NPG Negative Population Growth, Inc.

THE *OTHER* SOIL EROSION: LONG-TERM EROSION OF OUR PRODUCTIVE FARMLAND BASE FROM U.S. POPULATION GROWTH

An NPG Forum Paper
by Leon Kolankiewicz

Introduction – Appreciating the Land That Feeds Us

In the new century, sustainable agriculture has become a buzzword of sorts, and fresh, healthy (preferably organic), locally-grown food is an ideal if not a mantra. In the Mid-Atlantic States, for example, the popular retro restaurant chain Silver Diner (with 15 restaurants in Maryland, Virginia and New Jersey) reoriented itself several years ago to emphasize "fresh & local ingredients," mirroring a nation-wide trend that is especially evident among younger consumers.

Tangible (not just rhetorical) support for local agriculture is a welcome development, along with vegetarianism and veganism. All of these bespeak a greater awareness of our fundamental dependence on land, soil, water, and energy for food production and healthy eating, and all reduce our per capita and collective demands on crucial natural resources. The movement to "buy local" reduces energy consumption and carbon dioxide emissions from transporting bulk foodstuffs long (frequently intercontinental) distances, while lessening or eliminating meat consumption cuts down enormously on the amount of land, water, fertilizers, pesticides, and fossil fuels needed to grow the grain fed to billions of cattle, pigs, and chickens. Confined Animal Feeding Operations (CAFOs) or feedlots are notorious polluters of water. And incredibly, on a global scale, raising livestock to feed humans generates even more greenhouse gas emissions than driving cars.[1]

However, in the United States, none of these positive trends has yet to occur at scale, and even if they did, the long-term productive potential of American farmland would continue to erode, and with it, our food security. Ongoing and projected U.S. population growth, driven almost entirely by high immigration rates, and the sprawl these forces engender, are a major reason why.

Figure 1. Guilty as charged – raising livestock to feed meat-eating humans damages land, wildlife habitat, water and even the climate.

Since 1980, the American Farmland Trust (AFT) has worked at "saving the land that sustains us."[2] AFT not only publicized alarming rates of farmland loss but pioneered the use of conservation easements to protect farmland from the clutches of developers. While AFT's and many other farmland conservation efforts are laudable and necessary, over the long term they will come to naught unless Americans are willing to grasp the nettle of immigration-driven population growth. If immigration rates are not lowered substantially, and if the U.S. population is allowed to continue soaring skyward with no end in sight, as projected by the U.S. Census Bureau and other demographers, America's ability to feed herself and continue exporting food to an ever-hungrier planet will be severely compromised.

In a recent NPG Forum Paper, [3] University of Washington geomorphologist and author[4] David R. Montgomery discusses how the march of farming and ranching across the continents since the advent of agriculture, to feed ever-growing human populations, has eroded plant- and crop-nurturing soils at a rate at least an

order of magnitude greater than the rate of soil formation. Montgomery ponders the existential threat this poses to modern civilization. This NPG Forum Paper, by comparison, considers another form of "erosion": the long-term, inexorable erosion of America's productive agricultural land base if we acquiesce to the population growth the Census Bureau says is headed America's way if high immigration rates continue unabated.

NRI – Measuring Trends in Developed Lands and Farmlands

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) has been surveying land use trends nationally for decades. It is the go-to source for dependable, accurate information on long-term trends in America's productive agricultural land base. NRCS's National Resources Inventory (NRI) is based on rigorous scientific and survey protocols. The first NRI was released in 1982, making use of 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 conversion of agricultural lands to non-agricultural uses, such as transportation, industry, commercial and residential land uses,[5] all a consequence of a growing U.S. population.

The NRI covers the entire surface area (both land and water) of the United States, including all 50 states, Puerto Rico, and the U.S. Virgin Islands. The sample includes all land ownership categories, including federal lands such as national forests, parks and military installations, although NRI data collection activities have historically focused on non-federal lands.[6]

Data for the initial 1982 NRI were collected beginning in 1980 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. Beginning in 2000, special high-resolution imagery was obtained for each NRI sample site.[7]

In 2004, NRCS established three 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.

The NRI is noted for its longitudinal fidelity, that is, its reliability and consistency through time. NRI users can be confident that, for example, differences in the amount of developed land shown for 2002 and 2010 accurately reflect true differences "on the ground."

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.

Unsustainable Trend 1 – Increasing Developed Land

The NRI's "developed land" category includes three subcategories: (a) large tracts of urban and built-up land; (b) small tracts of built-up land of less than 10 acres; and (c) land outside of these built-up areas that is in a rural transportation corridor (roads, railroads, and associated rights-of-way).[8]

The growth in the area of developed land in the U.S. from urban sprawl in recent decades – most of it driven by incessant, immigration-driven U.S. population growth – is little short of extraordinary (Figure 2). Indeed, more than one-third (37%) of all the land that has ever been developed in the entire history of the United States was developed just between 1982 and 2010, the most recent year for which NRI data are available.

