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Vanishing Open Spaces in Florida

POPULATION GROWTH AND SPRAWL IN THE SUNSHINE STATE

by Leon Kolankiewicz, Roy Beck and Anne Manetas

March 2015

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- "Sprawl in California" (2000)
- "Overpopulation = Sprawl in Florida" (2000)
- "Weighting Sprawl Factors in Large U.S. Cities" (2001)
- "Outsmarting Smart Growth" (2003)
- "Population Growth and Sprawl in the Chesapeake Bay Watershed" (2003)
- "Vanishing Open Spaces" (2014)
- "Packing Population into Piedmont Ensures an Emerging Megalopolis" (2014)

VANISHING OPEN SPACES IN FLORIDA

How an Exploding Population Continues Devouring Natural Habitat and Farmland in the Sunshine State

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VANISHING OPEN SPACES IN FLORIDA

How an Exploding Population Continues Devouring Natural Habitat and Farmland in the Sunshine State

Executive Summary

The Florida of orchards, grasslands, marshes, pine scrub and open beaches continues to disappear at a rapid rate under the bulldozer's blade of constant new development. In the 2000-2010 decade -- despite a severe economic downturn near the end -- Florida's 30 Urbanized Areas sprawled out and destroyed 1,220 additional square miles of surrounding farmland and natural habitat.

Figure ES-1 Florida's iconic citrus groves are a less and less common sight.

How much of that was related to consumption and development patterns that increased the amount of developed Florida land per average Florida resident? And how much of it was related to the increase in the number of Florida residents over that decade? Answering that question was the primary goal of this report, as it has been the last 15 years in numerous other studies of national, regional, and state sprawl by the authors.

Key Findings: The chief finding of this study is that one factor -- population growth -- far outweighed all consumption factors in Florida's losses of open space during the last decade.

Dozens of consumer, government and business choices, along with private lifestyle preferences, contributed to Florida's loss of open space. But all of those factors combined did not come close to the power of population growth in driving the state's sprawl, government data reveal.

As elected officials persisted with policies that encourage or force population growth both nationally and locally, nearly 3 million people were added to Florida from 2000 to 2010.

The study determined that 96% of the elimination of surrounding farmland and natural habitat over the decade was related to the extra demand that all the new residents put on housing, shopping malls, streets, schools, government buildings, waste treatment systems, parking lots, places of work and entertainment, and other facilities and infrastructure.

The factors causing an increase in per capita consumption of developed land (or declining population density) were found to be related to just 4% of the open-space losses around Urbanized Areas.

Thus, the study suggests, one of the costs of population growth in Florida's 30 Urbanized Areas in the previous decade was about 1,171 square miles of Florida's nature and farmland that no longer exist.

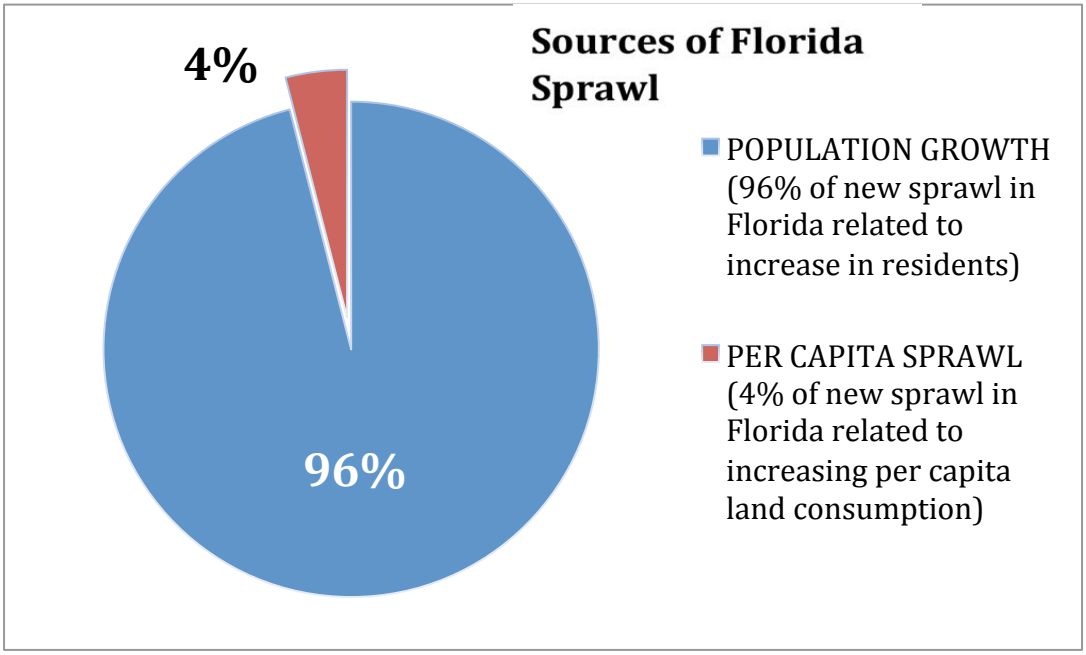


Figure ES-2 Apportioning Factors in Sprawl by Florida's 30 Urbanized Areas (2000-2010)

The methodology of this study is the "Holdren Method" developed by physicist John Holdren to quantify the respective contributions of population and per capita consumption in total change of any resource use. The data for our analysis came from two independent, longitudinal datasets, delineations, and methodologies – from two distinct federal agencies and research programs – the Census Bureau's Urbanized Areas and the U.S. Department of Agriculture's National Resources Inventory.

Trends Voters Want Halted: The past decade adds to an unprecedented trend of Florida destruction over more than a quarter of a century. In the 1982-2010 period measured by the National Resources Inventory, 4,186 square miles of Florida's natural and agricultural space were converted into urban and suburban development, resorts, vacation homes, roads, and rural commercial sites.

A scientific survey commissioned for this study found that, although most Floridians can't remember a time when nature wasn't disappearing rapidly before their eyes, most reject this as a trend that should continue.

Nearly half (47%) said the loss of open space over the last three decades had made Florida a ***worse*** place to live. The other half seemed to value many of the things that development has added to their lives. A quarter (26%) said that on balance all the development had made Florida a ***better*** place to live. And the rest indicated that the benefits and losses from the development had been about equal.

But looking to the future, only 7% said Florida needs any more development. While nearly half (48%) of voters said Florida has already developed too much, 38% said the state has developed as much as it should.

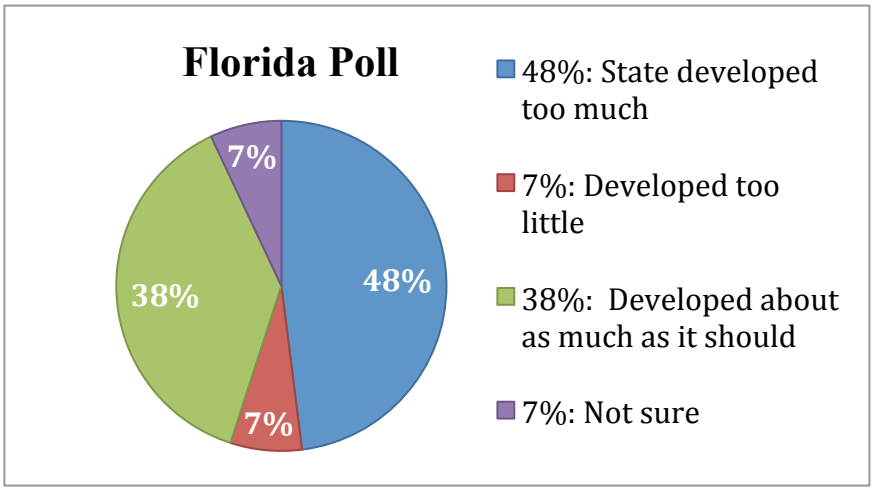


Figure ES-3 Responses to question: "Has Florida developed too much, too little or about as much as it should?" *Source: February 2015 Florida Survey of 800 Likely Voters by Pulse Opinion Research*

The survey found no statistical difference in answers on this question among voters who have been in Florida less than 10 years, those in the state between 10 and 30 years, and those residents of more than 30 years. Regardless of when they arrived or were born in Florida, only about one of every 14 voters thought Florida could use more development.

More specifically, the survey found large majorities of voters wanting to protect both agricultural land and natural habitat from further development. As will be shown below, most Florida voters want their leaders to take the actions that this study found are most

necessary to protect those lands – actions that would reduce future population growth in Florida.

Figure ES-4 A satellite night photo captures the lights of human development and a sense of why most Floridians feel the human footprint is becoming out of balance.

Table ES-1 shows that Florida's *rate* of sprawl ranked sixth among all states both in the past decade and since 1982. (In actual acreage of habitat and farmland eliminated, Florida ranked second in both periods.)

Table ES-1. Sprawl in top six states, ranked by percentage

Ranking (by percentage) 2002-2010	Total Sprawl (percentage), 2002-2010 Recent	State	Total Sprawl (percentage), 1982-2010 Overall	Total Sprawl Ranking by Percentage, 1982-2010
1	18.7%	Nevada	134.3%	1
2	17.6%	Utah	90.8%	7
3	17.4%	Arizona	114.0%	2
4	15.6%	Delaware	81.8%	12
5	13.0%	Texas	69.1%	17
6	11.1%	Florida	94.9%	6

Florida Taming Per Capita Land Consumption: One piece of good news for the open spaces of Florida is that in most cities, Floridians have gone on a bit of a diet when it comes to how much land has been developed to meet all the transportation, housing, work, commerce, recreation, utilities and cultural needs of the average resident.

In 22 of the 30 Urbanized Areas, per capita land consumption was reduced over the decade. This increase in population density (another way of looking at lower per capita consumption) can be the result of many factors, including "smart growth" policies by government and

business encouraging denser development and "infill," economic conditions and personal preferences that cause people to live in smaller spaces or more persons per household, and restrictions on suburban development.

The other, mostly larger, Urbanized Areas increased their per capita land consumption enough to outweigh the reductions in the 22 "dieters." As a result, the per capita land consumption in the combined Urbanized Areas grew by 2% over the decade. The biggest per capita appetite for more developed land was the Palm Coast-Daytona Beach-Port Orange Urbanized Area. Over the decade, per capita land consumption grew by 16% to 0.33 acre per resident. The per capita land appetite grew by 7% for both Jacksonville (to 0.32 acre) and Cape Coral (to 0.40 acre). Sarasota-Bradenton was the only other Urbanized Area with significant per capita growth (5% to 0.33 acre).

The average resident of Florida's 30 Urbanized Areas had 0.27 acre of developed land, compared to 0.22 acre for the average resident of the nation's 100 largest Urbanized Areas.

The 2% overall growth in Florida's per capita land consumption in the most recent decade was a reduction from growth in past decades and less than half the 5% per capita appetite growth rate for the largest 100 Urbanized Areas in the nation. **(The percentages highlighted in green in Table ES-2, indicate Urbanized Areas that enjoyed reductions in per capita land consumption.)**

Table ES-2. Per capita land consumption in Florida's Urbanized Areas – 2000 and 2010

Urbanized Area	Fraction of Acre per Resident – 2000	Fraction of Acre per Resident - 2010	% Change in Per Capita Land Consumption, 2000-2010
Bonita Springs	0.435	0.386	**(-11%)**
Cape Coral	0.372	0.399	7%
Deltona	0.388	0.339	**(-13%)**
Fort Walton Beach--Navarre--Wright	0.405	0.402	**(-1%)**
Gainesville	0.311	0.297	**(-5%)**
Homosassa Springs--Beverly Hills--Citrus Springs	N/A	0.715	N/A
Jacksonville	0.298	0.319	7%
Kissimmee	0.359	0.323	**(-10%)**

Urbanized Area	Fraction of Acre per Resident – 2000	Fraction of Acre per Resident - 2010	% Change in Per Capita Land Consumption, 2000-2010
Lady Lake--The Villages	0.631	0.403	**(-36%)**
Lakeland	0.387	0.356	**(-8%)**
Leesburg--Eustis--Tavares	0.466	0.460	**(-1%)**
Miami (including Ft. Lauderdale, etc.)	0.145	0.144	**(-1%)**
North Port—Port Charlotte	0.467	0.449	**(-4%)**
Ocala	0.534	0.457	**(-14%)**
Orlando	0.251	0.253	1%
Palm Bay--Melbourne	0.358	0.328	**(-8%)**
Palm Coast--Daytona Beach--Port Orange	0.285	0.329	16%
Panama City	0.491	0.411	**(-16%)**
Pensacola	0.434	0.438	1%
Port St. Lucie	0.400	0.354	**(-11%)**
Sarasota--Bradenton	0.310	0.325	5%
Sebastian--Vero Beach South--Florida Ridge	0.431	0.414	**(-4%)**
Sebring--Avon Park	0.488	0.479	**(-2%)**
Spring Hill	0.524	0.496	**(-5%)**
St. Augustine	0.414	0.398	**(-4%)**
Tallahassee	0.357	0.337	**(-6%)**
Tampa--St. Petersburg	0.249	0.251	1%
Titusville	0.381	0.354	**(-7%)**
Winter Haven	0.433	0.427	**(-1%)**
Zephyrhills	0.489	0.418	**(-15%)**
Weighted Average (Mean)	**0.262**	**0.266**	**2%**

The greatly reduced growth in per capita land consumption during the last decade was the primary reason for a smaller level of overall open-space destruction than in the 1990s. But the somewhat slower rate of clearing, scraping and paving is hardly sustainable at 1,220 square miles per decade.

Florida agriculture -- a disappearing security and tradition: The area of cropland in Florida decreased by 23 percent from 1982 to 2010, the area of pastureland by 15 percent, of rangeland by 39 percent, and of total rural lands by 10 percent. These trends do not bode well for the new century.

For some Floridians, these agricultural lands are worth preserving for no other reason than that they are part of the state's deep history and traditions. They brag that America's cattle ranching began in Florida with the "cow hunters" and their "cracker" horses and cows more than 400 years ago. Of course, these rangelands themselves represent a rolling back of the natural habitat that the Spanish explorers found before they introduced livestock. But for generations now, the livestock and the citrus orchards have been not just a museum piece of Florida's past but an important part of the country's food supply.

Figures ES-5&6 Rangeland loss threatens Florida's unique "cracker" horses and cows that have descended through "natural selection" to Florida's environment from livestock established by the Spanish more than 400 years ago. *(photos by Dave Feeler)*

As higher and higher percentages of Floridians live in large metropolitan areas, one might wonder if a lack of connection to the state's rural traditions would result in less interest in even having a strong agricultural presence. But the survey of Florida voters found that only 8% say it is "okay to leave food production to other states and countries." Instead, 87% say "it is

important to keep Florida farmland in agricultural use."

Other states aren't doing their part, either, in maintaining food sufficiency. Government data show that the country now has about one-third less cropland for each American than it did 30 years ago. Similar to findings of nationwide polls, nearly all Floridians believe it is very important (72%) or somewhat important (20%) "to protect U.S. farmland from development so the United States is able to produce enough food to completely feed its own population in the future."

Support for protecting Florida's agricultural land is just as strong among residents arriving in the last 10 years as among those who have lived in the state more than 30 years, the survey found.

But those near-universal opinions are not stopping the farmland destruction. Today, tourists at the Bok Tower Gardens atop Iron Mountain (one of Florida's highest points at 295 feet) can still look in one direction at Florida's past – seemingly unending orange groves and pastureland. But in the other direction into the horizon are thousands upon tens of thousands of acres that are succumbing to the voracious appetite of the populations moving into the Orlando/Disney/Kissimmee megalopolis that is devouring central Florida.

The survey of voters suggests that most Floridians feel that agricultural land should not be sacrificed to accommodate additional residents. Asked to choose between two values, 71% said "it is unethical to pave over and build on good farmland," while 14% chose the other option that "the need for more housing is a legitimate reason to pave over farmland."

Figure ES-7 A view of Florida's agricultural past still is possible from one side of the Bok Tower Gardens atop Iron Mountain.

But until voters insist on different behavior from their elected officials, the often-well-drained and flat farmland is prime target for developers to use to accommodate the growing populations that the elected officials are encouraging.

A particularly troubling example is the citrus groves that are one of the most iconic symbols of the state. Population growth alone is not the cause of their decline over the last decade that included a string of destructive hurricanes and intense battles with diseases. But nobody disputes that sprawling urbanization is one of the three horsemen of the recent citrus apocalypse.

Government data show that Florida began the decade with 756,000 acres of citrus groves but ended with only 517,100 acres. While the acreage previously had its ups and downs, every year of the most recent decade saw fewer acres than the year before during a 32% disappearance of citrus acreage.

Responsibility to Rest of World to Save the State's Original Natural Inhabitants:
Sprawl in the United States is more than a domestic issue. It also has global implications. The relentless and accelerating disappearance of natural habitats dominated by communities of wild plants and animals, replaced by biologically impoverished artificial habitats dominated by human structures and communities, contributes cumulatively to what may become a "state shift" or "tipping point" in Earth's biosphere. This would be an uncontrollable, rapid transition to a less desirable condition in which the biosphere's ability to sustain us and other species would be severely compromised. A 2012 paper in the prestigious British scientific journal *Nature* reviews the evidence that: "…such planetary scale critical transitions have occurred previously in the biosphere, albeit rarely, and that humans are now forcing another such transition, with the potential to transform Earth rapidly and irreversibly into a state unknown in human experience."

The Florida Fish and Wildlife Conservation Commission lists 133 species of animals in the state as threatened or endangered. Habitat loss is the main threat to these organisms. When wildlife habitat is fragmented or destroyed, wild animals and plants have been robbed of their homes and sources of food and/or water. Wildlife populations will invariably and inevitably decline, sometimes to the point of endangerment, extirpation (localized extinction) or extinction in the wild altogether.

Much of this is happening in non-coastal Florida, which author Michael Grunwald (*The Swamp: The Everglades, Florida and the Politics of Paradise*) acknowledges doesn't have the visual power of many other of North America's natural marvels. Much of his description of the Everglades describes the rest of interior Florida, as well:

> *" It's not a breathtaking geological marvel like Yosemite; it's mostly a flat, muddy expanse of shallow water and razor-edged sawgrass, in uncomfortable proximity to the sprawling civilization that is modern South Florida. But the Everglades is one of America's most important ecological jewels, providing kitchens and nurseries for flora and fauna found nowhere else on Earth. It's become a motherhood-and-apple-pie issue in the post-Earth Day era, forcing politicians of all stripes to pledge to save it and revive it."*

For many species and eco-systems, their ability to thrive or even survive may depend on whether the human beings who live in their midst decide to bear the responsibility for saving them for the rest of the world. If Floridians don't, who will?

Polling finds Floridians inclined to understand this. Asked from an environmental standpoint how important it is to save Florida's "marshes, grasslands, pine scrub and dunes," 70% of voters said it is "very important," and another 22% said "somewhat important." Only 6% said saving these natural areas from development is "not very important" or "not important at all."

It is heartening to see that kind of public inclination despite the likelihood that only a small percentage of Floridians are fully aware of just how precarious the future is for many of their fellow non-human inhabitants of the state.

On a weekend just prior to release of this study, youngsters heard Leslie – a guide on a Forever Florida eco-tour vehicle – describe panther tracks she sees on the conservancy property. Each male panther requires 200 square miles of un-fragmented, contiguous territory, she explains -- something harder and harder to find as development spreads its tentacles throughout the state. A little further, she pulls the vehicle alongside the burrow of a gopher tortoise. "Pay special attention to that hole," Leslie says as she rhapsodizes on the tortoise as a "keystone species" upon which as many as 350 to 400 species depend for their own well-being. These species rely on the burrows for resting, reproducing, protection from temperatures and especially for ducking under the regular fires that are essential to their eco-systems. But a string of threats, particularly development that is fragmenting its habitat, has made it more and more difficult for the gopher tortoise to reproduce, let alone to thrive. Gopher tortoises are now a state-protected Species of Special Concern.

Figure ES-8 Proliferating roads and heavier traffic are one of the threats facing the gopher tortoise (*Credit*: "Gopher Tortoise Crossing - Road Sign" by Jean-Lou Justine - Own work. Licensed under CC BY-SA 4.0 via Wikimedia Commons)

According to the World Wildlife Fund, habitat loss poses the greatest threat to endangered species. The United States is home to over 1,000 endangered or threatened animal and plant species that are seriously harmed by ever-encroaching development.

Leslie's examples of the panther and the gopher tortoise pointed to two aspects of habitat -- nature's need for both un-fragmented territory and for periodic fire -- that relate to major adverse effects of encroaching development that extend beyond the zone of impervious surfaces, pavement, and rooftops. The fact is that development disturbs natural habitat even without destroying or altering it directly with bulldozers and construction. Development can cause habitat fragmentation, breaking up large, intact areas of natural habitat into smaller strips, shreds, and fragments. In such cases, these smaller disparate, disconnected habitat bits and pieces may be too small to support viable populations of various wild flora and fauna, which are prevented from interacting and breeding due to development barriers like buildings, walls, fences, and streets. Fragmentation is accompanied with biodiversity impoverishment and species loss, of both wild plants and animals.

And then there is the problem of what happens to wildland fire management when even a small residential or commercial development reaches into a natural area. Every human development expects protection from fire and tends to object to any idea of actually starting a fire or allowing one to spread. But many of the natural habitats in Florida into which developments move evolved with periodic or frequent lightning-caused wildfires and have become dependent on them to rejuvenate soils and maintain ecosystem health. Habitats such as pine savanna need fires on a fairly rapid rotation (1 to 3 years); without it, fire-intolerant plants tend to take over from fire-adapted plants. Nearby residents of the public lands, parks and wildlife refuges that use prescribed (deliberately set) fire as a habitat management tool complain about smoke and worry about prescribed fires escaping into their neighborhoods, which makes fire managers' job tense and difficult. The windows of opportunity to set manageable fires that can achieve habitat objectives get smaller and smaller as development encroaches closer and closer.

Sources of Human Population Growth As Nature's Populations Decline: What can be the future of species that depend on un-fragmented habitat if Florida continues to add nearly 300,000 new residents a year (3 million a decade)? **Table ES-3** shows the change in population of each of the 30 Florida Urbanized Areas the past decade.

Table ES-3 Population growth in Florida's Urbanized Areas – 2000 to 2010

Urbanized Area	Population in 2000	Population in 2010	% growth
Bonita Springs	221,251	310,298	40%
Cape Coral	329,757	530,290	61%
Deltona	147,713	182,169	23%
Fort Walton Beach--Navarre--Wright	152,741	191,917	26%

Urbanized Area	Population in 2000	Population in 2010	% growth
Gainesville	159,508	187,781	18%
Homosassa Springs--Beverly Hills--Citrus Springs	N/A	80,962	N/A
Jacksonville	882,295	1,065,219	21%
Kissimmee	186,667	314,071	68%
Lady Lake--The Villages	50,721	112,991	123%
Lakeland	199,487	262,596	32%
Leesburg--Eustis--Tavares	97,497	131,337	35%
Miami (including Ft. Lauderdale, etc.)	4,919,036	5,502,379	12%
North Port—Port Charlotte	122,421	169,541	38%
Ocala	106,542	156,909	47%
Orlando	1,157,431	1,510,516	31%
Palm Bay--Melbourne	393,289	452,791	15%
Palm Coast--Daytona Beach--Port Orange	255,353	349,064	37%
Panama City	132,419	143,280	8%
Pensacola	323,783	340,067	5%
Port St. Lucie	270,774	376,047	39%
Sarasota--Bradenton	559,229	643,260	15%
Sebastian--Vero Beach South--Florida Ridge	120,962	149,422	24%
Sebring--Avon Park	45,123	61,625	37%
Spring Hill	102,193	148,220	45%
St. Augustine	53,519	69,173	29%
Tallahassee	204,260	240,223	18%
Tampa--St. Petersburg	2,062,339	2,441,770	18%
Titusville	52,922	54,386	3%

Urbanized Area	Population in 2000	Population in 2010	% growth
Winter Haven	153,924	201,289	31%
Zephyrhills	53,979	66,609	23%
All Florida UAs	**13,517,135**	**16,365,240[1]**	**21%**

[1]Not including 2010 population of Homosassa Springs--Beverly Hills--Citrus Springs

Florida's total population rose from 15,982,349 in the year 2000 to 18,801,310 in 2010. The latter included about two and a half million Florida residents who live in small cities, towns and rural areas outside the 30 Urbanized Areas.

This addition of 2.82 million residents was the 3rd largest of any state during the decade. As in most states, the population growth was the result of many factors, including births to U.S. natives in the state, and people moving into Florida from other states.

But most of the state's population growth was the result of federal immigration policies, according to federal data. New immigrants and births to immigrants during the decade totaled about 1.9 million, equal to two-thirds (67%) of Florida's total population growth.

NUMBERS THAT DROVE FLORIDA SPRAWL (2000-10)

2.8 million – Total population growth

1.3 million – New immigrants
0.6 million – New births to immigrants
1.9 million – Pop. growth due to immigration

In 2010, the total population of immigrants living in Florida included 1.29 million who entered the United States in 2000 or later. Federal data also show that 611,000 children living in Florida in 2010 had an immigrant mother and were born in 2000 or later.

Our earlier studies reported our findings on ways in which an Urbanized Area's population growth from immigrants would have either a greater or lesser effect on sprawl than a net population growth of the same size from U.S.-born residents. We could find no precise method of quantification but concluded that the various factors largely balanced each other.

The majority of immigrants now live in suburbs where the sprawl occurs. And the adult children of immigrants were found to be just as likely to shun living in high-density core cities as the adult children of natives. In fact, the lower incomes of immigrants were causing immigrants to move to the edges of cities and even to rural settlements beyond the cities to find cheaper housing.

Nonetheless, it is important to emphasize that the sprawl that occurs because of high immigration levels has nothing to do with the quality of immigrants as people or individuals but everything to do with the quantity of population growth that occurs because of immigration.

Solutions: This report makes clear that the level of destruction of natural habitat and farmland over the last decade was not inevitable. Rather, it was the result of choices – primarily choices made by local, state and federal government officials. Those officials can make different choices for the future if they want to stop the future destruction of a thousand square miles of Florida open space each decade.

First, local policy makers who truly are trying to curb sprawl in Florida cities have a number of policy actions to pursue. This report discusses ways that local officials can slow local population growth through such means as stopping subsidies and tax breaks to attract new residents, investment and development, and by requiring developers to pay the full costs of the population growth they attract.

Although a few small and medium-size cities across the nation have made such decisions to suppress their own population growth, the desire to be bigger and bigger is the most common aspiration of politicians in every municipality and county, no matter how small or large. Most of them see population growth as an indicator of the vibrancy and vitality of their respective communities. However, there is little evidence to suggest that unfettered population growth is any of those things.

Well-known sprawl critic and urban planner Eben Fodor, author of the seminal book *Better Not Bigger*, challenged this very notion in his 2010 study "Relationship between Growth and Prosperity in 100 Largest U.S. Metropolitan Areas." Fodor's study found that rapidly expanding metropolitan areas did not hold up well in terms of standard economic indicators such as unemployment, per capita income, and poverty rates in comparison with slower growing metropolitan areas. His findings suggest that local governments that restrain their population growth not only will make life a lot easier for the plants and animals in the surrounding open spaces but also for the human beings already living in their urban areas.

This report also cites some of the measures that local officials can implement to try to stop the growth in per capita land consumption that leads to destruction of farmland and natural habitat. Smart Growth efforts with zoning, gasoline prices and road building, for example, help discourage residents and businesses from locating outside the current urban boundaries and help funnel new residents into the already-developed areas.

"Infill" is one of the most promising ways to mitigate sprawl from new residents, at least for awhile. The idea is to channel new housing and other structures onto vacant land that exists inside areas where the natural habitat and farmland have already been largely eliminated. A drive through the planned community of Poinciana today illustrates the infill potential. With reports of the impending building of Disney World, developers in the 1960s and 1970s laid out a planned city over 47,000 acres of nearby rangeland and natural habitat. The 10 villages of Poinciana now have more than 70,000 residents who are largely first and second-generation residents of the United States. But the planners laid out streets and lots that were

to handle a population of 225,000. Vacant lots abound between long-established homes. Certain kinds of wildlife can make their own homes easily inside the dense vegetation on many vacant lots, although the fragmentation has destroyed any semblance of a real eco-system or natural habitat inside the urban boundary. None of the land inside that boundary is considered non-developed by government surveys.

Theoretically, the next 100,000 new residents of Florida could build and move into homes on the vacant lots of Poinciana without requiring the destruction of any more farm land or natural habitat. This possibility of large-scale infill exists in under-utilized developments throughout Florida.

Figure ES-9 Florida developments are full of vacant lots like these two in a well-established Poinciana neighborhood.

Aggressive use of infill in the short-term could greatly reduce the pace of open-space destruction while the nation moves toward a stabilized population that a few decades from now would no longer be a driver of sprawl.

But if the federal government persists in forcing population growth through an historically high immigration program, all efforts at infill will only help until current vacant lots are filled. And then the rate of sprawl would explode back to a level like that Florida has endured in recent decades.

Fertility of U.S.-born women has not been a contributor to long-term population growth since 1972 when the average births per woman fell below 2.1. The sole source of long-term population growth in the United States is federal immigration policies that both invite legal immigrants and allow illegal immigrants to settle at a rate four times higher than replacement level (when in-migration equals out-migration).

Any serious efforts to halt the loss of farmlands and wildlife habitats must include reducing the volume of U.S. population growth. And a presidential commission on sustainability concluded that the U.S. population cannot be stabilized without deep reductions in annual legal immigration and more effective control of illegal immigration.

Nearly all long-term population growth in the United States is in the hands of federal policy makers, because nearly all long-term population growth is related to federal immigration policies that have increased the annual settlement of immigrants from one-quarter million in the 1950s and1960s to more than a full million per year since 1990. Until the numerical level of national immigration is addressed, even the best local plans and political commitment will be unable to stop sprawl because nearly all those additional people will settle in some community.

The results of the federal population-growth policies are clearly seen in Florida. The Census Bureau reported on December 23, 2014 that between July 1, 2013 and July 1, 2014, Florida added an average of 803 new residents each day. The state's population grew by 293,000 over this one-year period, reaching 19.9 million.

Studying this kind of population growth and its effect on the natural habitats of this country led the Population and Consumption Task Force of President Clinton's Council on Sustainable Development to conclude in 1996:

> *"This is a sensitive issue, but reducing immigration levels is a necessary part of population stabilization and the drive toward sustainability."*

Florida's voters apparently agree. Two-thirds (64%) told pollsters this year that the federal government should "reduce annual immigration to slow Florida's population growth." Only 3% said the government should increase immigration and population growth.

Told that the government currently allows one million legal immigrants a year, only 16% of voters said that level should continue. Nearly two-thirds (63%) said immigration should be cut at least in half. And 45% said cut annual immigration at least to 100,000, while more than half of those said they preferred immigration be cut to zero.

By a 5-1 margin, Florida voters said they were less likely to vote for a candidate supporting higher immigration than they were more likely. Nonetheless, most of Florida's U.S. Representatives and Senators have a record of voting to maintain the current high levels of immigration and population growth, and half of them are on record urging an increase in those levels.

The sprawl pressures of population growth are similar regardless of where the new residents originate – from another state or another continent. But very few Urbanized Areas are likely to be able to subdue population growth and sprawl if the federal government continues policies that add around 20 million people to the nation each decade (through immigration and births to immigrants), all of whom have to settle in some locality.

VANISHING OPEN SPACES IN FLORIDA

How an Exploding Population Continues Devouring Natural Habitat and Farmland in the Sunshine State

1. INTRODUCTION

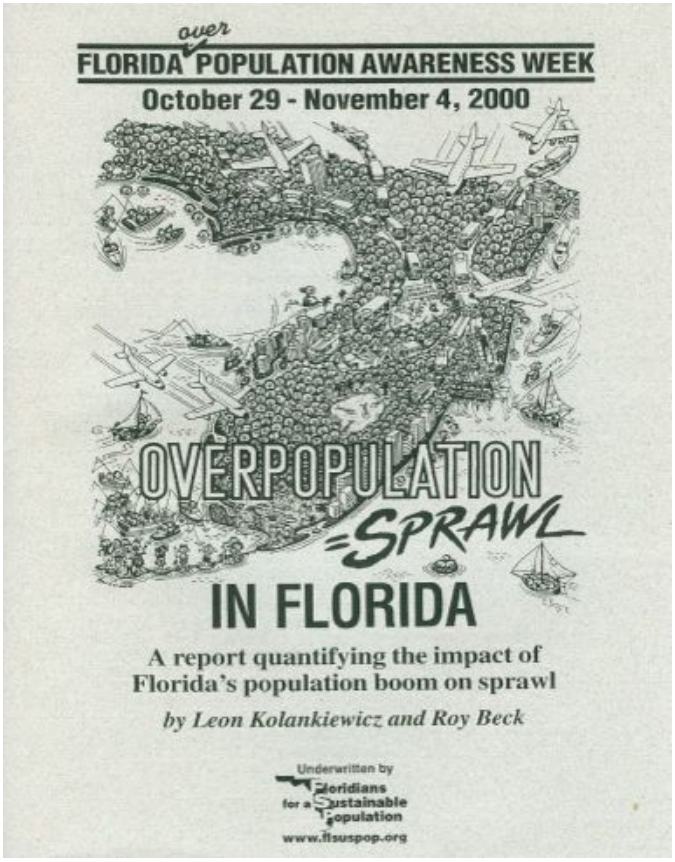
In the late 1990s and early 2000s, more than a decade ago, this report's authors were encouraged by like-minded scientists, scholars, planners, and conservationists around the country to explore and quantify the role of population growth in urban sprawl. At the time, in both academic and government research on the subject, as well as in the popular press and the pronouncements of anti-sprawl activist organizations, if population was mentioned at all, it was typically to dismiss or minimize its importance as a causal agent of sprawl. Yet intuitively and logically, it seemed there should be a correlation to some extent between the population size of a city and the extent of the physical area it occupied. Likewise, it seemed that a city's rate of population growth – how quickly it was adding residents per year or per decade – should have some bearing on how rapidly it was sprawling outwards, that is, on the rate at which rural land or open space at its perimeter was being converted into urban or built-up land.

