# Redefining Progress

Sustainable Indicators Program

## Reducing a City's Ecological Footprint: The Case of Santa Monica (1990-2000)


Jason Venetoulis

May 2004

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Environmental Programs Division
Santa Monica Sustainable City Program
200 Santa Monica Pier, Ste. J.
Santa Monica, CA 90401-3126
Phone: (310) 458-2213.
www.ci.santa-monica.ca.us/environment/INDEX.HTM

Redefining Progress
1904 Franklin Street, 6th floor
Oakland, CA 94612 U.S.A.
Phone: 510-444-3041
www.rprogress.org

*1904 Franklin Street, 6th floor*
*Oakland, CA 94612 U.S.A.*

*510-444-3041*
*www.rprogress.org*

**Santa Monica's Ecological Footprint (1990-2000)**

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**Summary of findings**

This study examines the City of Santa Monica's Ecological Footprint in 1990 and 2000. The Ecological Footprint provides a quantitative assessment of the biologically productive area (the amount of nature) required to produce the resources (food, energy, and materials) and to absorb the waste put out by the city's residents over the course of a year. The major results of Santa Monica's Footprint assessment reveal that between 1990 and 2000 the city's Footprint has:

1. declined by 167 square miles;
2. gone down ½ an acre for each per person living in Santa Monica; and
3. become nearly 4 acres smaller than the US average.

The results also reveal that reductions in the use of natural gas and diesel, increased recycling rates, and the City's procurement of geothermal energy explain much of the Footprint reductions over the decade.

However, the study also revealed that in the larger context of global ecological sustainability and equity concerns the city's Footprint still cannot be considered ecologically sustainable and is, on average, 16 acres above the Fair Earthshare. Increases in electricity and gasoline use and built space offset many of the gains made in the 1990s.

Santa Monica's dedication to sustainability has helped reduce its Ecological Footprint, though there is still room for progress as the pursuit of sustainability continues.

**What is the Ecological Footprint?**

The Ecological Footprint measures humanity's use of nature. A city's Footprint is the biologically productive area required to produce the resources (food, energy, and materials) and to absorb the waste put out by the city's residents over the course of a year. Since people use resources from all over the world, Footprints add up crop land, forests, and other natural resources that are utilized by a given population --wherever they may be located on the planet. Footprints can be used to evaluate a city, country, or the entire human population in terms of ecological sustainability. They can also be used to help reveal where the greatest potential for progress toward sustainability can be achieved.