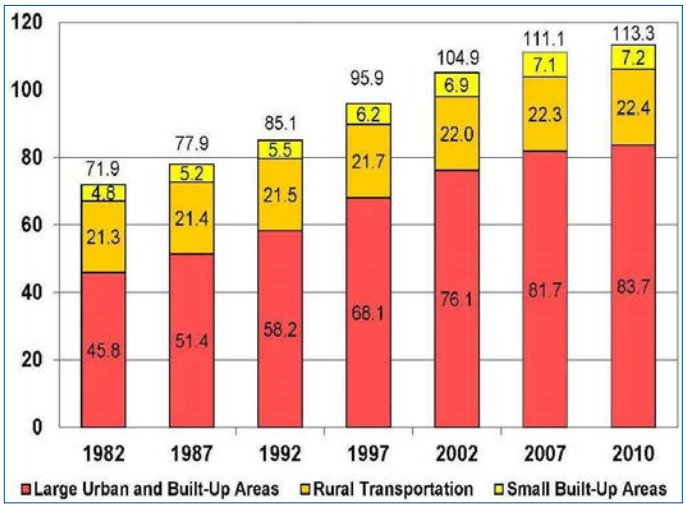

Figure 2. Increase in the area of developed land in the United States, 1982-2010. (millions of acres)
Source: National Resources Inventory, Natural Resources Conservation Service. See endnote 8.

In just the 28 years from 1982 to 2010, 41.4 million acres (approximately 65,000 square miles), an area about the size of Florida – of previously undeveloped non-federal rural land – succumbed to our growing cities. Of these 41 million acres lost – or "converted" as planners benignly and euphemistically refer to it – over 17 million acres were forest land, 11 million acres cropland, and 12 million acres pasture and rangeland (Figure 3).[9]

Figure 2 shows the increase in developed land 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 plus some of the Mid-Atlantic.

The annual increase in developed land over this 28-year period varied from 760,000 acres to 2,159,000 acres, and averaged 1.5 million acres/year (Table 1). The low of 760,000 acres/year was the annual average for the 2007-2010 period, corresponding to the Great Recession.

Period	Period Growth in Developed Land (thousand acres)	Annual Growth in Developed Land (thousand acres)	Added Acreage for Each Person Added to Population During Period Shown	
1982-1987	6,025	1,205	1982-1987: 0.58	1982-1992: 0.58
1987-1992	7,205	1,441	1987-1992: 0.57	
1992-1997	10,796	2,159	1992-1997: 0.85	1992-2002: 0.65
1997-2002	9,007	1,801	1997-2002: 0.45	
2002-2007	6,121	1,224	2002-2007: 0.45	2002-2010: 0.39
2007-2010	2,281	760	2007-2010: 0.30	

Table 1. Increase in developed land and developed land per capita, 1982-2010.
Sources: NRI, NRCS (2013). See endnote 8.
Kolankiewicz et al. (2014). See endnote 6.

As the NRCS stated in its 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."[10]

All of this newly developed land was originally either agricultural land or natural habitat. Figure 3 shows the sources of newly-developed lands in five-year increments from 1982 to 2007.

Much of the newly developed land – roughly a third of it – had been designated as prime farmland before it was developed (Figure 4). This, according to NRCS, is land that has "the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses."[11]

Prime farmlands may or may not actually be in use at the moment as producing farmland. They may be serving as cropland, pastureland, rangeland, forest land, other rural land, or be set aside in the Conservation Reserve Program (which protects marginal areas especially subject to erosion). However, urban, built-up (i.e., developed) land and water do not qualify as prime farmland, even at those sites that once had soils that would have qualified before they were covered with concrete or asphalt or inundated by a reservoir.

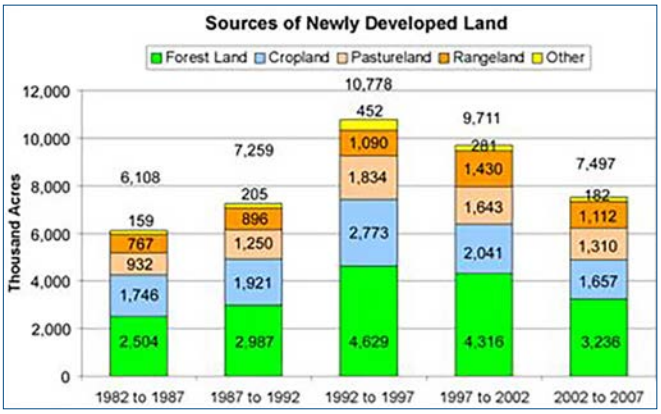

Figure 3. Sources of newly developed land in the U.S. from 1982 to 2007.
Source: NRCS (2013). See endnote 10.

