POPULATION GROWTH and the DIMINISHING NATURAL STATE of ARIZONA

Analysis of National Resources Inventory & U.S. Census Data on Development and Habitat Loss in a Thirsty Grand Canyon State

EXECUTIVE SUMMARY

To accommodate more than four million additional residents over the last four decades – mostly from other countries and other states – Arizona's cities have sprawled over vast areas of fragile ecosystems, particularly the desert biomes surrounding Phoenix and Tucson.

Compounding the challenges, Arizona has struggled to cope with what scientists believe may be a long-term mega-drought while the state continues to be flooded each year by new residents competing with nature and agriculture for diminishing water resources. *(Section 1.5)*

The more than doubling of both Arizona's population and its developed land were among the highest rates in the nation over the last four decades.

Our study questions the wisdom and sustainability of state and local efforts to encourage population growth.

Key Findings for the 1982-2017 Period

THE LOSS: 1,744 square miles (1.1 million acres) of Arizona's natural habitat and farmland disappeared under buildings, pavement, gravel and other surfaces, representing a profound, long-term loss of agricultural potential, ecological values and functions, and quality-of-life amenities for Arizonans. *(Section 1.2)* This destruction is not a sustainable trend.

CAUSE OF THE HABITAT/FARMLAND LOSS: Arizona's population growth of 4.2 million was responsible for 12 times more sprawl than all other factors combined (Figure ES-1). *(Section 3.1.4)* All the other dozens of factors relate to the land utilization choices of individuals, businesses, and government entities. These combined factors contribute to a per capita land consumption figure, which in most Arizona cities not only did not increase but diminished by 2017. In other words, most Arizonans in 2017 were living on less land per person and more densely than in 1982. But population growth negated all the anti-sprawl benefits of that density. *(Section 2.4)* This population trend is not sustainable.

CAUSE OF THE POPULATION GROWTH: Federal immigration policies were the source of the largest part of Arizona's population growth, when counting people born in other

countries and their U.S.-born children (whether they moved to the state from another country or through another state). The two additional sources of population growth were (1) other people moving from elsewhere in the country – often enticed by Arizona's state and local pro-development policies and driven by population-related pressures elsewhere -- and (2) births to U.S.-born Americans in the state. *(Section 2.3)* **Current federal immigration rates are incompatible with maintaining the optimal quality and quantity of Arizona's natural habitats and agricultural lands.**

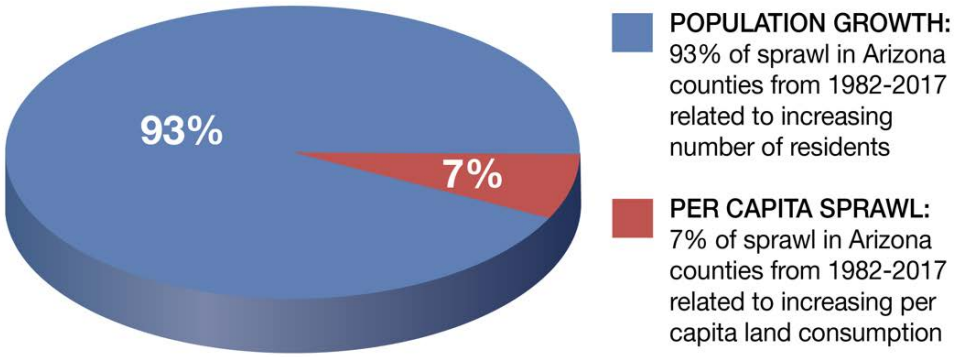

Figure ES-1. Sprawl Factors (Increasing Population and Increasing Per Capita Land Consumption) in all Arizona Counties, 1982-2017

The pie chart in **Figure ES-1** illustrates the main finding of this study which conforms with data available from the incomparable federal National Resources Inventory (NRI) of all U.S. lands. *(Section 2.2.2)* The NRI originated in 1982 and its most recently available data are from 2017. Our study examines the effects – and quantifies the roles – of per capita human consumption patterns and overall population growth in the loss of Arizona's open space (which includes both natural habitat and farmland).