One of the conservation groups most interested in our research was Floridians for a Sustainable Population (FSP), under its late co-founder and president Joyce Tarnow. Funding received from FSP allowed NumbersUSA to prepare a sprawl report focused on Florida in particular, entitled *Overpopulation = Sprawl in Florida*.[1] This study was originally released during Florida Overpopulation Awareness Week, from October 29 to November 4, 2000.

Joyce Tarnow, 1939-2014

It found that Florida's rapid population growth was the No. 1 factor in the state's urban sprawl from 1970 to 1990. In fact, in most Urbanized Areas of Florida, the amount of land per resident did not grow at all, indicating that growth in per capita consumption was not a factor in any of the sprawl in those cities. Rather, the volatile growth of Florida's population (from 6.8 million to 12.9 million during the two-decade period of study) outweighed the sprawl effect of all other factors combined, suggesting that anti-sprawl efforts in Florida must also try to limit nationwide and statewide population growth in order to be effective.

[1] Leon Kolankiewicz and Roy Beck. 2000. *Overpopulation = Sprawl in Florida*. Arlington, VA: NumbersUSA. 30 pp. Available online at: https://www.numbersusa.com/content/resources/publications/publications/studies/sprawl-florida.html



While there is more than one way to define sprawl, our studies, including our Florida study, consider it to be the conversion of open spaces like farmland and natural habitat into developed land holding man-made structures and surfaces on the expanding edges of urban areas or elsewhere.

Much like the original Florida sprawl study, this update attempts to move beyond what has often been an abstract and non-quantitative discussion about the loss of farmland, natural habitat and open space and about how much to blame population growth, development decisions and Americans' personal consumption desires. This update uses the most recent data from the same reliable, authoritative government agency sources and applies the same methods as our original study in quantifying the roles of the two Overall Sprawl factors: increase in per capita land consumption and population growth.

1.1 Still a Problem After All These Years (and Americans and Floridians Are Still Concerned)

When the first edition of this study was published in 2000, sprawl was a hot topic with many environmental organizations, and the general public worried about the impacts of ever-expanding cities and the nation's steadily disappearing rural land.[2] Thirteen years later, sprawl is still devouring valuable farm and forestland, both in Florida and nationwide, but national and state environmental groups, by and large, have shifted their focus to global issues and away from the loss of habitat and open space due to the unsustainable growth of cities in America.

[2] David P. Fan, David N. Bengston, Robert S. Potts, Edward G. Goetz. 2005. The Rise and Fall of Concern about Urban Sprawl in the United States: An Updated Analysis. Bengston, David N., tech. ed. 2005. Policies for managing urban growth and landscape change: a key to conservation in the 21st Century. Gen. Tech. Rep. NC-265. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Research Station. 51 pp.

Despite our nation's many economic setbacks over the last decade, sprawl continues to be a major threat to rural land and natural habitats in the United States. Nationally, in just the eight years from 2002 to 2010 over 8.3 million acres (approximately 13,000 square miles) – an area larger than Maryland – of previously undeveloped land succumbed to the bulldozer's blade.

Although sprawl by name is not particularly evident in the news these days, the results of sprawl continue to fuel numerous local controversies and are a factor in many of the nation's most pressing environmental challenges. Americans remain concerned and want the trends halted.

Joyce Tarnow's legacy

Upon Joyce Tarnow's passing in early 2014, the group she co-founded and served as long-term president, Floridians for a Sustainable Population, posted this appreciation:

> Joyce was…a tireless worker for clean water, clean air, wise land use, and Florida's quality of life. She joined the fray against a jetport in Miami, the Cross-Florida Barge Canal, and sprawling growth every place she lived. There isn't a corner of Florida that hasn't benefited from her efforts. Her steadiest of visions focused on a recognition of the arithmetic simplicity that population growth on Earth had finally exceeded sustainable limits, threatening the very life-support systems making the planet habitable for humans and other living creatures. Joyce travelled the world, hiking, scuba diving, birding, and giving testament to the core truth of overpopulation lying at the heart of so many of humanity's global and local problems….

In the 1982-2010 period measured by the National Resources Inventory, 4,186 square miles of Florida's open spaces were converted into housing, shopping malls, streets, schools, government buildings, waste treatment facilities, parking lots, vacation homes, resorts, highways, and places of work and entertainment.

Polling of Florida voters found that when thinking about the ecosystems and agricultural areas of the state, 48% of voters said Florida has already developed too much, and another 38% said the state has developed as much as it should. Considering the balance of what development over the last three decades has added to their lives and what it has taken away, 26% said Florida is a better place to live. But only 7% thought more development is needed.

As our citizens seek better economic opportunities, new sprawling cities have emerged in traditionally less developed areas of the country. This new development puts pressure on natural resources, habitats, and species in many ecologically sensitive areas. It is for these reasons that the authors of the original study decided an updated edition was in order.

This update examines the quantity and rate of rural land lost to development surrounding Florida's 30 Urbanized Areas (UAs – entities defined by the Census Bureau as central cities

and the contiguous development of their suburbs). In these 30 UAs alone, 1,220 square miles of surrounding rural land were lost to urbanization during the most recent decade between the 2000 Census and 2010 Census. We also examine the factors behind this sprawl, determining the degree to which population growth and growth in per capita land consumption (decreasing population density) each "drove" sprawl from 2000 to 2010.

Figure 1. Once and future paradise? Florida's natural environment is a unique and irreplaceable treasure

This update also includes changes in the amount of Developed Land in Florida as delineated by the National Resources Inventory (NRI) of the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture.

Although rates (percentage increases) of sprawl are important, the most significant environmental fact about a city's sprawl – or a state's increase in developed land – is the actual area in acres or square miles of rural land that has been urbanized or developed.

Table 1 lists the top 10 Urbanized Areas in Florida that eliminated the most rural land over the past

Table 1. Florida's top sprawlers (2000 to 2010)

Urbanized Area	**Sprawl** (sq. miles)
1. Tampa--St. Petersburg	155
2. Orlando	145
3. Cape Coral (including Fort Myers)	138
4. Miami (including Ft. Lauderdale, etc.)	123
5. Jacksonville	120
6. Palm Coast--Daytona Beach--Port Orange	66
7. Sarasota--Bradenton	56
8. Kissimmee	54
9. Port St. Lucie	39
10. Bonita Springs	37
Total open space lost to Florida's ten worst sprawlers from 2000 to 2010	**933**

decade (2000-2010). Clearing, scraping, paving, and building over hundreds of square miles of Florida's hardwood and pine forests, wetlands, croplands, pastures, range, and scrub, they truly earned the dubious distinction as the state's "Top Sprawlers."

These ten worst offenders devoured Florida's precious remaining open space at a rate of 164 acres per day for each and every one of the 3,650 days between 2000 and 2010.

Table 2. Florida's Top Ten Most Populous Urbanized Areas in 2010

Urbanized Area	Population in 2010
1. Miami (including Ft. Lauderdale, etc.)	5,502,379
2. Tampa--St. Petersburg	2,441,770
3. Orlando	1,510,516
4. Jacksonville	1,065,219
5. Sarasota--Bradenton	643,260
6. Cape Coral (including Fort Myers)	530,290
7. Palm Bay--Melbourne	452,791
8. Port St. Lucie	376,047
9. Palm Coast--Daytona Beach--Port Orange	349,064
10. Pensacola	340,067
Total Population in 2010	**13,211,403**

Eight UAs are found in both **Table 1** and **Table 2;** that is they are Top 10 in both aggregate, cumulative population size and 2000-2010 land area sprawl: Miami, Tampa--St. Petersburg, Orlando, Jacksonville, Sarasota--Bradenton, Cape Coral (including Fort Myers), Port St. Lucie, and Palm Coast--Daytona Beach--Port Orange.

Figure 2 is a map that provides a sense of scale, depicting the size, shape, and location of Florida's 30 Urbanized Areas and several dozen of Urban Clusters (smaller urban zones/population centers also designated and delineated by the Census Bureau) within the Florida as a whole in 2010, after more than a century of nearly continuous population growth and urban expansion. It is remarkable how much of Florida is already located within Census-designated Urbanized Areas.

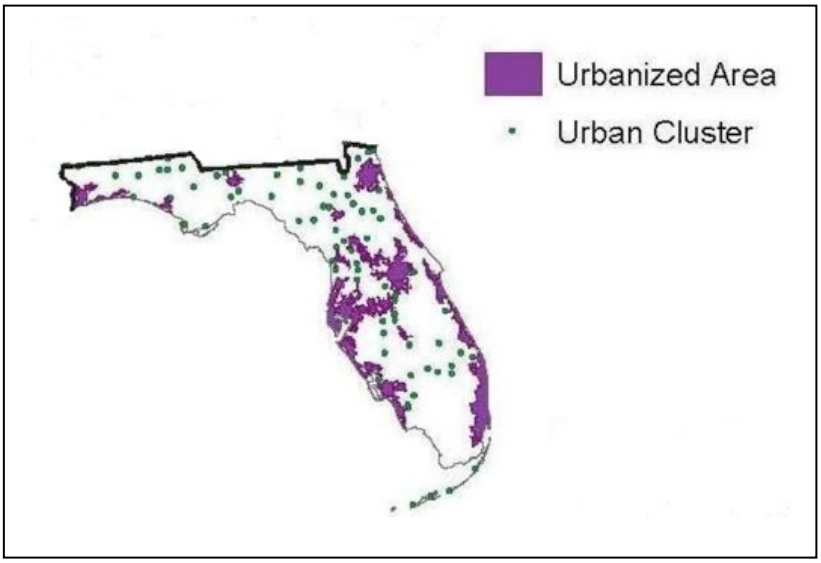


Figure 2. Urbanized Areas (UAs) and Urban Clusters in Florida, 2010
Source: U.S. Census Bureau, 2010 Census Urban Area Delineation Program

Figure 3 is a satellite image of Florida at night. The brightly lit areas correspond closely to **Figure 2's** densely populated Urbanized Areas, and are heavily concentrated along Florida's nearly entire Atlantic Coast, central Gulf Coast, and central zone crossing the state from Daytona Beach in the east through Orlando and environs and over to Tampa-St. Petersburg in the west. **Figure 3** is a small portion of **Figure 4**, which is a composite nighttime satellite image of the United States. Viewing this image, it is easy to understand why astronomers say that residents of the United States east of the Mississippi River could go their entire lives without ever once seeing the Milky Way Galaxy in which we reside due to the combination of the glow and glare from artificial lighting that cloak urbanized areas and the air pollution that the traffic, factories, and power plants surrounding these areas often generate.

Figure 3. Satellite image of Florida at night

Figure 3b. Composite satellite image of the United States at night

The rest of this section provides background on what sprawl is all about and what is at stake due to its relentless march outwards. Section 2 then describes our methodology, sources and definitions. Then, our findings for the period after 2000 begin with Section 3.

1.2 Paving Over Farmland, Wildlife Habitat, and Open Space that Rejuvenates the Human Spirit

One of the primary concerns about urban sprawl has been that it is replacing our nation's forests, wetlands, and prime farmland with subdivisions, new and expanded roads, strip malls, and business parks. In fact, nationwide, from 1982 to 2010, 41.4 million acres (approximately 65,000 square miles) – an area about equivalent to the state of Florida – of previously undeveloped non-federal rural land was paved over to accommodate our growing cities.[3] Of these 41 million acres lost – or "converted" as land managers and planners

[3] U.S. Department of Agriculture. 2013. *Summary Report: 2010 National Resources Inventory*. Natural Resources Conservation Service (NRCS), Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. Available on the World Wide Web at: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1167354.pdf.

generally refer to it – over 17 million acres were forestland, 11 million acres cropland, and 12 million acres pasture and rangeland.[4]

As the NRCS put it in their 2007 summary report, reviewing the 1982-2007 quarter-century:

> *"The net change of rural land into developed land has averaged 1.6 million acres per year over the last 25 years, resulting in reduced agricultural land, rangeland, and forest land. Loss of prime farmland, which may consist of agriculture land or forest land, is of particular concern due to its potential effect on crop production and wildlife."*[5]

Figure 4 Where suburban development and nature meet, nature almost always must retreat.

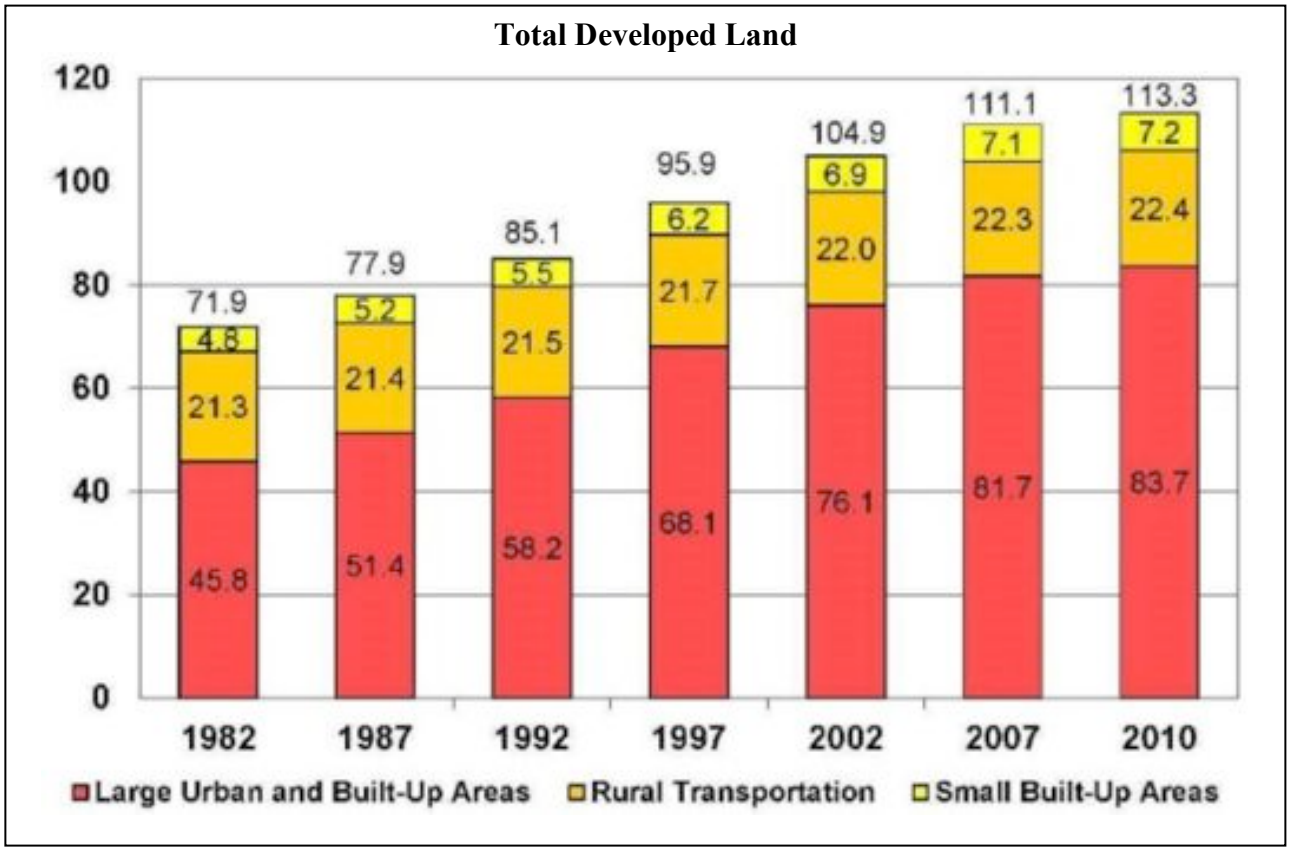
Figure 4a The fire-dependent pine savanna ecosystem once covered large areas along the Eastern Coastal Plain, including Florida. It is a mix of scattered pines, grasses, forbs and herbs. Logging, grazing and fire suppression have eliminated most pine savanna.

[4] Leon Kolankiewicz, Roy Beck and Anne Manetas. 2014. *Vanishing Open Spaces: Population Growth and Sprawl in America*. Arlington, VA: NumbersUSA. Available online at: https://www.numbersusa.com/content/resources/publications/publications/studies/outsmarting-smart-growth-population-grow.html

[5] Natural Resources Conservation Service (NRCS). 2013. 2007 National Resources Inventory: Development of Non-Federal Rural Land. March.

Figure 5 shows the increase in developed land nationwide from 1982 to 2010, as tracked by the NRCS and the NRI initially in 5-year intervals, and later more frequently. The total area of developed land grew from 71.9 million acres (112,356 square miles) in 1982 to 113.3 million acres (177,096 square miles) in 2010. This latter area is about equal in size to the states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, Delaware, New York, and Pennsylvania, in other words, all of New England and then some. All of this land was originally developed from either agricultural land or natural habitat. As the NRCS observes: "more than one-third of all land that has ever been developed in the lower 48 states was developed during the last quarter-century."

Figure 5. Change in Developed Land nationwide, 1982-2010



In Florida alone, according to the Natural Resources Conservation Service (NRCS) and its National Resources Inventories (NRIs) the amount of developed land almost doubled in the 28 years between 1982 and 2010, from 2,809,100 acres (4,389 square miles) to 5,476,300 acres (8,557 square miles). **Table 3** and **Figure 6** show the relentless increase in developed land in Florida at five-year intervals from 1982 to 2010. It is worth reiterating once more that all of the land developed during this 28-year period was land taken permanently from Florida's agricultural land base or its natural habitats. These lost farmlands, open spaces, and wildlife habitats are irreplaceable on any relevant time scale.

Table 3. Increase in Developed Land in Florida, 1982-2010

Year	Area of Developed Land (thousand acres)	Period	Added annual increment of Developed Land during period (acres)	Average amount of land consumed by sprawl every day during period (acres)
1982	2,809.1			
1987	3,127.6	1982-1987	63,700	175
1992	3,732.1	1987-1992	120,900	331
1997	4,410.4	1992-1997	135,660	372
2002	4,930.5	1997-2002	104,020	285
2007	5,358.8	2002-2007	84,660	232
2010	5,476.3	2007-2010	40,833	112
Average		**1982-2010**	**95,257**	**261**

Source: *Source*: NRCS, 2013. *Summary Report: 2010 National Resources Inventory*, **Table 1**.

On average, on each of the 10,220 days in the 28 years between 1982 and 2010, approximately 261 acres of open space in Florida succumbed to the bulldozer, asphalt, concrete, and buildings.

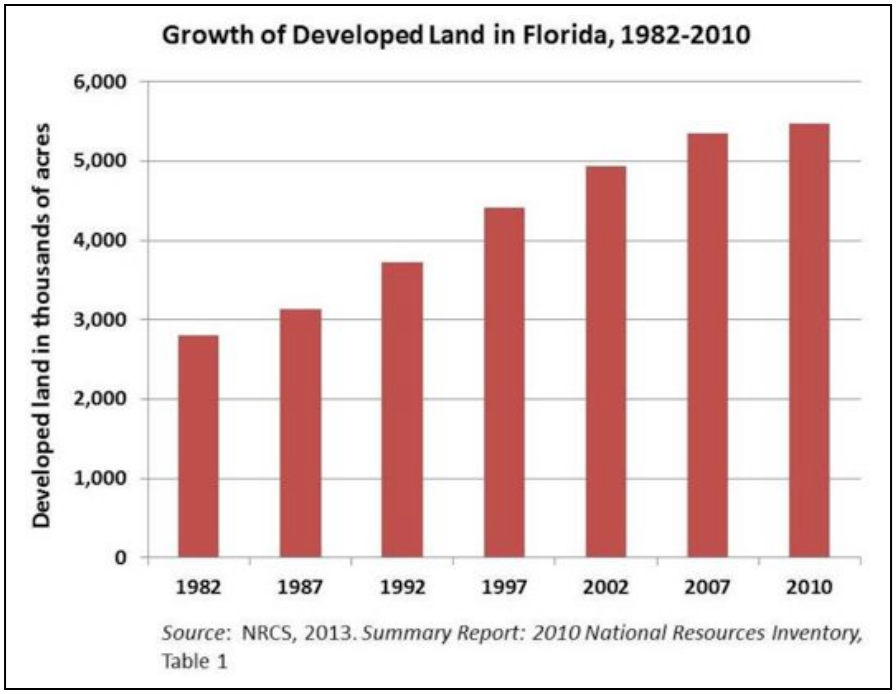


Figure 6. Growth of Developed Land in Florida, 1982-2010
Source: NRCS, 2013. *Summary Report: 2010 National Resources Inventory*.

The area of cropland in Florida decreased by 23 percent from 1982 to 2010, the area of pastureland by 15 percent, of rangeland by 39 percent, and of total rural lands by 10 percent. These open space trends do not bode well for the new century.

1.2.1 Endangered Species

Within the overall open-space acreage threatened by sprawl are some of our most critical natural habitats. According to the World Wildlife Fund, habitat loss poses the greatest single threat to endangered species. The United States is home to over 1,000 endangered or threatened animal and plant species that are seriously harmed by ever-encroaching development. Eliminating forests and wetlands not only threatens native species, but has serious human health, safety, and economic consequences as well. Wetlands are important filters that clean pollutants out of our water. Wetlands can also moderate the devastating effects of floods by acting as natural buffers and sponges, soaking up and storing floodwaters. According to the U.S. Environmental Protection Agency, nearly two-thirds of all fish we consume spend some portion of their lives in wetlands, which often serve as "nurseries" for juveniles. Paving over our nation's breadbasket and valuable habitats with unrelenting sprawl entails serious long-term economic and human health and safety costs that we simply cannot afford.

Table 4. Endangered and threatened wildlife species (animals only) in Florida

Species Designation	Fish	Amphibians	Reptiles	Birds	Mammals	Invertebrates	Total
Federally Endangered	3	1	4	9	22	8	47
Federally Threatened	2	1	6	4	1	6	20
FT/SA*	0	0	1	0	0	3	4
FXN	0	0	0	1	0	0	1
State Threatened	3	0	7	5	3	1	19
State Species of Concern	6	4	6	16	6	4	42
Total	**14**	**6**	**24**	**35**	**32**	**22**	**133**

*Federally threatened because of similarity of appearance

The Florida Fish and Wildlife Conservation Commission lists 133 species of animals in the state as threatened or endangered. Habitat loss is the main threat to these organisms. When wildlife habitat is fragmented or destroyed, wild animals and plants have been robbed of their homes and sources of food and/or water. Wildlife populations will invariably and inevitably

decline, sometimes to the point of endangerment, extirpation (localized extinction) or extinction in the wild altogether.

Much of this is happening in non-coastal Florida, which author Michael Grunwald (*The Swamp: The Everglades, Florida and the Politics of Paradise*) acknowledges doesn't have the visual power of many other of North America's natural marvels. Much of his description of the Everglades describes the rest of interior Florida, as well:

> *"It's not a breathtaking geological marvel like Yosemite; it's mostly a flat, muddy expanse of shallow water and razor-edged sawgrass, in uncomfortable proximity to the sprawling civilization that is modern South Florida. But the Everglades is one of America's most important ecological jewels, providing kitchens and nurseries for flora and fauna found nowhere else on Earth. It's become a motherhood-and-apple-pie issue in the post-Earth Day era, forcing politicians of all stripes to pledge to save it and revive it."*

For many species and eco-systems, their ability to thrive or even survive may depend on whether the human beings who live in their midst decide to bear the responsibility for saving them for the rest of the world. If Floridians don't, who will?

Polling finds Floridians inclined to understand this. Asked from an environmental standpoint how important it is to save Florida's "marshes, grasslands, pine scrub and dunes," 70% of voters said it is "very important," and another 22% said "somewhat important." Only 6% said saving these natural areas from development is "not very important" or "not important at all."[6]

> **QUESTION:** From an environmental standpoint how important is it to save Florida's marshes, grasslands, pine scrub and dunes?
>
> 70% Very important
> 22% Somewhat important
> 5% Not very important
> 1% Not at all important
> 3% Not sure

[6] 2015 Florida Poll on Sprawl and Population. Florida Survey of 800 likely voters conducted February 25-27, 2015 by Pulse Opinion Research.

It is heartening to see that kind of public inclination despite the likelihood that only a small percentage of Floridians are fully aware of just how precarious the future is for many of their fellow non-human inhabitants of the state.

On a weekend just prior to release of this study, youngsters heard Leslie – a guide on a Forever Florida eco-tour vehicle – describe panther tracks she sees on the conservancy property. Each male panther requires 200 square miles of un-fragmented, contiguous territory, she explains --something harder and harder to find as development spreads its tentacles throughout the state. A little further, she pulls the vehicle alongside the burrow of a gopher tortoise. "Pay special attention to that hole," Leslie says as she rhapsodizes on the tortoise as a "keystone species" upon which as many as 350 to 400 species depend for their own well-being. These species rely on the burrows for resting, reproducing, protection from temperatures and especially for ducking under the regular fires that are essential to their eco-systems. But a string of threats, particularly development that is fragmenting its habitat, has made it more and more difficult for the gopher tortoise to reproduce, let alone to thrive. Gopher tortoises are now a state-protected Species of Special Concern.

Figure 7. Gopher tortoise at Canaveral National Seashore, Merritt Island, Florida. The gopher tortoise is state-threatened and one of the species harmed by habitat loss.

According to the World Wildlife Fund, habitat loss poses the greatest threat to endangered species. The United States is home to over 1,000 endangered or threatened animal and plant species that are seriously harmed by ever-encroaching development.

Leslie's examples of the panther and the Gopher tortoise pointed to two aspects of habitat -- nature's need for both un-fragmented territory and for periodic fire -- that relate to major adverse effects of encroaching development that extend beyond the zone of impervious surfaces, pavement, and rooftops. The fact is that development disturbs natural habitat even without destroying or altering it directly with bulldozers and construction. Development can cause habitat fragmentation, breaking up large, intact areas of natural habitat into smaller strips, shreds, and fragments. In such cases, these smaller disparate, disconnected habitat bits and pieces may be too small to support viable populations of various wild flora and fauna, which are

prevented from interacting and breeding due to development barriers like buildings, walls, fences, and streets. Fragmentation is accompanied with biodiversity impoverishment and species loss, of both wild plants and animals.

And then there is the problem of what happens to wildland fire management when even a small residential or commercial development reaches into a natural area. Every human development expects protection from fire and tends to object to any idea of actually starting a fire or allowing one to spread. But many of the natural habitats in Florida into which developments move evolved with periodic or frequent lightning-caused wildfires and have become dependent on them to rejuvenate soils and maintain ecosystem health. Habitats such as pine savanna need fires on a fairly rapid rotation (1 to 3 years); without it, fire-intolerant plants tend to take over from fire-adapted plants. Nearby residents of the public lands, parks and wildlife refuges that use prescribed (deliberately set) fire as a habitat management tool

aFigure 8. Threatened and endangered species in Florida affected by human population growth, sprawl, and habitat loss. Clockwise from top left: eastern indigo snake, Florida panther, West Indian manatee, Florida scrub jay

complain about smoke and worry about prescribed fires escaping into their neighborhoods, which makes fire managers' job tense and difficult. The windows of opportunity to set manageable fires that can achieve habitat objectives get smaller and smaller as development encroaches closer and closer.

Sprawl in the United States is more than a domestic issue. It also has global implications. The relentless and accelerating disappearance of natural habitats dominated by communities of wild plants and animals, replaced by biologically impoverished artificial habitats dominated by human structures and communities, contributes cumulatively to what may become a "state shift" or "tipping point" in Earth's biosphere. This would be an uncontrollable, rapid transition to a less desirable condition in which the biosphere's ability to sustain us and other species would be severely compromised. A 2012 paper in the prestigious British scientific journal *Nature* reviews the evidence that: "…such planetary scale critical transitions have occurred previously in the biosphere, albeit rarely, and that humans are now forcing another such transition, with the potential to transform Earth rapidly and irreversibly into a state unknown in human experience."[7]

1.2.2 Agriculture

Ominous, divergent trends – an increasing population, a decreasing arable land base, diversions of water supplies needed for irrigated agriculture to urban populations, and a modern, mechanized agriculture that is heavily dependent on limited fossil fuels at all stages – have led some scientists to conclude that someday within this century the United States may cease to be a net food exporter.[8] Food grown in this country would be needed for domestic consumption. By mid-century, the ratio of arable land per capita may have dropped to the point that, "the diet of the average American will, of necessity, include more grains, legumes, tubers, fruits and vegetables, and significantly less animal products."[9] While this may in fact constitute a healthier diet, it would also represent a significant loss of choice for a country that has always prided itself on its abundant agriculture, plentiful consumer options, and comparative freedom from want.

Table 5 documents the gradual, long-term loss of Florida's cropland, pastureland, and rangeland from 1982 to 2010. In that 28-year span, croplands declined by 23 percent, pastureland by 15 percent, rangeland by 39 percent, and total rural land by 10 percent.

[7] Barnosky, A.D. et al. 2012. "Approaching a state shift in Earth's biosphere." *Nature*, Vol. 486, 7 June.
[8] Pimentel, D. and M. Giampietro. 1994. "Food, Land, Population and the U.S. Economy." Washington, D.C.: Carrying Capacity Network; David Pimentel and Marcia Pimentel. 1997. "U.S. Food Production Threatened by Rapid Population Growth." Washington, D.C.: Carrying Capacity Network; D. Pimentel, M. Whitecraft, Z. R. Scott, L. Zhao, P. Satkiewicz, T. J. Scott, J. Phillips, D. Szimak, G. Singh, D. O. Gonzalez, and T. L. Moe. 2010. Will Limited Land, Water, and Energy Control Human Population Numbers in the Future? *Human Ecology*. 12 August.
[9] Pimentel and Giampietro. 1994. See footnote #8.

Table 5. Decrease in rural lands in Florida, 1982-2010*

Year	Cropland	Pastureland	Rangeland	Forestland	Other Rural Lands	Total Rural Land
1982	3,580.5	4,379.2	4,361.4	13,259.9	2,486.5	28,067.5
1987	3,193.5	4,659.9	4,036.9	13,236.7	2,495.3	27,716.3
1992	3,049.9	4,575.9	3,504.3	13,185.1	2,514.3	26,954.4
1997	2,779.9	4,380.6	3,221.5	13,109.4	2,668.4	26,279.8
2002	2,889.6	3,891.3	2,913.9	13,243.0	2,711.2	25,738.7
2007	2,792.7	3,729.8	2,705.5	13,124.0	2,865.9	25,283.0
2010	2,742.6	3,728.1	2,671.7	13,110.0	2,839.7	25,153.7

*In thousands of acres
Source: NRCS, 2013. *Summary Report: 2010 National Resources Inventory*, Table 2.

For some Floridians, these agricultural lands are worth preserving for no other reason than that they are part of the state's deep history and traditions. They brag that America's cattle ranching began in Florida with the "cow hunters" and their "cracker" horses and cows more than 400 years ago. Of course, these rangelands themselves represent a rolling back of the natural habitat that the Spanish explorers found before they introduced livestock. But for generations now, the livestock and the citrus orchards have been not just a museum piece of Florida's past but an important part of the country's food supply.[10]

As higher and higher percentages of Floridians live in large metropolitan areas, one might wonder if a lack of connection to the state's rural traditions would result in less interest in even having a strong agricultural presence. But the survey of Florida voters found that only 8% say it is "okay to leave food production to other states and countries." Instead, 87% say "it is important to keep Florida farmland in agricultural use."

QUESTION: Is it important for Florida to keep its remaining farmland in agricultural use or is it okay to leave food production to other states and countries?

87% It is important to keep Florida farmland in agricultural use
8% It is okay to leave food production to other states and countries
5% Not sure

[10] Florida Cracker Horse Association. http://www.floridacrackerhorses.com/history.htm. Found on 16MAR15.

Other states aren't doing their part, either, in maintaining food sufficiency. Government data show that the country now has about one-third less cropland for each American than it did 30 years ago. Support for protecting Florida's agricultural land is just as strong among residents arriving in the last 10 years as among those who have lived in the state more than 30 years, the survey found.

But those near-universal opinions are not stopping the farmland destruction. Today, tourists at the Bok Tower Gardens atop Iron Mountain (one of Florida's highest points at 295 feet) can still look in one direction at Florida's past – seemingly unending orange groves and pastureland. But in the other direction into the horizon are thousands upon tens of thousands of acres that are succumbing to the voracious appetite of the populations moving into the Orlando/Disney/Kissimmee megalopolis that is devouring central Florida.

The survey of voters suggests that most Floridians feel that agricultural land should not be sacrificed to accommodate additional residents.

The poll found that most Floridians consider the preservation of good cropland to be not just a practical issue but one of ethics. The poll forced people to choose between the practical need for more housing (a pressure that exists in nearly every Urbanized Area in the country) and the ethics of destroying food-producing land to provide more housing. The relatively high number (15%) answering "not sure" indicates that many people haven't thought about this tradeoff between two things they probably think of as "good" or that they are unwilling to choose between them.

> **QUESTION:** Is it unethical to pave over and build on good farmland or is the need for more housing a legitimate reason to pave over and build on farmland?
>
> 71% It is unethical to pave over and build on good farmland
> 14% The need for more housing is a legitimate reason to pave over farmland
> 15% Not sure

But until voters insist on different behavior from their elected officials, the often-well-drained and flat farmland is prime target for developers to use to accommodate the growing populations that the elected officials are encouraging.

A particularly troubling example is the citrus groves that are one of the most iconic symbols of the state. Population growth alone is not the cause of their decline over the last decade that included a string of destructive hurricanes and intense battles with diseases. But nobody disputes that sprawling urbanization is one of the three horsemen of the recent citrus apocalypse.