Prime farmlands possess the soil quality, growing season, and water supply needed to produce high yields of crops sustainably when properly managed. In general, they have an adequate and reliable water supply either from precipitation or irrigation; a favorable growing season; acceptable pH, salt and sodium content; and minimal rocks. Their soils are permeable to both water and air. In addition, prime farmlands are not overly erodible or saturated with water for a long period of time, and either they do not flood frequently or they are protected from flooding by levees or other structures.[12]

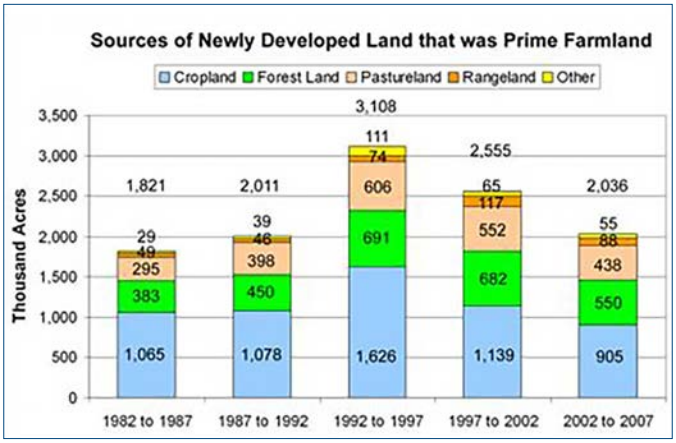

Figure 4. Sources of newly-developed land from 1982 to 2007 that was prime farmland.
Source: NRCS (2013). See endnote 10.

Unsustainable Trend 2 – Decrease in Farmland

Figure 5 depicts the steady erosion of the nation's fixed stock of prime farmland from 1982 to 2007. Roughly two-thirds of this prime farmland was actually cultivated cropland. However, prime farmland being used as cropland actually saw the greatest decline between 1982 and 2007, from 229.4 million acres to 202.4 million acres; that is a fall of 27 million acres or 12 percent.

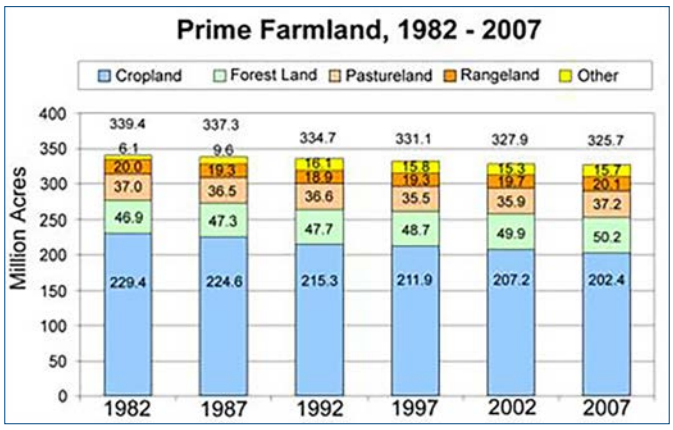

Figure 5. Decrease in the area of prime farmland in the U.S. from 1982 to 2007.
Source: NRCS (2013). See endnote 10.

The NRI also keeps track of trends in overall cropland, pastureland and rangeland acreages in the U.S., including those lands used for these purposes that are not considered prime farmland. The NRI estimates that the overall amount of cropland in the United States decreased from 420 million acres in 1982 to 361 million acres in 2010, a decrease of nearly 60 million acres (14 percent) in just 28 years (Figure 6). Some of this cropland (cumulatively, 27 million acres in 2010) was withheld from active farming with federal government support and subsidies and placed into the CRP, but as already noted, these tend to be marginal or fragile sites on which cultivation is not deemed to be sustainable in any case.

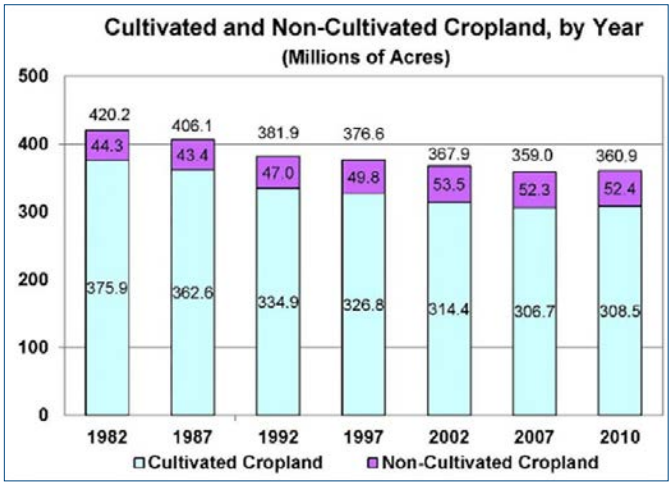

Figure 6. Area of Cropland in the United States, 1982-2010.
Source: U.S. Dept. of Agriculture (2013). See endnote 8.

Even with the ecologically-ignorant, politically-expedient federal ethanol mandate and strong financial incentives over much of the last decade to grow corn in order to produce ethanol as fuel for vehicles, the amount of cropland still dropped by seven million acres in the eight years between 2002 and 2010, increasing slightly between 2007 and 2010.[13] Figure 7 depicts the land uses into which cropland was converted.

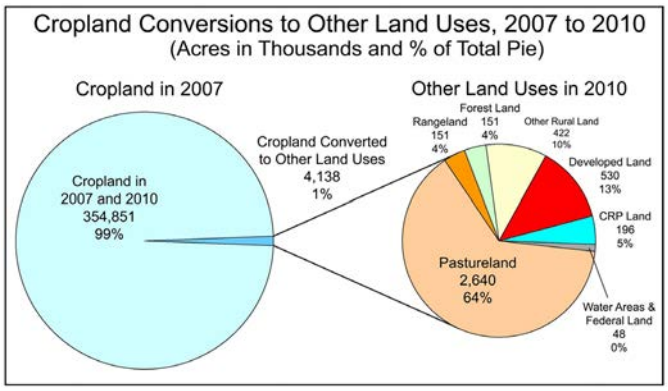

Figure 7. Cropland converted to other land uses from 2007 to 2010.
Source: U.S. Dept. of Agriculture (2013). See endnote 8.