Survey: Arizonans Want Less Development & Population Growth

Most Arizonans are concerned about the development and population trends in their state, according to a scientific April 2020 survey of 1,000 likely voters in Arizona that was commissioned for this study and conducted by the polling firm Pulse Opinion Research. *(Appendix H)*

- ARIZONANS WANT LESS NEW DEVELOPMENT: Asked about the amount of current development in their state, only 8% said there is "too little" development. An overwhelming majority (86%) of Arizona voters indicated they would rather see no additional development, or not much more.

That result is not surprising given the relentless development Arizonans have endured at a rate faster than any state except Nevada (**Table ES-1**). Arizonans may be worn out from the rapid change and disruption.

Table ES-1. Top 2 Sprawl States, 1982-2017					
State	**Developed Land Area 1982**	**Developed Land Area 2017**	**Overall Sprawl 1982-2017**	**% Increase in Area of Developed Land**	**National Ranking by % Increase**
Nevada	336 sq. mi.	850 sq. mi.	514 sq. mi.	153%	1
Arizona	**1,536 sq. mi.**	**3,280 sq. mi.**	**1,744 sq. mi.**	**114%**	**2**

- ARIZONANS WANT LESS NEW POPULATION GROWTH: Informed that the state's demographers project that Arizona's population of 7.4 million is trending toward an additional 3 million by 2050, joining Tucson and Phoenix together into a single mega-city, voters found the prospect more negative than positive by a 69-17 ratio.

  Only 8% said they desire Arizona's population growth to continue at its present pace. Nearly all (88%) expressed a desire for much less population growth, either by growing "much more slowly" (48%), not growing at all (26%) or reducing current population size (14%).

Population Growth Negated Density Benefits

Two overall factors create the spread in development over Arizona's ecosystems and farmland:

1. **Population growth.** The increase created by births and newcomers minus deaths and outmigration to other destinations.

2. **Growth in per capita land consumption.** This is the measurement of the average amount of developed land that is required for each resident's employment, parks, other recreation, education, religion and culture, transportation, commerce, utilities, waste handling, and other urban needs.

We examined these factors as well as overall habitat and farmland destruction in all 15 Arizona counties and applied a standard scientific formula for apportioning cause between the two factors *(Appendix C)*.

The pie chart in **Figure ES-1** above displays the bottom-line finding of this study. Only 7% of the loss of Arizona's habitat and farmland statewide was found to be related to growth in per capita land consumption (that is, factors beyond the massive population growth between 1982 and 2017). *(Section 3.1.4)*

Table ES-2. Population Growth vs. Growth in Per Capita Developed Land Consumption in Arizona Counties, 1982-2017		
County	**% POPULATION GROWTH, 1982-2017**	**% GROWTH IN PER CAPITA LAND CONSUMPTION, 1982-2017**
Apache	37%	18%
Cochise (Sierra Vista UA)	41%	28%
Coconino (Flagstaff UA)	78%	-3%
Gila	38%	23%
Graham	57%	35%
Greenlee	-20%	98%
La Paz	63%	63%
Maricopa (Phoenix UA)	168%	-4%
Mohave (Lake Havasu City UA)	231%	-5%
Navajo	63%	-16%
Pima (Tucson UA)	81%	-14%
Pinal	346%	-24%
Santa Cruz	115%	-18%
Yavapai (Prescott UA)	208%	-23%
Yuma	158%	65%
Total	**144%**	**-12%**

As shown in **Table ES-2**, all but one of the counties had explosive population growth from 1982 through 2017. But only about half the counties (7 of 15) experienced any growth at all in per capita land consumption.

In the other eight counties, per capita land consumption did not grow and, in fact, shrank. Their negative percentages for per capita growth are shown in green-highlighted boxes (as are all negative percentages throughout this study).

Government restrictions, land costs, and personal choices in those eight counties resulted in residents living in higher density (more people per square mile of developed area). The average individual in those counties has less developed land than in 1982 for all urban purposes.

Nonetheless, the per capita land *reductions* in the eight counties did not stop the counties from devouring large expanses of additional acreage of natural habitat and farmland for urban development. As you will see in **Table ES-4**, all eight of those counties with less per capita land consumption nonetheless had major increases in sprawl because galloping population growth negated the anti-sprawl benefits of increasing density.