Government data show that Florida began the decade with 756,000 acres of citrus groves but ended with only 517,100 acres. While the acreage previously had its ups and downs, every

year of the most recent decade saw fewer acres than the year before during a 32% disappearance of citrus acreage.[11]

Preserving farmland and maintaining its fertility is more than a question of producing an adequate supply of food and engendering a healthy diet for Americans, it is a matter of national security. According to Brig. Gen. (Ret.) W.E. King, Ph.D., P.E., Dean of Academics, U.S. Army Command and General Staff College, Fort Leavenworth, Kansas, without a sustainable environment and resources that meet basic human needs, instability and insecurity will be the order of the day.[12] The World Food Summit held in Rome, Italy in 1996 revived interest in the issue of food security, and thus, in farmland preservation because of its bearing on food security.[13] As Oxford ecology professor Norman Meyers noted in a now-classic 1986 article:

> *"…national security is not just about fighting forces and weaponry. It relates to watersheds, croplands, forests, genetic resources, climate and other factors that rarely figure in the minds of military experts and political leaders…"*[14]

One of the lasting consequences for the world food system of the global crisis in food prices from 2007 to 2008 has been the accelerating acquisition of farmland in poorer countries by wealthier countries which seek to ensure their food supplies. As the International Food Policy Research Institute states:

> *"Increased pressures on natural resources, water scarcity, export restrictions imposed by major producers when food prices were high, and growing distrust in the functioning of regional and global markets have pushed countries short in land and water to find alternative means of producing food."*[15]

[11] Treasure Coast citrus industry's sweet-and-sour reality by Nadia Vanderhoof. 8:15 PM, Jul 9, 2011 http://www.tcpalm.com/news/treasure-coast-citrus-industrys-sweet-and-sour

[12] King, W.E. A Strategic Analytic Approach to the Environmental Security Program for NATO. W. Chris King, Ph.D. P.E.is Brigadier General, US Army retired and Dean of Academics, US Army Command and General Staff College, Fort Leavenworth, Kansas.

[13] Tweeten, L. 1998. Food Security and Farmland Preservation. *Drake Journal of Agricultural Law*. 3:237-250.

[14] Meyers, N. 1986. The Environmental Dimension to Security Issues. *The Environmentalist*. 6(4): 251-257; Liotta, P.H., et al. (eds.). 2007. Proceedings of the NATO Advanced Research Workshop on Environmental Change and Human Security: Recognizing and Acting on Hazard Impacts. Newport, Rhode Island, 4-7 June 2007.

[15] International Food Policy Research Institute. 2009. "Land grabbing" by foreign investors in developing countries. Available online at: http://www.ifpri.org/publication/land-grabbing-foreign-investors-developing-countries.

By 2009, foreign governments and investors had already purchased more than 50 million acres (78,000 square miles) of farmland – an area the size of Nebraska – in Africa and Latin America.[16]

Finally, U.S. agriculture and related food industries contribute nearly $1 trillion to our national economy annually. They comprise more than 13 percent of the GDP and employ 17 percent of the labor force. World demand for U.S. agricultural exports is only expected to increase over the foreseeable future due to a rapidly growing world population, increasing demand for meat and dairy products, and expanding global markets.[17]

Americans and Floridians are not unaware of these national security implications, according to a Florida poll[18] of likely voters in 2015 (see **Appendix I** for the entire poll results):

> **QUESTION:** Government data show that the country now has about one-third less cropland for each American than it did 30 years ago. How important is it to protect U.S. farmland from development so the United States is able to produce enough food to completely feed its own population in the future?
>
> 72% Very important
> 20% Somewhat important
> 4% Not very important
> 1% Not at all important
> 3% Not sure

1.3. Physiological and Psychological Benefits of Open Space

Open space, parks, green spaces, natural areas – including wetlands, riparian corridors, farmland, beaches, rivers, lakes, the ocean, fields and forests – provide demonstrable mental and physical health benefits. They have proven to be preventative measures that can actually lower health care costs and reduce the need for health interventions. Exploring or even just gazing upon natural areas – such as a swamp or mangrove-fringed estuary next to a city – gives human beings a sense of perspective, continuity in a changing world, spiritual renewal, well-being, and a feeling of harmony with the world around us. The presence of open space within and adjacent to our urban areas – and the assurance that this open space will outlast us – serves to counter-balance the stress and strain of modern life.

Contact with nature and open space provides both physiological and psychological benefits. Research on the physiological benefits of open space has centered on how direct or indirect

[16] Leahy, S. 2009. Wealthy Countries and Investors Buying Up Farmland in Poor Countries. Available online at: http://stephenleahy.net/2012/05/17/wealthy-countries-and-investors-buying-up-farmland-in-poor-countries/.
[17] American Farmland Trust. 2013. Farmland Protection. Available on the World Wide Web at: http://www.farmland.org/programs/protection/.
[18] Op. cit. Footnote #7, Pulse Opinion Research. **Appendix I** includes the entire poll's results.

(vicarious) experience with vegetated and/or natural landscapes reduces stress, and anxiety.[19] A series of studies spanning nearly 20 years in the seventies and eighties linked photo simulations of natural settings to reduced stress levels as measured by heart rate and brain waves. One study revealed that subjects experienced more "wakeful relaxation" in response to slides showing vegetation only and vegetation with water as compared with urban scenes without vegetation. These data were corroborated by attitude measures which indicated lower levels of fear and sadness when experimental subjects observed nature-related slides, as opposed to urban slides.[20] In studies of hospital patients, recovery was faster, there were fewer negative evaluations in patient reports, and there was less use of analgesic drugs among post-surgery patients with views of exterior greenery than among control group patients with views of buildings.[21]

Figure 9. Florida's natural areas are crucial not only for outdoor recreation and the tourist economy but for spiritual well-being (kayaking in Tomoka State Park in Volusia County)

[19] Rubenstein, N.R. The Psychological Value of Open Space. Chapter 4 in *The Benefits of Open Space*. The Great Swamp Watershed Association. 1997. Available on the World Wide Web at: http://www.greatswamp.org/publications/rubinstein.htm.

[20] Ulrich, R. 1979. Visual landscapes and psychological well-being. *Landscape Research*, 4(1): 17-23.

[21] Ulrich, R. 1983. Aesthetic and affective response to natural environment. Chapter 3 in I. Altman, & J. F. Wohlwill (Eds.), *Human Behavior and Environment*: Volume 6 (pp. 85-126). New York: Plenum Press; Ulrich, R. 1984. Views through a window may influence recovery from surgery. *Science*, 224, 420-421.

In other research, breast cancer survivors who engaged in personally enjoyable and nature-related "restorative activities" showed dramatic effects on their cognitive process and quality of life.[22] At the end of three months, the experimental group showed significant improvements in attention and self-reported quality of life measures; they had begun a variety of new projects. Control group members, meanwhile, who had been given no advice regarding nature exposure activities, continued with deficits in measures of attention, had started no new projects, and had lower scores on quality of life measures. This research underscored that difference between nature as an amenity and as a human need. As one reviewer of the study observed:

> *"People often say that they like nature; yet they often fail to recognize that they need it...Nature is not merely 'nice.' It is not just a matter of improving one's mood, rather it is a vital ingredient in healthy human functioning."*[23]

There is an important distinction between nature as amenity and nature as need. As one book affirms:

> "*Viewed as an amenity, nature may be readily replaced by some greater technological achievement. Viewed as an essential bond between human and other living things, the natural environment has no substitutes."*[24]

While there are many anecdotal reports connecting the natural environment or open space to everything from increased self-esteem to stress reduction, there are few studies attempting to categorize the many phrases used to identify the worth of a walk in the woods or a day bird-watching beside a marsh.[25] Few studies track long-term longitudinal effects on changed attitudes and behavior. While it is difficult to characterize and quantify the long-term manner in which lives are modified, it is easy to acquire narrative accounts about the effect of a favorite overlook, trail, or patch of woods on one's psyche. One of the best known of such testimonials is from pioneering naturalist-conservationist John Muir:

> "*Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop away from you like the leaves of Autumn."*

Natural settings are unparalleled in their ability to furnish solitude and privacy. They also have "existence value," that is, there is value to knowing that they are simply *there* and to the

[22] Cimprich, B. E. 1990. Attentional fatigue and restoration in individuals with cancer. Unpublished Doctoral Dissertation, University of Michigan.
[23] Kaplan, S. (1992). The Restorative Environment: Nature and human experience. In D. Relf (ed.), *The Role of horticulture in human well-being and social development: A National Symposium* [Proceedings of Conference Held 19-21 April 1990, Arlington, VA] (pp. 134-142). Portland, OR: Timber Press.
[24] Kaplan, R., & Kaplan, S. (1989). *The Experience of nature: A Psychological perspective*. New York: Cambridge University Press.
[25] Op. cit. Footnote #18, Rubenstein.

very idea that we *could* get away into them, if we so chose; this is a value in and of itself, which provides for a psychological "time-out" and a sense of wellbeing.

A 2014 national survey[26] of Americans found most of them at least superficially recognizing the value of non-developed open spaces for their emotional well-being.

QUESTION: Do you feel an emotional or spiritual uplift from time spent in natural areas like woodlands and open grasslands?

70% - Yes
18% - No
12% - Not sure

A majority of Floridians indicated to pollsters that they want to have easy access to natural areas near where they live.

QUESTION: How important is it to you that you can fairly easily spend time in natural areas near where you live?

60% Very important
31% Somewhat important
6% Not very important
1% Not at all important
2% Not sure

1.4 Why Americans (and Floridians) Still Don't Like Sprawl

While not garnering the media attention they once did, the topics of urban sprawl and the environment remain a major concern to many American citizens. According to the Land Trust Alliance, voters still care deeply about conserving our remaining natural land, approving over 80% of land conservation measures on the ballot around the country in November 2012.[27] The 46 measures passed nationally provided a total of $767 million to protect and improve water quality, acquire new parks and open space, and conserve working farms and ranches. Many of the referenda won by landslides – 27 measures passed with at least 65% of the vote. National and regional non-governmental land conservancies such as The Nature Conservancy, the Trust for Public Land, Tampa Bay Conservancy, Inc., and the North Florida Land Trust continue to garner substantial public support.

Urban sprawl also imposes significant economic and financial costs on the public. These costs are often hidden in the form of taxpayer subsidies to build new roads, water supply

[26] Pulse Opinion Research, 2014; **Appendix J** to this report.
[27] Land Trust Alliance. 2012. Voters Approve 81% of Land Conservation Ballot Measures. Available at: http://www.landtrustalliance.org/policy/public-funding/voters-enthusiastically-approve-new-spending-on-conservation-nationwide.

systems, sewage collection and treatment systems, and schools to accommodate runaway growth.[28]

In essence, Americans still value our rural land and natural habitats, oppose longer commute times to work and to daily, weekly, and monthly open-space destinations, increased environmental degradation, and higher economic costs, all of which are part of the price tag of sprawling urban development.

As noted earlier, the 2015 polling[29] found sizeable majorities of Floridians who feel strongly about the need to protect farmland and natural habitats for themselves, for their fellow Floridians and for the nation's wildlife. The loss of agricultural land concerns most Florida voters, with 87% answering that it is "important for Florida to keep its remaining farmland in agricultural use" rather than being willing to "leave food production to other states and countries." Only 14% of voters said the "need for more housing is a legitimate reason to pave over farmland," contrasted with 71% who said it is unethical to build on good farmland.

Florida voters place a high value on the ecosystems of their state, with 70% saying it is "very important" and 22% saying it is "somewhat important" to "save Florida's marshes, grasslands, pine scrub and dunes." Polling found three-quarters of Floridians expect a continuation of recent trends to make life where they live "worse." Few things affect the day-to-day quality of life of modern-day Americans as much as changes in traffic and commuting. Asked if a continuation of recent trends would make traffic "much worse," 83% said yes, while only 12% said they thought the government would "be able to build enough extra transportation capacity to accommodate the extra people." (Poll results are shown in their entirety in **Appendix I**.)

2. THE FACTORS IN SPRAWL

Over the past few decades, dozens of diverse factors have been suggested as causes of America's relentless, unending sprawl, defined here as the expansion of urban land at the expense of rural land.

1. One factor is population growth.
2. All the other factors combine to increase per capita land consumption.

This study examines the relative importance of those two overall factors.

[28] Eben Fodor. 1999. *Better Not Bigger: How to Take Control of Urban Growth and Improve Your Community*. New Catalyst Books; Eben Fodor. 2012. "The Myth of Smart Growth." Available at: www.fodorandassociates.com/Reports/Myth_of_Smart_Growth.pdf.
[29] Op. cit. Footnote #7, Pulse Opinion Research. Also see **Appendix I.**

2.1 Sprawl Defined

The word "sprawl" is not a precise term. But we do indeed use the term "Overall Sprawl" in a precise way in this study – it is the amount of rural land lost to development.

Fortunately, it is easy to measure the amount of Overall Sprawl because of two distinct, painstaking processes conducted by two unrelated federal agencies: the U.S. Census Bureau (Census) and the Natural Resources Conservation Service (NRCS) of the U.S. Department of Agriculture (USDA). Using data from decennial censuses, Census has tabulated changes in the size and shape of the nation's Urbanized Areas (UAs) every 10 years for more than a half a century (since 1950), while the NRCS has estimated changes in the size and shape of America's Developed Lands every five years for more than a quarter-century (since 1982).

The Census Bureau uses a rather complicated but consistent set of conditions to measure the spread of cities into surrounding rural land. Census defines the contiguous developed land of a central city and its suburbs an "Urbanized Area." It is possible to measure sprawl from decade to decade by calculating the change in overall acreage of a specific UA.

The NRCS uses remote sensing, survey, and statistical techniques to derive estimates of changes in land use on the nation's non-federal lands. Built-up or developed lands are one of the categories of land use NRCS delineates.

Defining sprawl by the Census standards has some limitations that are discussed in **Appendix D**. But the UA delineations, coupled with the NRI surveys, are unequalled as uniform quantitative longitudinal measures of rural urbanization by cities and towns in all regions of the country.

2.2 Our Two Main Data Sources

Urbanized Area data from the 2000-2010 Census and Developed Land data from the 2002-2010 National Resources Inventories served as our main data sources for the current update of our prior 2000–2003 sprawl studies. While the Census data pertain to a discrete list of designated cities, the NRI data furnish a portrait that also includes development in places outside of the boundaries of the Census Bureau's UAs. Therefore, we were able to assess and include traditional sprawl and development within large American cities as well as the more diffuse development and sprawl dispersed across entire states, as evidenced in the NRI data. The NRI refers to these areas of more dispersed development as "Small Built-up Areas." In 2010, Small Built-up Areas comprised 7.2 million acres or about six percent of the total of 113.3 million acres of Developed Land in the contiguous United States.

This study provides an update on the amount of sprawl over the most recent periods for which the most comprehensive government data are available: 2000-2010 for UAs and

2002-2010 for Developed Lands. Urbanized Area data are calculated only once every 10 years. Thus, our study can assess the march of sprawl up until 2010.

NRI data available span uninterrupted from 1982-2007 in five 5-year intervals (1982-1987, 1987-1992, 1992-1997, 1997-2002, 2002-2007), although the most recent interval is three years (2007-2010). These data quantify how much rural land was converted into developed or built-up land over these discrete time intervals, as well as over the 28-year time period in its entirety. Therefore, we are able to see how sprawl has consistently impacted areas outside of the Census' Urbanized Areas over the last 28 years.

2.2.1 Census Bureau's Urbanized Areas

The U.S. Census Bureau classifies geographic areas of the United States as either urban or rural. Urban places are those characterized by densely developed land; they include residential, commercial, industrial and other non-residential urban land uses.[30]

The Census Bureau has been making these classifications for a long time: it first defined urban places in reports following the 1880 and 1890 censuses. It adopted the current minimum population threshold for urban areas of 2,500 a century ago back in the 1910 Census; any incorporated place that contained at least 2,500 people within its boundaries was designated as urban. All territories outside of these urban places, regardless of their population densities, were considered rural.[31]

Census started designating densely populated Urbanized Areas of 50,000 or more residents beginning with the 1950 Census, accounting for the increased presence of densely inhabited suburban development on the periphery of large cities. Outside of UAs, the Bureau continued to identify as urban any incorporated place or census designated place of at least 2,500 and less than 50,000 people.

Beginning with the 2000 Census, the Bureau introduced the concept of "urban clusters" (UCs), replacing urban places located outside of UAs. These are defined based on the same criteria as UAs, but represent areas containing at least 2,500 and less than 50,000 people. "Rural" areas continue to be defined as any population, housing, or territory outside of urban areas.

According to the Census Bureau, in the 2010 Census, an urban area consists of a "densely settled core of census tracts and/or census blocks that meet minimum population density requirements, along with adjacent territory containing non-residential urban land uses as well

[30] U.S. Census Bureau. 2013. 2010 Census Urban and Rural Classification and Urban Area Criteria. Accessed at: http://www.census.gov/geo/reference/ua/urban-rural-2010.html
[31] U.S. Census Bureau. 2010 Census Urban Area FAQs. Accessed at: http://www.census.gov/geo/reference/ua/uafaq.html.

as territory with low population density included to link outlying densely settled territory with the densely settled core."[32] In essence, UAs represent America's "urban footprint."[33]

For the 2010 Census, the Bureau utilized Geographic Information System (GIS) software from the world's largest developer and supplier of GIS software, the Environmental Systems Research Institute, Inc. (ESRI) to delineate the nation's urban areas.[34]

The initial delineation of an urbanized core includes census tracts or blocks with a population density of 1000 people per square mile (ppsm). Adjacent tracts or blocks with a density of 500 ppsm are then added iteratively. Impervious qualifying blocks are also added iteratively to the UA. These are areas of impervious ground surface (covered with pavement or structures) that support non-residential urban land use such as commercial or industrial; they have low population density because they are non-residential, but they are functionally part of the urban landscape. The Bureau uses an ESRI tool called ArcGIS Spatial Analyst to analyze the Multi-Resolution Land Characteristics Consortium (MRLC) National Land Cover Database (NLCD) 2006 impervious 30-meter raster dataset. Holes or enclaves in the polygon less than five square miles in area that are completely surrounded by qualifying land are filled in, and counted as part of the UA.[35]

UA delineation may also employ "hops" and "jumps." These are a means of connecting outlying densely settled territory with the main body of the UA or UC. A hop is a connection from one urban area core to other qualifying urban territory along a road connection of half a mile (0.5 mile) or less in length; multiple hops may be made along any given road corridor. This criterion recognizes that alternating patterns of residential development and non-residential development are a typical feature of urban landscapes.

A jump is a connection from one urban area core to other qualifying urban territory along a road connection between 0.5 mile and 2.5 miles in length; only one jump may be made along any given road connection. The jump concept has been part of the UA delineation process since the 1950 Census. It provides a means for recognizing that urbanization may be offset by intervening areas that have not yet developed. The Census Bureau changed the maximum jump distance criterion from 1.5 miles to 2.5 miles between the 1990 and 2000 censuses.[36]

The Census Bureau lists a number of revealing facts and figures about UAs in 2010:

- **3,573**: Total number of 2010 Census urban areas in the United States
  - **486**: Number of Urbanized Areas (UAs)

[32] See note 29.
[33] U.S. Census Bureau. 2011. The Use of ESRI Software in the Delineation of Urban Areas for the 2010 Census. PowerPoint presentation at the ESRI International User Conference July 12th, 2011.
[34] Ibid.
[35] Ibid.
[36] Ibid.

  - **3,087**: Number of Urban Clusters (UCs)
- **71.2%**: Percent of U.S. population living within Urbanized Areas
- **80.7%**: Percent of the U.S. population that is urban
- **16**: Number of UAs with populations of 2,500,000 or more
- **41**: Number of UAs with populations of 1,000,000 or more
- **179**: Number of UAs with populations of 200,000 or more
- **36**: Number of new UAs between 2000 and 2010
- **2,534.4** persons per square mile: Overall Urbanized Area population density in the U.S.

Between 2000 and 2010, the country's urban population grew by 12.1%, in comparison with total U.S. population growth of 9.7% during the same period. In other words, America's urban areas grew at a faster pace than the country as a whole, continuing a demographic trend – a relative shift or migration of the population from rural to urban areas – that has been underway for more than a century. This trend is evident around the entire world.

2.2.2 Natural Resources Conservation Service's National Resources Inventory and Developed Lands

The National Resources Inventory (NRI) is based on rigorous scientific and survey protocols. The U.S. Department of Agriculture's NRCS began developing the NRI in 1977 in response to several Congressional mandates. The first NRI published in 1982 used most of the survey methodology and protocols utilized by earlier inventories. However, the scope and sample size of the 1982 NRI were expanded to meet the demands of the Soil and Water Resources Conservation Act (RCA) of 1977, as well as to better address emerging issues like the permanent loss of agricultural lands to nonagricultural uses, such as transportation, industry, commercial and residential land uses.[37]

The NRI covers the entire surface area (both land and water) of the United States, including all 50 states, Puerto Rico, the U.S. Virgin Islands, and certain Pacific Basin islands. The sample includes all land ownership categories, including federal lands (e.g., national parks, national wildlife refuges, national forests, Bureau of Land Management lands, military installations), although NRI data collection activities have historically focused on non-federal lands. Sampling is conducted on a county-by-county basis, using a stratified, two-stage, area sampling scheme. The two-stage sampling units are nominally square segments of land and points within these segments. The segments are typically half-mile-square parcels of land equal to 160-acre quarter-sections (a section is a square of territory one mile on each side, and comprising one square mile or 640 acres in area) in the Public Land Survey System, but there are a number of exceptions in the western and northeastern U.S. Three specific sample

[37] U.S. Department of Agriculture. 2009. *Summary Report: 2007 National Resources Inventory*, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. 123 pages. http://www.nrcs.usda.gov/technical/NRI/2007/2007_NRI_Summary.pdf.

points are selected for most segments, although two are selected for 40-acre segments in irrigated portions of some western States, and some segments originally contained only one sample point.[38]

The 1997 NRI sample contained about 300,000 sample segments and 800,000 sample points. Whereas the NRI was conducted every five years up to 1997, an annual or continuous approach was begun in 2000. Each year a subset of between 71,000 and 72,000 segments from the 1997 sample is selected for observation. The subset is selected using a "supplemented panel rotation" design, meaning that a "core panel" of about 40,000 segments is observed each year along with a different supplemental or rotation panel chosen for each year.

The NRI survey system uses points as the sampling units rather than farms or fields, because land use and land unit boundaries often change in some parts of the country. Utilizing points has allowed the survey process to generate a database with dozens of factors or data elements that are properly correlated over many years. Thus, analyses and inferences based on these data are using proper combinations of longitudinal data.[39]

Data for the initial 1982 NRI were collected by thousands of field staff of the Soil Conservation Service (SCS – precursor agency to NRCS), whose efforts were supplemented by contractors and employees of other agencies working under SCS supervision. Data collection began in the spring of 1980 and ran for more than two years, finishing in the autumn of 1982. For the 1987 NRI, data were also collected by teams of trained personnel. Remote sensing techniques (via aircraft or satellite) were used to update 1982 conditions for about 30 percent of the sample sites. Reliance upon remote sensing increased during the 1990s. Beginning in 2000, special high-resolution imagery was obtained for each NRI sample site.[40]

In 2004, NRCS established Remote Sensing Laboratories (RSLs) in Greensboro, NC; Fort Worth, TX; and Portland, OR. These three labs were designed, equipped, and staffed to take advantage of modern geospatial technologies, enabling efficient collection and processing of NRI survey data. The RSLs are now staffed with permanent employees whose full-time job is NRI data collection and processing.[41]

A number of quality control and quality assurance (QCQA) processes are conducted by NRCS and contract staff as well as by the Statistical Unit and NRCS resource inventory specialists. Many of these QCQA processes are embedded within the survey software developed by NRCS and the Statistical Unit. The QCQA processes ensure that differences in

[38] Ibid.
[39] Ibid.
[40] Ibid.
[41] Ibid.

the data over time reflect actual changes in resource conditions, rather than differences in the perspectives of two different data collectors, or changes in technologies and protocols.

One of the special features of the NRI is its genuine longitudinal nature, that is, its reliability and consistency through time, so that users of this dataset can be confident that, for example, differences in the area of developed land shown for 2007 and 1997 accurately reflect true differences "on the ground" or in reality. Even though many operational features of the NRI survey program have evolved over the years, processes have been implemented to ensure that data contained within the 2007 NRI database are longitudinally consistent. Data collection protocols always include review and editing of historical data for the particular NRI sampling units being observed.[42]

NRI's broadest classification divides all U.S. territory into three categories: federal land, water areas, and non-federal land. Non-federal land is broken out into developed and rural. Rural lands are further subdivided into cropland, Conservation Reserve Program (CRP) land, pastureland, rangeland, forestland, and other rural land. In the present study we are concerned only with developed land.

NRI's category of developed land differs from that used by other federal data collection entities. While other studies and inventories emphasize characteristics of human populations (e.g., Census of Population) and housing units (e.g., American Housing Survey), for the NRI, the intent is to identify which lands have been permanently eliminated from the rural land base. The NRI Developed Land category includes: (a) large tracts of urban and built-up land; (b) small tracts of built-up land less than 10 acres in size; and (c) land outside of these built-up areas that is in a rural transportation corridor (roads, interstates, railroads, and associated rights-of-way).

2.3 Population Growth

A city or state's population grows based on personal behavior – births and in-migration – and on local and national governmental actions. Looking more closely, the net increase (or decrease) in population in any given time period (e.g., one year, one decade) is due to the number of births minus the number of deaths plus the number of in-migrants minus the number of out-migrants.

An urban area's population growth today is much more likely to be the result of enticing residents from elsewhere. Local and state governments can and do create many incentives that encourage people to move into a city. These include aggressive campaigns to persuade industries to move their factories and jobs from another location, public subsidies for the infrastructure that supports businesses, expansion of water service and sewage lines into new areas, new housing developments and new residents, and general public relations that

[42] Ibid.

increase the attractiveness of a city to outsiders. Even without trying, a city can attract new residents just by maintaining amenities and a high quality of life, especially if the nation's population is growing significantly, as continues to be the case today.

2.3.1 Population Growth in Florida's Urbanized Areas

Table 6 shows population growth in Florida's Urbanized Areas from 2000 to 2010. On average, these UAs grew by 21 percent in just ten years, or an annual compound (exponential) rate of 1.93%.

Table 6. Population growth in Florida's Urbanized Areas – 2000 to 2010

Urbanized Area	Population in 2000	Population in 2010	% growth
Bonita Springs	221,251	310,298	40%
Cape Coral	329,757	530,290	61%
Deltona	147,713	182,169	23%
Fort Walton Beach--Navarre--Wright	152,741	191,917	26%
Gainesville	159,508	187,781	18%
Homosassa Springs--Beverly Hills--Citrus Springs	N/A	80,962	N/A
Jacksonville	882,295	1,065,219	21%
Kissimmee	186,667	314,071	68%
Lady Lake--The Villages	50,721	112,991	123%
Lakeland	199,487	262,596	32%
Leesburg--Eustis--Tavares	97,497	131,337	35%
Miami (including Ft. Lauderdale, etc.)	4,919,036	5,502,379	12%
North Port—Port Charlotte	122,421	169,541	38%
Ocala	106,542	156,909	47%
Orlando	1,157,431	1,510,516	31%
Palm Bay--Melbourne	393,289	452,791	15%
Palm Coast--Daytona Beach--Port Orange	255,353	349,064	37%

Urbanized Area	Population in 2000	Population in 2010	% growth
Panama City	132,419	143,280	8%
Pensacola	323,783	340,067	5%
Port St. Lucie	270,774	376,047	39%
Sarasota--Bradenton	559,229	643,260	15%
Sebastian--Vero Beach South--Florida Ridge	120,962	149,422	24%
Sebring--Avon Park	45,123	61,625	37%
Spring Hill	102,193	148,220	45%
St. Augustine	53,519	69,173	29%
Tallahassee	204,260	240,223	18%
Tampa--St. Petersburg	2,062,339	2,441,770	18%
Titusville	52,922	54,386	3%
Winter Haven	153,924	201,289	31%
Zephyrhills	53,979	66,609	23%
All Florida UAs	**13,517,135**	**16,365,240[1]**	**21%**

[1]Not including 2010 population of Homosassa Springs--Beverly Hills--Citrus Springs

2.3.2 Source of Most of Florida's Population Growth

Florida's total population rose from 15,982,349 in the year 2000 to 18,801,310 in 2010.[43]

This addition of 2.82 million residents was the 3rd largest of any state during the decade. As in most states, the population growth was the result of many factors, including births to U.S. natives in the state, and people moving into Florida from other states.[44]

However, most of the state's population growth was the result of federal immigration policies, according to federal data. New immigrants and births to immigrants during the decade totaled about 1.9 million, equal to two-thirds (67 percent) of Florida's total population growth. In 2010, the total population of immigrants living in Florida included 1.29 million

[43] CensusViewer. Population of Florida: Census 2010 and 2000 Interactive Map, Demographics, Statistics, Quick Facts. http://censusviewer.com/state/FL.
[44] Census Bureau. http://www.census.gov/prod/cen2010/briefs/c2010br-01.pdf, ranking of top 5 states by population growth from 2000 to 2010 censuses.

who entered the United States in 2000 or later.[45] Federal data also show that 611,000 children living in Florida in 2010 had an immigrant mother and were born in 2000 or later.[46]

2.4 Per Capita Land Consumption

Per capita land consumption statistics are a useful way to understand the combined power of numerous land use and consumption choices that can lead to urban sprawl. [See **Table 7** for the per capita numbers for the Florida Urbanized Areas and **Appendices B and C** for how the statistic is calculated.] When Census Bureau data show that per capita land consumption in Orlando is 0.25 acre, that means it takes just a quarter of an acre to provide the average Orlando resident with space for housing, work, retail, transportation, education, religious and other private assembly, government, recreation and all other urban needs.

Table 7 shows the variation of per capita land use among Florida's 30 Urbanized Areas. The average Miami resident "occupies" between one-tenths and two-tenths (0.14) of an acre, while on the other extreme, the average resident of the Homosassa Springs--Beverly Hills--Citrus Springs UA uses about five times as much, almost ¾ of an acre (0.72). In general, larger cities like Miami and Tampa-St. Petersburg have higher population densities, which should come as no surprise.

Table 7. Per capita land consumption in Florida's Urbanized Areas – 2000 and 2010

Urbanized Area	Fraction of Acre per Resident – 2000	Fraction of Acre per Resident - 2010	% Change in Per Capita Land Consumption, 2000-2010
Bonita Springs	0.435	0.386	**(-11%)**
Cape Coral	0.372	0.399	7%
Deltona	0.388	0.339	**(-13%)**
Fort Walton Beach--Navarre--Wright	0.405	0.402	**(-1%)**
Gainesville	0.311	0.297	**(-5%)**
Homosassa Springs--Beverly Hills--Citrus Springs	N/A	0.715	N/A

[45] The public use file of the 2010 American Community Survey shows 1.29 million immigrants living in the state who indicated they arrived in 2000 or later.

[46] Public use file of the Current Population Survey Annual Social and Economic Supplement shows 611,000 children living in the state in 2010 who were born in 2000 or later and who have an immigrant mother. The Current Population Survey asks respondents, including children, about their parent's place of birth.

Urbanized Area	Fraction of Acre per Resident – 2000	Fraction of Acre per Resident - 2010	% Change in Per Capita Land Consumption, 2000-2010
Jacksonville	0.298	0.319	7%
Kissimmee	0.359	0.323	**(-10%)**
Lady Lake--The Villages	0.631	0.403	**(-36%)**
Lakeland	0.387	0.356	**(-8%)**
Leesburg--Eustis--Tavares	0.466	0.460	**(-1%)**
Miami (including Ft. Lauderdale, etc.)	0.145	0.144	**(-1%)**
North Port—Port Charlotte	0.467	0.449	**(-4%)**
Ocala	0.534	0.457	**(-14%)**
Orlando	0.251	0.253	1%
Palm Bay--Melbourne	0.358	0.328	**(-8%)**
Palm Coast--Daytona Beach—Port Orange	0.285	0.329	16%
Panama City	0.491	0.411	**(-16%)**
Pensacola	0.434	0.438	1%
Port St. Lucie	0.400	0.354	**(-11%)**
Sarasota--Bradenton	0.310	0.325	5%
Sebastian--Vero Beach South--Florida Ridge	0.431	0.414	**(-4%)**
Sebring--Avon Park	0.488	0.479	**(-2%)**
Spring Hill	0.524	0.496	**(-5%)**
St. Augustine	0.414	0.398	**(-4%)**
Tallahassee	0.357	0.337	**(-6%)**
Tampa--St. Petersburg	0.249	0.251	1%
Titusville	0.381	0.354	**(-7%)**
Winter Haven	0.433	0.427	**(-1%)**

Urbanized Area	Fraction of Acre per Resident – 2000	Fraction of Acre per Resident - 2010	% Change in Per Capita Land Consumption, 2000-2010
Zephyrhills	0.489	0.418	**(-15%)**
Weighted Average (Mean)	**0.262**	**0.266**	**2%**

The increase in per capita land consumption (Per Capita Sprawl) is an important cause of Overall Sprawl in many urban areas. Census data on the nation's Urbanized Areas allow us to track the change in per capita land consumption from decade to decade.

At a minimum, the per capita land consumption figure reflects the combined outcome of all the following individual and institutional choices and factors:

- Development
  - Consumer preferences for size and type of housing and yards
  - Developer preferences for constructing housing, offices and retail facilities
  - Governmental subsidies that encourage land consumption, and fees and taxes that discourage consumption
  - Quality of urban planning and zoning
  - Level of affluence
- Transportation
  - Governmental subsidies and programs for highways, streets and mass transit
  - Consumer preferences favoring the mobility and flexibility offered by using private vehicles rather than public transit
  - Price of gasoline (cheap gas encourages sprawl)
- Quality of existing communities and ability to hold onto their residents
  - Quality of schools
  - Reality and perceptions concerning crime and safety
  - Ethnic and cultural tensions or harmony
  - Quality of government leadership
  - Job opportunities
  - Levels of pollution
  - Quality of parks, other public facilities and infrastructure
- Number of people per household
  - Marriage rate and average age for marriage
  - Divorce rate
  - Recent fertility rate

- Level of independence of young adults
- Level of affluence enabling single people to live separately

Table 8 compares growth in population to growth in per capita land consumption in Florida UAs from 2000 to 2010. On average, these UAs grew in population by 21 percent, while their per capita land consumption increased by two percent, with a majority of UAs actually decreasing their per capita land consumption (that is, increasing their population density).