Of course, and as alluded to above, development is not the only factor responsible for the degradation and disappearance of high-quality agricultural land. Arable land is also vulnerable to other damaging natural

and artificial forces such as soil erosion from wind and water, as well as salinization and waterlogging from irrigation, which can compromise the fertility, productivity, and depth of soils, and possibly even lead to their premature withdrawal from agriculture. Over time, tilling soil can damage soil structure and depth and expose agricultural soils to wind and water erosion, while harvesting crops removes nutrients and exhausts soil fertility, which must be boosted by the application of nonrenewable, fossil fuel-based and mined fertilizers (e.g., nitrogen and phosphorus in their various forms).

Many of these adverse effects are aggravated by intensive industrial agricultural practices needed to constantly raise agricultural productivity (yield per acre) in order to provide ever more food for America's and the world's ever-increasing populations and more meat- and dairy-intensive diets.

Thus, the potent combination of relentless development and land/soil degradation from soil erosion and other factors is reducing America's productive agricultural land base even as the demands on that same land base from a growing population are increasing.

If the same pace of cropland conversion and loss that occurred from 1982 to 2010 were to continue to the year 2100, America will have lost an additional 193 million acres of its remaining 361 million acres of cropland, for a total cumulative loss of 253 million acres. Only 168 million acres would then remain – about 40 percent of the original allotment – and none of this acreage would be in pristine condition after two centuries or so of intensive exploitation. Soils and nutrients, while perhaps not depleted, would require even greater inputs of costly fertilizers. Three of the most crucial fertilizers – anhydrous ammonia (NH_3) and ammonium nitrate (NH_4NO_3) (produced using 3-5% of the world's natural gas production via the Haber-Bosch process), and phosphorus (P), produced from phosphate mines – may be far more expensive, perhaps prohibitively so, by 2100 than at present, due to the inexorable depletion of the highest-quality reserves of these non-renewable resources.

Table 2 shows the amount of cropland per capita in the United States in 1982, 2010, and projected to 2050 and 2100, assuming the same rate of cropland decline from 1982 to 2010 and using the most recent Census Bureau projections. Available cropland will have declined from 1.9 acres per person in 1982 to 0.3 acre per person in 2100, an 84 percent decrease. Figure 8 graphically depicts this striking loss in the form of a bar chart.

Year	Cropland in 48 contiguous states (millions of acres)	U.S. Population in Millions (48 states)	Acres of cropland per capita
1982	420	225	1.9
2010	361	306	1.2
2050	276[1]	400[2]	0.7
2100	168[1]	571[2]	0.3

Table 2. Projected long-term decline in cropland per capita given current trends.

[1] Projected using annual rate of cropland loss from 1982-2010 (2.1 million acres)

[2] Most recent projections from the United States Census Bureau

Source: Kolankiewicz et al. (2014). See endnote 6.

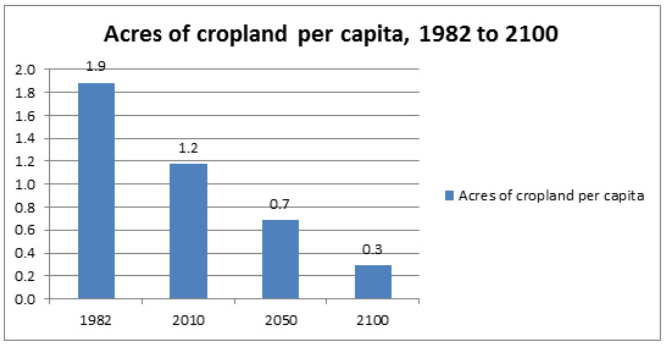

Figure 8. Projected long-term decline in cropland per capita, given current trends.

Source: Kolankiewicz et al. (2014). See endnote 6.

However, this dire projection is not a prediction – merely an extrapolation of current trends – and this grim scenario may not come to pass, even if the U.S. continues to reject a national policy of population stabilization or to enact more aggressive farmland protection measures. This is because rising demand and prices for foodstuffs would increase the value of land maintained as cropland vis-à-vis developed land, and because conversion from other types of lands to cropland, including pastureland, rangeland, forest land and other natural areas, would certainly occur. This actually did happen in the 2007 to 2010 timeframe (Figure 9), during which the area in cropland increased by 1.9 million acres; most of this was CRP land called back into production because high agricultural commodity prices encouraged farmers to plant it. Again, in a perfect world, erosive or sensitive CRP lands should *not* be cultivated and would best be conserved as wildlife habitat; that is why the voluntary

Conservation Reserve Program was established in the first place in the 1980s.