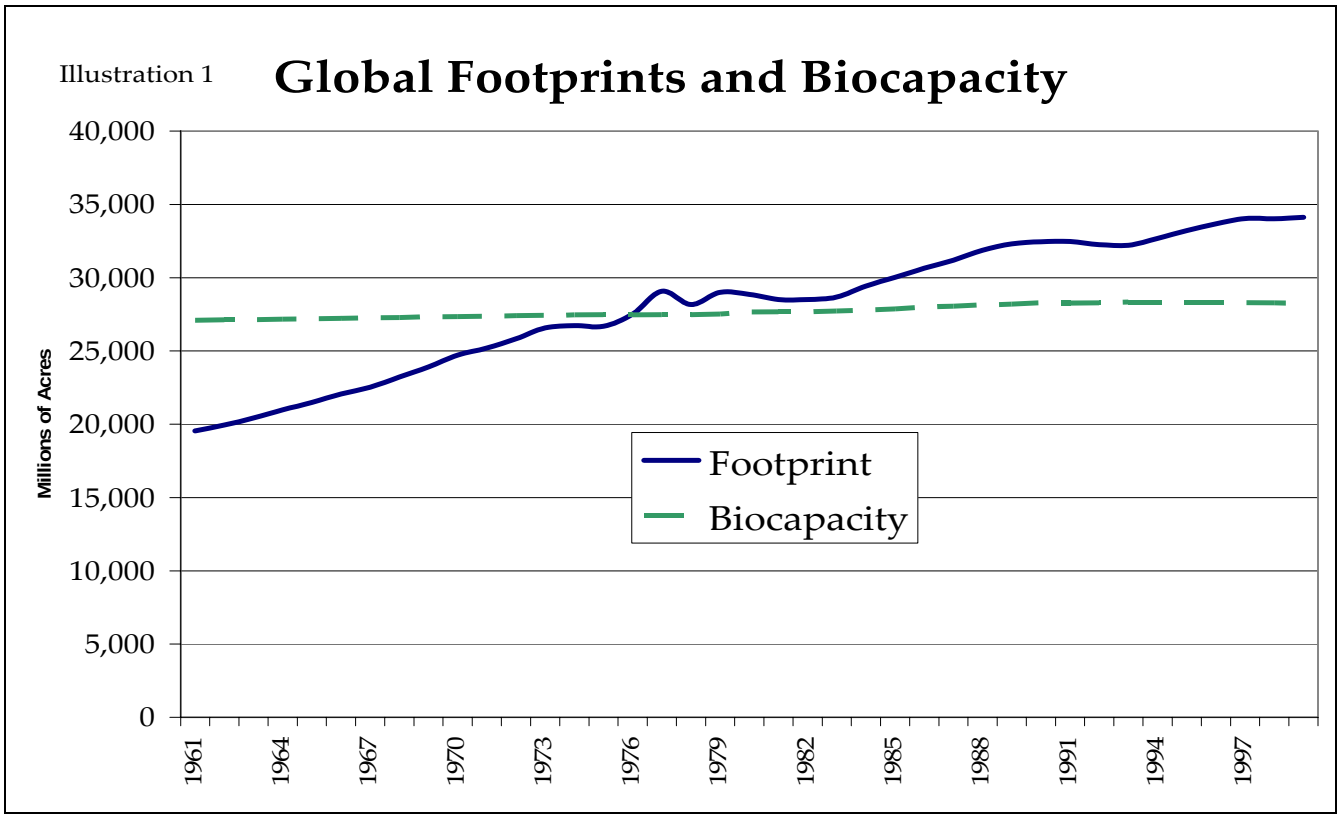
Footprints are not bad or good per se. We all have Ecological Footprints; it is their size that differs. On a global scale, humanity's entire Ecological Footprint can be compared to the total available natural capital and services. When our Footprint is within the annual regenerative capabilities of nature our Footprint is sustainable. For some it may be surprising to know that the ecological limits can be transgressed, but only for a limited time.

From the Footprint perspective, sustainability requires living within the regenerative and absorptive capacity of the planet. The corollary in the biological sciences is typically referred to as a sustainable yield. If we are taking more from nature than can be provided indefinitely, we are on an unsustainable track. The liquidation of our ecological assets is called "overshoot" and is not ecologically sustainable. In this situation, the Earth's natural capital is drawn down and nature's absorptive sinks are swamped. This leaves less nature for future generations of all life.

In the late 1970s humanity's collective Ecological Footprint breached the sustainability mark and has been unsustainable ever since (Loh et al., 2002). By 2000 the ecological deficit reached nearly 1 acre per person or 9 million square miles. **See Illustration 1 below**. Not all Ecological Footprints are the same, and as might be expected the average Footprint in the U.S. (24.3 acres per person) is more than four times larger than the global average Footprint of 5.4 acres per person.

Finally, it is worth noting that Ecological Footprinting does not capture all the impacts humanity has on the rest of nature. Toxics, for example, are not included. Even with the planned improvements in the methodology that Redefining Progress is undertaking, an exact and definitive estimate is probably not possible. Moreover, there is much more to life than nature's utility to one species. Footprints do, however, offer one of the most comprehensive assessment tools and can help inform, educate, and point the way toward a more sustainable path.

Illustration 1




Source: Redefining Progress, 2004.

When considering a U.S. city's Footprint it is worthwhile to examine it within the context of global sustainability. Is the city's Footprint above or below the world average? If everyone on the planet had similar Footprints to the average city resident, would this be a sustainable level? Is the city's Footprint getting bigger or smaller? Where can the greatest progress be made in reducing human pressure on the planet and future generations, if sustainability is the city's goal? Footprint helps answer these important questions, though it is not a substitute for action.