Table 8. Population growth vs. growth in per capita land consumption Florida's Urbanized Areas, 2000-2010

Urbanized Area	% POPULATION GROWTH, 2000-2010	% GROWTH IN PER CAPITA LAND CONSUMPTION, 2000-2010
Bonita Springs	40%	**(-11%)**
Cape Coral	61%	7%
Deltona	23%	**(-13%)**
Fort Walton Beach--Navarre--Wright	26%	**(-1%)**
Gainesville	18%	**(-5%)**
Homosassa Springs--Beverly Hills--Citrus Springs	NA*	NA*
Jacksonville	21%	7%
Kissimmee	68%	**(-10%)**
Lady Lake--The Villages	123%	**(-36%)**
Lakeland	32%	**(-8%)**
Leesburg--Eustis--Tavares	35%	**(-1%)**
Miami (including Ft. Lauderdale, etc.)	12%	**(-1%)**
North Port—Port Charlotte	39%	**(-4%)**
Ocala	47%	**(-14%)**

Urbanized Area	% POPULATION GROWTH, 2000-2010	% GROWTH IN PER CAPITA LAND CONSUMPTION, 2000-2010
Orlando	31%	1%
Palm Bay--Melbourne	15%	**(-8%)**
Palm Coast--Daytona Beach--Port Orange	37%	16%
Panama City	8%	**(-16%)**
Pensacola	5%	1%
Port St. Lucie	39%	**(-11%)**
Sarasota--Bradenton	15%	5%
Sebastian--Vero Beach South--Florida Ridge	24%	**(-4%)**
Sebring--Avon Park	37%	**(-2%)**
Spring Hill	45%	**(-5%)**
St. Augustine	29%	**(-4%)**
Tallahassee	18%	**(-6%)**
Tampa--St. Petersburg	18%	1%
Titusville	3%	**(-7%)**
Winter Haven	31%	**(-1%)**
Zephyrhills	23%	**(-15%)**
All Florida Urbanized Areas	21%	2%

2.5 Measuring Overall Sprawl

Using both the Census Bureau (Urbanized Area) and National Resources Inventory (Developed Land) data, we were able to measure the overall amount different settlements around Florida sprawled, along with what fraction or percentage of that sprawl could be attributed to population growth and what portion was a result of an increase in per capita land use.

With the Census Bureau Urbanized Areas, the Overall Sprawl was measured by calculating the change in the land area of each of the UAs from the 2000 Census to the 2010 Census. Meanwhile, the NRI provided the exact data on how many acres of rural land had been converted into developed land in 5-year increments within their 25-year time span.

We were able to compare changes in urbanized or developed land area across different time periods for the same city or state as well as make comparisons between cities and states, as to which sprawled the most and which sprawled the least.

3. FINDINGS

This study focuses on the loss of previously undeveloped land (including cropland, pastureland, rangeland, forest, and other natural habitat and open space) in the state of Florida. At its most basic level, there are three reasons for an increase in the area of developed land: 1) each individual, on average, is consuming more land; 2) there are more people; or 3) a combination of the two factors is working together to create sprawl. This study attempts to quantify the relative roles the two fundamental factors behind sprawl: rising per capita land consumption and population growth.

3.1 Florida Urbanized Areas and Developed Areas

3.1.1 Per Capita Sprawl and Overall Sprawl

Many respected environmental organizations and urban planners contend that implementing Smart Growth, New Urbanism, and LEED[47] building strategies into our new and existing cities is the best way to rein in sprawl in our cities. However, this is based on the premise that it is only or primarily our land-use choices that cause Florida's sprawl. As our study a decade ago showed conclusively, Per Capita Sprawl could not explain Overall Sprawl in Florida's Urbanized Areas; indeed, it accounted for very little of it. By comparing the

[47] LEED stands for Leadership in Energy & Environmental Design. According to the U.S. Green Building Council, LEED "is transforming the way we think about how our buildings and communities are designed, constructed, maintained and operated across the globe. Comprehensive and flexible, LEED is a green building tool that addresses the entire building lifecycle recognizing best-in-class building strategies." http://www.usgbc.org/leed

percentage growth of per capita land consumption with the percentage growth of Overall Sprawl in all of Florida's 30 Urbanized Areas from 2000 to 2010 in **Figure 10,** we find that the Per Capita Sprawl percentage is much smaller than the Overall Sprawl percentage: 2 percent versus 22 percent. This is not to denigrate Smart Growth, New Urbanism, and the LEED program, but to recognize their limitations. These multi-faceted, multi-jurisdictional approaches have indeed slowed the pace at which sprawl is converting the countryside into pavement and buildings over the last decade. Given incessant population growth, however, they will be capable only of slowing sprawl, not stopping it.

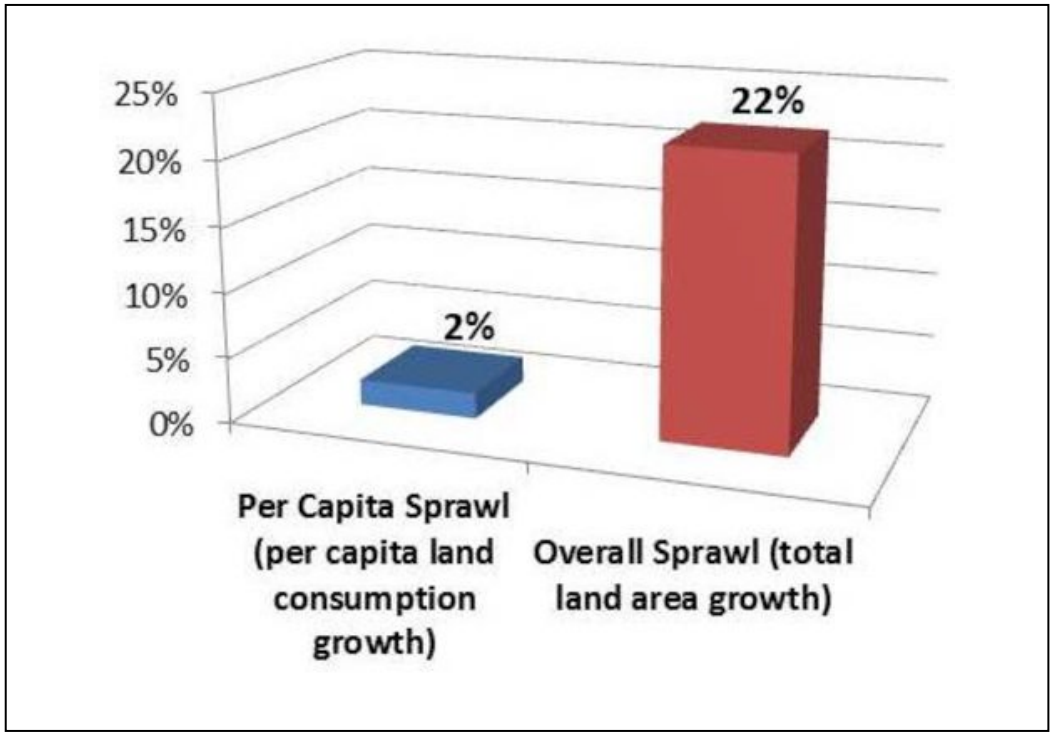


Figure 10. Per Capita Sprawl vs. Overall Sprawl in Florida's UAs, 2000-2010

Description**:** The growth in per capita land consumption reflects the combined effects of land use planning, government subsidies, urban policies and individual consumption decisions that determine residential densities.

Even the best Smart Growth, New Urbanism, and LEED strategies are able to engineer only so much population density. As long as population is still growing, the land area taken up by Florida's cities will almost certainly continue to grow.

Table 9. Per capita sprawl vs. overall sprawl
Florida's Urbanized Areas – 2000 to 2010

Urbanized Area	% Change in Per Capita Land Consumption, 2000-2010 (PER CAPITA SPRAWL)	% Change in Overall Land Consumption, 2000-2010 (OVERALL SPRAWL)
Bonita Springs	**(-11%)**	24%
Cape Coral	7%	72%
Deltona	**(-13%)**	8%
Fort Walton Beach--Navarre--Wright	**(-1%)**	25%
Gainesville	**(-5%)**	12%
Homosassa Springs--Beverly Hills--Citrus Springs	N/A	N/A
Jacksonville	7%	29%
Kissimmee	**(-10%)**	51%
Lady Lake--The Villages	**(-36%)**	42%
Lakeland	**(-8%)**	21%
Leesburg--Eustis--Tavares	**(-1%)**	33%
Miami (including Ft. Lauderdale, etc.)	**(-1%)**	11%
North Port—Port Charlotte	**(-4%)**	33%
Ocala	**(-14%)**	26%
Orlando	1%	32%
Palm Bay--Melbourne	**(-8%)**	6%
Palm Coast--Daytona Beach--Port Orange	16%	58%
Panama City	**(-16%)**	-10%
Pensacola	1%	6%

Urbanized Area	% Change in Per Capita Land Consumption, 2000-2010 (PER CAPITA SPRAWL)	% Change in Overall Land Consumption, 2000-2010 (OVERALL SPRAWL)
Port St. Lucie	**(-11%)**	23%
Sarasota--Bradenton	5%	21%
Sebastian--Vero Beach South--Florida Ridge	**(-4%)**	19%
Sebring--Avon Park	**(-2%)**	34%
Spring Hill	**(-5%)**	37%
St. Augustine	**(-4%)**	24%
Tallahassee	**(-6%)**	11%
Tampa--St. Petersburg	1%	19%
Titusville	**(-7%)**	-5%
Winter Haven	**(-1%)**	29%
Zephyrhills	**(-15%)**	5%
Weighted Average (Mean)	**2%**	**22%**

3.1.2 Per Capita Sprawl vs. Population Growth

Since all Overall Sprawl is explained by the combination of population change and per capita consumption change, we can learn much about their relative roles by simply lining up those percentages side by side.

Figure 11 aggregates the 30 UAs in Florida and finds that their average population change was 21% while their per capita land change was 2%. Thus we can see that the rate of population growth was nearly three times as much as of a factor as the rate of per capita land change in urban sprawl nationwide. Even after just a cursory examination of **Figures 10 and 11,** it should be obvious not only that Per Capita Sprawl cannot account for all or even most of Overall Sprawl, but that for UAs between 2000 and 2010 it does not appear to be nearly as significant a factor in generating sprawl as Population Growth is. Subsequent sections will explore this finding further by apportioning responsibility for sprawl in cities and states between Population Growth and Per Capita Sprawl by using another methodology.

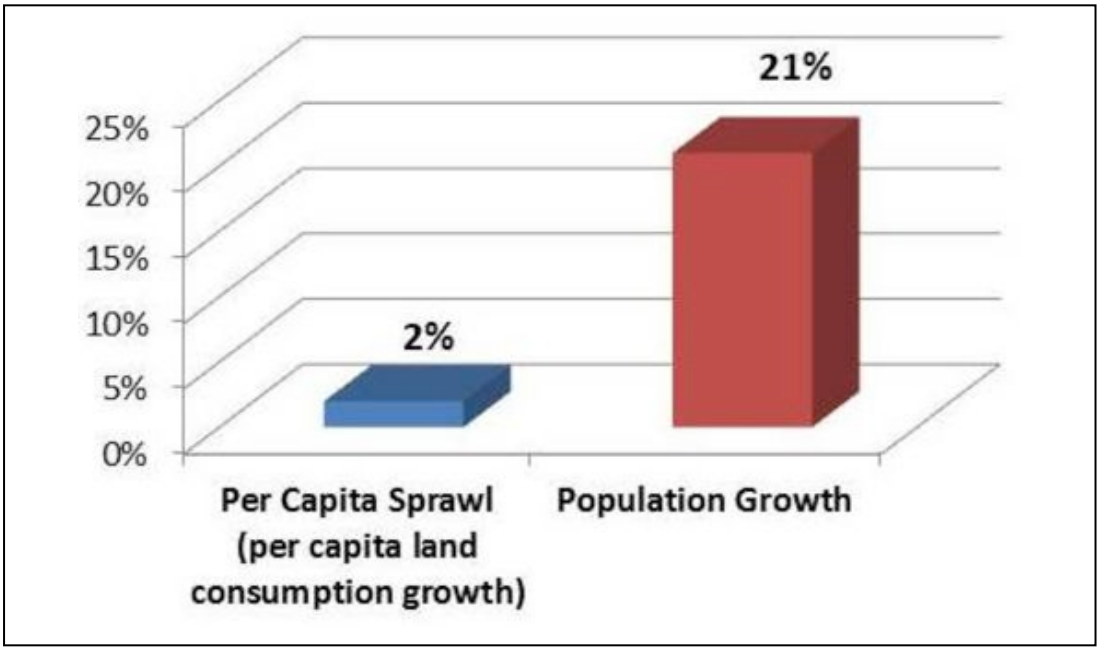


Figure 11. Per Capita Sprawl vs. Population Growth in Florida's 30 UAs, 2000-2010

Description**:** When comparing the growth rates of the two factors behind Overall Sprawl we find that population growth was more than 10 times greater than per growth in capita land consumption from 2000 to 2010.

Since our primary concern is the ongoing loss of rural lands – agricultural lands, natural habitats, and other open space – to development and sprawl, it is worth seeing how much of this loss is related to Per Capita Sprawl and how much to Population Growth.

The findings of the current updated study broadly reinforce one of the conclusions of our original sprawl studies a decade ago – that when investigating the causes of sprawl, and presenting findings, it is best to avoid absolutes or categorical statements. Unlike some who have looked into the sprawl phenomenon, we attribute sprawl neither to population growth exclusively nor declining density exclusively, that is, to increasing per capita land consumption. Once again, our findings are unequivocal that both factors are involved and important, although it is evident that, in Florida especially, the population growth factor substantially outweighs the Per Capita Sprawl factor in importance.

Figure 12 compares the rates of sprawl when the largest UAs are divided into groups based on the rate of population growth from 2000-2010. On average, cities that added more population clearly sprawled over greater area. Strikingly, the 11 cities that experienced 31-50 percent population growth sprawled twice as much on average (32 percent) as compared to those cities that experienced 11-30 percent population growth (16 percent). Cities that grew by more than 50 percent averaged 55 percent sprawl (i.e., 55% increase in the area of urbanized land) between 2000 and 2010.

Figure 12. Florida cities with more population growth experienced more sprawl

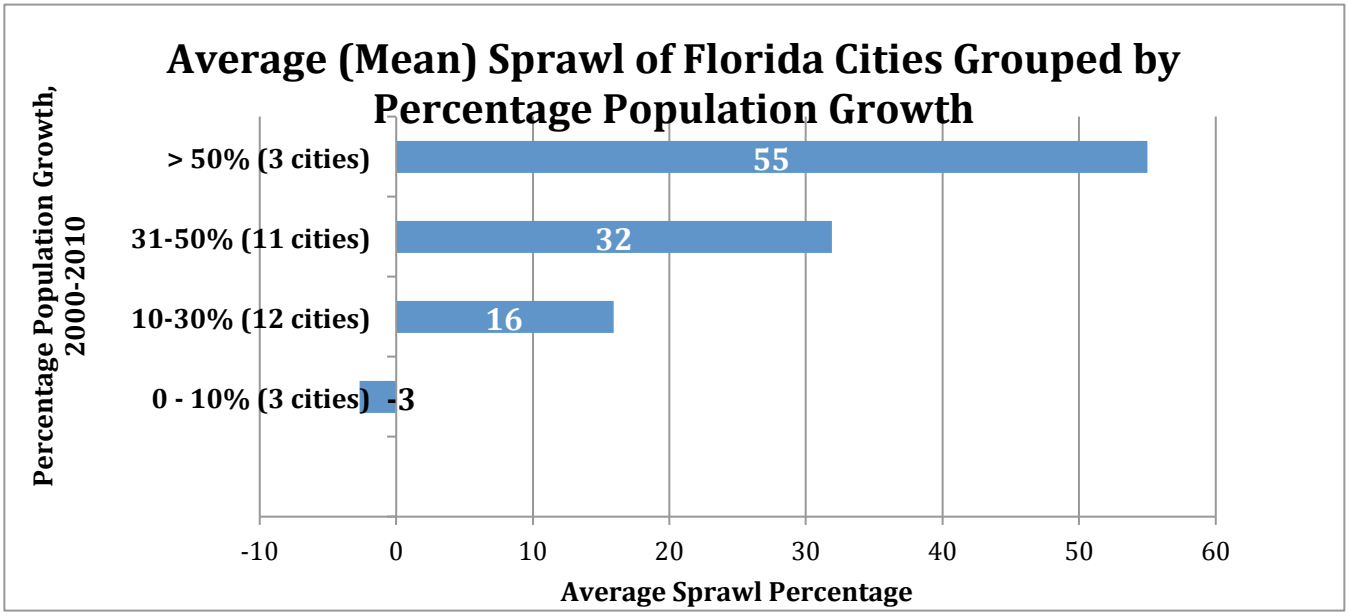


Figure 13 displays the results of another grouping that once again demonstrates population growth's preeminent role in driving sprawl. This figure highlights the amount of population growth in the top third of sprawling cities versus the bottom third of sprawling cities.

The 10 cities in Florida with the most sprawl (93.1 square miles on average) between 2000 and 2010 had average population growth of approximately 220,000. In contrast, the 10 cities with the least sprawl (just 6.6 square miles on average) averaged less than 25,000 population growth during the same decade.

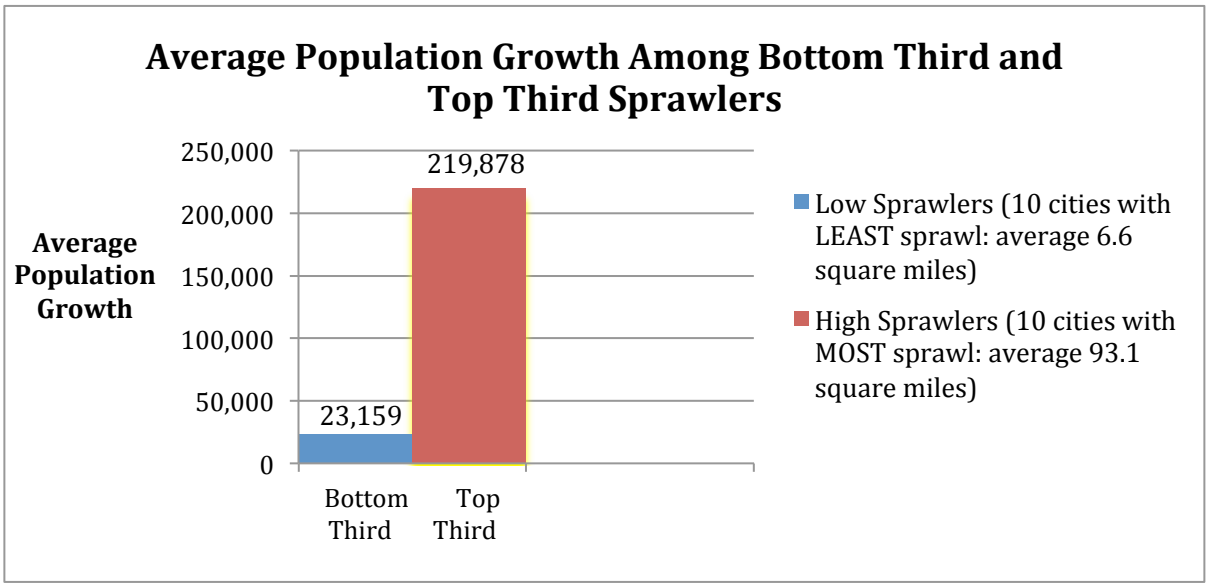


Figure 13. Population growth in Florida's highest sprawlers versus lowest sprawlers

3.1.3 Relative Weight of Sprawl Factors in Florida's Urbanized Areas

To better understand and quantify the respective roles of population growth and per capita land consumption in generating Overall Sprawl, we can use a more mathematically sophisticated method that is sometimes used to apportion consumption of natural resources between two or more factors. John Holdren, Ph.D., Assistant to the President for Science and Technology and Director of the White House Office of Science and Technology Policy since 2009, developed and applied this methodology in a scientific paper evaluating how much of the increase in energy consumption in the United States in recent decades was due to population growth, and how much to increasing per capita energy consumption.[48] This "Holdren method" can be applied to virtually any type of resource in which use of the resource in question is increasing over time, and the number of resource consumers is changing, the amount of the resource being used by each consumer on average is changing, or both.

This study, as did our studies a decade ago, applies this method to sprawl. Rural, undeveloped land is thus the resource in question. As in the case of looking at energy consumption, the issue here is how much of the increased total consumption of rural land (Overall Sprawl) is related to the increase in per capita land consumption (Per Capita Sprawl) and how much is related to the increase in the number of land consumers (Population Growth).

Table 10 applies the Holdren method to all of Florida's 30 Urbanized Areas. In the case of Jacksonville, for example, 26 percent of its Overall Sprawl was related to, or explained by, increases in per capita land consumption, and 74 percent was related to its population growth over the past decade. **Table 10** shows how much of the sprawl in Florida's towns and cities is related to population growth and how much is related to growth in per capita land consumption (declining population density).

[48] John P. Holdren. 1991. "Population and the Energy Problem." *Population and Environment*, Vol. 12, No. 3, Spring 1991. Prior to becoming Director of the White House Office of Science and Technology Policy in the Obama Administration in 2009, Holdren was Teresa and John Heinz Professor of Environmental Policy and Director of the Program on Science, Technology, and Public Policy at Harvard University's Kennedy School of Government, as well as Professor of Environmental Science and Public Policy in the Department of Earth and Planetary Sciences at that university. Trained in aeronautics/ astronautics and plasma physics at MIT and Stanford, he co-founded and for 23 years co-led the campus-wide interdisciplinary graduate degree program in energy and resources at the University of California, Berkeley. On April 12, 2000 he was awarded the Tyler Prize for Environmental Achievement at the University of Southern California, which administers the award. The Tyler Prize is the premier international award honoring achievements in environmental science, energy, and medical discoveries.

Table 10. Sources of sprawl in Florida's Urbanized Areas, 2000-2010

Urbanized Area	Total Sprawl 2000 to 2010 (square miles)	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to GROWTH IN PER CAPITA LAND CONSUMPTION
Bonita Springs	36.8	100%	0%
Cape Coral	138.5	87%	13%
Deltona	6.9	100%	0%
Fort Walton Beach--Navarre—Wright	24.0	100%	0%
Gainesville	9.6	100%	0%
Homosassa Springs--Beverly Hills--Citrus Springs	NA*	NA*	NA*
Jacksonville	119.8	74%	26%
Kissimmee	53.5	100%	0%
Lady Lake--The Villages	21.1	100%	0%
Lakeland	25.4	100%	0%
Leesburg--Eustis--Tavares	23.4	100%	0%
Miami (including Ft. Lauderdale, etc.)	122.5	100%	0%
North Port—Port Charlotte	29.6	100%	0%
Ocala	23.1	100%	0%
Orlando	144.5	96%	4%
Palm Bay--Melbourne	12.2	100%	0%
Palm Coast--Daytona Beach--Port Orange	65.8	68%	32%
Panama City	NA**	NA**	NA**

Urbanized Area	Total Sprawl 2000 to 2010 (square miles)	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to GROWTH IN PER CAPITA LAND CONSUMPTION
Pensacola	13.3	84%	16%
Port St. Lucie	39.1	100%	0%
Sarasota--Bradenton	56.3	74%	26%
Sebastian--Vero Beach South—Florida Ridge	15.2	100%	0%
Sebring--Avon Park	11.7	100%	0%
Spring Hill	31.3	100%	0%
St. Augustine	8.4	100%	0%
Tallahassee	12.6	100%	0%
Tampa--St. Petersburg	154.7	96%	4%
Titusville	NA**	NA**	NA**
Winter Haven	30.2	100%	0%
Zephyrhills	2.3	100%	0%
All Florida Urbanized Areas	1,220.5	96%	4%

*Homosassa Springs--Beverly Hills--Citrus Springs only became a designated Urbanized Area in 2010 so sprawl from 2000 to 2010 could not be measured.
Census Bureau Urbanized Area data for Panama City and Titusville show smaller areas in 2010 than 2000 as a result of changes in UA delineation criteria; this anomaly also occurs with a small fraction of other cities around the country and prevents sprawl measurement and causal factor apportionment; see **Appendix D.
Source: U.S. Census Bureau data

Given this apportionment or breakdown, opponents of sprawl in Florida should know that nearly their entire problem has been the inability to stabilize Florida's population. In contrast, a very small part of the problem has been the inability to stabilize per capita land use within urban development in the state. Overall, 96 percent of the sprawl in Florida from 2000 to 2010 was related to population growth and eight percent to increasing per capita land consumption (declining population density). **Figure 14** displays the relative magnitude of these factors on a pie chart.

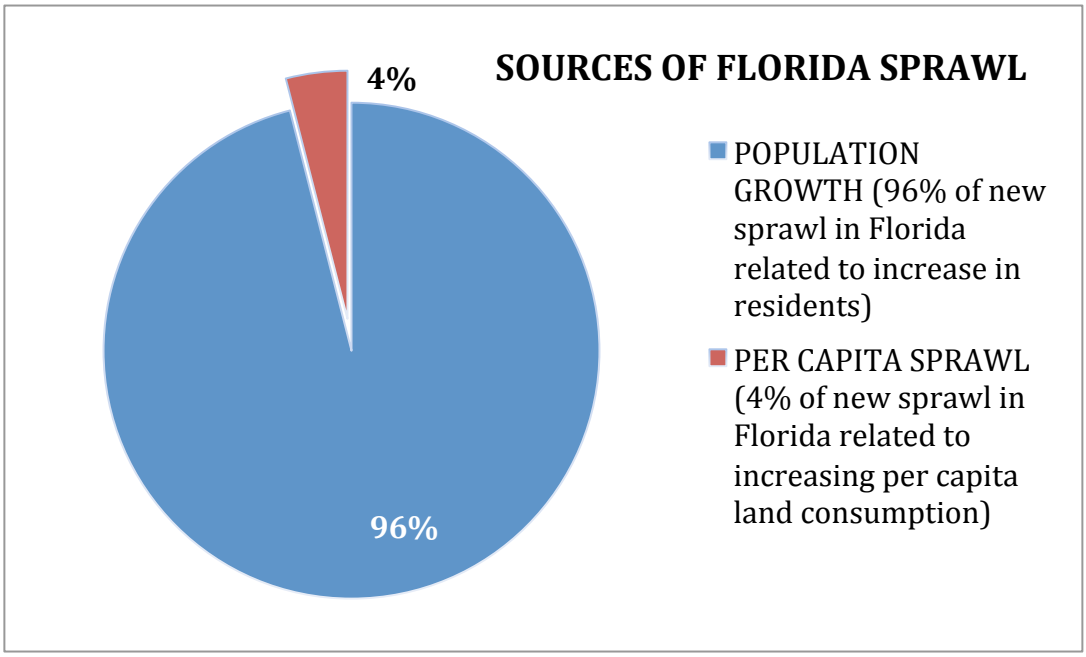


Figure 14. Percentages of sprawl related to population growth and per capita sprawl in Florida's 30 Urbanized Areas

Description: Approximately eight percent of the sprawl in Florida's town and cities was related to increasing per capita land consumption. Approximately 96 percent of the sprawl was related to population growth. *Source*: U.S. Census Bureau, 2000-2010

3.1.4 Florida's Urbanized Areas Versus Florida's Developed Areas

Recall that the Census Bureau's Urbanized Areas and the Natural Resources Conservation Service's Developed Areas in the National Resources Inventory (NRI) are measured in two totally different manners, with different methodologies for collecting data on urban areas versus rural areas, and two completely distinct ways of defining the two land uses. Thus, quantifying sprawl using these two very different databases would not be expected to generate identical results, and indeed, our calculations do not. However, they produce quite similar results, which is a sign of the robustness of our findings and an indication of their probable veracity.

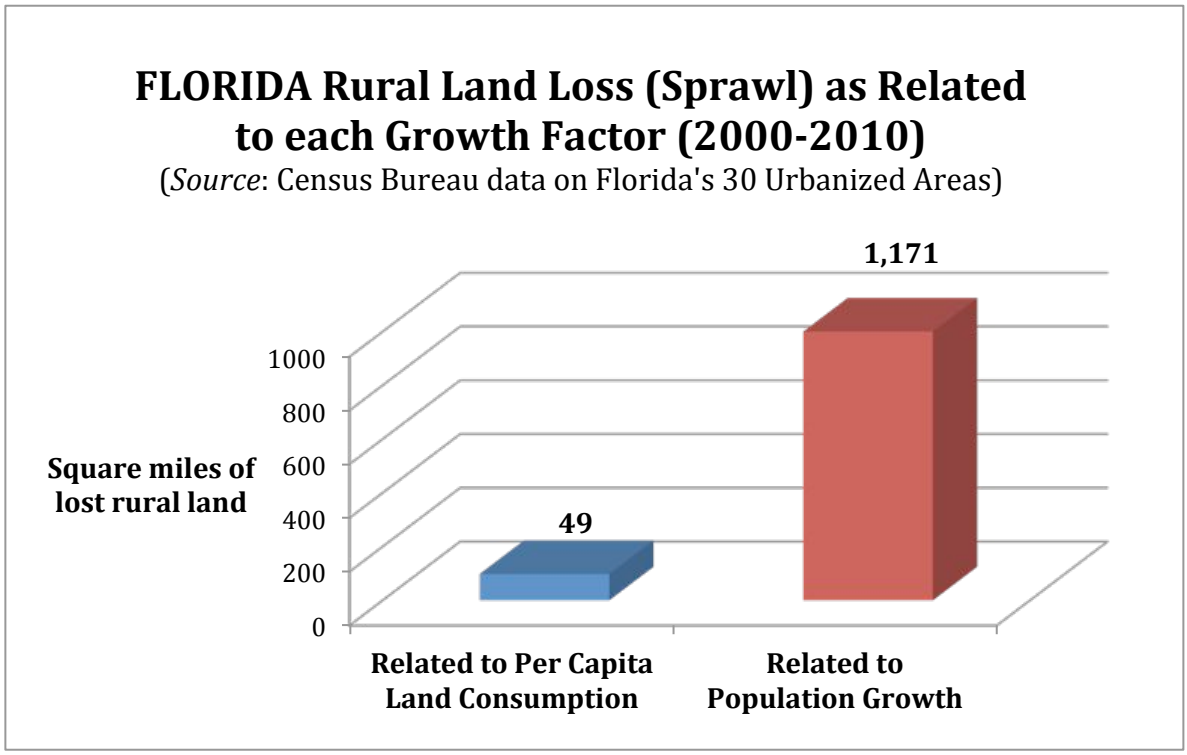


Figure 15. Rural land lost to per capita sprawl vs. population growth in Florida's 30 UAs, 2000-2010

Between 2000 and 2010, Florida's 30 UAs sprawled across and consumed 1,220 additional square miles of land in aggregate. **Figure 15** indicates that population growth in the largest UAs is responsible for more than 20 times as much loss of rural land as Per Capita Sprawl (or rising land consumption per capita): 1,171 square miles vs. 49 square miles.

From 2002 to 2010, a slightly different time frame than the Census Bureau's most recent decade (2000 to 2010), the analysis of NRI Developed Land data for Florida shows that population growth accounted for virtually one hundred percent (100%) of sprawl in the state. Nevertheless, the fact that analysis of one source's land use data yields 100 percent and the other 96 percent means that the two sources broadly concur on the relative importance of the two factors driving Florida's sprawl.

If the Census Bureau Urbanized Areas data were exaggerating the contribution of population growth to sprawl, applying the Holdren method to the National Resources Conservation Service's National Resources Inventory results would likely give us a significantly lower figure.

Unlike the Census Bureau data, the NRCS survey picks up development such as weekend cottages and second homes that are built by city residents far enough into the country that

they don't get included in the data on expanding Urbanized Areas (because they don't have permanent residential populations). The NRI includes them in the "Small Built-up Areas" category. The NRI survey also captures all the rural land that succumbs to the development of recreational areas, resorts, roads, manufacturing, parking areas, and sprawling towns under 50,000 residents.

3.2 Florida Compared to Other States

It is interesting to compare the relative amounts and causes of sprawl in Florida and other states using the NRI data on Developed Land. Here we do so for two time periods: 1982 to 2010 and 2002-2010. The first covers the nearly entire three-decade period of NRCS NRI land use data, while the second concentrates on the most recent eight-year period.

3.2.1 Developed Land from 1982 to 2010

Figure 16 shows that over the entire 28-year period between 1982 and 2010, greater than six out of every ten acres developed (63%) was associated with population growth and four out of every ten acres developed (37%) was associated with growing per capita land consumption or Per Capita Sprawl.

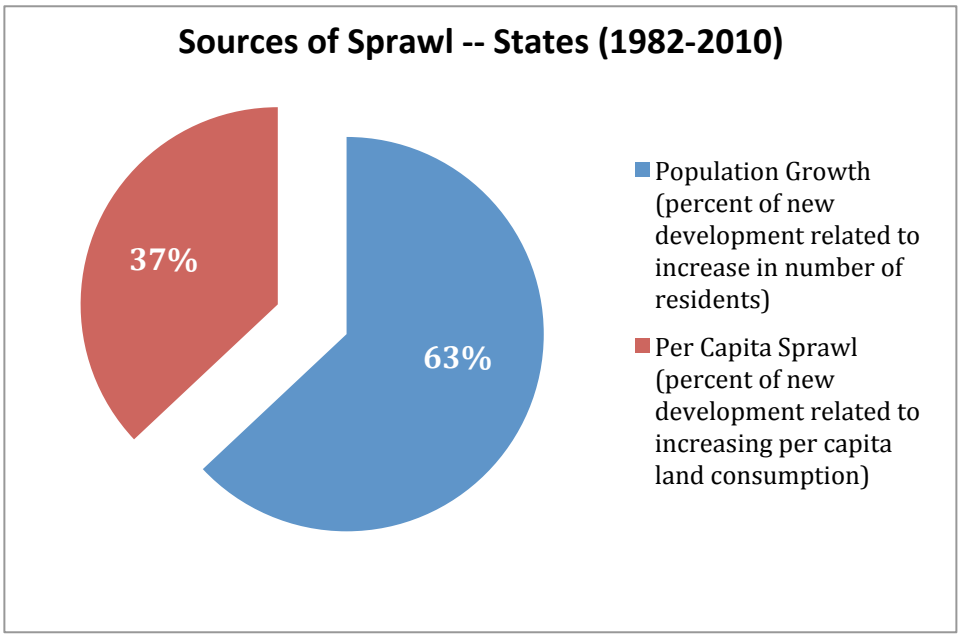


Figure 16. Sources of sprawl in 48 contiguous states, 1982-2010
Source: National Resources Inventory 1982-2010

Table 11 shows total sprawl in the 48 contiguous states from 1982 to 2010, and the percentages of that total sprawl associated with either population growth or Per Capita Sprawl (growth in per capita land consumption).

