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stop sprawl

Environmental Impacts of Density Calculator

Some communities are nicer than others, some create more traffic, water and air pollution than others. It's a matter of good planning, design, and convenience. This interactive Better Communities Advisor helps you chose what your future will be. You can weigh your neighborhood plans, or proposed changes to it, against others. More efficient and compact Smart Growth uses up less farmland and generates less water and air pollution, and traffic.

The densities labeled 'efficient' provide transportation, living, and work choices for residents and workers but do not represent a Sierra Club endorsement of a specific density level. That should ultimately be decided by the communities themselves. The denser neighborhoods in Paris and Manhattan are shown for comparison.

What do you want for your future? Use this program to choose.
(Why does this matter? How are the calculations made?)

Neighborhood average households/residential acre? [ ]

Your auto fuel efficiency, miles per gallon? [ ]
(More information on fuel economy standards)

Cost of a gallon of gas? [ ]

Calculate!

Given **2** households per acre, **20** miles per gallon and gas at **$1.00** per gallon:

	Dense Urban	Efficient Urban	Your Data	Suburban Efficient	Sprawl
Acres of Land Used for 1,000 households	2.5	10.0	**500.0**	100.0	1,000.0
Square Yards of Roads and Sidewalks per 1,000 households	1,750	7,000	**350,000**	70,000	700,000
Daily Water Use, gallons per household	173	192	**1,471**	422	2,800

Shopping Opportunities (Service/Retail) per Acre	192.73	48.31	**1.13**	4.98	.65
Transit Opportunities within 1/4 mile (24-hour average)	1,067.92	260.77	**.00**	18.63	.00
Average Vehicles per household	.2	.7	**2.2**	1.6	2.4
Parking Places necessary per household	1.38	5.02	**15.29**	11.06	17.11
Annual Vehicle Miles Traveled per household	4,927	7,609	**25,941**	15,662	32,237
Annual Gallons of Gas consumed per household at 20 miles per gallon	246	380	**1,297**	783	1,612
Cost of that gas at $1.00/gallon	$246	$380	**$1,297**	$783	$1,612
Annual pounds of Volatile Organic Compound (VOC) pollution per household	13.0	20.0	**68.3**	41.2	84.9
Annual pounds of Nitrogen Oxide pollution per household	32.3	49.9	**170.2**	102.8	211.6
Annual pounds of Particulate Emissions (PM10) pollution per household	59.13	91.31	**311.29**	187.95	386.84
Annual Tons of Global Warming CO2 emitted per household	3.4	5.3	**18.2**	11.0	22.6

Our Resource Consumption Levels Depend on How We Live

Land Consumed - sprawling residential development replaces habitat, natural areas, and productive farmland. We are losing about 2.2 million acres of farmland to developers each year, about 360 acres per minute. In some neighborhoods each family uses

less land than in others. By definition, the amount of land used in development (acres/household) is the inverse of the density (households/res. acre). Residential acreage excludes commercial, industrial, greenspace, and agricultural land.

Concrete or asphalt in roads and sidewalks - paved surfaces create water pollution and require drilling, mining, and transporting of cement and asphalt. When more than 20% of the watershed is paved over and developed, water pollution skyrockets. One lot, and the abutting sidewalk and street, can serve a single family dwelling (sfd) or a 40-unit apartment building. If only a single family house, it takes 40 times as much to serve 40 families. The water, sewer, electrical, telephone, cable and other such services lie under the street and branch off into each lot, so the single family houses use that much more piping, et al.

Water Used - requires damming, transporting, loss of stream flow. Watering lawns and washing of cars are the major household water use, especially for single family dwellings, and washes fertilizers, herbicides and pesticides off the lawns into streams and bays.

Shopping Opportunities - equals local employment, neighborhood convenience, shorter trips and less driving. Higher efficiency in housing provides nearby destinations -- work, shopping, education and recreation, specially if the zoning allows markets and restaurants in residential areas, as was common before 1940.

Transit service - alternatives to driving. Higher housing efficiency and convenience shortens trips. More are walked, biked or taken on transit. With more riders, more public transit service is provided. Of course, otherwise convenient neighborhoods located just off transit corridors might lack great service. Or, low density neighborhoods located above a subway stop might have great service, but these are exceptions.