**Methodology**

Redefining Progress has calculated Ecological Footprints for over 180 countries (See: Loh, 2002), numerous regions (most recently in the San Francisco Bay Area), and an increasing number of cities and businesses. The EF calculations for Santa Monica were estimated using local data where available and reliable. Where local data are missing or limited, county, state, or national data are scaled to the local level. In the case of Santa Monica, local data included:

| | |
|---|---|
| • Acreage and land use types<br>• Electricity use by source<br>• Natural gas use<br>• Gasoline and Diesel fuel use | • Transportation and vehicles<br>• Road miles<br>• Housing characteristics<br>• Waste and Recycling |

Footprinting requires converting various factors into ecologically productive land area equivalents. For example, 100 pounds of beans might require 1/2 acre of arable (farm) land to be produced. And then there is the energy, transportation, packaging, and built space involved in bringing beans to market.

The largest component of a Footprint tends to be associated with energy use. The carbon dioxide emitted from fossil fuel use typically makes up the largest part of the energy component of the footprint. Global average (per acre) forest sequestration rates are used as the baseline for estimating the 'carbonprint.' For example, if one metric tonne of $CO_2$ requires about 2.5 acres of forest land to absorb, fossil fuel use that resulted in a tonne of $CO_2$ would add 2.5 acres to a Footprint. Emission factors for natural gas, gasoline, and diesel are standardized in the scientific literature. The mix of energy sources that go into the production of electricity varies by region. To some extent this reduces a city's ability to change its' Footprint without reducing energy use instead of moving to renewable energy sources. In the case of Santa Monica, Lawrence Berkeley National Laboratory estimates that for each kWh used in Southern California 2.2 pounds of carbon are emitted (Price et al., 2002), which is nearly double San Francisco Bay Area average, for example. The City of Santa Monica does purchase geothermal energy and this was taken into account in the calculations.

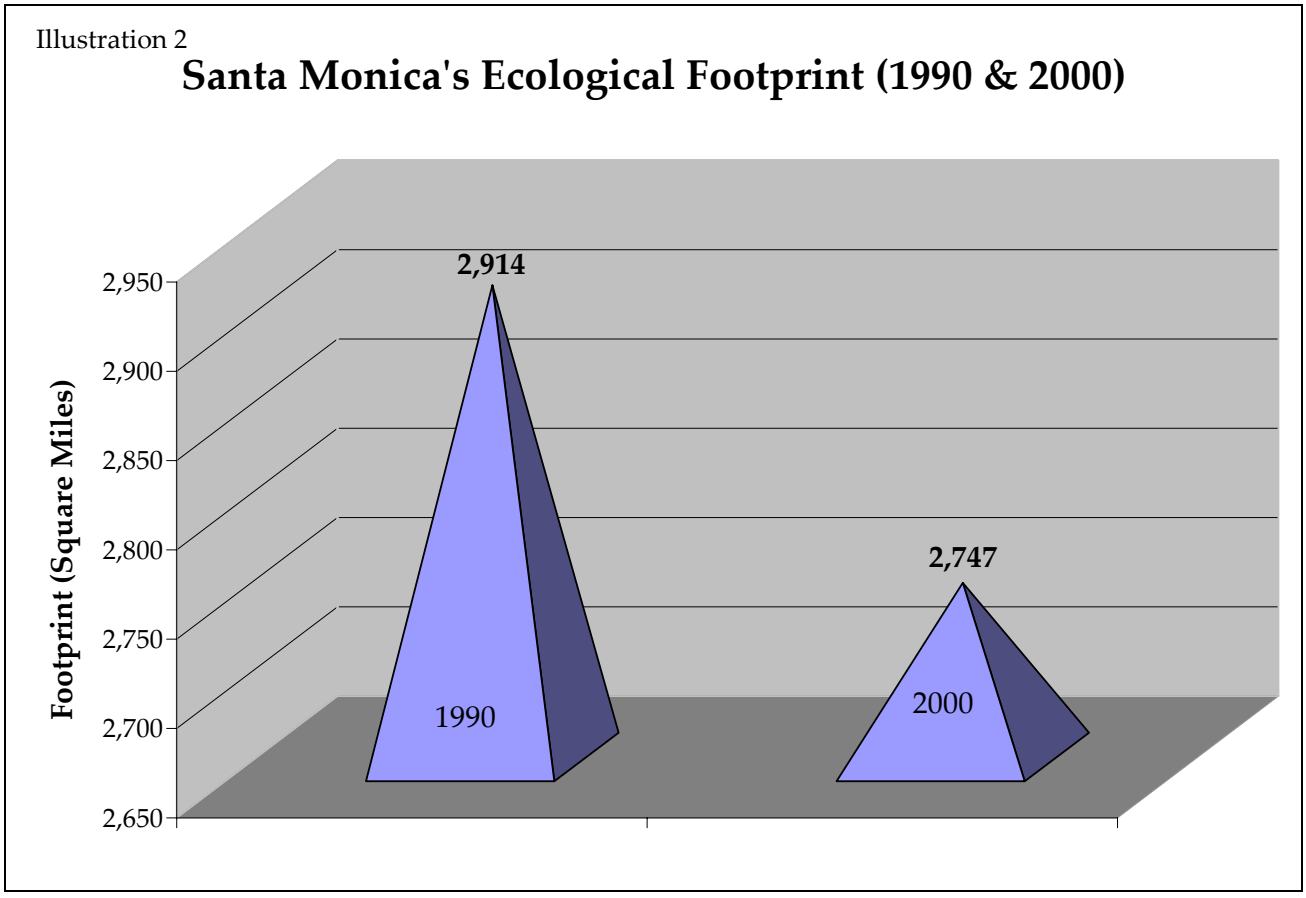
Other factors in the Footprint include: built space, housing, seafood, food, products, and services, and waste/recycling. Built space is treated as formerly productive arable land. Sea Space (fisheries) impacts are estimated based on the most productive areas of the ocean (near the shore) and not the entire ocean. Wood and materials in housing are amortized over 40 years and based upon the materials and energy that go into the construction of the average home in the US, adjusted for Santa Monica's average square footage per housing unit. Recycling is treated as a positive because it reduces energy and landfill space demand.