Table 11. Sources of sprawl in the 48 contiguous states, 1982-2010

State	Total Sprawl (square miles), 1982-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Alabama	1,964	35%	65%
Arizona	1,763	100%	0%
Arkansas	967	58%	42%
California	3,323	97%	3%
Colorado	1,093	100%	0%
Connecticut	366	53%	47%
Delaware	203	68%	32%
Florida	**4,168**	**88%**	**12%**
Georgia	3,735	74%	26%
Idaho	537	100%	0%
Illinois	1,228	44%	56%
Indiana	1,134	50%	50%
Iowa	462	32%	68%
Kansas	604	86%	14%
Kentucky	1,515	27%	73%
Louisiana	1,008	10%	90%
Maine	551	29%	71%
Maryland	830	69%	31%
Massachusetts	1,001	28%	72%

State	Total Sprawl (square miles), 1982-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Michigan	2,153	21%	79%
Minnesota	1,079	74%	26%
Mississippi	1,097	31%	69%
Missouri	1,302	60%	40%
Montana	361	84%	16%
Nebraska	230	100%	0%
Nevada	497	100%	0%
New Hampshire	507	56%	44%
New Jersey	1,038	38%	62%
New Mexico	941	67%	33%
New York	1,555	32%	68%
North Carolina	3,771	65%	35%
North Dakota	119	7%	93%
Ohio	2,033	19%	81%
Oklahoma	1,034	43%	57%
Oregon	673	100%	0%
Pennsylvania	2,529	15%	85%
Rhode Island	91	34%	66%
South Carolina	2,020	55%	45%
South Dakota	233	98%	2%
Tennessee	2,274	49%	51%
Texas	5,591	94%	6%
Utah	646	89%	11%

State	Total Sprawl (square miles), 1982-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Vermont	204	47%	53%
Virginia	2,027	70%	30%
Washington	1,439	100%	0%
West Virginia	813	0%	100%
Wisconsin	1,196	57%	43%
Wyoming	245	42%	58%
Total Sprawl	**64,147**	**63%**	**37%**

Source: NRCS National Resources Inventory

Figure 16 and **Table 11** reveal two key conclusions: 1) in developing 4,168 square miles of open space between 1982 and 2010, Florida was the second-most sprawling state in the country, following only Texas (5,591 square miles) and surpassing even California (3,323 square miles); and 2) with an estimated 88 percent of its sprawl related to population growth, Florida was significantly higher than the national average of 63 percent. The role of a growing population in driving sprawl was much higher in Florida than nationally.

3.2.2 Developed Land from 2002 to 2010

If we examine national-level data for the most recent eight-year period, from 2002-2010, the role of the Population Growth factor is higher than the average for the entire 28-year period. Whereas the 28-year average was 63 percent from 1982 to 2007, Population Growth accounted for 91 percent of the conversion from rural land to developed land from 2002 to 2010 (**Figure 17).** As noted above, for Florida in particular, population growth was associated with virtually all (100%) sprawl in the state from 2002 to 2010.

Thus, it is evident that both nationally, and in the case of Florida in particular, the relative importance of population growth in driving urban sprawl and land development has trended upward over time, to the extent that in the first decade of the 21st century, population growth now accounts for between seven to nine out of every ten acres of land developed or urbanized in the United States, and in Florida, virtually all of it. The Census Bureau Urbanized Area data sets and the NRCS National Resources Inventory Developed Land data sets corroborate one another in confirming this broad temporal trend.

Table 12 shows total sprawl in each of the 48 contiguous states from 2002 to 2010, and the percentages of that total sprawl associated with either Population Growth or Per Capita

Sprawl (growth in per capita land consumption). As would be expected from **Figure 16,** which aggregates or lumps all of the states together and shows that the percentage of total sprawl due to population growth was higher from 2002 to 2010 than it was for the entire 28-year period (1982-2010), we observe that in most individual states, the percentage of sprawl related to population growth from 2002 to 2010 is higher than it was across the entire 28-year period (1982-2010). In other words, we can infer that the role of population growth in driving the nation's sprawl has increased over time.

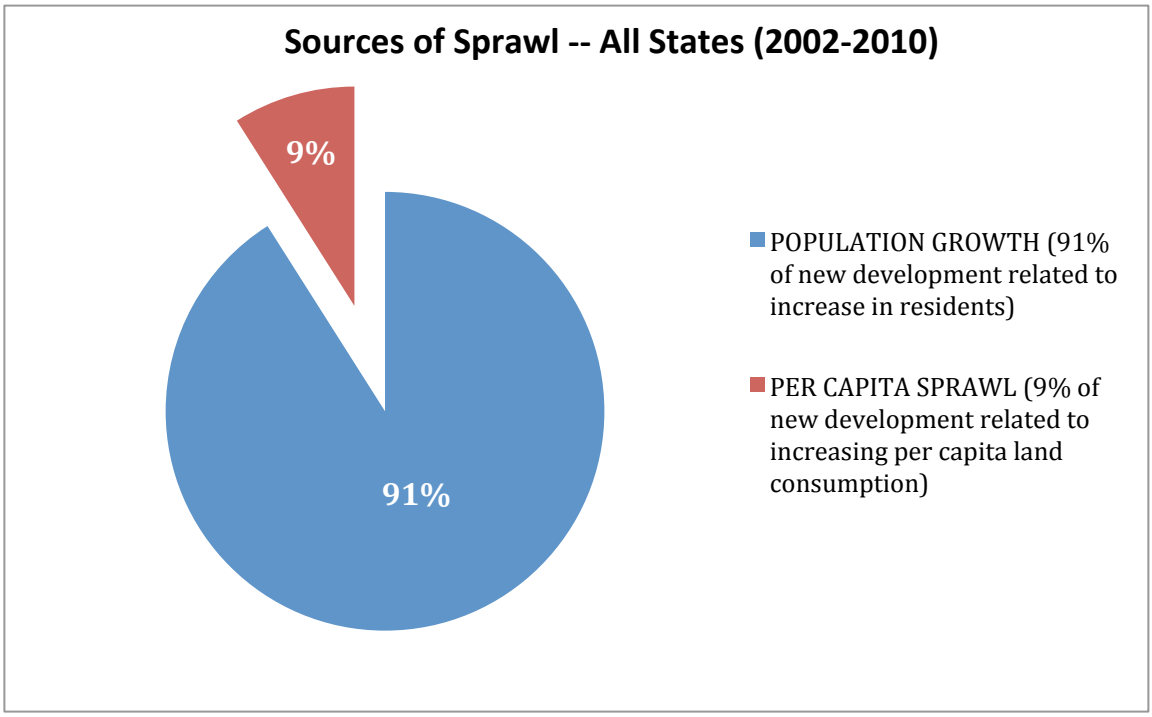


Figure 17. Sources of recent sprawl in the 48 contiguous states, 2002-2010

Description: The NRI calculates the conversion of rural land to developed land in 49 states and U.S. territories. Included in this figure are the 48 coterminous states. These data indicate that from 2002 to 2010 approximately one-tenth of the loss of rural land nationwide was related to an increase in developed land per person, and about nine-tenths of the loss was related to population growth.

Table 12. Sources of recent sprawl in the 48 contiguous states, 2002-2010

State	Total Sprawl (square miles), 2002-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Alabama	386	75%	25%
Arizona	490	100%	0%

State	Total Sprawl (square miles), 2002-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Arkansas	278	75%	25%
California	656	91%	9%
Colorado	198	100%	0%
Connecticut	63	91%	9%
Delaware	61	75%	25%
Florida	**853**	**100%**	**0%**
Georgia	646	100%	0%
Idaho	124	100%	0%
Illinois	283	36%	64%
Indiana	275	72%	28%
Iowa	148	77%	23%
Kansas	136	100%	0%
Kentucky	236	80%	20%
Louisiana	229	19%	81%
Maine	104	32%	68%
Maryland	150	92%	8%
Massachusetts	132	36%	64%
Michigan	321	0%	100%
Minnesota	177	100%	0%
Mississippi	265	38%	62%
Missouri	325	75%	25%
Montana	113	100%	0%
Nebraska	67	100%	0%

State	Total Sprawl (square miles), 2002-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Nevada	137	100%	0%
New Hampshire	86	44%	56%
New Jersey	106	72%	28%
New Mexico	143	100%	0%
New York	248	30%	70%
North Carolina	581	100%	0%
North Dakota	19	100%	0%
Ohio	381	18%	81%
Oklahoma	311	76%	24%
Oregon	128	100%	0%
Pennsylvania	341	62%	38%
Rhode Island	17	0%	100%
South Carolina	354	100%	0%
South Dakota	38	100%	0%
Tennessee	434	96%	4%
Texas	1,572	100%	0%
Utah	203	100%	0%
Vermont	36	28%	72%
Virginia	413	100%	0%
Washington	271	100%	0%
West Virginia	0	41%	59%
Wisconsin	304	59%	41%
Wyoming	80	100%	0%

State	Total Sprawl (square miles), 2002-2010	% of Total Sprawl Related to Growth in POPULATION	% of Total Sprawl Related to Growth in PER CAPITA LAND CONSUMPTION
Total Sprawl	**12,917**	**91%**	**9%**

Source: NRCS, 2013. *Summary Report: 2010 National Resources Inventory*

As **Table 12** shows, from 2002 to 2010, according to the NRI, the amount of total sprawl in Florida (853 square miles) was second only to Texas (1,572 square miles).

3.2.3 Scatter Plots of Population Growth and Sprawl

Another useful way to examine the relationships between the factors in sprawl is by using scatter plot analysis. **Figure 18** is a scatter plot that examines the relationship between each state's percentage population growth on the x-axis (horizontal axis) and the percentage increase in the area of developed land (i.e., sprawl) on the y-axis (vertical axis). The scatter plot has a "best fit" line that shows the linear relationship between the data points.

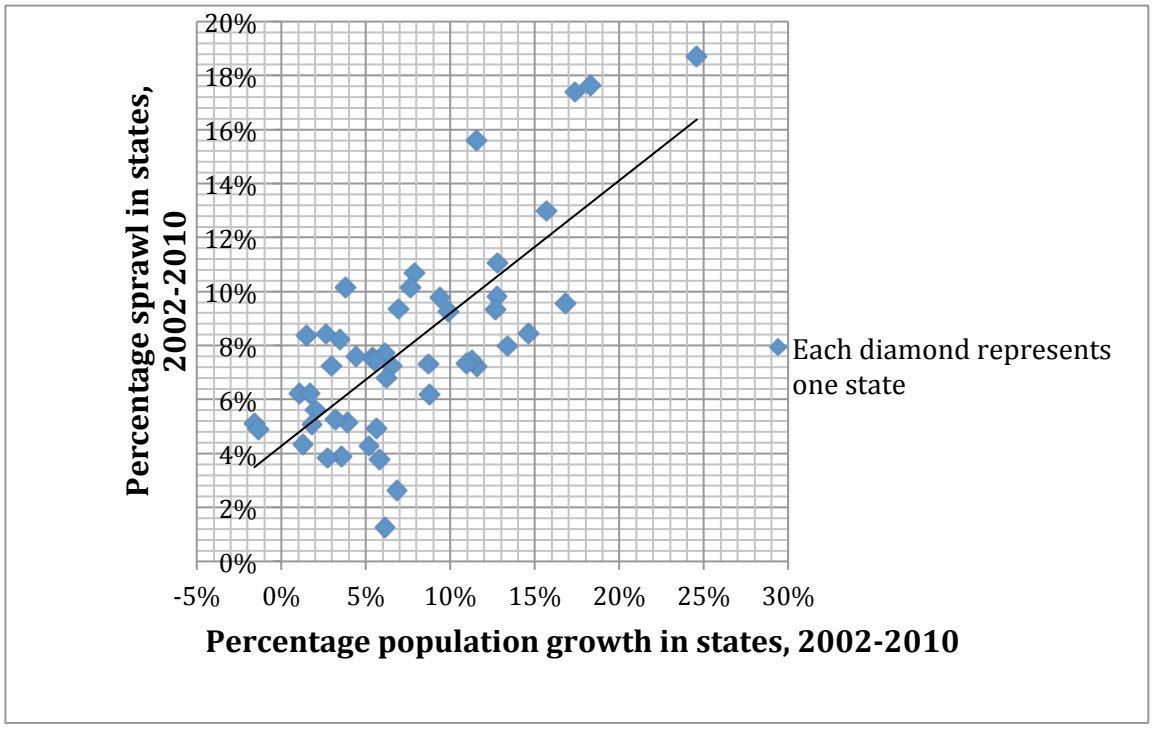


Figure 18. Scatter plot of population growth vs. sprawl in 48 states, 2002-2010
Sources: Census Bureau and National Resources Inventory

The left-to-right, upward-trending "best fit" line for **Figure 18** indicates that there is a positive relationship between population increase and Overall Sprawl. States with more population growth were also states where more land is being developed. These results are not surprising, but if sprawl and population growth were not related, as some have always

contended, the trend line would be flat or negative. While this scatter plot alone does not prove that population growth causes sprawl, it does strongly suggest and reinforce the hypothesis that the two are closely correlated.

Figure 19 is a similar scatter plot with the percentage population growth from 2000 to 2010 in each Florida Urbanized Area on the x-axis and the percentage increase in the area of urbanized land (i.e., Overall Sprawl) for each of those UAs on the y-axis. Once again, there is a clear correlation between population growth and sprawl, as evidenced by the left-to-right upward (positive) slope of the "best fit" line. Sprawl is clearly a function of population growth.

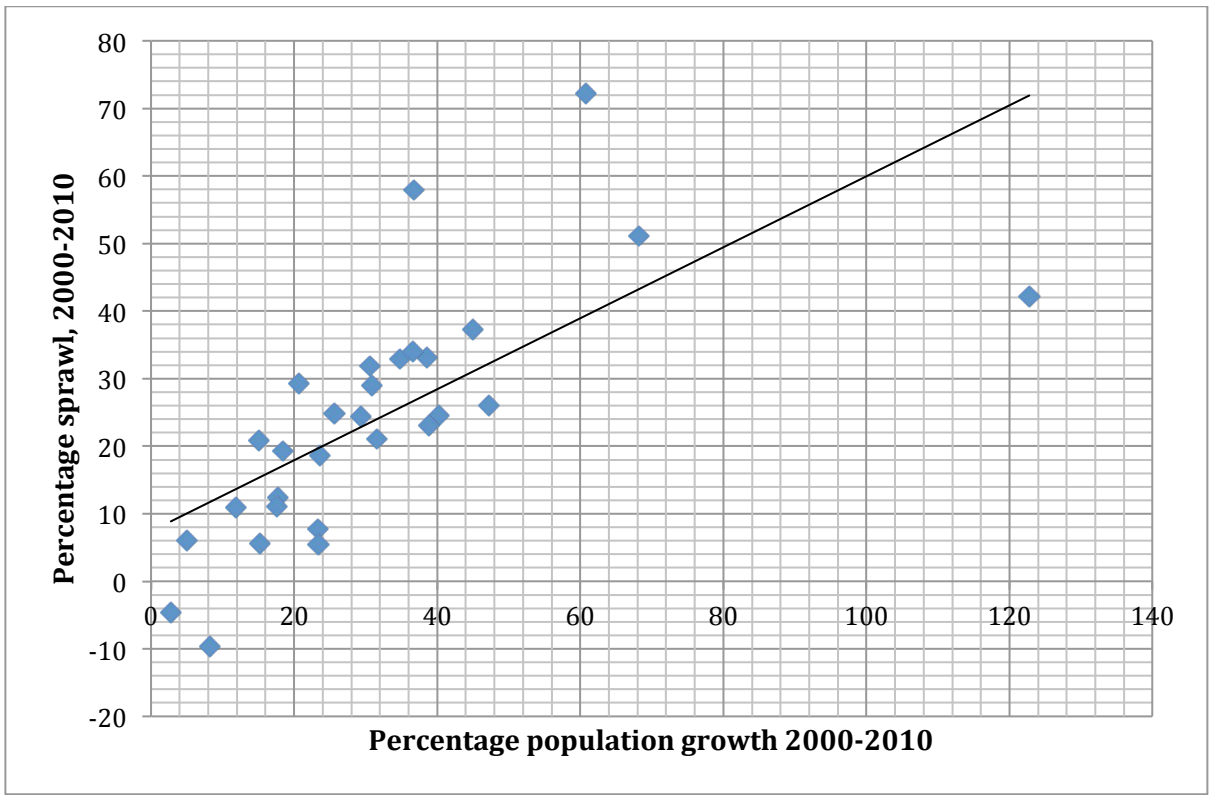


Figure 19. Scatter plot of population growth vs. sprawl in Florida, 2000-2010

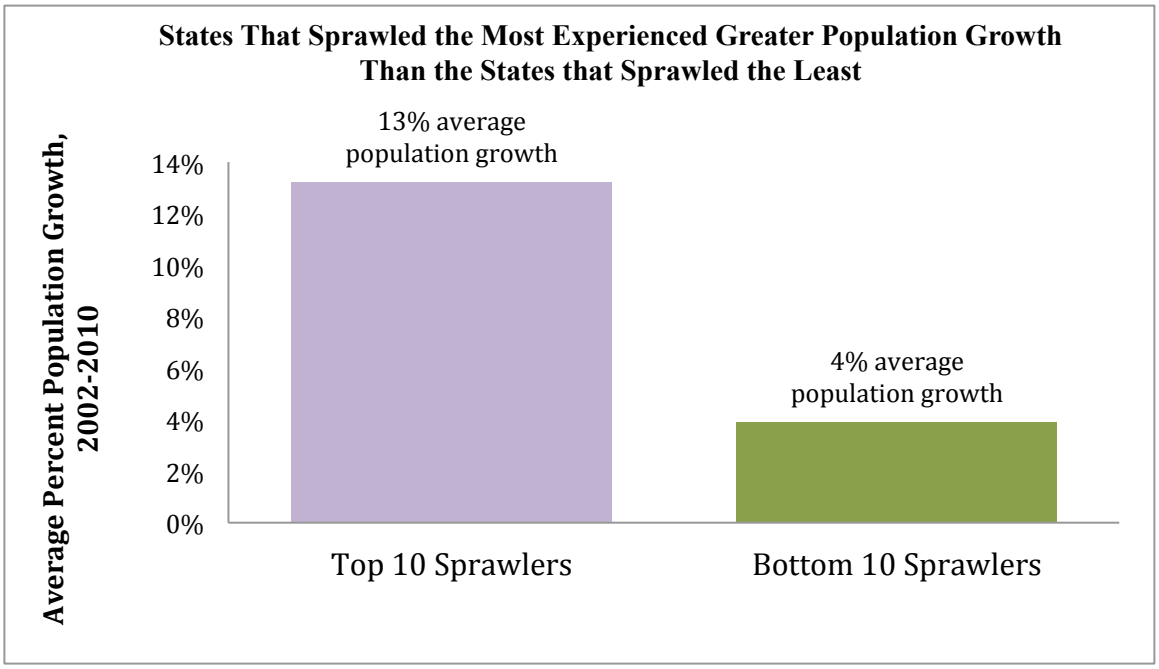
3.3 Trends

From 2000 to 2010 the most significant factor contributing to Overall Sprawl in the United States was the addition of more than 17 million new residents to our nation's Urbanized Areas, and the additional nine million residents who settled elsewhere. Per Capita Sprawl was halted in 192 of our cities, and was responsible for less than 30% of Overall Sprawl in Urbanized Areas during the same period of study.

Likewise, in Florida, the addition of nearly 3 million new residents to Urbanized Areas between 2000 and 2010 was responsible for almost all sprawl in the Sunshine State.

At the national level, NRCS data on sprawl in the contiguous 48 states from 2002-2010 were also consistent with our findings for the cities. From 2002-2010 population growth was the most important factor in the loss of non-federal rural land, accounting for 91 percent of new development. The ten states experiencing the most sprawl by percentage (Nevada, Utah, Arizona, Delaware, Texas, **Florida**, Arkansas, Oklahoma, Mississippi, and Georgia) had populations that grew on average more than three times as fast as the ten least sprawling states by percentage (Massachusetts, Minnesota, Rhode Island, New York, Kansas, Connecticut, New Jersey, Nebraska, South Dakota and North Dakota) (**Figure 20**).

Figure 20. Comparison of population growth between high and low sprawling states



Description: The populations of ten states experiencing the most sprawl by percentage (Nevada, Utah, Arizona, Delaware, Texas, **Florida**, Arkansas, Oklahoma, Mississippi, and Georgia), grew on average more than three times faster than the ten least sprawling states (Massachusetts, Minnesota, Rhode Island, New York, Kansas, Connecticut, New Jersey, Nebraska, South Dakota and North Dakota)

Figure 21 looks at the same data and the same 2002-2010 time period from a different angle.

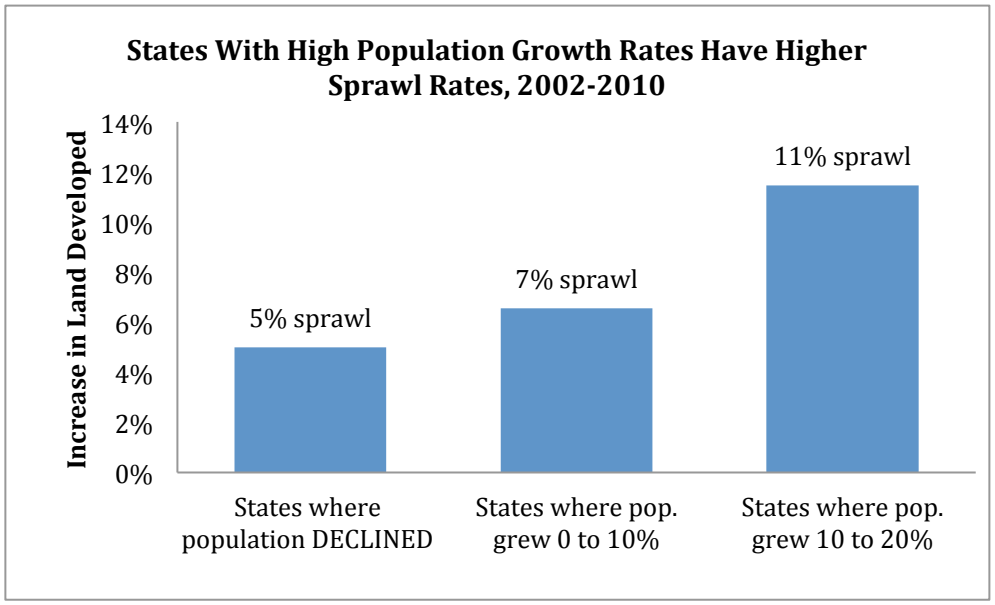


Figure 21. Comparison of sprawl in slow-growing vs. fast-growing states

Table 13 ranks the states according to their sprawl rate from 2002 to 2010, from highest to lowest, by percentage. **Table 10** also includes the entire 28-year, 1982-2010 period, so that for each state, the percent sprawl and ranking are provided for the entire extended period of study. Florida was in sixth place both in the most recent 2002-2010 time period and the overall 1982-2010 time period.

Table 13. Sprawl in 48 states, ranked by percentage

Ranking (by percentage) 2002-2010	Total Sprawl (percentage), 2002-2010 Recent	State	Total Sprawl (percentage), 1982-2010 Overall	Total Sprawl Ranking by Percentage, 1982-2010
1	18.7%	Nevada	134.3%	1
2	17.6%	Utah	90.8%	7
3	17.4%	Arizona	114.0%	2
4	15.6%	Delaware	81.8%	12
5	13.0%	Texas	69.1%	17
6	**11.1%**	**Florida**	**94.9%**	**6**
7	10.7%	Arkansas	50.7%	28

Ranking (by percentage) 2002-2010	Total Sprawl (percentage), 2002-2010 Recent	State	Total Sprawl (percentage), 1982-2010 Overall	Total Sprawl Ranking by Percentage, 1982-2010
8	10.2%	Oklahoma	44.4%	32
9	10.2%	Mississippi	61.7%	18
10	9.8%	Georgia	106.8%	3
11	9.8%	Tennessee	87.8%	8
12	9.6%	Idaho	61.2%	19
13	9.4%	Alabama	77.0%	14
14	9.3%	South Carolina	95.2%	5
15	9.3%	Virginia	71.1%	15
16	8.5%	North Carolina	102.2%	4
17	8.4%	Maine	69.9%	16
18	8.4%	Louisiana	51.5%	27
19	8.2%	New Hampshire	80.5%	13
20	8.0%	Wyoming	29.2%	41
21	7.7%	Kentucky	85.3%	9
22	7.6%	Wisconsin	38.5%	36
23	7.6%	Indiana	40.6%	34
24	7.5%	New Mexico	84.4%	10
25	7.4%	Missouri	38.4%	37
26	7.3%	Washington	57.1%	23
27	7.3%	Montana	27.9%	42
28	7.3%	West Virginia	82.1%	11
29	7.2%	California	52.0%	26
30	7.2%	Colorado	59.1%	20

Ranking (by percentage) 2002-2010	Total Sprawl (percentage), 2002-2010 Recent	State	Total Sprawl (percentage), 1982-2010 Overall	Total Sprawl Ranking by Percentage, 1982-2010
31	6.8%	Maryland	54.4%	25
32	6.2%	Vermont	49.4%	29
33	6.2%	Ohio	45.4%	31
34	6.2%	Oregon	44.0%	33
35	5.6%	Illinois	29.9%	40
36	5.2%	Pennsylvania	58.5%	21
37	5.2%	Iowa	18.1%	46
38	5.1%	Michigan	48.3%	30
39	5.1%	Massachusetts	57.6%	22
40	4.9%	Minnesota	40.2%	35
41	4.9%	Rhode Island	34.0%	39
42	4.3%	New York	35.1%	38
43	4.3%	Kansas	22.3%	44
44	3.9%	Connecticut	27.8%	43
45	3.8%	New Jersey	56.4%	24
46	3.8%	Nebraska	14.1%	47
47	2.6%	South Dakota	18.4%	45
48	1.3%	North Dakota	8.4%	48

Sources: NRCS National Resources Inventory; U.S. Census Bureau

Table 14 arranges the states according to the amount they sprawled from 2002 to 20010, from highest to lowest, in terms of total or overall area, not percentage. **Table 14** also includes the entire 28-year, 1982-2010 period, so that for each state, the amount of sprawl and ranking are provided for the entire extended period of study. By this measure of sprawl,

Florida is in second place both for the more recent 2002-2010 time period, as well as the overall 1982-2010 time period. Only Texas lost more open space to sprawl than Florida.

Table 14. Sprawl in 48 states, ranked by area

Ranking (by area) 2002-2010	Total Sprawl (square miles), 2002-2010 Recent	State	Total Sprawl (square miles), 1982-2010 Overall	Total Sprawl Ranking by Area, 1982-2010
1	1,572	Texas	5,591	1
2	**853**	**Florida**	**4,168**	**2**
3	656	California	3,323	5
4	646	Georgia	3,735	4
5	581	North Carolina	3,771	3
6	490	Arizona	1,763	13
7	434	Tennessee	2,274	7
8	413	Virginia	2,027	10
9	386	Alabama	1,964	12
10	381	Ohio	2,033	9
11	354	South Carolina	2,020	11
12	341	Pennsylvania	2,529	6
13	325	Missouri	1,302	17
14	321	Michigan	2,153	8
15	311	Oklahoma	1,034	25
16	304	Wisconsin	1,196	19
17	283	Illinois	1,228	18
18	278	Arkansas	967	28
19	275	Indiana	1,134	20
20	271	Washington	1,439	16

Ranking (by area) 2002-2010	Total Sprawl (square miles), 2002-2010 Recent	State	Total Sprawl (square miles), 1982-2010 Overall	Total Sprawl Ranking by Area, 1982-2010
21	265	Mississippi	1,097	21
22	248	New York	1,555	14
23	236	Kentucky	1,515	15
24	229	Louisiana	1,008	26
25	203	Utah	646	33
26	198	Colorado	1,093	22
27	177	Minnesota	1,079	23
28	150	Maryland	830	30
29	148	Iowa	462	39
30	143	New Mexico	941	29
31	137	Nevada	497	38
32	136	Kansas	604	34
33	132	Massachusetts	1,001	27
34	128	Oregon	673	32
35	124	Idaho	537	36
36	122	West Virginia	813	31
37	113	Montana	361	41
38	106	New Jersey	1,038	24
39	104	Maine	551	35
40	86	New Hampshire	507	37
41	80	Wyoming	245	42
43	63	Connecticut	366	40
44	61	Delaware	203	46

Ranking (by area) 2002-2010	Total Sprawl (square miles), 2002-2010 Recent	State	Total Sprawl (square miles), 1982-2010 Overall	Total Sprawl Ranking by Area, 1982-2010
45	38	South Dakota	233	43
46	36	Vermont	204	45
47	19	North Dakota	119	47
48	17	Rhode Island	91	48

Sources: NRCS National Resources Inventory, Census Bureau

Overall, at a national level, two main temporal trends are evident in both the Census Bureau's UA data set and the NRI's Developed Land data set. The first trend, supported primarily by the NRI data, is that Overall Sprawl may have peaked in the late 1990s but continued into the late 2000s at a very high rate that still exceeded that experienced in the 1980s and early 1990s. The second temporal trend is that the role of the population growth factor has increased markedly over time, from approximately half (50%) in the 1970-1990 period to roughly 70% in the 2000s. The Census Bureau and NRCS data, obtained in such different manners, are remarkably consistent in this regard.

In contrast to the nation at large, in Florida, the percentage of sprawl associated with population growth has always been in the 90-100 percent range. This has not changed. The rate of sprawl in Florida peaked in the early 1990s at the rate of 162.5 square miles per year or 372 acres per day on average (**Table 15**). Every day another 372 acres, more than half a square mile, of Florida's open space was devoured. The effect of the Great Recession beginning in about 2007-2008 in Florida was quite pronounced, with the rate of sprawl plummeting more than 50 percent from the rate of the previous decade. But even then, sprawl did not sleep or cease in Florida, and every day on average, another 112 acres of Florida's natural habitat and farmland fell under the bulldozer's blade.

Table 15. Increase in developed land in Florida, 1982-2010

Year	Area of Developed Land in Florida (square miles)	Time Period	Increase in Developed Land (Overall Sprawl) in square miles	Average Annual Sprawl (square miles)	Average Daily Rate of Sprawl (acres)
1982	4,389.2				
1987	4,886.9	1982-1987	497.7	99.5	175
1992	5,831.4	1987-1992	944.5	188.9	331

1997	6,891.3	1992-1997	1,059.9	212.0	372
2002	7,703.9	1997-2002	812.6	162.5	285
2007	8,365.3	2002-2007	661.4	132.3	232
2010	8,556.7	2007-2010	191.4	63.8	112

Source: National Resources Inventory, *2010 Summary Report*

Table 16 contains data on Florida Urbanized Areas for the 1970-1990 period and the most recent 2000-2010 period and allows us to compare the first and second trends city by city and in aggregate. *(NOTE: In 1990, there were only seven Urbanized Areas in Florida compared with the 30 in 2010.)*

While sprawl in Florida may have slowed in recent years, especially in the wake of the 2008 Great Recession, it still continues at a very high, environmentally destructive, and unsustainable rate. Almost all sprawl in Florida is due to population growth, not other sprawl-inducing factors that increase per capita land consumption (reduce population density).

Table 16. Florida cities sprawl data, 1970-1990 vs. 2000-2010

Urbanized Area	Sprawl per Decade, 1970-1990 (sq. miles)	% Sprawl explained by Population Growth, 1970-1990	Sprawl per Decade, 2000-2010 (sq. miles)	% Sprawl explained by Population Growth, 2000-2010
Ft. Lauderdale-Hollywood-Pompano, FL[1]	26.8	100%	NA	NA
Jacksonville, FL	78.2	90%	119.8	74%
Miami, FL (including Ft. Lauderdale, etc.)	47.0	100%	122.5	100%
Orlando, FL	131.5	97%	144.5	96%
Pensacola, FL-AL	44.5	49%	13.3	84%
Tampa-St. Petersburg, FL	179.4	85%	154.7	96%
West Palm Beach-Boca Raton, FL[1]	85.1	100%	NA	NA

[1] Absorbed into Miami UA by 2000 and 2010 UA delineations.

4. CONCLUSIONS AND POLICY IMPLICATIONS

4.1 Conclusions

At both the state level of Florida and the national level there is a broad correlation between population size and sprawl: generally, the larger a city or state's population, the larger the land area it will sprawl across. This is shown clearly in **Figure 22**, a simple scatter plot of the 48 contiguous states' cumulative populations and developed land areas in 2010. The positive (upward tilting toward the right) slope of the best-fit line means that as a state's population increases, the area of built-up, developed land increases as well. This

demolishes the whimsical notion entertained by those prone to wishful thinking and fairy tales that there is no connection between population size or growth rates and environmental impact.

Sprawl continues to devour rural land around Florida's cities at a very rapid rate.