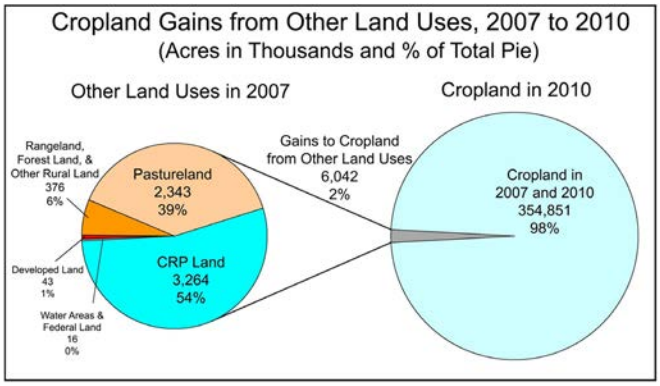

Figure 9. Cropland gains from other land uses, 2007-2010.
Source: NRCS, 2013. *Summary Report: 2010 National Resources Inventory*.

Nevertheless, given the rough magnitude of this projected decrease in cropland per capita, that is, the acreage of land on which to cultivate grains and other crops for each future resident, biotechnology (genetically modified organisms – GMOs – and the like) will have to work wonders in constantly raising yields per acre in order to maintain the diverse, meat- and dairy-rich diet to which Americans became accustomed in the late 20th century. The improbability of this prospect is suggested by a 2013 paper in the scientific journal *Nature Communications*.[14] It concludes:

> "Previous projections of food security are often more optimistic than what historical yield trends would support. Many econometric projections of future food production assume compound rates of yield gain, which are not consistent with historical yield trends."

And:

> "…there is evidence of yield plateaus or abrupt decreases in rate of yield gain, including rice in eastern Asia and wheat in northwest Europe, which account for 31% of total global rice, wheat and maize production."

Worrisome, divergent, clearly unsustainable trends – an ever-increasing population, a decreasing arable land base, diversion of water supplies needed for irrigated agriculture to growing urban populations, and a modern, mechanized agriculture that is highly dependent on limited fossil fuels and other inputs at all stages – have led some scientists to think the unthinkable: that before the current century has concluded the United States may cease to be a net food exporter.[15] Food grown in this country would be needed for domestic consumption. Furthermore, by mid-century, to say nothing of century's end, the ratio of arable land per capita may have dropped to the point that the typical American diet will necessarily be comprised of much more grains, legumes, tubers, fruits and vegetables, and much less animal products. While most cardiologists would concur that this in fact represents a "heart-healthier" diet, it would also represent a momentous loss of dietary freedom for the American people, who have always prided themselves on our abundant agriculture, plentiful consumer choice, and comparative freedom from want.

Preserving farmland and safeguarding its fertility are more than a question of producing an adequate supply of food and engendering a healthy diet for Americans, they are also a matter of national security. According to Brig. Gen. (Ret.) W. Chris 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 reign.[16] 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.[17] As Oxford University ecology professor Norman Meyers observed 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…"[18]

Agriculture and related food industries contribute nearly $1 trillion to America's national economy annually. They comprise more than 13 percent of our GDP and employ 17 percent of our 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.[19]

Americans are not unaware of these national security implications, according to a national poll[20] of 1,000 likely voters conducted in April 2014. When asked, "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% responded that it was "very important" and another 21% "somewhat important," for a total of

92% agreeing that it was very or somewhat important.

When the same poll asked, "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?" not as many Americans appeared to share the same sense of urgency, but only a distinct minority thought it unimportant. Twenty-six percent thought it was "very important," 46% "somewhat important" (for a total of 72% very or somewhat important) and 25% "not very important" or "not important at all."

The 2014 poll also found that most Americans consider the treatment of good cropland to be not only a practical issue but an ethical one. The poll forced people to choose between the practical need for more housing (a pressure that exists in nearly every urban area in the country) and the ethics of eliminating food-producing land to make available more area for constructing new housing.

> **QUESTION**: 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

The high level (22%) answering "not sure" indicates that a lot of people haven't thought about this tradeoff between two things they probably think of as "good" or that they are unwilling to make this hard choice.

Unsustainable Trend 3 – Ongoing Population Growth with No End in Sight

Most NPG Forum readers are well aware of the enormous existing U.S. population size – 321 million and counting, the third largest in the world – and of continuing rapid U.S. population growth, as well as the dominant role of immigration in forcing this growth. The two decades just completed, 1990-2000 and 2000-2010, witnessed the highest and third-highest increments added to U.S. population in history, since the first census was undertaken in 1790: 33 million (1990s) and 27 million (2010s), respectively. Far from approaching the negative population growth NPG advocates, or even stabilization, the U.S. population is at present on a trajectory to grow with no end in sight to mid-century and far beyond.

The most recent 2014 Census Bureau projections have slumped slightly from earlier ones,[21] though this may well be just a lingering and temporary effect of lower fertility and illegal immigration rates triggered by the Great Recession that began in 2007-2008 and has been slow to release its demoralizing grip. Even so, Census projects substantial demographic growth in the years ahead: to 398 million Americans by 2050 and 417 million by 2060.

In 2060, according to the Census Bureau, *net* immigration would be responsible for annual population growth of 1.5 million (up from 1.25 million in 2015), while natural increase (births minus deaths), would account for 400,000 new Americans every year. Immigration would thus directly cause nearly 80% of our population growth in any given year. But even this understates immigration's full effect, because it does not include the number or percentage of those 400,000 births that would be to immigrants themselves, and that would not take place in the U.S. had prior acts of immigration and settlement not occurred. Thus, conservatively, by mid-century, immigration then occurring would directly and indirectly account for 80-90% of the annual population growth in any given year.