Food, products, and services Footprint factors are based on national data from Redefining Progress's national Ecological Footprint calculations. These estimates use government data on national production and trade of all major resources and goods. For this study, they were scaled to the local level using population figures and adjusted for net imports-exports using Los Angeles county economic data. More information about the general Footprinting methodology can be found at Redefining Progress's website.

**The Results: Santa Monica's Ecological Footprint**

The results of Santa Monica's Footprint assessment reveal Santa Monica's Footprint in 1990 was 2914 square miles. By 2000 the city reduced its Ecological Footprint by 167 square miles (5.7%) to 2747 square miles. (See: Illustration 2.) On a per person basis, Santa Monica's Footprint went from 21.4 acres in 1990 to 20.9 acres in 2000. The 2000 average is 3.4 acres smaller than the US average (24.3 acres) but still almost four times larger than the global average Footprint of 5.4 acres per person. Santa Monica can also be compared with other regions that have had their Footprints estimated by Redefining Progress. Compared to the average Footprint in the Ojai Valley (23 acres) and Sarasota County (23 acres), Santa Monica's Footprint is smaller. Santa Monica's per capita Footprint is about the same as the average in San Francisco Bay Area, despite the Bay Area's less carbon intensive energy mix.

Illustration 2



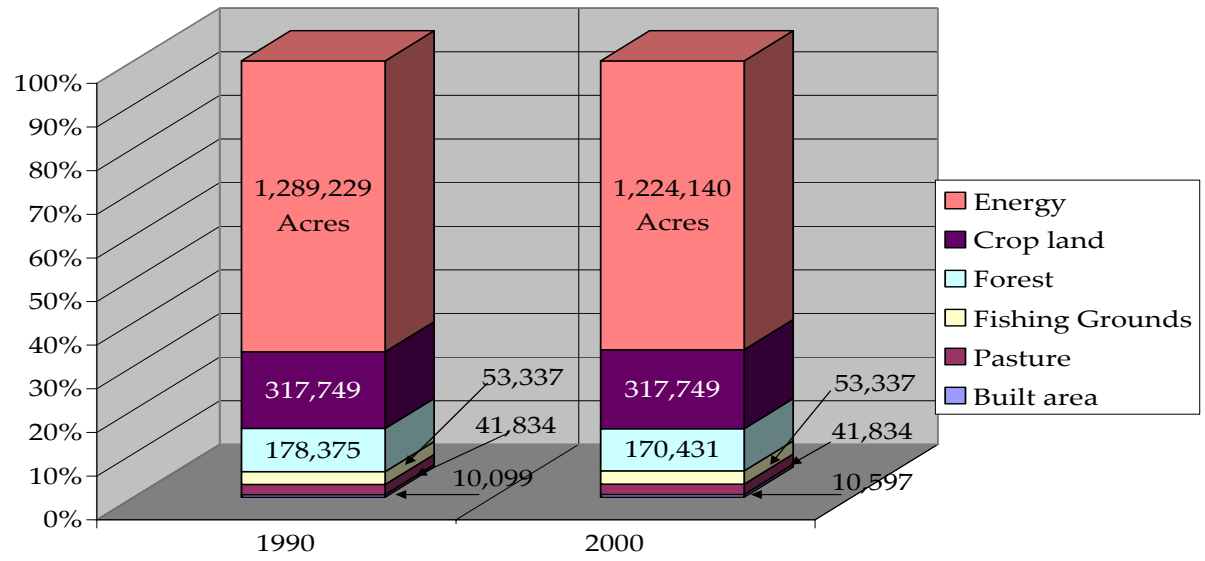

To help get a picture of where the greatest gains can made in reducing the city's Footprint, it is useful to identify changes in the largest contributors its Footprint. Illustration 3, below, provides a breakdown of the Footprint components for Santa Monica in 1990 and 2000. Table 1, below, provides figures on the major factors that changed over the decade and how they influenced the size of Santa Monica's Footprint.

As can be seen in the table and illustration, the largest segment of the City's Footprint is associated with energy.

Since 1990 there has been an over all reduction in the energy component of the Santa Monica's Footprint. In part this is explained by the City's procurement of renewable (geothermal) energy in 1999, and the reduction in overall natural gas and diesel fuel use. Both show up in the Footprint as the amount of forest area needed to absorb carbon dioxide emissions –a *waste* product of fossil fuel use. Additional reductions in overall energy use and an increase in the mix of renewable (solar, wind, and geothermal) energy would probably lead to the greatest reductions in Santa Monica's Footprint.

