or asummers@drcog.org to contribute.
- Did you miss a newsletter or a meeting? [Visit our website](#) for past newsletter issues and Data Consortium meeting materials.



Denver Regional Council of Governments
1001 17th St., Suite 700, Denver, CO 80202

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