Vehicles - requires mining, manufacture, drilling and transporting. Inconvenient neighborhoods allow little alternative to driving and high vehicle ownership.

Parking - requires land for parking, less for nature. Each vehicle demands many parking places -- home, curbside, work, shopping, recreation.

Driving and Traffic - brings congestion, frustration, pollution. Convenient neighborhoods reduce vehicle miles traveled (VMT), give alternatives to driving (walking, biking, public transit) and shorten many driving trips. Other factors that are important to convenient neighborhoods, like nearby stores and restaurants, sidewalks and short streets, generally accompany higher density and are absent in low density sprawl.

Gasoline - requires drilling, refining, transporting and distributing. Increasing VMT increases gasoline consumption.

Air Pollution - Cancer-causing and asthma-indusing pollution includes Volatile Organic Compounds, Nitrogen Oxides, Particulates, and CO2, the major greenhouse gas. Air pollution rains out as water pollution. Increasing VMT increases pollution.

Explanations of Calculations

400 Households (Hh)/Residential Acre (Res Ac) (Dense Urban) - Mostly highrises, examples: the Upper East and West Sides in Manhattan, and smaller neighborhoods in Paris, Chicago, San Francisco and elsewhere.
100 Hh/Res Ac (Efficient Urban) - Mostly 3-5 story apartment houses with occasional highrises and single family dwellings (sfd), examples: Northeast San Francisco (Russian, Nob and Telegraph Hills, North Beach, Chinatown and Fisherman's Wharf), River North in Chicago, Beacon Hill in Boston.
10 Hh/Res Ac (Suburban Efficient) - Row houses with occasional single-family dwellings and apartment houses: Lower density areas of larger cities, and older suburbs. Typical of the neighborhoods in which many of our parents and grandparents were raised.
3 Hh/Res Ac - Typical of single-family dwellings in sprawl.
1 Hh/Res Ac (Sprawl) - - Lower end of single-family dwellings in sprawl.
0.1 Hh/Res Ac - Ranchettes.

Concrete or asphalt in roads and sidewalks - based on a 10 yard wide half-street and sidewalk and 70 yard front on a 1 acre lot, or 700 sq. yards.

Water -- Kimberly Knox, SF Water Dept Water Cons (personal commun.): 55 g/p-d for multi-family units (~50 du/res ac): assume that is 80% indoor use (44 g/p-d). Sakrison, "Water Use in Compact Communities: The Effect of New Urbanism, Growth Management and Conservation Measures on Residential Water Demands" Washington Dept of Ecology, 1998, Table 11 for 4, 7 and 12 du/ac for outdoor water use (add indoor). Assume 3.8 persons/household.

Traffic, Vehicles and Driving (VMT), Local shopping, Transit service - based upon data developed for the Location Efficient Mortgage® studies of the Chicago, Los Angeles and San Francisco regions by the Institute for Location Efficiency (Natural Resources Defense Council, Center for Neighborhood Technology and Surface Transportation Policy Project). The data are for the Metropolitan Planning Agencies' (CATS, SCAG and MTC, respectively) travel analysis zones, generally a census tract or two. To see how location efficiency can cut your auto costs and qualify you for a Location Efficient Mortgage®, see www.cnt.org.

Parking - based on 7 parking places per vehicles.

Gasoline, Volatile Organic Compounds, Nitrogen Oxides, Particulates and CO2 - based on the VMT and mpg input by user: 23.94 mg VOC/gallon, 59.66 mg NOx/gallon, 28 lb CO2/gal, and 0.012 pounds PM10/mile (primarily reentrained road dust). Tests of average in-use cars over typical operating conditions yield CO, NOx and hydrocarbon emissions that actually increase **faster** than fuel consumption (data from Matthew Barth, et al. "Comprehensive Modal Emissions Model (CMEM), version 2.0 Users Guide". University of California, Riverside. 3 January 2000.). Here, emissions are conservatively assumed to increase proportional to fuel consumption.

Questions? Email John Holtzclaw.

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