If instead we were to ask what share of the expected growth of the U.S. population to 2050, 2060, or 2100 would be due directly and indirectly to immigration underway right now, or that which has taken place since 1970, when the contemporary immigration boom began to gather force, the percentage would be higher yet, pushing 100 percent.

An Environmental Impact Statement (EIS)[22] being developed by the Washington-based NGO Progressives for Immigration Reform (PFIR) includes three scenarios or alternatives with illustrative population projections under three assumed, reasonably foreseeable immigration rates to the year 2100. These curves or trajectories all assume replacement level fertility (which has now been more-or-less maintained for four decades) and show the profound influence of differential immigration rates in determining our divergent demographic – and environmental – futures (Figure 10).

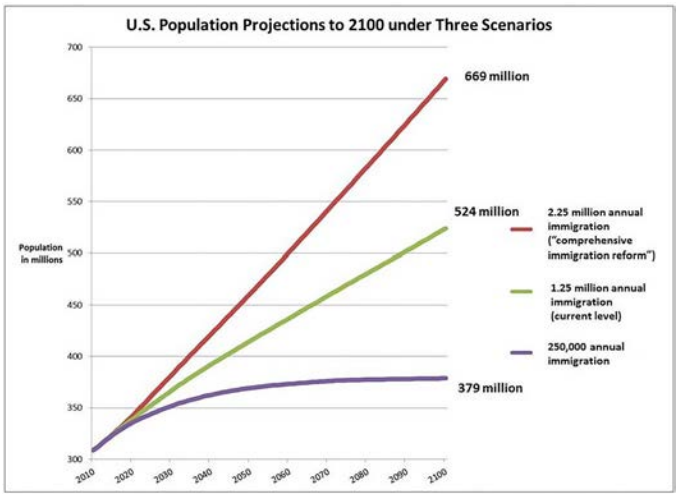

Figure 10. U.S. population projections to 2100 under three reasonably forseeable alternatives.
Source: PFIR (2015). See endnote 22.

Whatever the specifics are, as Figure 10 reveals dramatically, immigration rates will without a doubt exercise the dominant role in determining future U.S. population size, and therefore, future demographic pressure on our farmland base from urban sprawl.

Neglected Culprit – The Role of Population Growth in Sprawl and Farmland Loss

While anti-sprawl and "smart growth" organizations as well as all levels of government (local, state, federal) have been loath to acknowledge it, population growth is the principal factor behind sprawl, as demonstrated conclusively by a series of studies over the past 15 years.[23] A 2003 news conference at the National Press Club to release the results of that year's study (Beck et al. 2003) led to a hostile encounter with the executive director of the NGO Smart Growth America, who vociferously rejected its findings.

Conservationists define sprawl as the increase in size of built-up, urbanized, or developed areas, usually taking the form of outward expansion on the periphery of urban cores and previously developed suburbs. This expansion of urban/suburban land takes place at the expense of rural land, including farmland and natural habitat. Ultimately, all of the various factors or causes behind sprawl can be reduced to just two:

1. Increase in the number of residents, i.e. population growth
2. Increase in per capita land consumption, or declining population density

Virtually all anti-sprawl and farmland preservation campaigns around the country have focused exclusively on the second of these two factors – decreasing population density – and ignored the first, population growth. Among the sub-factors that have been suggested by planners and activists over the years as contributing to decreasing population density and thus sprawl in developed and metropolitan areas are the following (in no particular order):

a. Public subsidies
b. Zoning ordinances
c. Racism, "white flight," etc.
d. Inner city and inner suburb crime
e. Quality of schools
f. Cheap gasoline
g. Lower land prices
h. More bureaucratic red tape and regulations in inner areas
i. "Brownfield" liability concerns
j. Consumer preferences for larger houses and yards
k. Business sector preferences
l. Telecommunications advances
m. Rising affluence
n. Freeways and interstates
o. Housing policies
p. Competition for tax revenue
q. Reduction in household size
r. "NIMBYism"
s. Environmental Justice
t. Fear of terrorism[24]

Once again, when aggregated, all of these sub-factors together have the net effect of reducing population density, that is, of increasing per capita land consumption.

In the case of any given urbanized area, state, region, or the country as a whole, it is possible to calculate the relative importance of the population factor versus the density factor in driving sprawl (conversion of rural land to urban land) during specified time periods. Long-term data from the USDA/NRCS's NRI discussed above (from 1982 to 2010) and from the U.S. Census Bureau's Urbanized Area designations (from 1950 to 2010), state and county population estimates, and decadal censuses allow researchers to derive estimates of the percentages of sprawl related to population growth or to declining population density (increasing per capita land consumption) from two distinct federal government agencies (one in the Department of Commerce, the other in the Department of Agriculture) using two completely different methodologies. This allows researchers to

compare the results and see how consistent or robust they are.

An initial 2001 study of the 100 largest Census-designated urbanized areas in the U.S. found that between 1970 and 1990, while there was substantial variation from city to city, on the whole, population growth explained approximately half of sprawl and declining density the other half.[25] A 2003 study using NRI data on developed land obtained similar results.

