



## Employment Diversity

This EnviroAtlas national demographics map depicts an index of employment diversity within each U.S. Census block group in 2010. Job counts used in the equation are from eight employment categories: retail, office, service, industrial, entertainment, education, healthcare, and public administration.

### Why is measuring employment diversity important?

Employment diversity is one of many measures or variables used by city planners to examine the proportions of residents, jobs, and services in urban areas and to guide development planning for efficient city plans and transit networks. This Smart Location index of employment diversity, sometimes called an entropy index, uses a set of 8 job categories to measure land use diversity within and among census block groups. It is expressed as values between 0 and 1. Values of the index closer to 1 indicate higher levels of employment diversity within census block groups and values near 0 suggest a lack of diversity with few employment opportunities.<sup>1</sup>

From a city planning perspective, it is most efficient to have concentrations of jobs near a large working age population. With the growth of urban metropolitan areas, many communities across the U.S. have experienced a decline in traditional downtown employment centers in favor of office parks and retail in outer suburbs. In Chicago for example, regional job availability in these scattered urban subcenters has increased from 9% in 1970 to almost 26% in 2000.<sup>2</sup> Entropy measures used in planning analysis help to distinguish between areas of employment diversity that are mainly commuting centers and those that also attract and maintain workers as local residents.<sup>3</sup> Commercial developers tend to attract other commercial development to these employment subcenters, and typically they exclude residential development. In fact, the Chicago study showed that population density increased with distance from the nearest subcenter.<sup>2</sup> Without a concurrent development of housing near these employment subcenters, dispersion of employment to the suburbs can result in reduced accessibility by workers due to longer average trip distances, increased traffic, and lack of public transit.

Compact neighborhoods, with a mix of residences, employment opportunities, and services, offer a number of



Photo: Kansas City, Missouri, city center, Wikimedia Commons

environmental benefits to counteract these trends. Research indicates that people who live in compact neighborhoods walk and bicycle more, use transit more, and drive less than people living in lower density neighborhoods. A recent study showed that both high employment density and diversity within a neighborhood had a positive influence on the decision to ride a bicycle.<sup>4</sup> On the other hand, higher neighborhood employment density and diversity alone were not sufficient to encourage walking; employment-to-housing ratio (jobs-to-housing balance) was a stronger predictor of walking than employment diversity.<sup>4</sup> These complementary metrics used together may help to locate block groups that would benefit from increased affordable-accessible housing.

Workplaces that are centrally located and accessible to more households can reduce vehicle miles traveled (VMT), fuel consumption, and [greenhouse gas emissions](#) (GHGs) associated with employee commuting trips. In addition to reducing fuel consumption and congestion, the local economy and standard of living benefit by providing easy access to available jobs.

### How can I use this information?

Identifying employment diversity within an area of study (e.g., a census block group) can be useful in a number of different urban planning contexts. Planners may want to identify neighborhoods with optimal job diversity and housing density that can support new or enhanced transit service. Localities may also consider employment diversity when prioritizing neighborhood improvements and community services.

This data layer may be used with other EnviroAtlas demographic and Smart Location data layers to compare the proportions of residents, jobs, and services among community block groups. For a particular census block group, one can compare the employment diversity value with the employment to housing ratio. For example, a block group with an employment diversity value of 0.67 and an employment to housing ratio of >2 has a good diversity of employment; however, an employment to housing ratio >1.5 indicates that the block group is a net commuter block group that would benefit from increased housing.

An EnviroAtlas aerial-image base map (seen by increasing the transparency of the map layers) can be used to show the spatial distribution of the built environment within the census block groups. For select communities, users can overlay EnviroAtlas community land cover maps that show impervious surfaces, street trees, and other common land covers at 1-meter resolution.

### How were the data for this map created?

The [2010 Census](#) provided a count of workers in each census block group. The 2010 [Census LEHD](#) (Longitudinal Employer Household Dynamics) Workplace Area Characteristics (WAC) tables provided employment data at the census block group level for all states except Massachusetts. Massachusetts employment data came from InfoUSA. The WAC tables summarize workers by employment location rather than home location. The denominator of the entropy equation includes the 8 employment types (retail, office, service, industrial, entertainment, education, healthcare, and public administration). The equation for the employment diversity metric is:

$$D2b\_E8MixA = -E/(\ln(8)).$$

To see the identity and content of each factor in the equation, please see metric D2b\_E8MixA in Table 5 on page 18 of the [Smart Location Database User Guide](#).

### What are the limitations of these data?

Summarizing and estimating various metrics across block groups may create misleading results. It is important to remember that jobs or residences are not distributed evenly

### Selected Publications

1. Wagner, J.E., and S.C. Deller. 1993. [A measure of economic diversity: An input-output approach](#). Staff Paper 93.3, Report produced for U.S. Forest Service and University of Wisconsin. 20 p.
2. McMillen, D.P., and T.W. Lester. 2003. [Evolving subcenters: employment and population densities in Chicago, 1970–2020](#). *Journal of Housing Economics* 12: 60–81.
3. Masip Tresserra, J. 2012. [Towards a methodology to identify and characterize urban sub-centres: Employment entropy information versus employment density](#). RSA European Conference 2012, Networked regions and cities in times of fragmentation: Developing smart, sustainable, and inclusive places, May 13–16, 2012, Delft, The Netherlands.
4. Cervero, R., and M. Duncan. 2003. [Walking, bicycling, and urban landscapes: Evidence from the San Francisco Bay area](#). *American Journal of Public Health* 93(9):1478–1483.

throughout the area of a block-group. Census block groups may include both developed and undeveloped areas. The aerial-image base map gives an indication of the proportions of developed and undeveloped land in each census block group. A large block group may be diverse, but jobs, housing and services may be widely distributed with low accessibility (e.g., little or no public transit). In urban centers, block groups may be quite small and rather uniform in land use even though they may be very close to another more diverse block group. This indicator is most useful for drawing attention to regional patterns or specific neighborhoods that would benefit from further study.

### How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. This data layer is incorporated into a larger EPA data product called the [Smart Location Database](#). The Smart Location Database is a nationwide geographic data resource for measuring location efficiency. Most attributes are available for every census block group in the United States.

### Where can I get more information?

A selection of resources on the relationships among city planning, employment, and environmental quality is listed below. More details about this metric are available in the [Smart Location Database User Guide](#). In addition, EPA's [Smart Growth Program](#) provides tools, resources, and technical assistance to communities seeking to pursue compact and transit-oriented development strategies. For additional information on the data creation process, access the [metadata](#) for the data layer from the drop down menu on the interactive map layer list. To ask specific questions about this data layer, please contact the [EnviroAtlas Team](#).

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