Although the pace of sprawl in Florida may have peaked in the late 1990s, our most recent data show that it continues to devour open space at a rate exceeding 100 acres per day, or one square mile every six days, and over 60 square miles or 40,000 acres per year. (This rate has likely accelerated with the gradual waning of the "Great Recession"). Even at this reduced rate, sprawl would continue to convert an additional 600 square miles or 400,000 acres of Florida's valuable agricultural land and wildlife habitat into built-up land every decade. By 2050, another 2,100 square miles (1,344,000 acres) of Florida's vanishing rural lands will have been paved or covered with subdivisions; hotels; industrial, office and theme parks; schools; and commercial strips, at great cost to Florida's agricultural potential, wildlife habitat, quality of life, and environmental sustainability.

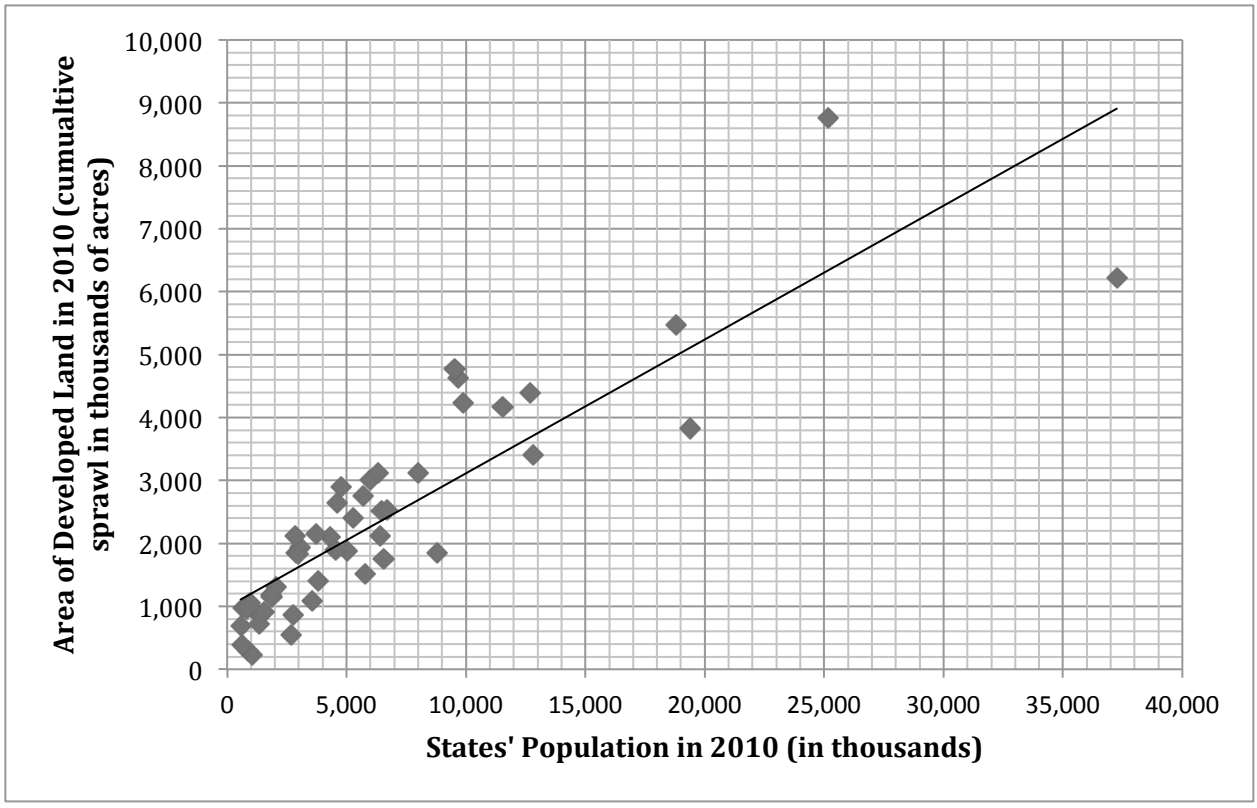


Figure 22. Cumulative developed land area (sprawl) is a function of population size
Source: U.S. Census Bureau; NRCS, 2013. *Summary Report: 2010 National Resources Inventory*

Smart growth efforts, higher gasoline prices, fiscal and budgetary constraints (limiting new road-building, for example), and the recession-inducing mortgage meltdown may have all played roles in slowing Florida's rate of sprawl late in the first decade of this century. The extent to which any of these and still other unforeseen factors may affect the rate of sprawl in the coming decades is unknown and unpredictable. Yet as more and more of Rural Florida succumbs to development – chipped away and clogged with roads, vehicles, people, facilities and infrastructure – at some point it will not be possible to maintain this rapid rate of sprawl simply because other critical land uses – e.g., high-value cropland; national and state parks, forests, and wildlife refuges; mines; watersheds and reservoir buffer zones; utility corridors; military bases and arsenals – will represent a larger and larger fraction of the remaining undeveloped land. To some extent, water scarcity is also likely to restrict far-flung, never-ending development in Florida.

The role of population growth in driving sprawl in Florida has stayed consistently high over the last several decades – much higher than the national average.

From 1970 to 1990, our earlier studies – based on two independent, longitudinal datasets, delineations, and methodologies – from two distinct federal agencies and research programs – the Census Bureau's Urbanized Areas and the USDA's National Resources Inventory – showed clearly that on a nationwide scale, population growth and increasing per capita land consumption (what we referred to as "land use choices") were each responsible for about half of the sprawl America was then experiencing. In Florida, in contrast, population growth accounted for not just half, but the overwhelming majority of all sprawl. According to our analysis of the Census Bureau's Urbanized Area database, population growth was associated with almost all sprawl in the state's UAs from 1970 to 1990. And according to our breakdown of the USDA's National Resources Inventory, from 1982 to 1997, population growth accounted for 73 percent of the Florida's sprawl.

In our more recent 2014 study of national sprawl, *Vanishing Open Spaces*, using more recent data from the same two agencies and the same two long-term data gathering programs, during the decade just passed (2000-2010), population growth accounted for approximately 70-90% of sprawl on the national scale; declining density or increasing per capita land consumption accounted for about 10-30%. In other words, nationally, the relative role of the population growth factor has increased by about 20-40 percentage points (from 50 to 70-90) over the four-decade period from 1970 to 2010 that the study encompasses.

In Florida, meanwhile, the sprawl-forcing population growth factor went from already higher than the national average to even higher yet. In Urbanized Areas, our analysis shows population growth as related to about 96 percent of sprawl in the state. For the state as a whole, using the USDA/NRCS's National Resources Inventory, our analysis indicates that population growth accounted for virtually all (100 percent) of sprawl within the state.

Attempts to direct development to limited areas are not enough to offset population growth.

A central goal of Smart Growth is to preserve open space, farmland, natural beauty and critical environmental areas by preventing declining density. Thus, places where population density increases should be hailed as success stories. Between 2000 and 2010 in Florida, there were 23 out of 30 Urbanized Areas (77 percent of all Florida UAs) whose density either remained constant or increased – in other words, their per capita land consumption remained constant or decreased. However, many of these cities still experienced appreciable sprawl, totaling 528 square miles between 2000 and 2010. This was about 43 percent of all sprawl in Florida.

No city in Florida has yet gone to the lengths of trying to control sprawl than **Portland, Oregon** has, and perhaps no city better exemplifies the shortcoming and limitations of the "smart growth" approach than Portland.

Despite being lauded for its urban growth boundary (UGB), extensive light rail infrastructure, and high-density mixed-use developments, even Portland has been unable to contain its own sprawl. Between 2000 and 2010, the Portland UA decreased its per capita land consumption by 5.31% from 0.1916 acre per person to 0.1814 acre per person. (By comparison, the average per capita 2010 land consumption in Florida Urbanized Areas was 0.2663 acre/person, almost 50 percent higher than Portland.)

However, despite its modest gain in population density over the decade, the Portland UA still sprawled outward an additional 50.4 square miles. The addition of 266,760 people during the decade was more than enough to wipe out the increased population density and cause the urbanized area to swell by an additional 11 percent. While the UGB and other smart growth initiatives have certainly slowed the pace of sprawl in Portland, some contend that they have driven up real estate and housing prices within the city. This has led to spill-over sprawl in other nearby cities as people seek sanctuary from higher home prices. Supporting this contention is the nearby city of Salem, Oregon, whose urbanized area population grew by 14% from 2000 to 2010, and which has quickly become the second largest city in Oregon.

Of the 192 Urbanized Areas in the United States which over the last decade experienced a decline in per capita land area, **Raleigh, North Carolina** is another informative example of the limits of gradually shrinking the acreage afforded to each person in which to live, work, shop, play. Per capita land consumption decreased by 0.003 acre. At the same time, the population grew by over 300,000 people, causing the Raleigh Urbanized Area to become more densely populated. But despite Raleigh's drop in per capita acreage, its 63 percent increase in population caused it to sprawl out over 198.5 square miles in these 10 years.

The drop in per capita land consumption can be explained by the efforts of city planners to tame sprawl by directing development toward certain centers within the Urbanized Area.

These were not enough to prevent the construction of new suburban neighborhoods, the development of retail centers, and the creation of roads and highways to connect these sprawl products.

In **Florida**, the **Miami UA** reduced its per capita land use (increased its density) slightly from 0.1452 acre/person in 2000 to 0.1441 acre/person in 2010, a decrease of almost one percent. According to the conventional wisdom voiced by Smart Growthers, because density increased, by definition there was no sprawl on the Miami UA periphery from 2000 to 2010, yet the region still lost over 122 square miles of open space during this period.

In the first edition of this study more than a decade ago, 18 of the 100 largest Urbanized Areas in the U.S. had reduced per capita land consumption, and during that time period all 18 of those Urbanized Areas still experienced Overall Sprawl. Between 2000 and 2010, 26 Urbanized Areas had a decline in their per capita land consumption, and 22 of those cities experienced Overall Sprawl. The four areas that did not sprawl saw a decrease in their total urbanized land area by an average of 18.5 square miles. While it is encouraging to see that some cities are stopping both their per capita and Overall Sprawl, 22 of the nation's major cities that stopped per capita growth still sprawled in an unsustainable manner. A stronger approach must be taken towards suppressing sprawl before our already dwindling rural lands disappear altogether.

Stabilized population alone does not prevent sprawl.

In **Pittsburgh, Pennsylvania**, many local officials see population growth as a driver of economic development and an indicator of the vibrancy of the locales they represent. This mentality is seen in the aggressive campaigns and taxpayer subsidies that local officials use to attract new residents. However, economic growth does not necessarily require growing populations and sprawling cities. According to a 2012 study by Eben Fodor and Associates, **cities experiencing rapid population growth had higher rates of unemployment** and were more affected by the 2007-2008 recession than were cities with slower growth rates. Florida cities certainly fall into this camp.[49]

This can be seen in urbanized areas like Pittsburgh, which have benefited from a stabilized population in recent years. From 2000 to 2010, Pittsburgh experienced no population-induced sprawl and had a relatively low level of Overall Sprawl. One benefit Pittsburgh has seen from a stabilized population is that it has an unemployment level of only 6.6%, well below the national rate. Energized largely by strong gains in the education, healthcare, financial, and natural gas industries, Pittsburgh has been able to distance itself from both the image of the "smoky city" of steel mills and the image of the city of shut-down steel mills.

[49] Eben Fodor. 2012. Relationship Between Growth and Prosperity in the 100 Largest U.S. Metropolitan Areas. *Economic Development Quarterly*. Available at: http://edq.sagepub.com/content/26/3/220.

Pittsburgh has also been making headlines in the 2000s as one of the country's most livable cities. In 2011 *The Economist* Intelligence Unit named it America's most livable city, and the 29th most livable city in the world. Despite having a stable population and diverse economy, the Pittsburgh Urbanized Area sprawled over an additional 52.8 square miles in the last decade. The reason was high levels of Per Capita Sprawl. One possible culprit could be that Pittsburgh has fewer people per household than the nationwide average. This means that the population of Pittsburgh requires more dwellings and more area for the same population size than do other American cities of comparable population size. Also, the decline of the steel industry left parts of the city abandoned as "brownfields", driving residents to build outward into the suburbs. Cases like Pittsburgh highlight the necessity of a two-pronged approach to addressing both population growth – undertaken primarily at a national level, not a local one – and per capita consumption sprawl.

4.2 Policy Implications

In order for Florida policy makers to reduce the negative impacts of sprawl and over-development, they must adopt a two-pronged approach. Building on the findings of our original studies a decade ago, and using the same analysis of U.S. Census Bureau and U.S. National Resource Conservation Service data, this study provides further evidence of the necessity for such a two-pronged approach in order to effectively combat sprawl in Florida. Furthermore this study found that the role of population growth in contributing to Overall Sprawl has remained very high in Florida from the 1970s to the present. These findings further reinforce the need for measures that both reduce wasteful over-consumption of our land and resources as well as others that address the large population boom that persists in our country as a whole and in Florida in particular.

While the findings of this study directly challenge the assumptions of many Smart Growth and New Urbanism advocates that population growth plays only a small role in Overall Sprawl, they do not discount the necessity for smarter urban planning that reduces per capita land consumption. The results of this study suggest that in Florida only about four percent of recent sprawl was caused by a complicated array of zoning laws, infrastructure subsidies, and complex socioeconomic forces. Efforts to make cities and communities more space-efficient and livable are certainly needed, but they largely ignore the main concern that sprawl is eating away at Florida's remaining undeveloped lands.

Following the logic of this study's findings it isn't hard to conclude that even the most aggressive and well-intentioned policies promoting smarter growth, better urban planning, and higher residential densities cannot escape the immense population pressures facing many communities around the rapidly growing state of Florida. Florida recently surpassed New

York to become the third most populous state in the country.[50] The Census Bureau reported on December 23, 2014 that between July 1, 2013 and July 1, 2014, Florida added an average of 803 new residents each day, passing New York in the process. The state's population grew by 293,000 over this period, reaching 19.9 million.

No city in Florida has done as much to aggressively limit sprawl as Portland, Oregon, with its Urban Growth Boundary and extensive light rail system. Yet, despite planners' best efforts the city continues to sprawl significantly, due entirely to the addition of over 260,000 new residents. Even the best-intentioned and politically palatable urban planning policies are only able to slow, but not halt, urban sprawl. Using this approach, a given patch of open space beyond the existing periphery of a typical rapidly expanding city would fall to sprawl a bit later rather than sooner, but fall to sprawl it would. Under Smart Growth alone, Florida's cities will never stop devouring countryside as long as the state's population boom continues – until no open space is left outside of protected parks and wildlife reserves.

Simply stated, the results of this study indicate that in Florida, population growth has more than ten times the impact on sprawl than all other factors combined. Neglecting the population factors in the anti-sprawl fight would be to ignore more than 90 percent of the problem.

4.2.1 Local Influence on Sprawl

Local policy makers truly trying to curb sprawl in Florida cities have a number of policy actions to pursue. While most local officials see population growth as an indicator of the vibrancy and vitality of their respective communities, there is little evidence to suggest that unfettered population growth is any of those things. Well-known sprawl critic and urban planner Eben Fodor, author of *Better Not Bigger*,[51] challenged this very notion in his 2010 study "Relationship between Growth and Prosperity in 100 Largest U.S. Metropolitan Areas."

Fodor's study found that rapidly expanding metropolitan areas did not hold up well in terms of standard economic indicators such as unemployment, per capita income, and poverty rates in comparison with slower growing metropolitan areas. Yet, despite this, local officials and city planners continue to offer subsidies and tax breaks to attract new residents, investment and development. Many times these subsidies are born unfairly by existing residents, who see their property taxes rise and are stuck paying the bill for sprawling highways, new schools, water and waste water treatment, and energy grids ever farther from the urban core.

[50] U.S. Census Bureau. 2014. Florida Passes New York to Become the Nation's Third Most Populous State, Census Bureau Reports. December 23 news release. Accessed online at: http://www.census.gov/newsroom/press-releases/2014/cb14-232.html.
[51] Eben Fodor. See note #27.

Many cities have overly complicated zoning laws that drive up home prices. New immigrants and low income families are being priced out and into the more affordable suburbs and Sunbelt cities. This is especially evident in Florida's sprawling cities, which are rapidly expanding due to a large influx of immigrants, young professionals, retirees, and Northerners seeking the cheap housing and favorable business climate. Sprawl in the Sunbelt is of particular concern because their growth puts added strain on already scarce water resources. In order for cities to properly address sprawl, taxpayer subsidies need to be removed and the true costs of development need to be borne by those developing the land. Also, as Harvard economist Edward Glaeser suggests, the true social costs of activities such as driving should be paid for. More sensible planning policies and zoning ordinances can help curb sprawl and reduce the size of population booms in areas not suited to handle large populations.

4.2.2 National Influence on Population Growth

Beyond the short term, local Florida officials supportive of growth control and management can hope only to slow population growth in their jurisdictions if national population continues to increase by some 2.5 to 3 million additional residents each year. These 25-30 million additional Americans each decade will nearly all settle in some community, inevitably leading to additional sprawl as far and as long as the eye can see. Many of these added millions will choose to seek a home in Florida.

In essence there are only three sources of national population growth: native fertility (in conjunction with slowly increasing life spans), immigration, and immigrant fertility. We know the following about their contribution to long-term growth:

- Native fertility: At 1.9 births per woman, it remains below the replacement level of 2.1 and has not been a source of long-term population growth in the U.S since 1971.

- Immigration: The sole source of long-term population growth in the United States is immigration, due both to new immigrants (arriving at about four times higher than the "replacement level" where immigration equals emigration) and to immigrants' fertility, which despite declines during the recession has remained well above replacement level.

Thus, long-term population growth in the United States and Florida is in the hands of federal policy makers. It is they who have increased the annual settlement of immigrants from one-quarter million in the 1950s and1960s to over a million since 1990. Until the numerical level of national immigration is addressed, even the best local plans and political commitment will be unable to stop sprawl. Any serious efforts to halt the loss of farmland and wildlife habitat in Florida must include reducing the volume of population growth, which requires lowering the level of immigrants entering the country each year unless Americans and immigrants decide to move to a one-child per woman average.

A far more sustainable immigration level would be the approximately half-million a year recommended in 1995 by the bi-partisan U.S. Commission on Immigration Reform, established by President Clinton and chaired by former Congresswoman Barbara Jordan.

That would appear to be a popular option among most Americans and Floridians. Polls of America's likely voters in 2014 and Florida's likely voters in 2015 by Pulse Opinion Research found that reducing immigration was a popular policy choice among most when linked with the goal of slowing down U.S. population growth (see **Appendix I** and **Appendix J** for the full survey questions and results).

> **QUESTION:** Census data show that new immigrants and births to immigrants have been equal to two-thirds of all Florida population growth since the year 2000. Should the federal government reduce annual immigration to slow down Florida's population growth, keep immigration and population growth at the current level, or increase annual immigration and population growth?
>
> 64% Reduce immigration to slow down Florida population growth
> 26% Keep immigration and population growth the same
> 3% Increase immigration and population growth
> 7% Not sure
>
> **QUESTION:** Currently the government allows one million legal immigrants each year. How many legal immigrants should the government allow each year -- two million, one million, a half-million, 100,000, or zero?
>
> 6% Two million
> 16% One million
> 18% Half a million
> 21% 100,000
> 24% Zero
> 15% Not sure

When informed that immigration levels currently are around one million a year, voters were asked by pollsters what level they would prefer. Only 22% chose keeping it at one million or increasing it. But 63% of voters said they preferred to cut immigration by at least half, which would put immigration at about the level advocated by the Jordan Commission.

This lower level of immigration at around 500,000 a year would drive far less sprawl than the present levels exceeding a million a year. But unless Americans decide to lower their birth rates to far below replacement level, the 500,000 a year would still drive considerable population growth and sprawl indefinitely.[52]

[52] Camarota, Steve, *Projecting Immigration's Impact on the Size and Age Structure of the 21st Century American Population*, Center for Immigration Studies, December 2012

That is why another federal commission recommended far greater reductions in immigration. The President's Council on Sustainable Development in 1996 recommended that the United States stabilize its population in order to meet various environmental and quality-of-life goals, and it called for reducing immigration to a level that would allow for a stable population. At current just below-replacement native fertility rates, that would require a return down to at least the quarter-million level of immigration in the 1950s and 1960s.

The Population and Consumption Task Force of President Clinton's Council on Sustainable Development concluded in 1996: "This is a sensitive issue, but reducing immigration levels is a necessary part of population stabilization and the drive toward sustainability."[53]

QUESTION: If a political candidate supports higher immigration and population growth, would that make you more likely to vote for them, less likely or would it not make much difference?

11% More likely
56% Less likely
26% It wouldn't make much difference
7% Not sure

In our 2003 study, we devoted several pages to our findings on ways in which an Urbanized Area's population growth from immigrants would have either a greater or lesser effect on sprawl than a net population growth of the same size from U.S.-born residents. We could find no precise method of quantification but concluded that the various factors largely balanced each other.

A key way in which growth from immigration has a somewhat smaller effect on sprawl is the lower average income level and, thus, a lower consumption level of the average immigrant. But we found that an assumption about immigrants having less of an effect because they presumably prefer central cities to suburbs was false. The majority of immigrants now live in suburbs where the sprawl occurs.[54] And the adult children of immigrants were found to be just as likely to shun living in core cities as the adult children of natives. In fact, the lower incomes were causing immigrants to move to the edges of cities and even to rural settlements beyond the cities to find cheaper housing.

[53] President's Council on Sustainable Development. 1996. *Population and Consumption Task Force Report.* 1996. Co-Chairs: Dianne Dillon-Ridgley, Co-Chair, Citizen's Network for Sustainable Development and Timothy E. Wirth, Under Secretary for Global Affairs, U.S. Department of State.
[54] Jill H. Wilson and Audrey Singer. October 2011. *Immigrants in 2010 Metropolitan America: A Decade of Change*. Metropolitan Policy Program at Brookings. Available online at http://www.brookings.edu/~/media/research/files/papers/2011/10/13%20immigration%20wilson%20singer/1013_immigration_wilson_singer.pdf.

Nonetheless, it is important to note that the sprawl that occurs because of high immigration levels has nothing to do with the quality of immigrants as people or individuals but everything to do with the quantity of population growth that occurs because of immigration. This can be seen by simply observing that cities with high population growth have high amounts of sprawl, regardless of whether most of the incoming new residents come from another region of the United States or from another continent.

On a local level, the sprawl pressures of population growth are similar regardless of where the new residents originate. But very few Urbanized Areas are likely to be able to subdue population growth and sprawl if the federal government continues policies that add around 20 million people to the nation each decade, all of whom have to settle in some locality. The reality – which can only be mitigated but not eliminated by good planning or Smart Growth – is that these localities all occupy lands that were formerly productive agricultural lands or irreplaceable natural habitats.

Appendix A
Glossary

Central Place – The Census Bureau delineates an urbanized area (UA) as one or more "central places" and the "urban fringe" (the adjacent densely settled surrounding territory) that together contain a minimum of 50,000 residents. A central place functions as the dominant center of each UA. The identification of a UA central place permits the comparison of this dominant center with the remaining territory in the UA. A central place generally is the most densely populated and oldest city in a metropolitan area.

Density – Shorthand for population density, or the number of residents per unit area, usually measured in number of residents per acre or square mile. Density is the mathematical inverse or opposite of land consumption per person (per capita). For example, a density of five persons or residents per acre equals 3,200 per square mile. This in turn equals a per capita land consumption of 0.2 acre per person.

Developed Land – As defined by the U.S. Department of Agriculture's Natural Resources Conservation Service in its National Resources Inventories (NRIs), issued every five years since 1982, built-up or paved land that is at least one-quarter acre in area. Developed land can include built-up areas outside of urbanized areas, towns, or cities. The NRI Developed Land category includes: (a) large tracts of urban and built-up land; (b) small tracts of built-up land less than 10 acres in size; and (c) land outside of these built-up areas that is in a rural transportation corridor (roads, interstates, railroads, and associated rights-of-way).

Foreign Born – Describing a person born in a country other than the United States. Excludes those born abroad to American parents. Can be used as a noun or an adjective.

High-Density – A large number of residents per unit area, usually measured in terms of residents per acre or square mile. While there is no one precise, agreed-upon criterion or threshold of high-density residential development, a density of approximately 5,000 per square mile would be considered relatively high-density.

Holdren Method – Mathematical methodology for determining the percentages of Overall Sprawl attributable to Per Capita Sprawl and Population-driven Sprawl, in other words, to increasing per capita land consumption (decreasing population density) and to population growth.

Hop – a connection from one urban area core to other qualifying urban territory along a road connection of half a mile (0.5 mile) or less in length; multiple hops may be made along any given road corridor. This criterion recognizes that alternating patterns of residential development and non-residential development are a typical feature of urban landscapes.

Immigration – Permanent movement (i.e., settlement) of a foreign-born person to the United States either with permission from U.S. authorities (legal immigration) or without such permission (illegal immigration).

Immigrant Fertility – Fertility of foreign-born immigrants to the United States, usually expressed in terms of the Total Fertility Rate (TFR) of women, which is the average total number of children born to women of a defined group during the course of their reproductive years.

Jump – a connection from one urban area core to other qualifying urban territory along a road connection between 0.5 mile and 2.5 miles in length; only one jump may be made along any given road connection.

Low-Density – Relatively low population density, or low number of residents per unit area (acre or square mile). Urban / suburban densities of 1,000-2,000 per square mile would be considered low-density, though still enough to qualify as urban.

Native Born – A person born in the United States.

Natural Habitat – That portion of rural or undeveloped land that consists of upland and bottomland forests, woodlands, savanna, scrub-shrub, natural grasslands or prairie, wetlands (marshes, swamps, bogs), ponds, watercourses, deserts, alpine meadow and tundra. Natural habitats support wildlife and provide other ecosystem services. They may be in public or private ownership.

New Urbanism – A movement that sees urban centers as potentially vibrant communities that can mix and harmonize residential and commercial uses in clever and innovative ways to make cities satisfying and safe places to live and work. New urbanism supports such concepts as higher density in urban cores, mixed uses, mass transit, close proximity of dwellings to workplace, walkable communities, bicycle lanes, community gardens, and others. New urbanism sees relentless sprawl in America as one consequence of the abandonment of our central cities.

Per Capita Land Consumption – Average amount of land used by each resident of an urbanized area or developed area. Includes not just residential land but all developed land used by urban residents, including commercial, institutional, small park, transportation (e.g., streets, roads, railroads, freeways, parking lots), and industrial land uses.

Open Space – Land lacking significant built structures or pavement. Includes rural and undeveloped lands and natural habitat outside of urban boundaries; also includes larger natural areas, parks and green space within urban areas, such as golf courses and extensive lawns or gardens. Yards or wooded lots on quarter-acre lots in residential areas would not qualify as open space.

Overall Sprawl – See "sprawl" below. Overall sprawl is the sum of Per Capita Sprawl and Population-driven sprawl [the total amount of open space converted to development over a period of time].

Per Capita Sprawl – Sprawl that is driven by increase in per capita land consumption, that is, land consumption per resident, of an urbanized area, developed area, city or town; Per Capita

Sprawl is measured in terms the increase in acres or square miles of developed or urbanized acres of land per person. Per Capita Sprawl and population-driven sprawl add up to 100 percent of Overall Sprawl.

Population-driven Sprawl – Sprawl that is driven by increase in the population of an urbanized or developed area. Population-driven and Per Capita Sprawl add up to 100 percent.

Population Growth – Increase in the number of residents of a given area, such as a town, city, urbanized area, state, or country over time. Population growth is equal to the total births of native-born residents minus the total deaths of native-born residents minus the emigration of native-born residents PLUS total immigration of the foreign born plus births to the foreign born minus deaths of the foreign born minus emigration of the foreign born (i.e., return to the country of their birth or a third country). In recent decades, annual population growth in the United States as a whole has been running about 2.5 million to 3 million per year on average, or roughly 30 million per decade.

Rural Land – Undeveloped lands outside of urban areas, including farmland, pastureland, rangeland, and natural or semi-natural habitats, like forests, woodlands, wetlands, grasslands or prairie, and deserts. Rural lands may be flat or mountainous, and publicly or privately owned.

Smart Growth – The use of a variety of land-use, planning, statutory, regulatory, taxing, and other tools by federal and state governments and local jurisdictions (municipalities) to reduce haphazard, low-density, and poorly planned development in a given region.

Smart Growth Movement – A loose, eclectic coalition of environmentalists, local growth-control activists, New Urbanists, municipal and regional planners, think-tanks, the federal government and many state governments, and even some home-builders united by their interest in slowing the rate of sprawl, and making existing communities more sustainable and livable.

Sprawl – As defined in this study, the increase in the physical area of a town or city over time – outward expansion – as undeveloped or rural land at its periphery is permanently converted to developed or urbanized land as population and/or per capita land consumption grow. More specifically, in this study, sprawl is 1) the increase in the area of the Census Bureau's Urbanized Areas, as delineated every 10 years in the decadal censuses, and/or 2) the increase in the area of a state's area of Developed Land, as determined by the Natural Resources Conservation Service.

Suburbs – Residential or commercial zones on the outskirts of a central city or town; generally corresponds to "urban fringe." Tend to have a lower population density than the central place or urban core, though not always, as when downtown districts are dominated by office, institutional, and commercial zones.

Urban Core – Used in this report as another description for "central location" as defined by the Census Bureau. The urban core is the entire city that anchors a metropolitan area, and usually is at its center. It generally is the oldest, most densely populated and most built-up portion of an urbanized area.

Urban Fringe – Built-up areas near the edge of an urbanized area, generally with lower population density than the urban core; generally corresponds to the inner and outer suburbs of a town or city.

Urban Sprawl – See "sprawl."

Urbanized Area – As defined by the U.S. Census Bureau, an area of contiguous census blocks or block groups with a population of at least 50,000 and an average population density of at least 1,000 residents per square mile.

Appendix B
Calculating Per Capita Land Consumption

The per person land consumption in each state or Urbanized Area can be expressed as:

(1) $a = A / P$

where:

a = area of developed or urbanized land area for the average resident
A = Area of total developed or urbanized land in a state
P = Population of that state

For example, in 2010 Oregon had 3,831,074 residents and approximately 1,407,600 developed acres. Thus, per capita developed land use for all purposes was around 0.367 acre (between one-third and four-tenths of an acre) per resident.

The land used per person is the total developed land area divided by the total number of people. This is the inverse of population density, which is the number of people per unit area of land. When per capita land consumption goes up, density goes down; when per capita land consumption goes down, density goes up.

The developed land area of any given state can be expressed as:

(2) $A = P \times a$

This can be stated as: the total developed area in square miles (or acres) of a state can be simply expressed or "factored" into the product of the Population of the state (*viz*., *P*) multiplied by the per capita urban land consumption (*viz*., a). This second equation (2) is the basis for attributing or apportioning the shares of sprawl (viz. growth in *A*) back onto two contributing factors, the growth in *P* and the growth in *a*.

Appendix C
Apportioning Shares of Overall Sprawl Between Population Growth and Per Capita Sprawl

A methodology for quantifying the respective contributions of population growth and changes in per capita consumption of any type of resource use was outlined in a 1991 paper by physicist John Holdren ("Population and the Energy Problem." *Population and Environment*, Vol. 12, No. 3, Spring 1991). Although Dr. Holdren's 1991 paper dealt specifically with the role of population growth in propelling the increase in U.S. energy consumption, the same methodology can also be applied to many types of population and resource consumption analyses.

In the case of sprawl, the resource under consideration is rural land, namely the expansion over time in the total acreage of rural land urbanized or converted into developed land and subsequently used for urban purposes, such as for housing, commerce, retail, office space, education, light and heavy industry, transportation, and so forth.

As stated in **Appendix B**, the total land area developed in a city (urbanized area) or state can be expressed as:

(1) $A = P \times a$

Where*:*

A = Area of total are (in acres or square miles) of development in city or state
P = Population of that city or state
a = area of city or state used by the average resident (per capita land use)

Following the logic in Holdren's paper, if over a period of time Δt (e.g., a year or a decade), the population grows by an increment ΔP and the per capita land use changes by Δa, the total urbanized land area grows by ΔA, expressed as:

(2) $A + \Delta A = (P + \Delta P) \times (a + \Delta a)$

Subtracting eqn. (1) from eqn. (2) and dividing through by A to compute the relative change (i.e., $\Delta A/A$) in urbanized land area over time interval Δt yields:

(3) $\Delta A/A = \Delta P/P + \Delta a/a + (\Delta P/P) \times (\Delta a/a)$

Now equation (3) is quite general and makes no assumption about the growth model or time interval. On a year-to-year basis, the percentage increments in P and a are small (i.e., single digit percentages), so the second order term in equation (3) can be ignored. Hence following the Holdren paradigm, eqn. (3) states that the percentage growth in urbanized land area (viz., 100 percent x $\Delta A/A$) is the sum of the percentage growth in the population (100

percent x $\Delta P/P$) plus the percentage growth in the per capita land use (100 percent x $\Delta a/a$). Stated in words, equation (3) becomes:

(4) *Overall percentage land area growth = Overall percentage population growth + Overall percentage per capita growth*

In essence, the Holdren methodology quantifies population growth's share of total land consumption (sprawl) by finding the ratio of the overall percentage change in population over a period of time to the overall percentage change in land area consumed for the same period. This can be expressed as:

$$\text{(5)} \quad \textit{Population share of growth} = \frac{\textit{(Overall percentage population growth)}}{\textit{(Overall percentage land area growth)}}$$

The same form applies for per capita land use:

$$\text{(6)} \quad \textit{Per capita land use share of growth} = \frac{\textit{(Overall \% per capita land use growth)}}{\textit{(Overall \% land area growth)}}$$

The above two equations follow the relationship based on Prof. Holdren's equation (5) in his 1991 paper. A common growth model follows the form (say for population):

$$\text{(7)} \quad P(t) = P_0(1 + g_p)t$$

Where $P(t)$ is population at time t, P_0 is the initial population and g_p the growth rate over the interval. Solving for g_p the growth rate yields:

$$\text{(8)} \quad \ln(1 + g_p) = (1/t) \ln(P(t)/P_0)$$

Since $\ln(1 + x)$ approximately equals x for small values of x, equation (8) can be written as:

$$\text{(9)} \quad g_p = (1/t) \ln(P(t)/P_0)$$

The same form of derivation of growth rates can be written for land area (A) and per capita land use (a)

$$\text{(10)} \quad g_A = (1/t) \ln(A(t)/A_0)$$

$$\text{(11)} \quad g_a = (1/t) \ln(a(t)/a_0)$$

These three equations for the growth rates allow the result of equation (4) to be restated as:

$$\text{(12)} \quad gP + g_a = g_A$$

Substituting the formulae (equations 9 through 11) for the growth rates and relating the initial and final values of the variables P, a and A over the period of interest into equation (12), the actual calculational relationship becomes:

(13) ln (*final population / initial population*) + ln (*final per capita land area / initial per capita land area*) = ln (*final total land area / initial total land area*)

In other words, the natural logarithm (ln) of the ratio of the final to initial population, plus the logarithm of the ratio of the final to initial per capita land area (i.e., land consumption per resident), equals the logarithm of the final to the initial total land area.