A 2014 study showed that the role of population growth in forcing sprawl and paving over farmland has increased in more recent years. For the same 100 largest urbanized areas in which population growth accounted for about half of all sprawl between 1970 and 1990, between 2000-2010 population growth now accounted for about 70% of sprawl, an increase of 20%.

The increasing importance of population growth in forcing sprawl is shown by Figures 11 and 12, which use NRI data on developed land. Figure 11 is a pie chart that shows that for the entire 28-year study period between 1982 and 2010, population growth accounted for 63% of sprawl in the contiguous 48 states, and "per capita sprawl" (increasing per capita land consumption or declining density) accounted for 37%.

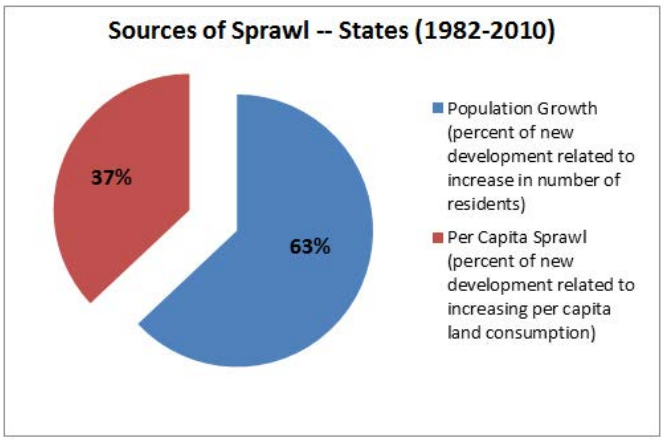

Figure 11. Sources of sprawl in 48 contiguous states, 1982-2010.
Source: National Resources Inventories 1982-2010, U.S. Census state population estimates, Kolankiewicz et al. (2014). See endnote 6.

However, in the most recent segment of that 28-year time span, the eight years between 2002 and 2010, the percentage of sprawl related to population growth was higher – 91%. More than nine out of every ten acres of land – including farmland – developed between 2002 and 2010 was associated with population growth in the states, while less than 10% was associated with all the various sub-factors that contribute to declining population density. Figure 12 is a pie chart depicting these results.

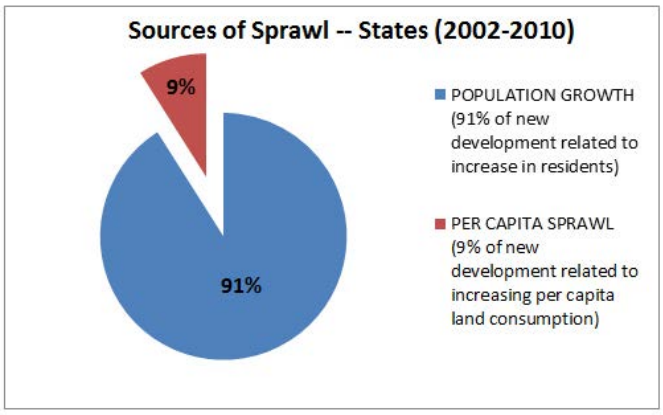

Figure 12. Sources of sprawl in 48 contiguous states, 2002-2010.
Source: National Resources Inventories 2002-2010, U.S. Census state population estimates, Kolankiewicz et al. (2014). See endnote 6.

Figures 13 and 14 are scatter plots with least-squares regression lines displaying the area of developed land (sprawl) as a function of population growth in the contiguous 48 states. Figure 13 shows population growth and sprawl for the 2002-2010 period, while Figure 14 shows the population size of each state (x or horizontal axis) and the cumulative area of developed land in each state (y or vertical axis) as of 2010. The upward slopes on the lines in each graph clearly indicate that population size is correlated with land development, including permanent loss of farmland to that development.

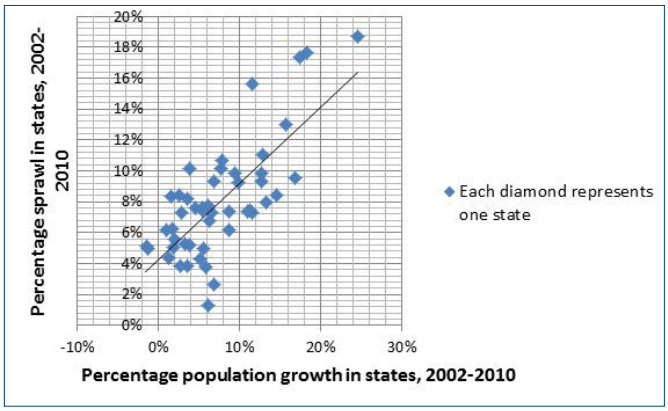

Figure 13. Scatter plot of population growth vs. sprawl in 48 States, 2002-2010.
Sources: Census Bureau and National Resources Inventory, Kolankiewicz et al. (2014). See endnote 6.