Most of the impacts from transportation also show up in the energy category, for example, those associated with gasoline, diesel, and increasingly natural gas powered vehicles. Between 1990 and 2000 the transportation component of Santa Monica's Footprint increased about 2,000 acres. Reduced dependence on fossil fuel powered vehicles would shrink this part of the city's Footprint. The City of Santa Monica is moving ahead of the curve on this front with solar powered electric vehicle charging stations, aggressive public transportation promotions, and a city employee trip reduction program, yet there remains lots of room for progress. Additional benefits to the economy can coincide with a reduction in fossil fuel use. Fossil fuels that are

Illustration 3 Santa Monica's Footprint Breakdown by Category




imported result in the export of local economic capital and thus a reduction in imported energy demand can help keep more money in the local economy.

| Table 1. Changes in Major Footprint Factors<br>Santa Monica 1990-2000 | | | |
|---|---|---|---|
| Factor | Reduction | Increase | Footprint Effect (square miles) |
| Natural Gas | 7.7 Million Therms | | -45 |
| Diesel Fuel | 614,500 Gallons | | -6.5 |
| Recycling | | 143,800 Tons | -26 |
| Electricity | | 97.5 Million kWh | +39 |
| Gasoline | | 927,400 gallons | + 9 |
| Built Space | | 51.7 acres | +1.13 |
| Reductions associated with population decline and products and services, and increases in the percentage of renewable energy and biocapacity (parks) account for much of the remaining changes in 1990 & 2000. | | | |

Increases in recycling rates during the 1990s in Santa Monica have also helped the city reduce its Footprint. According to the Natural Resources Defense Council (1997), for every ton of glass, paper, plastic, and metal diverted from landfills and recycled the city reduces its potential energy use by about 50%. At a recycling rate of 62% and growing, effectively reducing the size of the total waste stream would help reduce Santa Monica's Footprint. Such efforts are in large part beyond the control of local government and are the responsibility of community members, businesses, and product providers that determine packaging standards.

In the case of food, consumer products, and services local data was not available. As such, US averages were used and thus the findings are not indicative of Santa Monica's specific impacts. It is worth noting, however, that food and products that come from local or regional sources, i.e. farmers market, have the potential to lower ecological impacts due to reduced energy and transportation requirements as compared to out-of-state imports.