In the case of Florida from 1982 to 2010, this formula would appear as:

(14) ln (*18,801,310 residents / 10,471,407residents*) + ln (*0.29127acre per resident / 0.26826 acre per resident*) =ln (*5,476,300 acres / 2,809,100 acres*)

Computing the ratios yields:

(15) ln (1.79549) + ln (1.08577) = ln (1.94949)

0.58528 + 0.08229 = 0.66757

Then applying equations (5) and (6), the percentage contributions of population growth and per capita land area growth are obtained by dividing (i.e., normalizing to 100 percent) each side by 0.05018:

(16) $\frac{0.58528}{0.66757} + \frac{0.08229}{0.66757} = \frac{0.66757}{0.66757}$

Performing these divisions yields:

(17) 0.88 + 0.12 = 1.0

Thus, we note that in the case of the Florida from 1982 to 2010, the share of sprawl due to population growth was 88 percent [100 percent x (0.58528 / 0.66757)], while declining density (i.e., an increase in land area per capita) accounted for 12 percent [100 percent x (0.08229/ 0.66757)]. Note that the sum of both percentages equals 100 percent.

Appendix D
Anomalies – Urbanized Areas with populations that grew but areas that supposedly shrank

From 2000 to 2010 Panama City and Titusville both gained population, while at the same time losing overall urban area, according to the Census Bureau's decadal inventories of Urbanized Land.

In each of these areas, the reduction in developed urban land was likely on paper only, the result of changes in assumptions and calculations by the federal government. Although it is possible for an Urbanized Area to reduce its amount of actual developed land by returning large swaths of previously developed acreage to a natural, semi-natural, feral, or agricultural condition (as has happened in the case of Detroit, Michigan), that was not the case with these two Urbanized Areas that the government shows as having shrunk in land area over the last decade.

The cause for these anomalies can be traced to changes in the delineation criteria for the 2010 Census from the 2000 Census. The most notable of these changes is the use of census tracts rather than block groups for establishing initial urban cores. One consequence of these changes was for initial urban cores to decrease in territory for the 2010 Census from the 2000 Census.

Source:

Christopher J. Henrie. U.S. Census Bureau, Geography Division, Geographic Standards and Criteria. "Urban Area Data Anomalies." Email message to Brian S. Schoepfer, NumbersUSA. 5 June 2013.

Census Tracts, Blocks, and Block Groups

A **census tract** is a geographic area defined for the purpose of taking a census. Usually census tract boundaries coincide with the limits of cities, towns, or other municipalities. Several tracts typically exist within a single county. However, in unincorporated census tract boundaries are often arbitrary, except for coinciding with political lines.

Census tracts are divided into **block groups** and these are further subdivided into **census blocks**. According to the Census Bureau, tracts are "designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions." On average, about 4,000 inhabitants live in a census tract.

While censuses are conducted the world over, and have been carried out for centuries, the concept of the census tract was developed in the United States, where it was first applied in the 1910 decadal census.

A **census block** is the smallest geographic unit used by the Census Bureau for tabulation of 100-percent data (data collected from all houses, rather than a sample of houses). Several blocks comprise a **block group**. There are on average about 39 blocks per block group, but this varies. Blocks typically have a four-digit number, where the first digit indicates which block group the block is in. For example, census block 3019 would be in block group 3. There are about 8,200,000 blocks in the U.S.

Block boundaries are typically streets, roads or creeks. The size of census block populations varies considerably. There are about 2,700,000 blocks with zero inhabitants, while a block that is entirely occupied by an apartment complex might have several hundred inhabitants.

Appendix E
State and National Ranking of Florida Urbanized Areas by total Sprawl, 2000-2010

Table E-1. Alphabetical List of all 30 Florida's Census Bureau's Urbanized Areas, Their Sprawl 2000-2010, and Shares Apportioned between Population Growth and Per Capita Sprawl

Urbanized Area	Total Sprawl (square miles), 2000-2010	National/ State Sprawl Ranking* (No. 1 is worst)	% of Total Sprawl Related to POPULATION GROWTH	% of Total Sprawl Related to GROWTH IN PER CAPITA LAND CONSUMPTION
Bonita Springs	36.8	96 / 10	100%	0%
Cape Coral	138.5	16 / 3	87%	13%
Deltona	6.9	325 / 25	100%	0%
Fort Walton Beach–Navarre–Wright	24.0	144 / 15	100%	0%
Gainesville	9.6	271 / 24	100%	0%
Homosassa Springs–Beverly Hills–Citrus Springs**	N/A	N/A	N/A	N/A
Jacksonville	119.8	24 / 5	74%	26%
Kissimmee	53.5	69 / 8	100%	0%
Lady Lake–The Villages	21.1	167 / 18	100%	0%
Lakeland	25.4	136 / 14	100%	0%
Leesburg–Eustis–Tavares	23.4	151 / 16	100%	0%
Miami (including Ft. Lauderdale, etc.)	122.5	22 / 4	100%	0%
North Port–Port Charlotte	29.6	118 / 13	100%	0%
Ocala	23.1	155 / 17	100%	0%

Urbanized Area	Total Sprawl (square miles), 2000-2010	National/ State Sprawl Ranking* (No. 1 is worst)	% of Total Sprawl Related to POPULATION GROWTH	% of Total Sprawl Related to GROWTH IN PER CAPITA LAND CONSUMPTION
Orlando	144.5	15 / 2	96%	4%
Palm Bay–Melbourne	12.2	240 / 22	100%	0%
Palm Coast–Daytona Beach–Port Orange	65.8	50 / 6	68%	32%
Panama City	**-9.8**	*	N/A	N/A
Pensacola	13.3	226 / 20	84%	16%
Port St. Lucie	39.1	91 / 9	100%	0%
Sarasota–Bradenton	56.3	63 / 7	74%	26%
Sebastian–Vero Beach South–Florida Ridge	15.2	204 / 19	100%	0%
Sebring–Avon Park	11.7	249 / 23	100%	0%
Spring Hill	31.3	107 / 11	100%	0%
St. Augustine	8.4	292 / 26	100%	0%
Tallahassee	12.6	234 / 21	100%	0%
Tampa–St. Petersburg	154.7	13 / 1	96%	4%
Titusville	**-1.5**	*	N/A	N/A
Winter Haven	30.2	114 / 12	100%	0%
Zephyrhills	2.3	410 / 27	100%	0%

* These cities are not ranked because the Census Bureau reports they had no sprawl in the decade. In fact, they are shown as having less developed land in 2010 than in 2000. While it is possible for an Urbanized Area to reduce its developed land by converting large swaths of previously developed acreage to a natural state, the reduction shown in most of the Urbanized Areas was on paper only, the result of changes in calculations by the government.

**No comparable data for Census 2000

Source: U.S. Census Bureau, http://www.census.gov/geo/reference/ua/urban-rural-2010.html

Appendix F
Executive Summary of the 2000 Florida Sprawl Study:
Overpopulation = Sprawl in Florida

KEY OVERALL FINDINGS

- Florida's phenomenal population growth has been the No. 1 factor in the state's urban sprawl.
- The supposedly gluttonous appetite of Florida's citizens for more and more urban space per resident has in fact played little role in the sprawl. In most Urbanized Areas, the amount of land per resident did not grow at all and, thus, growth in per capita consumption was not a factor in any of the sprawl in those cities.
- The volatile growth of Florida's population far outweighed the sprawl effect of all other factors combined.
- To effectively bring relief to Floridians, anti-sprawl efforts must try to limit population growth while continuing to try to limit the many factors that increase the per capita urban land consumption – factors such as public decisions about zoning, land-use planning and transportation, and the choices made by developers and consumers.

[The period of study was the most recent two decades for which comprehensive government data are available (1970-90).]

THE REASON FOR THIS STUDY

Florida's urban areas sprawled out over an additional 1,600 square miles (one million acres) of formerly rural land of natural habitats, farmland and scenic open spaces during the two decades that were examined by this study. A major movement of governmental agencies, public officials, think tanks, corporations and advocacy groups is devoting more and more resources to taming Florida's relentless urban sprawl.

To be effective, anti-sprawl efforts must target the factors that are most responsible for the encroachment on the rural land. The relative contributions of the factors must be understood if anti-sprawl resources are to be used efficiently and effectively. This study quantifies those relative contributions.

The authors embarked upon this study after a literature search found that media stories, advocacy programs, governmental reports and political statements about sprawl rarely consider population growth as a factor that could be modified to reduce sprawl. This seemed surprising in light of Florida's population nearly doubling during the period of study – from 6.8 million to 12.9 million. The half-century view is even more startling; the state's human inhabitants have expanded from around 2.8 million in 1950 to 16 million in 2000.

WHAT WAS MEASURED

Sprawl can be measured qualitatively and quantitatively. This study looks exclusively at the quantitative measure of the amount of sprawl – the actual square miles of rural land that are converted to urban use as cities and suburbs expand beyond their boundaries. (We call this "Overall Sprawl.")

To determine how that has happened, the authors solely relied on the U.S. Bureau of Census's painstaking calculations for each Urbanized Area (which must have a minimum of 50,000 residents). This is done only once a decade, a couple of years after the national census. Nearly every organization that addresses sprawl relies on these data. What they haven't done is use those same data to quantify the relative roles of major growth factors.

'PER CAPITA SPRAWL' ALONE CANNOT EXPLAIN OVERALL SPRAWL

The study first checked to see if the data support the apparent assumption of most anti-sprawl efforts that per capita consumption factors are responsible for all or most sprawl.

The effect of all urban planning, development, transportation, business and consumer decisions that affect consumption shows up in the figure that tells us how much urban land is used on average for each resident. If that amount of land (about one-quarter to one-half acre per current resident in most Florida cities) grows, a city has "Per Capita Sprawl." A city can have no population growth at all, and still have considerable Overall Sprawl if the amount of land per resident is growing.

If Per Capita Sprawl were the sole factor in Overall Sprawl in Florida, the percentage growth of one would be the same for the other; for example, if per capita land consumption grew by 13%, total land consumption would also grow by 13%. Or if per capita land consumption growth were the overwhelming factor, its percentage growth would at least be close to that of Overall Sprawl.

But when we found these two percentages in Census Bureau data and placed them side by side, we learned:

- Not a single one of Florida's 20 Urbanized Areas had a Per Capita Sprawl percentage that was even close to being as high as the Overall Sprawl percentage. In the Tampa area, for example, Per Capita Sprawl was 13%, but the total land consumption rose by 123%.

- Overall Sprawl in the average older Florida Urbanized Area, for example, was 114% while Per Capita Sprawl was only 9%.

This simple comparison of U.S. Census Bureau data starkly reveals why Smart Growth efforts in Florida are likely to fail to stop sprawl if they focus virtually entirely on factors that cause per capita land consumption growth.

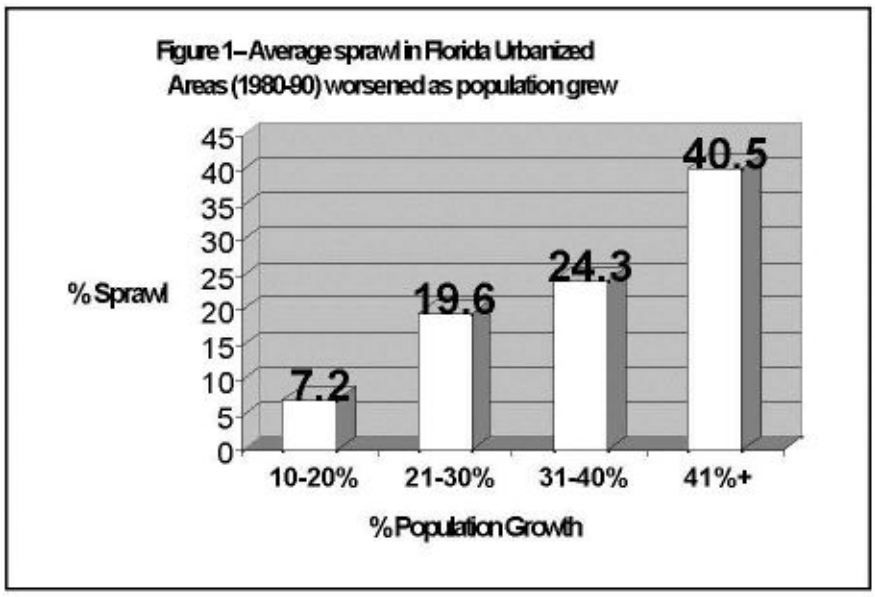
It is not that Smart Growth efforts are focused on the wrong factors but that many of them are focused too narrowly. Obviously, there is another factor involved in sprawl, and that factor is population growth.

COMPARING POPULATION GROWTH
TO PER CAPITA LAND CONSUMPTION GROWTH

When Per Capita Sprawl (which is the net result of all personal, business and governmental consumption decisions) cannot explain all of the total increase in urbanized land, the only other explanation for the rest of that increase has to be "population growth." Despite the considerable complexity of sprawl in an urban area, nearly all of the complexity can be boiled down into what end up being two rather simple factors in an equation: The amount of Overall Sprawl in an area is equal to the change in per capita land consumption times the change in population.

We can learn a lot about the relative importance of each of these two factors in Florida's sprawl by lining up the growth percentages side by side. An observer of these tables doesn't have to be a mathematician to see that population growth has been a far greater factor in Florida's Urbanized Areas than has been per capita land consumption growth.

- Per capita land consumption growth was larger than population growth only in Pensacola (54% vs. 52%).
- The average older Urbanized Area of Florida had 9% growth in per capita land consumption and 100% growth in population.
- The comparison may be more revealing among the average new Urbanized Areas (those which didn't meet Census Bureau criteria until 1980). They had a 10% reduction in per capita land consumption, but had 43% population growth.



COMPARISONS BY CATEGORY OF POPULATION GROWTH LENT CREDENCE TO COMMON SENSE VIEW OF ITS IMPORTANCE

The strong effect of population growth on sprawl could also be found when we clustered all 20 of Florida's Urbanized Areas according to their percentage of population growth during the 1980s. **Figure 1** shows a relationship that many observers would consider to be simple common sense.

In this Florida study – as well as in a study of the 100 largest Urbanized Areas of the United States released in February, 2001– we found that one city with higher population growth will not necessarily have more sprawl than another city with lower population growth. But we found that on average the rate of sprawl rises significantly as the rate of population growth rises.

Average sprawl was 7.2% in cities with 10-20% population growth; average sprawl was nearly six times higher (40.5%) in the cities in the highest population category.

APPORTIONING RELATIVE CONTRIBUTIONS OF EACH FACTOR TO OVERALL SPRAWL

With percentages for the two growth factors available, it is possible to look at their ratio to each other to get an idea of their relative contribution to Overall Sprawl. We used a standard method of calculating those ratios.

- In 19 of the 28 Urbanized Areas of the state, growth in per capita land consumption did not appear to be related to *any* of the sprawl – because there *was* no growth in consumption by the average resident.

- Despite stopping all *per capita* sprawl, though, those 19 still suffered major *overall* sprawl.

The results were striking:

- Population growth was related to 85% of the sprawl in the average older Florida Urbanized Area, and to 99.7% of the sprawl in the average new Urbanized Area.

- Increased per capita land consumption, on the other hand, was related to 15% of sprawl in the average older area and 0.3% of the sprawl in the average new area.

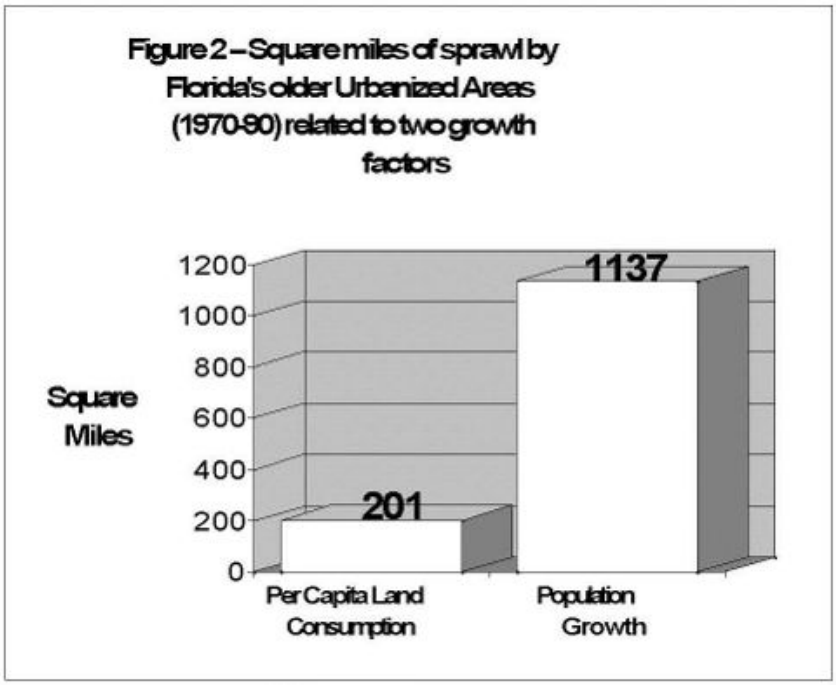


Figure 2 considers the 1,338 square miles of sprawl in those nine older Urbanized Areas between 1970 and 1990. When the proportions of 15% and 85% for the average city are applied to that sprawl, it suggests that 201 square miles of lost rural land was explained by increases in per capita land consumption and that 1,137 square miles of lost rural land was explained by population growth.

IMPLICATIONS

These findings suggest that those who would stop sprawl in Florida will need to address three levels of government: (a) local incentives that entice more people to move into particular cities, (b) state policies that attract residents from other states, and (c) federal policies that add population to Florida and the nation as a whole.

Although per capita land consumption growth has played very little role in driving sprawl in Florida, it would be a mistake to suggest that efforts to stop such growth or to reduce per capita land consumption are misplaced. For example, because the Ft. Lauderdale area's population grew by 102%, the Urbanized Area would have sprawled by 102% if per capita land consumption had stayed exactly the same. But the area actually sprawled by considerably less (54%). Why? Because land consumption for the average resident was reduced sharply by 24%. Whether residents of Ft. Lauderdale thought the quality of their lives was improved or deteriorated from living so much more densely is a question for another study. But decreasing the living, working and traveling space for each resident definitely reduced the amount of Overall Sprawl.

Of course, it is theoretically possible for a while to have strong population growth and no sprawl by forcing all new and old residents to remain within the confines of current urban land boundaries. Nothing

in the state's history, however, suggests the ability or willingness to do this even for one year, let alone in perpetuity. While the majority of Florida's Urbanized Areas did pack more residents into the average square mile, that extra density didn't come close to handling the additional residents that were being added at the same time.

According to the Census Bureau, current immigration, fertility and domestic migration trends will drive Florida's population to 20.7 million residents by 2025, with no peak in sight. Nothing that has occurred in Florida's cities thus far suggests that sprawl will not continue its march across the state's ever-more beleaguered rural and open spaces. In the process, the state's environment and quality of life for residents will pay an ever-higher price for the government's unwillingness to allow the population to stabilize.

These population policies, phenomena and trends – as has been shown by this study – are central to understanding the future of sprawl in Florida. Studies and plans from state commissions, think tanks, universities and advocacy groups that purport to offer blueprints for combating sprawl without dealing with population growth look either naïve, foolish or deceptive in light of the findings of this study.

This study builds on work done in another study, "Sprawl in California," presented in August of 2000 at a conference at the University of Southern California, and on a study of the 100 largest U.S. Urbanized Areas released in February, 2001.

Appendix G
Additional Findings of Our Previous Florida Sprawl Study in 2000

As noted in **Appendix F**, our earlier study on sprawl in Florida was called *Overpopulation = Sprawl in Florida*.[55] This study was initially distributed during Florida Overpopulation Awareness Week in 2000 and reprinted in 2001. Its key findings were as follows:

- Florida's phenomenal population growth has been the No. 1 factor in the state's urban sprawl.
- The supposedly gluttonous appetite of Florida's citizens for more and more urban space per resident in fact played little role in this sprawl. In most Urbanized Areas, the amount of land per resident did not grow at all and, thus, growth in per capita consumption was not a factor in any of the sprawl in those cities.
- The volatile growth of Florida's population far outweighed the sprawl effect of all other factors combined.
- To effectively bring relief to Floridians, anti-sprawl efforts must try to limit population growth while continuing to try to limit the many factors that increase the per capita urban land consumption – factors such as public decisions about zoning, land-use planning and transportation, and the choices made by developers and consumers.
- Florida's urban areas sprawled out over an additional 1,600 square miles (one million acres) of formerly rural land of natural habitats, farmland and scenic open spaces during the two decades (1970-1990) that were examined by the study.

When comparing the rates of growth in population and in per capita land consumption, the study found that about 85% of the sprawl in the average older Urbanized Area (those that were designated UAs before 1980) was related to population growth.

Most of Florida's cities had stopped the trend of increasing per capita urban land use (declining density). But Per Capita Sprawl continued to be a factor in 15 percent of Overall Sprawl in the nine older Urbanized Areas. In the average of the 11 other cities – the ones first declared Urbanized Areas in 1980 – Per Capita Sprawl was found to have been a factor in only 0.3% of the Overall Sprawl. Population growth was related to 99.7% of the Overall Sprawl. In the majority of Florida's 20 Urbanized Areas, population growth was the only sprawl-inducing factor.

Here we reproduce some of the graphics and tables from the 2000 Florida sprawl study. **Figure 3** quantifies how average sprawl was worse in those Florida Urbanized Areas with

[55] See footnote #1.

faster population growth. Those cities whose populations grew between 10-20 percent from 1980 to 1990 sprawled an average of 7.2 percent during that period. By comparison, those cities whose populations grew 41 percent or more sprawled by 40.5 percent on average during that same period.

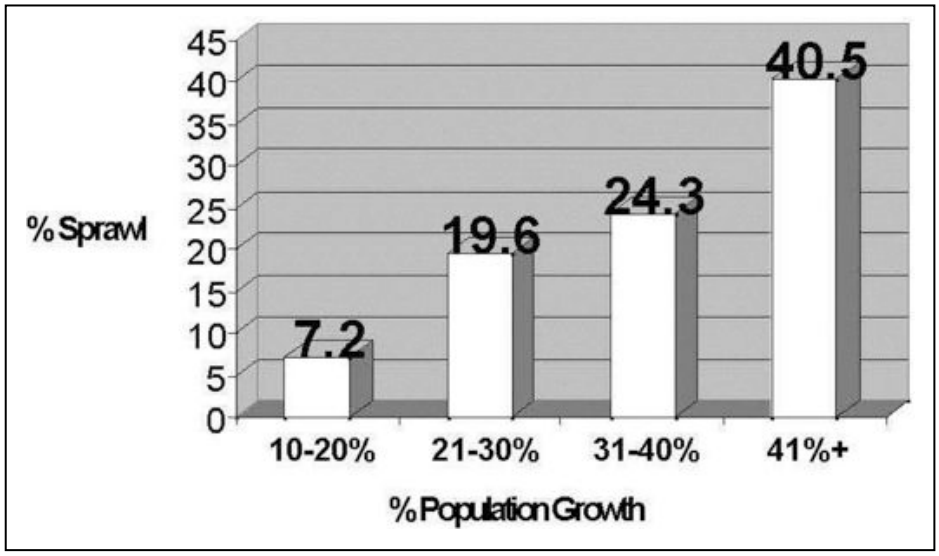


Figure 3. Average sprawl in Florida Urbanized Areas (1980-1990) worsened as population grew

Figure 4 shows the square miles of sprawl due to 1) increasing per capita land consumption and 2) increasing population.

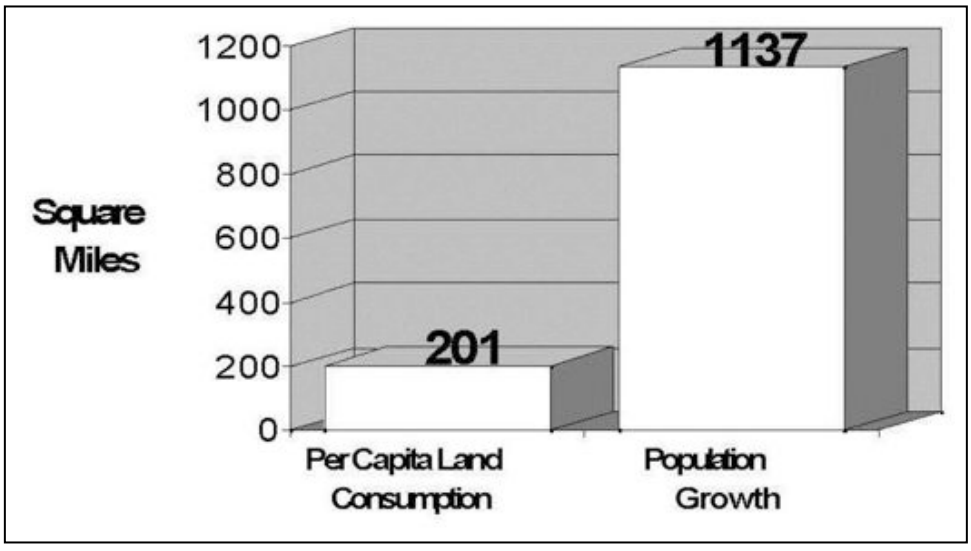


Figure 4. Square miles of sprawl by Florida's older Urbanized Areas (1970-1990) related to two growth factors

During the 1970-1990 time period that our 2000 study covered, a number of towns and cities had just crossed the population threshold to become a designated Urbanized Area by the

Census Bureau. Since these newer UAs were not listed as such in 1970, with their populations and areas unquantified in that year, it was not possible to examine the relationship between population growth and sprawl over the entire two-decade 1970-1990 period, and we had to limit ourselves to the single, more recent 1980-1990 timeframe. Thus, we divided up the UAs in Florida to the "older" or preexisting UAs and the "newer" ones that officially became UAs according to Census in 1980. The following two tables show Overall Sprawl in the older UAs (left) and the newer UAs (right). Of course, the newer UAs were much smaller in both population size and area than the older UAs, which was why the amount of sprawl was so much less in the new areas than the old ones (in addition to just covering one decade, compared to two).

Table 3. Two tables from the 2000 Florida sprawl study

Table 1a – Overall Sprawl in Florida's Older Urbanized Areas (1970 to 1990)*

Urbanized Area	Sprawl (sq. miles)
Ft. Lauderdale - Hollywood-Pompano Beach	114.9
Gainesville	32.2
Jacksonville	156.4
Miami-Hialeah	94.0
Orlando	262.9
Pensacola	88.9
Tallahassee	59.2
Tampa-Saint Petersburg-Clearwater	358.7
W. Palm Beach-Boca Raton-Delray Beach	170.2
Total	**1,337.4**

** The Census Bureau classified these as Urbanized Areas in 1970 or earlier.*

Table 1b – Overall Sprawl in Florida's New Urbanized Areas (1980 to 1990) *

Urbanized Area	Sprawl (sq. miles)
Daytona Beach	22.8
Fort Myers-Cape Coral	29.2
Fort Pierce	44.6
Fort Walton Beach	11.3
Lakeland	18.2
Melbourne-Palm Bay	66.2
Naples	6.9
Ocala	7.3
Panama City	18.5
Sarasota-Bradenton	43.0
Winter Haven	2.1
Total	**270.1**

** These did not meet Census Bureau criteria as Urbanized Areas until 1980.*

As we explain in greater depth later in this study, ultimately two main factors cause cities (urbanized areas) to sprawl: 1) population growth), and/or 2) growth in capita land consumption (lower population density). The following tables summarizing results from our 2000 Florida sprawl study utilize this terminology.

Table 4. Sources of Sprawl in Florida's Older Urbanized Areas from 1970 to 1990

Urbanized Area	% of Total Sprawl related to GROWTH IN PER CAPITA LAND CONSUMPTION was:	% of Total Sprawl related to POPULATION GROWTH was:
Ft. Lauderdale-Hollywood-Pompano Beach	0%	100%
Gainesville	20%	80%
Jacksonville	10%	90%
Miami-Hialeah	0%	100%
Orlando	3%	97%
Pensacola	51%	49%
Tallahassee	37%	63%
Tampa-Saint Petersburg-Clearwater	15%	85%
West Palm Beach-Boca Raton-Delray Beach	0%	100%
Mean of percentages	**15%**	**85%**
Weighted average*	**0%**	**100%**
**Land and population for all cities calculated together.*		

Table 5. Sources of Sprawl in Florida's New Urbanized Areas from 1980 to 1990

Urbanized Area	% of Total Sprawl related to GROWTH IN PER CAPITA LAND CONSUMPTION was:	% of Total Sprawl related to POPULATION GROWTH was:
Daytona Beach	0%	100%
Fort Myers-Cape Coral	0%	100%
Fort Pierce	2%	98%
Fort Walton Beach	0%	100%
Lakeland	0%	100%
Melbourne-Palm Bay	0%	100%
Naples	0%	100%
Ocala	0%	100%
Panama City	0%	100%
Sarasota-Bradenton	0%	100%
Winter Haven	0%	100%
Mean of percentages	**0.3%**	**99.8%**
Weighted average*	**0%**	**100%**
**Land and population for all cities calculated together.*		

From these two tables, it is evident that from 1970 to 1990, population growth accounted for the overwhelming share of sprawl both in Florida's older, larger cities and its newer, rapidly growing ones.

Appendix H
Advisors* to the 2001 study
"Weighing Sprawl Factors in Large U.S. Cities"

Urban Planning Oversight
Earl M. Starnes, *Ph.D., professor emeritus, urban and regional planning,* University of Florida
Eben Fodor, *urban planning consultant, Eugene (OR); author,* Better not Bigger: How to Take Control of Urban Growth and Improve Your Community
Gabor Zovanyi, *Ph.D., professor of urban planning*, Eastern Washington University
Robert Seaman, a*ssociate professor of environmental science,* New England College*; executive committee, American Society of Civil Engineers' Urban and Development Division*
Ruth Steiner, *Ph.D., professor of urban and regional planning,* University of Florida

Statistical Oversight
Alan J. Truelove, *Ph.D., statistician, retired professor,* University of the District of Columbia
B. Meredith Burke (1947-2002), *Ph.D., demographer*
Ben Zuckerman, *Ph.D.*, *professor of physics and astronomy,* UCLA*; member, UCLA Institute of the Environment*
David Simcox, *director, Migration Demographics*
Dick Schneider, *chair, Sierra Club Northern California Regional Sustainability Task Force*
Leon Bouvier (1922-2011), *Ph.D., demographer,* Old Dominion University (VA)
Mark C. Thies, *Ph.D., P.E., professor of chemical engineering,* Clemson University
Marshall Cohen, *Ph.D., professor emeritus of astronomy*, California Institute of Technology
Paul Nachman, *Ph.D., physicist*
Scott Briles, *Ph.D., engineer,* Los Alamos National Laboratory, University of California
Steven A. Camarota, *Ph.D., public policy analyst*
William E. Murray, Jr., *Ph.D., physicist*
Michael Mueller, *Ph.D., natural resource economist*

Continued on next page

***** The individuals on this list volunteered to provide advice and guidance to the 2001 Kolankiewicz-Beck sprawl study for NumbersUSA and to have their names listed prominently as Advisors inside the front cover.

The affiliations of the Advisors were listed for identification purposes only, and it was emphasized that the views in the report did not necessarily reflect the views either of the institutions listed alongside them or of all views of the Advisors. Several Advisors helped shape the methodology of the study during the 18 months it lasted, and also assisted with production of interim reports on California and Florida. As the national-level study neared completion, the authors sought the assurance of having many more Advisors with a broad array of expertise to read the results and examine the analysis and methodology. The authors gratefully acknowledged the detailed recommendations, rigorous reviews, and vigorous discussion from and among the Advisors.

Environmental and General Oversight

Albert Bartlett (1923-2013), *Ph.D., professor emeritus of physics,* University of Colorado
Betty B. Davis, *Ph.D.*, *psychologist*
Bill Smith, *Ph.D., dean, College of Global Economics, EarthNet Institute*
Craig Diamond, *adjunct faculty, environmental studies,* Florida State University*; technical advisor to the Sierra Club carrying capacity campaign*
David Pimentel, *Ph.D., professor of ecology and agricultural sciences,* Cornell University
Diana Hull*, Ph.D., behavioral scientist, retired,* Baylor College of Medicine
Edward G. Di Bella, *adjunct faculty,* Grossmont Community College (CA)*; president, Friends of Los Penasquitos Canyon Preserve*
Garrett Hardin (1915-2003), *Ph.D., professor emeritus of human ecology,* University of California, Santa Barbara
George Wolford, *Ph.D., president, EarthNet Institute*
Herbert Berry, *Ph.D., retired associate professor of computer information systems,* Morehead State University (KY)
James G. McDonald, a*ttorney, civil engineer*
Jeffrey Jacobs, *Ph.D.,* National Academy of Sciences
John Bermingham, *former Colorado state senator*
John Rohe, *attorney; board, Conservation News Service*
Linda Thom, *retired government budget analyst, Santa Barbara County (CA)*
Michael Hanauer, *member, Vision 2020, growth management project of Lexington, (MA)*
Ross McCluney, *Ph.D., principal research scientist, Florida Solar Energy Center,* University of Central Florida
Steve Miller, *former Las Vegas councilman, Clark County (NV) Regional Transportation Commissioner*
Stuart Hurlbert, *Ph.D., professor of biology,* San Diego State University
Terry Paulson, *Mayor Pro-tem, Aspen (CO) City Council*
Tom Reitter, *Livermore (CA) City Council*

Appendix I
2015 Florida Poll on Sprawl and Population

Florida Survey of 800 Likely Voters
Conducted February 25-27, 2015
By Pulse Opinion Research

1. About how long have you lived in Florida, less than 10 years, 10 to 30 years, or more than 30 years?

16% Less than 10 years
43% 10 to 30 years
41% More than 30 years
1% Not sure

2. The U.S. Department of Agriculture calculates that Florida over the last 30 years has turned more than four thousand square miles of farmland and natural habitat into housing, shopping malls, streets and other urban development. On balance, has this made Florida a better place to live, a worse place to live or did it not have much effect?