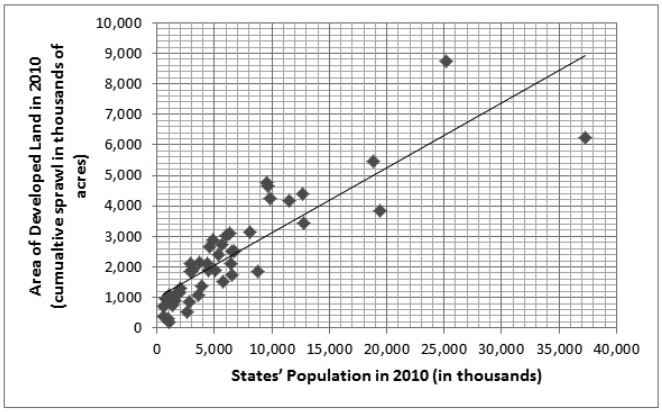

Figure 14. Cumulative developed land area (sprawl) as a function of population size.
Sources: U.S. Census Bureau; NRCS, 2013. *Summary Report: 2010 National Resources Inventory,* Kolankiewicz et al. (2014). See endnote 6.

The larger the population, and the faster the rate of population growth, the larger cities and developed areas become, and the more good land they gobble up as they grow. Unremitting U.S. population growth as projected by the Census Bureau and other demographers as far as the eye can see thus represents a serious long-term threat to our productive agricultural land base and to our collective food security as this century advances.

Conclusion – More Mouths to Feed Means Less Land to Feed Them On

Agricultural experts have warned for decades that California's most productive farmland is at risk from that state's relentless population growth. Farmers and ranchers have expressed the same fears. But it is not just California's Central Valley, the single most productive agricultural area of its size anywhere on Earth, which is threatened. Valuable farmland is falling under the bulldozer's blade and the cement mixer's shadow throughout the country, even in Alaska. Dr. Rupert Cutler, President Carter's Assistant Secretary of Agriculture for Conservation, Research, and Education, and now associated with Virginia Tech and James Madison University, once famously remarked: "Asphalt is the last crop."

Unfortunately, to date neither warnings nor concern nor smart growth nor farmland preservation easements have much slowed the pace at which some of the nation's most productive croplands and soils are being eaten up by development. Even as the number of mouths to feed in America has soared to 321 million, and continues to grow by 2-3 million annually, the very land and water resources needed to feed these multitudes – and the growing population of a world that has come to depend on America's agricultural exports – are inexorably shrinking.

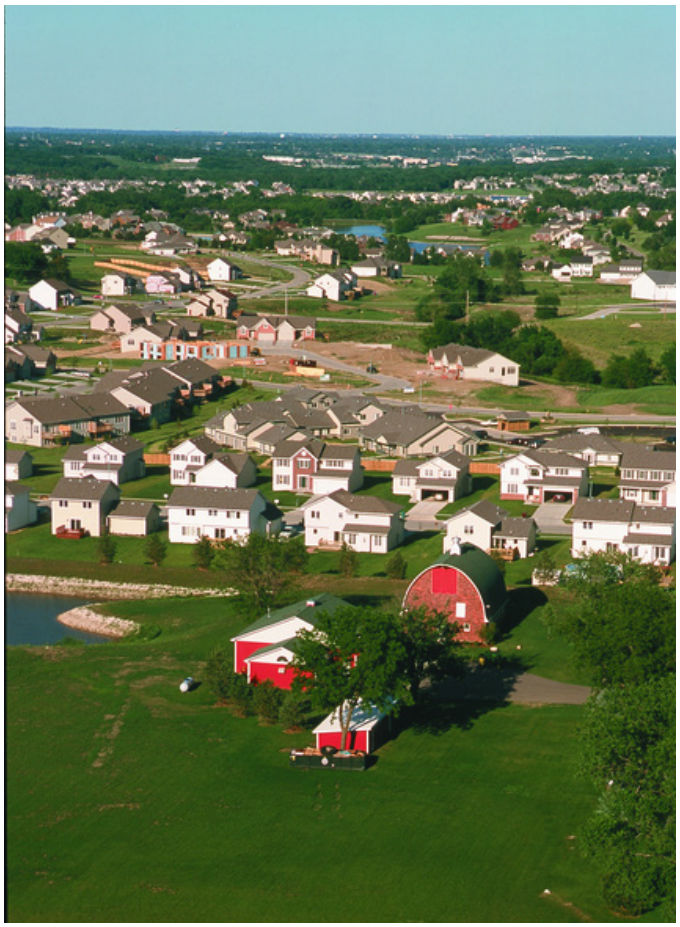

Figure 15. Sprawl in Iowa – America's breadbasket.
Courtesy Wikipedia Commons and Natural Resources Conservation Service

The irony is that total U.S. farmlands and cropland per capita are shrinking precisely because the tens of millions added to our population every decade are competing with farmers for water and for the very same land that is best at growing food. As population increases and sprawls across flat, arable land, the ability to feed that population decreases. Because they tend to have good soils and are easy to build on, flat lands with access to fresh water attract both agriculture and urbanization. When homes can be built to house hundreds of new residents on the land occupied by a single farm, in a market economy like America's, urbanization will displace agriculture every time as "the highest and best use."

Mass immigration is now fueling – and for the foreseeable future, it will continue to drive – America's

unsustainable population growth, unless reined in. Part of the reason that growth is unsustainable is because it is devouring the land it needs to feed itself, sawing off the limb it stands on. Eventually that limb will snap. But we're smarter than that – one hopes.

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