For example, Maricopa County reduced its per capita land consumption by 4% but still sprawled by 157% because of 168% population growth. Pinal County sprawled even more (238%) despite reducing per capita consumption by 24%, because its population soared 346%.

In 1915, there were just over one-quarter million residents in Arizona (263,000). A little over a century later (2018), this number had exploded by about 28 times to almost 7.2 million. The fact that this function on **Figure ES-2** is curving upward is suggestive of exponential growth for much of the period of record.

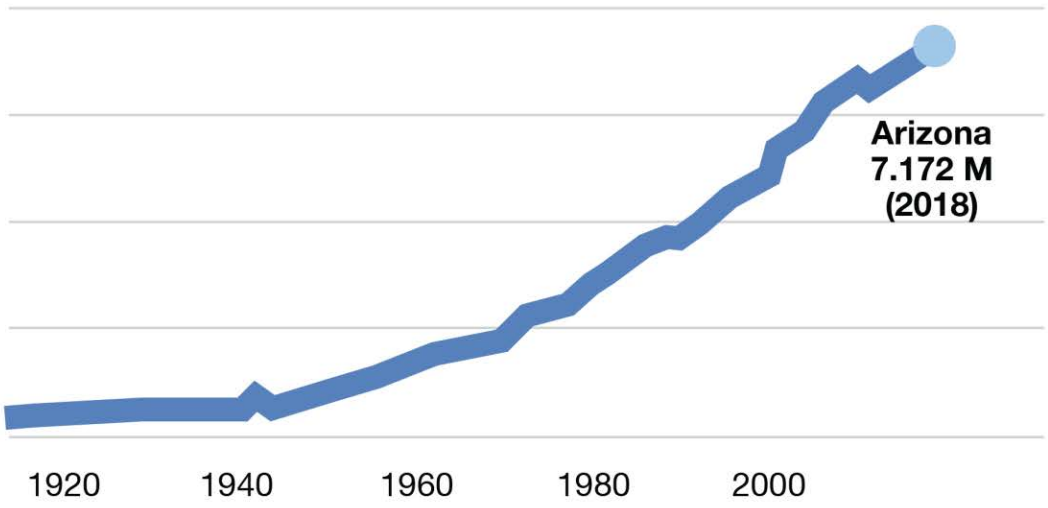

Figure ES-2. Population Growth in Arizona, 1915-2018

How Much to Sacrifice to Provide Water for Growing Desert Cities?

By the 1982 beginning of this report's study period, Arizona was already struggling to deal with water resource challenges. Rather than apply the brakes to population growth, government officials and developers have elected to entice and accommodate an additional 4.2 million residents to compete for water.

During the same period, Members of Congress have more than doubled the national population growth that is driven by immigration policies. Besides the direct effect in Arizona, immigration policies have created acute population issues in neighboring California from which millions of its previous residents have fled into less-densely-populated neighboring states. California is the No. 1 state source of Arizona's population growth. *(Section 2.3.3)*

Most of the water to handle this exploding Arizona population is supplied by surface water sources: 38% from the Colorado River, 18% from in-state streams and rivers (such as the Verde and Salt), and 3% from high-quality treated wastewater, that is, reclaimed water or effluent. The other 41% of Arizona's water is pumped from groundwater sources, aquifers beneath the ground surface, which are being drained or depleted to dangerously low levels.

If current water resources seem inadequate for the current population challenges, it appears that Arizona will have to make do with even less in the future. According to the National Climate Assessment conducted by experts in 13 federal agencies, there will be declines in snowpacks and streamflows in the American Southwest during this century, particularly in the Rocky Mountains, leading to "decreasing surface water supply reliability for cities, agriculture, and ecosystems." Lake Mead already has shrunk to less than 36% of its capacity (**Figure ES-3**). Freshwater aquatic ecosystems are expected to be especially hard-hit. Competition to drain the Colorado River will increase. Other states will be facing challenges similar to Arizona's and will also be dependent even more on the declining resources of the Colorado.

Figure ES-3. Drought and human demands are overstressing the Colorado River. In July 2019, the water level in Lake Mead stood at just 40% of full capacity

Transferring water rights from agriculture to municipalities, plus forcing higher population-density development and xeriscaping (landscaping designed to obviate the need for irrigation or supplemental watering), are all among the options entertained by the state's elected officials to accommodate additional residents.