26% This development has made Florida a better place to live
47% A worse place to live
20% It did not have much effect
7% Not sure

3. Has Florida developed too much, too little or about as much as it should??

48% Developed too much
7% Developed too little
38% Developed about as much as it should
7% Not sure

4. Government data shows that the country now has about one-third less cropland for each American than it did 30 years ago. How important is it to protect U.S. farmland from development so the United States is able to produce enough food to completely feed its own population in the future?

72% Very important
20% Somewhat important
4% Not very important
1% Not at all important
3% Not sure

5. Is it important for Florida to keep its remaining farmland in agricultural use or is it okay to leave food production to other states and countries?

87% It is important to keep Florida farmland in agricultural use
8% It is okay to leave food production to other states and countries
5% Not sure

6. Is it unethical to pave over and build on good farmland or is the need for more housing a legitimate reason to pave over and build on farmland?

71% It is unethical to pave over and build on good farmland
14% The need for more housing is a legitimate reason to pave over farmland
15% Not sure

7. From an environmental standpoint how important is it to save Florida's marshes, grasslands, pine scrub and dunes?

70% Very important
22% Somewhat important
5% Not very important
1% Not at all important
3% Not sure

8. How important is it to you that you can fairly easily spend time in natural areas near where you live?

60% Very important
31% Somewhat important
6% Not very important
1% Not at all important
2% Not sure

9. A study of government data found that nearly all of the destruction of Florida's farmland and natural habitat over the last decade was related to Florida's rapid population growth. Would doubling Florida's population again make it better, worse or not much different?

5% Better
75% Worse
14% Not much different
7% Not sure

10. If the population in YOUR AREA were to double, would traffic become much worse or would the government be able to build enough extra transportation capacity to accommodate the extra people?

83% Traffic would become much worse

12% The government would be able to build enough extra transportation capacity to accommodate the extra people
4% Not sure

11. Florida's population is on pace to double again over the next few decades. Would you prefer that Florida's population continue to double in size, that it grow much slower, that it stay about the same size, or that it become smaller?

7% Prefer Florida's population to double
49% Grow much slower
28% Stay about the same
13% Become smaller
3% Not sure

12. Census data show that new immigrants and births to immigrants have been equal to two-thirds of all Florida population growth since the year 2000. Should the federal government reduce annual immigration to slow down Florida's population growth, keep immigration and population growth at the current level, or increase annual immigration and population growth?

64% Reduce immigration to slow down Florida population growth
26% Keep immigration and population growth the same
3% Increase immigration and population growth
7% Not sure

13. Currently the government allows one million legal immigrants each year. How many legal immigrants should the government allow each year -- two million, one million, a half-million, 100,000, or zero?

6% Two million
16% One million
18% Half a million
21% 100,000
24% Zero
15% Not sure

14. If a political candidate supports higher immigration and population growth, would that make you more likely to vote for them, less likely or would it not make much difference?

11% More likely
56% Less likely
26% It wouldn't make much difference
7% Not sure

NOTE: Margin of Sampling Error, +/- 4 percentage points with a 95% level of confidence

Appendix J
2014 National Poll on Sprawl and Population

SPRAWL & POPULATION National Poll

Survey of 1,000 Likely Voters
Conducted April 1-2, 2014
By Pulse Opinion Research
NOTE: Margin of Sampling Error, +/- 3 percentage points with a 95% level of confidence

1* The U.S. Department of Agriculture calculates that over the last decade urban sprawl destroyed millions of acres of farmland and natural habitat equal in size to the entire state of Maryland. If this were to continue, would it be a major problem, somewhat of a problem, not much of a problem or not a problem at all?

42% A major problem
35% Somewhat of a problem
17% Not much of a problem
3% Not a problem at all
4% Not sure

GROUPINGS: 77% A major or somewhat PROBLEM
20% NOT MUCH or at all a problem

2* How important is it to protect farmland from development so the United States is able to produce enough food to completely feed its own population in the future?

71% Very important
21% Somewhat important
6% Not very important
0% Not important at all
2% Not sure

GROUPINGS: 92% Very or somewhat IMPORTANT
6% NOT VERY important

3* How important is it for the United States to have enough farmland to be able to feed people in other countries as well as its own?

26% Very important
46% Somewhat important
19% Not very important
6% Not important at all
2% Not sure

GROUPINGS: 72% Very or somewhat IMPORTANT
25% NOT VERY or at all important

4* Which do you agree with more: That it is unethical to pave over and build on good cropland or that the need for more housing is a legitimate reason to eliminate cropland?

59% It is unethical to pave over and build on good cropland
19% The need for more housing is a legitimate reason to eliminate cropland
22% Not sure

5* The government reports that to make room for growing cities the last three decades, 17 million acres of surrounding woodlands have been cut down. How significant a problem is this loss of natural wildlife habitat?

53% Very significant
32% Somewhat significant
11% Not very significant
1% Not at all significant
3% Not sure

GROUPINGS: 85% Very or somewhat SIGNIFICANT
12% NOT VERY or at all significant

6* Do you feel an emotional or spiritual uplift from time spent in natural areas like woodlands and open grasslands?

70% Yes
18% No
12% Not sure

7* How important is it that you can get to natural areas fairly quickly from where you live?

48% Very important
37% Somewhat important
11% Not very important
2% Not important at all
2% Not sure

GROUPINGS: Very or somewhat IMPORTANT
NOT VERY or at all important

8*A study of government data found that most of the development destruction of farmland and natural habitat over the last decade was related to rapid growth in the United States population. The Census Bureau projects the population is on pace to double this century. Would doubling the population in YOUR area make it better, worse or not much different?

9% Better
60% Worse
24% Not much different
7% Not sure

9* If the population in YOUR AREA were to double, would traffic become much worse or would the government be able to build enough extra transportation capacity to accommodate the extra people?

68% Traffic would become much worse
20% The government would be able to build enough extra transportation capacity to accommodate the extra people
13% Not sure

10* Over the rest of this century, would you prefer that the nation's population continue to double to 600 million, grow by half to 450 million, stay about the same as it is now at just over 300 million, or slowly become smaller?

9% Continue to double to 600 million
26% Grow by half to 450 million
43% Stay about the same at more than 300 million
12% Slowly become smaller
9% Not sure

GROUPINGS: 9% Continue present pace
81% Slow pace of growth by at least half

11* Census data show that since 1972, the size of American families has been at replacement-level. But annual immigration has tripled and is now the cause of nearly all long-term population growth. Does the government need to reduce immigration to slow down population growth, keep immigration the same and allow the population to double this century, or increase immigration to more than double the population?

68% Reduce immigration to slow down population growth
18% Keep immigration the same and allow population to double
4% Increase immigration to more than double the population
10% Not sure

12* Currently the government allows one million legal immigrants each year. How many legal immigrants should the government allow each year – two million, one million, a half-million, 100,000, or zero?

7% Two million
14% One million
23% Half a million
20% 100,000
20% Zero
16% Not sure

GROUPINGS: 21% Keep same level or increase
63% Cut immigration at least in half

Appendix K
Major Findings of our Previous National Sprawl Studies in 2001 and 2003

Our two sprawl studies – conducted more than a decade ago (published in 2001 and 2003) – were titled "Weighing Sprawl Factors in Large U.S. Cities: A report on the nearly equal roles played by population growth and land use choices in the loss of farmland and natural habitat to urbanization"[1] and "Outsmarting Smart Growth: Population Growth, Immigration, and the Problem of Sprawl."[2] They made a number of key findings and conclusions.

The two main findings from the 2001 study on the 100 largest Urbanized Areas in the U.S. were the following:

> **(1) Per Capita Sprawl:** About half the sprawl nationwide appears to be related to the land-use and consumption choices that lead to an increase in the average amount of urban land per resident (**Figure K-1**).
>
> **(2) Population Growth:** The other half of sprawl is related to the increase in the number of residents within those 100 Urbanized Areas.

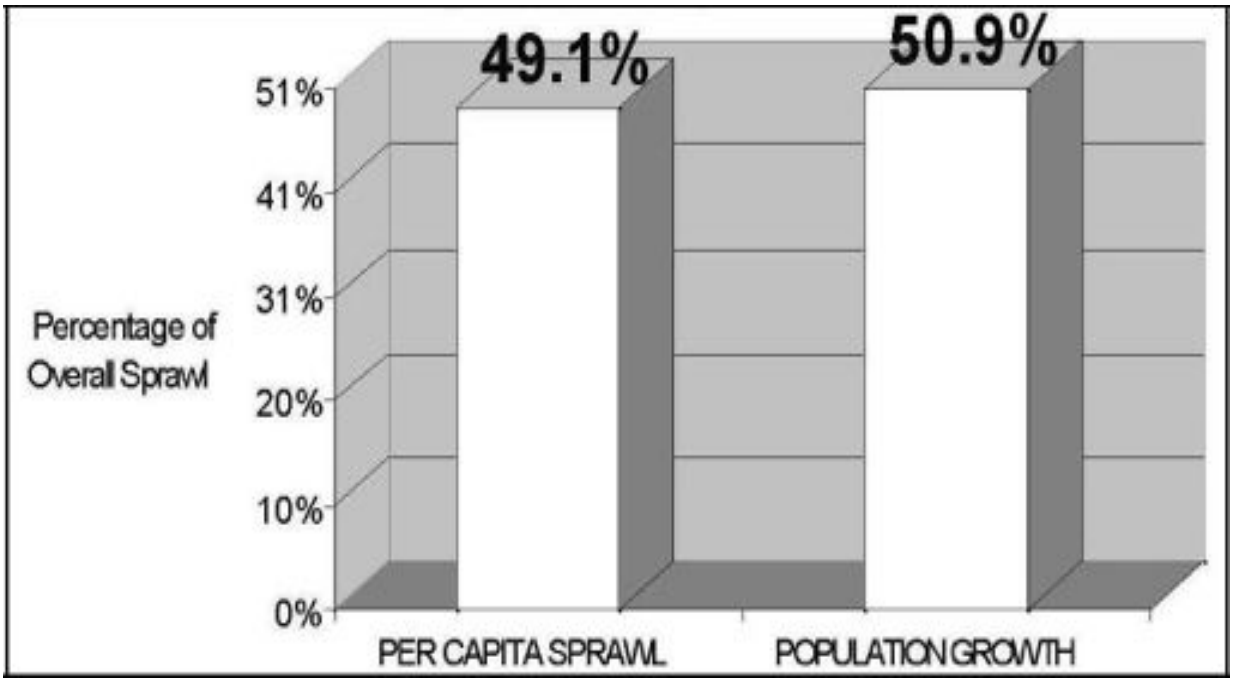
"On average, there are more of us, and each of us is using more urban land, and therein lie the two halves of the problem," wrote the authors in the 2001 study. These findings then led the authors to the following conclusions:

- The toll of urban sprawl on ecosystems, farmland and scenic open spaces cannot be substantially halted unless anti-sprawl efforts include a two-pronged attack using both land-use/consumption tools and population tools.
- Anyone advocating U.S. population stabilization who derides the importance of consumption and planning controls is ignoring half the story of American sprawl.
- Similarly, any Smart Growth advocate who relegates population growth to a side issue is turning a blind eye to half the problem and, thus, approximately half the solution, which is U.S. population stabilization.

[1] Kolankiewicz, L. and R. Beck. 2001. Weighing Sprawl Factors in Large U.S. Cities: A report on the nearly equal roles played by population growth and land use choices in the loss of farmland and natural habitat to urbanization. Analysis of U.S. Bureau of the Census Data on the 100 Largest Urbanized Areas of the United States. March 19. NumbersUSA: Arlington, VA. 64 pp. Available at: https://www.numbersusa.com/content/resources/publications/publications/studies/weighing-sprawl-factors-large-us-cities.html.

[2] Beck, R., L. Kolankiewicz, and S. Camarota. 2003. Outsmarting Smart Growth: Population Growth, Immigration, and the Problem of Sprawl. Washington, DC: Center for Immigration Studies. Center Paper 22. August. 122 pp. Available at: http://www.cis.org/sites/cis.org/files/articles/2003/sprawl.html.

Figure K-1. Sources of Urban Sprawl in 100 Largest Cities, 1970-1990



Source: Kolankiewicz and Beck (2001). Footnote #1.

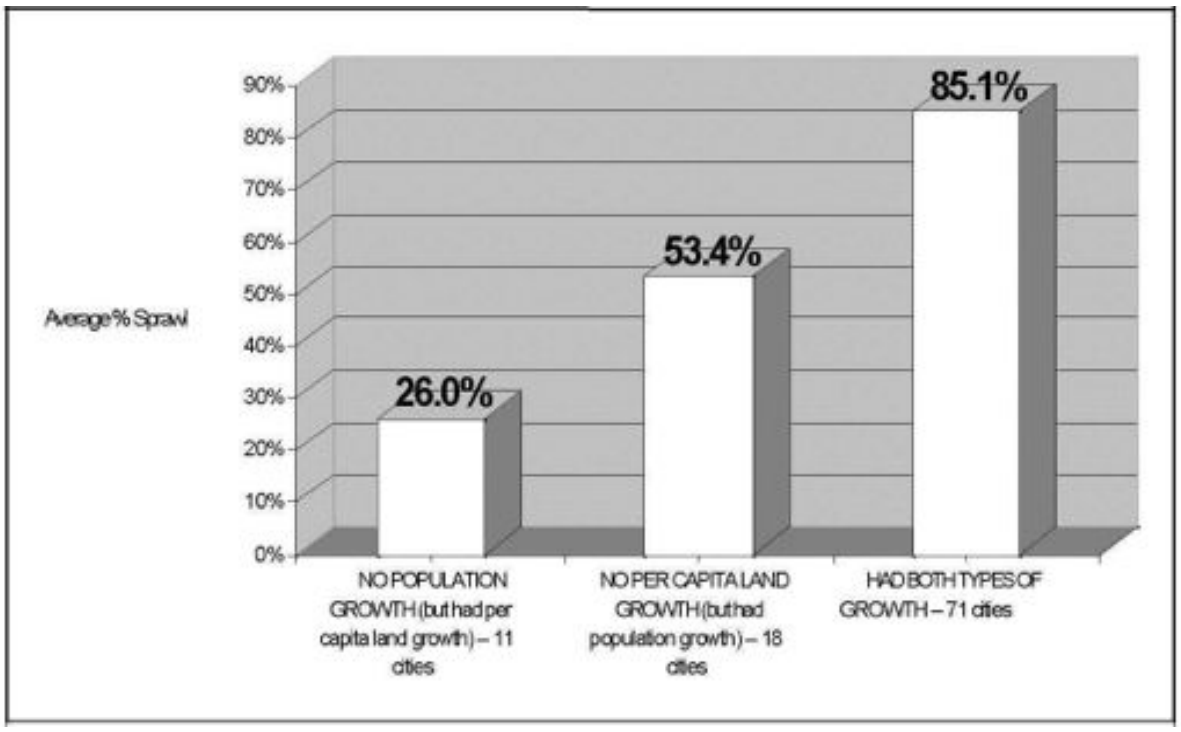
- Although the circumstances of each city are different, the power of both sprawl factors is potentially the same in each. Every city that wishes to restrain its land expansion will need to continually keep in mind the impacts on sprawl of both growth factors. Cities with no recent per capita land consumption growth should not throw away land-use tools, lest Per Capita Sprawl resume. And cities with no recent population growth will still need to be reminded regularly of the role population can play in sprawl, lest they inadvertently create incentives to promote population growth in the future.

- The forces driving overall national population growth cannot be ignored as contributors to sprawl, since national population growth manifests itself as growth in local communities.

The 2001 study concluded that cities with either, 1) no growth in population or, 2) no growth in per capita land consumption, still had sprawl. However, cities that had both types of growth had far higher sprawl (**Figure K-2**).

The main emphasis of the later 2003 study "Outsmarting Smart Growth" was analysis of sample data from the National Resource Conservation Service's NRI that estimated the increase in developed land from 1982-1997. That study reached these findings and conclusions:

Figure K-2. Average Sprawl Rate by Type of Growth, 100 Largest Cities, 1970-1990



Source: Kolankiewicz and Beck (2001). Footnote #1.

- The more a given state's population grew, the more the state sprawled (see **Figure K-3**). For example, states that grew in population by more than 30 percent between 1982 and 1997 sprawled 46% on average. In contrast, states that grew in population by less than 10% sprawled only 26% on average.

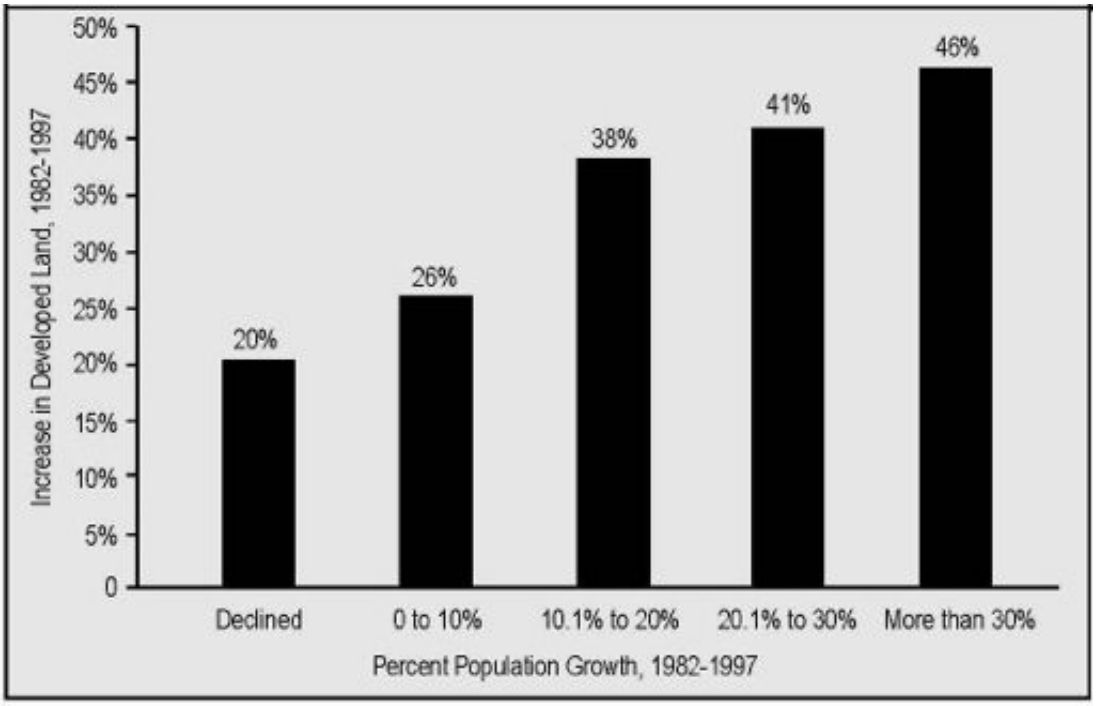
- On average, each 10,000-person increase in a state's population resulted in 1,600 acres of undeveloped rural land being developed, even controlling for other factors such as changes in population density.

- Apportioning the share of sprawl that is due to increases in population versus increases in per-capita land consumption shows that, nationally, population growth accounted for 52 percent of the loss of rural land between 1982 and 1997, while increases in per-capita land consumption accounted for 48 percent.

- While population growth is a key factor driving sprawl, our findings indicate that Smart Growth must also play a significant role in anti-sprawl efforts because per capita land use has been increasing. Between 1982 and 1997, land use per person rose 16 percent from 0.32 acres to 0.37 acres.

- There is significant variation between states in the factors accounting for sprawl. For example, population growth accounted for more than half of sprawl in five of the 10 states that lost the most land, while increases in per-capita land use accounted for more than half of sprawl in the other five worst sprawling states.

Figure K-3. Percentage Increase in Developed Land by State's Percentage Population Growth



Source: Beck, Kolankiewicz and Camarota (2003). Footnote #2.

- An examination of the nation's largest urban areas reveals the same pattern as in the states. Between 1970 and 1990, population growth accounted for slightly more than half of the expansion of urbanized land in the nation's 100 largest cities.

- In the 1990s, new immigration and immigrant fertility accounted for most of the 33-million increase in the U.S. population. Census Bureau data from 2002 indicate that the more than 1.5 million legal and illegal immigrants who settle in the country each year along with 750,000 yearly births to immigrants are equal to 87 percent of the annual increase in the U.S. population.

- Contrary to the common perception, about half the country's immigrants now live in the nation's suburbs. The pull of the suburbs is even greater in the second generation. Of the children of immigrants who have settled down and purchased a home, only 24 percent have done so in the nation's central cities.

- The suburbanization of immigrants and their children is a welcomed sign of integration. But it also means that they contribute to sprawl just like other Americans.

"In short," concluded the 2003 study, "Smart Growth efforts to slow or stop the increase in per capita land use are being negated by population growth. Immigration-driven population growth, in effect, is 'out-smarting' Smart Growth initiatives by forcing continued rural land destruction.

Appendix L
Population Growth and Rank in 48 Contiguous States, 1982-2010 and 2002-2010

Table L-1. Alphabetical List of 48 Contiguous States, their Population Growth from 1982 to 2010, and ranking by aggregate or absolute amount and percentage change

State	Population 1982	Population 2010	Total Population Growth, 1982-2010	Ranking by Total Population Growth	% Population Increase (or change) from 1982 to 2010	Ranking by Percentage Population Increase
Alabama	3,925,266	4,779,736	854,470	24	22%	23
Arizona	2,889,861	6,392,017	3,502,156	6	121%	2
Arkansas	2,294,257	2,915,918	621,661	30	27%	21
California	24,820,009	37,253,956	12,433,947	1	50%	12
Colorado	3,061,564	5,029,196	1,967,632	9	64%	6
Connecticut	3,139,013	3,574,097	435,084	34	14%	36
Delaware	599,148	897,934	298,786	37	50%	13
Florida	**10,471,407**	**18,801,310**	**8,329,903**	**3**	**80%**	**3**
Georgia	5,649,792	9,687,653	4,037,861	4	71%	5
Idaho	973,721	1,567,582	593,861	31	61%	8
Illinois	11,423,412	12,830,632	1,407,220	15	12%	38
Indiana	5,467,922	6,483,802	1,015,880	21	19%	28
Iowa	2,888,189	3,046,355	158,166	42	5%	45
Kansas	2,401,202	2,853,118	451,916	33	19%	27
Kentucky	3,683,445	4,339,367	655,922	29	18%	31

State	Population 1982	Population 2010	Total Population Growth, 1982-2010	Ranking by Total Population Growth	% Population Increase (or change) from 1982 to 2010	Ranking by Percentage Population Increase
Louisiana	4,352,608	4,533,372	180,764	41	4%	46
Maine	1,136,684	1,328,361	191,677	39	17%	33
Maryland	4,282,923	5,773,552	1,490,629	13	35%	19
Massachusetts	5,771,222	6,547,629	776,407	26	13%	37
Michigan	9,115,198	9,883,640	768,442	27	8%	42
Minnesota	4,131,450	5,303,925	1,172,475	18	28%	20
Mississippi	2,556,777	2,967,297	410,520	35	16%	34
Missouri	4,929,451	5,988,927	1,059,476	20	21%	24
Montana	803,986	989,415	185,429	40	23%	22
Nebraska	1,581,780	1,826,341	244,561	38	15%	35
Nevada	881,537	2,700,551	1,819,014	10	206%	1
New Hampshire	947,719	1,316,470	368,751	36	39%	17
New Jersey	7,430,968	8,791,894	1,360,926	16	18%	29
New Mexico	1,363,823	2,059,179	695,356	28	51%	11
New York	17,589,738	19,378,102	1,788,364	11	10%	41
North Carolina	6,019,101	9,535,483	3,516,382	5	58%	9
North Dakota	668,972	672,591	3,619	47	1%	47
Ohio	10,757,087	11,536,504	779,417	25	7%	43
Oklahoma	3,206,123	3,751,351	545,228	32	17%	32
Oregon	2,664,922	3,831,074	1,166,152	19	44%	16

State	Population 1982	Population 2010	Total Population Growth, 1982-2010	Ranking by Total Population Growth	% Population Increase (or change) from 1982 to 2010	Ranking by Percentage Population Increase
Pennsylvania	11,845,146	12,702,379	857,233	23	7%	44
Rhode Island	954,170	1,052,567	98,397	45	10%	40
South Carolina	3,207,614	4,625,364	1,417,750	14	44%	15
South Dakota	690,597	814,180	123,583	43	18%	30
Tennessee	4,646,041	6,346,105	1,700,064	12	37%	18
Texas	15,331,415	25,145,561	9,814,146	2	64%	7
Utah	1,558,314	2,763,885	1,205,571	17	77%	4
Vermont	519,109	625,741	106,632	44	21%	25
Virginia	5,492,783	8,001,024	2,508,241	7	46%	14
Washington	4,276,552	6,724,540	2,447,988	8	57%	10
West Virginia	1,949,604	1,852,994	-96,610	48	**-5%**	48
Wisconsin	4,728,870	5,686,986	958,116	22	20%	26
Wyoming	506,400	563,626	57,226	46	11%	39
Contiguous 48 States	229,586,892	306,073,283	76,486,391	N/A	33%	N/A

Sources: 2010 Census population counts for states* and U.S. Census Bureau estimates for 1982

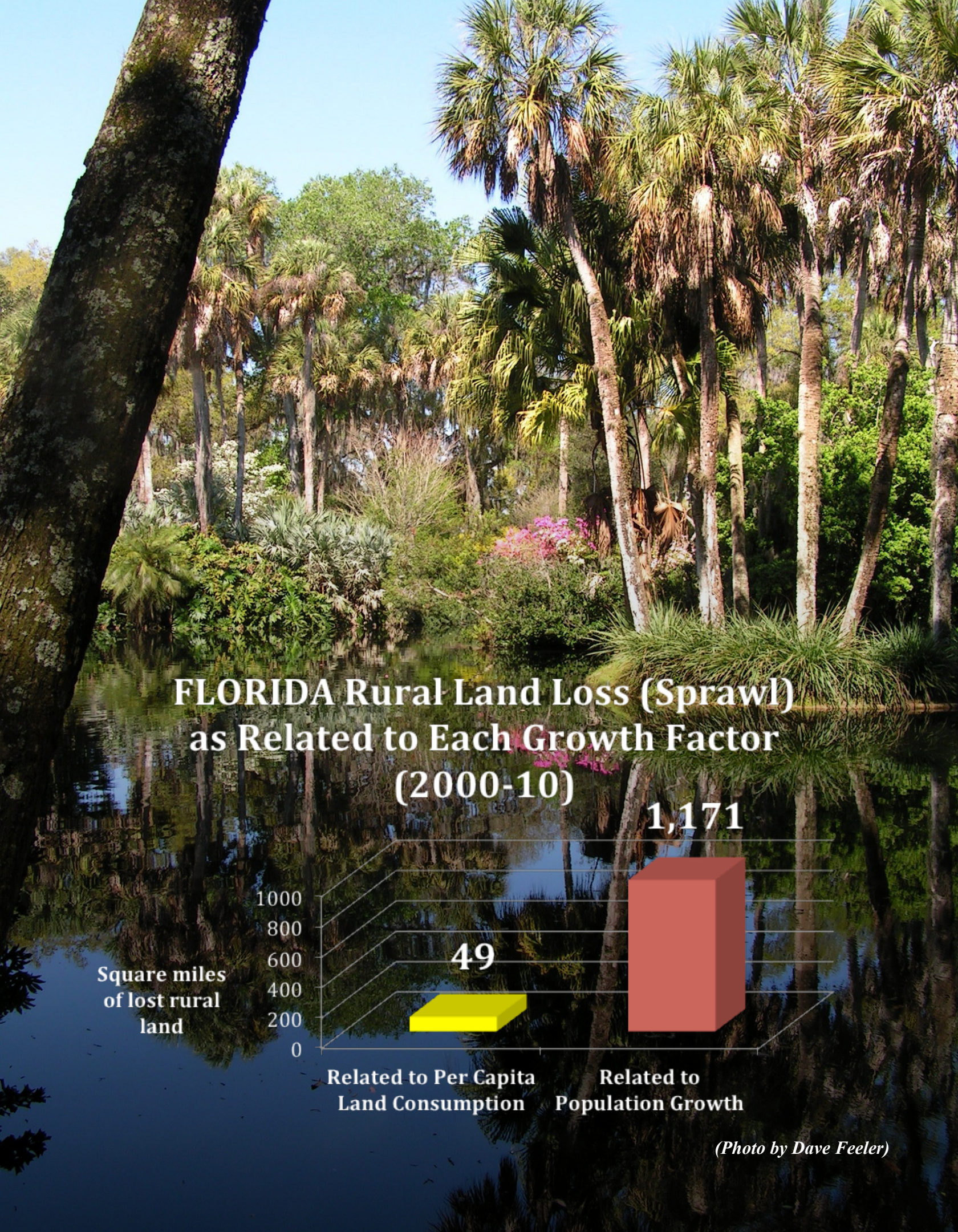
*Mackun, P., S. Wilson, T. Fischetti, and J. Goworowska. 2011. Population Distribution and Change: 2000 to 2010. 2010 Census Briefs. U.S. Census Bureau. Issued March 2011.

Table L-2. Alphabetical List of 48 Contiguous States, their Population Growth from 2002 to 2010, and ranking by aggregate or absolute amount and percentage change

State	Population 2002	Population 2010	Total Population Growth, 2002-2010	Ranking by Total Population Growth	% Population Increase (or change) from 2002 to 2010	Ranking by Percentage Population Increase
Alabama	4,471,006	4,779,736	308,730	19	7%	21
Arizona	5,444,881	6,392,017	947,136	6	17%	3
Arkansas	2,703,310	2,915,918	212,608	28	8%	19
California	34,963,856	37,253,956	2,290,100	2	7%	23
Colorado	4,507,762	5,029,196	521,434	11	12%	11
Connecticut	3,451,867	3,574,097	122,230	31	4%	35
Delaware	804,875	897,934	93,059	37	12%	12
Florida	**16,667,906**	**18,801,310**	**2,133,404**	**3**	**13%**	**8**
Georgia	8,591,169	9,687,653	1,096,484	5	13%	9
Idaho	1,342,103	1,567,582	225,479	27	17%	4
Illinois	12,578,317	12,830,632	252,315	22	2%	41
Indiana	6,151,102	6,483,802	332,700	16	5%	30
Iowa	2,931,084	3,046,355	115,271	34	4%	33
Kansas	2,712,383	2,853,118	140,735	30	5%	31
Kentucky	4,089,032	4,339,367	250,335	23	6%	25
Louisiana	4,465,490	4,533,372	67,882	39	2%	44
Maine	1,294,187	1,328,361	34,174	45	3%	40
Maryland	5,433,822	5,773,552	339,730	15	6%	24
Massachusetts	6,431,788	6,547,629	115,841	33	2%	42

State	Population 2002	Population 2010	Total Population Growth, 2002-2010	Ranking by Total Population Growth	% Population Increase (or change) from 2002 to 2010	Ranking by Percentage Population Increase
Michigan	10,043,737	9,883,640	**-160,097**	48	**-2%**	48
Minnesota	5,020,624	5,303,925	283,301	20	6%	28
Mississippi	2,859,196	2,967,297	108,101	35	4%	34
Missouri	5,676,209	5,988,927	312,718	17	6%	29
Montana	910,282	989,415	79,133	38	9%	18
Nebraska	1,725,545	1,826,341	100,796	36	6%	27
Nevada	2,167,645	2,700,551	532,906	10	25%	1
New Hampshire	1,272,185	1,316,470	44,285	43	3%	36
New Jersey	8,558,327	8,791,894	233,567	26	3%	39
New Mexico	1,850,562	2,059,179	208,617	29	11%	13
New York	19,132,542	19,378,102	245,560	24	1%	45
North Carolina	8,319,293	9,535,483	1,216,190	4	15%	6
North Dakota	633,861	672,591	38,730	44	6%	26
Ohio	11,414,816	11,536,504	121,688	32	1%	46
Oklahoma	3,485,515	3,751,351	265,836	21	8%	20
Oregon	3,521,520	3,831,074	309,554	18	9%	17
Pennsylvania	12,305,751	12,702,379	396,628	14	3%	37
Rhode Island	1,066,888	1,052,567	**-14,321**	47	**-1%**	47
South Carolina	4,104,683	4,625,364	520,681	12	13%	10
South Dakota	761,995	814,180	52,185	42	7%	22

State	Population 2002	Population 2010	Total Population Growth, 2002-2010	Ranking by Total Population Growth	% Population Increase (or change) from 2002 to 2010	Ranking by Percentage Population Increase
Tennessee	5,801,841	6,346,105	544,264	9	9%	16
Texas	21,730,350	25,145,561	3,415,211	1	16%	5
Utah	2,336,872	2,763,885	427,013	13	18%	2
Vermont	615,250	625,741	10,491	46	2%	43
Virginia	7,281,659	8,001,024	719,365	7	10%	15
Washington	6,061,872	6,724,540	662,668	8	11%	14
West Virginia	1,800,090	1,852,994	52,904	41	3%	38
Wisconsin	5,445,115	5,686,986	241,871	25	4%	32
Wyoming	497,204	563,626	66,422	40	13%	7
All 48 States	285,437,369	306,073,283	20,635,914		7%	



(Photo by Dave Feeler)