**Sustainability in the City**

The City of Santa Monica has a well deserved reputation as a leader in the sustainable communities' movement (ICLEI, 1997; Venetoulis 2001). For decades, the city's progressive population has elected representatives to the local and state government that are willing to be leaders on environmental, social, and economic issues –the three pillars of sustainability. The commitment to sustainability combined with the political will and leadership helped lay the ground work for the City of Santa Monica's Sustainable City Program's official adoption in 1994. It is worth noting that many communities pursuing sustainability often lack the political wherewithal to move the agenda forward, clearly this has not been the case in Santa Monica.

From the outset, the Sustainable City Program's guiding principle has been to meet the current generations' needs without compromising the ability of future generations to meet their own needs. "The long-term impacts of policy choices will be considered to ensure a sustainable legacy" (City of Santa Monica, 1994). Santa Monica's theme draws from the historic 1987 international agreement on sustainable development (World Commission on Sustainable Development, (Bruntland Report 1987) --a theme echoed by a majority of local and regional sustainability programs throughout the world. Setting itself apart from the pack, Santa Monica has followed its rhetoric with the establishment of a sustainability program, indicators to track progress toward specific targets, and substantive actions. As a result the City has adopted practices and policies that have decreased fossil fuel use, water use and pollution, increased green space, and engaged community members. Not all the trends over the last decade are favorable. The City of Santa Monica's 2002 Status reports indicates that a booming local economy in the late 1990s contributed to increase waste generation and energy use in the residential and commercial sectors.

The Ecological Footprint provides a captivating and compelling way to analyze numerous environmental impacts within the context of ecological sustainability. To be sure it does not address all the concerns that the City's sustainability program is focusing on. For example, household hazardous waste is not covered in the Footprint methodology. Still, by examining significant energy, land use, transportation, material consumption, and waste/recycling factors in Santa Monica the Ecological Footprint analysis conducted for this report revealed that the City has undertaken many positive (Footprint reducing) actions. The results of this study indicate that Santa Monica's dedication to sustainability has helped significantly reduce its Ecological Footprint, though there is still room for progress as the pursuit for sustainability continues. Over the next several years, Redefining Progress and the City of Santa Monica have committed to continue to track Santa Monica's Ecological Footprint.

## Appendix A: SM's Footprint Data by Category

| Santa Monica's Ecological Footprint Data By Category (All figures in acres) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **1990** | Built area | Pasture | Fishing Grounds | Forest | Crop land | Energy land | Total |
| Energy | 0 | 0 | 0 | 0 | 0 | 412,937 | 412,937 |
| Housing | 3,929 | 0 | 0 | 46,133 | 0 | 19,104 | 69,166 |
| Food | 0 | 38,335 | 55,127 | 0 | 293,846 | 148,404 | 535,712 |
| Products & Services | 3,439 | 4,902 | 0 | 138,226 | 34,563 | 414,684 | 595,815 |
| Transportation | 3,070 | 0 | 0 | 0 | 0 | 264,749 | 267,819 |
| Recycling | 0 | 0 | 0 | 0 | 0 | -16,403 | -16,403 |
| | 10,438 | 43,237 | 55,127 | 184,359 | 328,409 | 1,243,475 | 1,865,045 |
| | | | | | | | |
| **2000** | Built area | Pasture | Fishing Grounds | Forest | Crop land | Energy land | Total |
| Energy | 0 | 0 | 0 | 0 | 0 | 400,851 | 400,851 |
| Housing | 3,929 | 0 | 0 | 48,394 | 0 | 19,958 | 72,281 |
| Food | 0 | 37,091 | 53,337 | 0 | 284,308 | 143,587 | 518,323 |
| Products & Services | 3,598 | 4,743 | 0 | 122,037 | 33,441 | 366,116 | 529,935 |
| Transportation | 3,070 | 0 | 0 | 0 | 0 | 266,705 | 269,775 |
| Recycling | 0 | 0 | 0 | 0 | 0 | -32,806 | -32,806 |
| | 10,597 | 41,834 | 53,337 | 170,431 | 317,749 | 1,164,411 | 1,758,359 |

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