Arizona water resource managers are engaged in protracted discussions about expensive plans to recycle municipal waste and to run pipelines of desalinated seawater from the Pacific Ocean and the Gulf of California in order to satisfy this increasing demand for additional water resources, which is critical to the state's continued population growth.

But the wisdom of this pattern of endless population growth goes unquestioned by those in authority.

Tough Water Choices Ahead

One answer to Arizona's water problems, at least in the short term, is to divert the vast amounts of water used in agriculture and provide it for urban use. But citizens' opinions about their state's farming make this an unpopular option.

- By a 55-19 ratio in the Pulse Opinion Research survey, Arizonans opposed diverting water "used to cultivate crops" to "support additional population growth."

- 66% said it is very important "to protect U.S. farmland from development so the United States is able to produce enough food to feed its own population in the future." Another 25% said "somewhat important." Only 6% dismissed the importance. When it comes to producing food, taking water from agricultural use is viewed much the same as developing the land.

Another potential water source for an expanding population would be to further deplete the streams of the state. But they are more than sources of water for agriculture and urban use; they are complex ecosystems that support aquatic life, birds and other wildlife, which already are under stress due to current draining, channeling and other terrain-altering practices that manipulate streams and marshes.

- 39% of Arizonans now conclude it is "more important to use remaining water for farms and a growing urban population than to support wildlife habitat, fish and water birds."

- But a plurality of 47% still resist using the prospect of seemingly uncontrollable population growth as justification for further diminishing the aquatic ecosystems.

When the survey for this study presented citizens with several options and asked which they most preferred as a way to provide water for the 3 million additional residents projected by 2050:

- Only 10% chose diverting "water from the state's remaining surface water and aquifers" as their preferred option.

- Even less (7%) chose diverting water from agriculture as the best option.

- 31% declined to choose any diversion of water from inside the state and instead stated a preference for the construction of "a pipeline across Mexico and California to transport desalinated Pacific Ocean water."

- The most popular water option, though, was people refusing to accept the inevitability of the population growth – 44% chose "it is better not to add another 3 million residents," rather than try to find water to support them.

That publicly preferred water option of not adding another 3 million residents is rarely if ever offered by Arizona's public officials, policy experts, or the media. Arizona's previous 4 million growth (1982-2017) is shown by county in **Table ES-3.** The concept of slowing that kind of population growth in a thirsty desert – let alone the halting of it – is deemed not a topic for public discussion.

Table ES-3. Population Growth in Arizona Counties – 1982 to 2017

County	1982 Population	2017 Population	% growth
Apache	52,152	71,545	37%
Cochise (Sierra Vista UA)	88,373	124,864	41%
Coconino (Flagstaff UA)	79,156	141,001	78%
Gila	38,924	53,578	38%
Graham	23,830	37,481	57%
Greenlee	11,747	9,443	-20%
La Paz	12,692	20,706	63%
Maricopa (Phoenix UA)	1,611,847	4,327,184	168%
Mohave (Lake Havasu City UA)	62,539	207,017	231%
Navajo	66,910	109,079	63%
Pima (Tucson UA)	568,004	1,026,391	81%
Pinal	96,802	431,564	346%
Santa Cruz	21,689	46,566	115%
Yavapai (Prescott UA)	74,009	228,082	208%
Yuma	81,186	209,507	158%
All Arizona Counties	**2,889,860**	**7,044,008**	**144%**

The Necessary Choices to Stop Habitat/Farmland Destruction

Our study did find some good news. Arizona's rate of sprawl slowed down late in the first decade of this century. Among the factors playing a role in this easing of environmental stresses were the adoption of smart-growth policies: higher gasoline prices, fiscal and budgetary constraints (limiting new road-building, for example), the increasing popularity of denser city living and its accompanying cultural amenities, and the recession-inducing mortgage meltdown in 2008.

Nonetheless, our most recent data for the past decade or so show that sprawl continues to devour open space at a rate of almost 17,000 acres per year (26 square miles), or one square mile every two weeks. This -averages out to 46 acres per day. In all likelihood, this rate has accelerated with the gradual recovery from the Great Recession, although we do not yet have sufficient data to confirm this hypothesis.

Even at this reduced rate, sprawl would continue to convert an additional 170,000 acres (265 square miles) of Arizona's valuable rural lands, open space, agricultural acreage and wildlife habitat into pavement and buildings every decade.

That would be in addition to the losses reported in this study since 1982. The area of cropland in Arizona declined from 1,250,200 acres in 1982 to 906,400 acres in 2015, a decrease of 27 percent. Some of this land was retired from intensive and often irrigated cultivation and converted to pastureland, rangeland, forestland, and other rural land categories. However, much of it was also developed. "Asphalt is the land's last crop," remarked former U.S. Assistant Secretary of Agriculture and conservationist Rupert Cutler back in the 1970s. Once a piece of ground with its soils and the micro and macro-ecosystems they support are paved over, the probability of that patch of the Earth being restored within the foreseeable future to a functioning ecological habitat or productive agricultural land is very small.

None of that is a future that Arizonans indicated they want in this study's 2020 survey.

As noted earlier, most citizens strongly support protecting the agricultural ability of the state.

With virtually the same level of intensity, Arizona voters value the natural areas of the state.

- 73% said it is very important "from an environmental standpoint" to preserve Arizona's deserts, grasslands, woodlands, forests and canyons. Another 22% said "somewhat important." Only 4% said not very or not at all important.

In Section 1.2 and Section 1.3, this study reports on the specific threats and challenges to the sustainability of all those Arizona habitats as well as the- animals, birds and plants most at-risk. **Table ES-4** shows, county by county, rural lands and habitats lost to sprawl from 1982 to 2017.

Table ES-4. Rural Land Lost (Overall Sprawl) in AZ Counties – 1982 to 2017		
County	**Acres Lost – 1982 to 2017**	**Percentage Change**
Apache	42,300	62%
Cochise (Sierra Vista UA)	56,300	81%
Coconino (Flagstaff UA)	34,900	72%
Gila	11,400	69%
Graham	19,500	112%
Greenlee	1,600	59%
La Paz	18,000	165%
Maricopa (Phoenix UA)	414,900	157%
Mohave (Lake Havasu City UA)	107,400	214%
Navajo	37,100	38%
Pima (Tucson UA)	112,300	56%
Pinal	126,700	238%
Santa Cruz	18,500	77%
Yavapai (Prescott UA)	52,300	137%
Yuma	63,000	326%
Total	**1,116,200**	**114%**

The majority of Arizonans particularly value the natural areas that they can explore, - experience, and enjoy.

- 57% said it is very important that they can easily spend time in the natural areas near where they live, the areas most in danger of disappearing under the developers' bulldozer blades. Another 33% said "somewhat important," with only 7% saying not very or not at all important.

We address that desire in "Americans and Arizonans Love Their Open Space" *(Section 1.7)* and also their need for easy access to nature in "Rejuvenating the Human Spirit: Physiological and Psychological Benefits of Open Space" *(Section 1.6).*

Arizonans also fear changes in their everyday quality of life – particularly congestion -- if population trends continue.

- Only 14% of Arizonans said they believe government will be able to build enough transportation capacity to accommodate the extra traffic if the population in their own communities continues to increase significantly; 78% said they expect that traffic "would become much worse."

State and local officials can do a number of things to mitigate the losses from population growth that citizens deplore. For example, they can accelerate their efforts to increase population density in the cities through zoning changes and regulations such as those that move more residents into apartment and condo buildings instead of single-family houses, thereby reducing the amount of land needed outside the urban boundaries to handle extra people.

- 38% of Arizonans said they strongly or somewhat favor those pro-density efforts.

- But 51% said they strongly or somewhat oppose such efforts; twice as many strongly opposed (24%) as strongly supported (12%) those increased-density goals.

Regardless of the willingness of citizens or the leadership of officials to embrace increased-density measures in Arizona, the findings of this study explain how those efforts can only slow down the rate of the destruction of habitat and agricultural land if population growth continues. **Figure ES-4** shows how decisively population growth has driven sprawl in Arizona.

This study confirms the conclusion of President Bill Clinton's special Council on Sustainable Development in 1996 that full environmental protection is not possible without a stabilization of population.

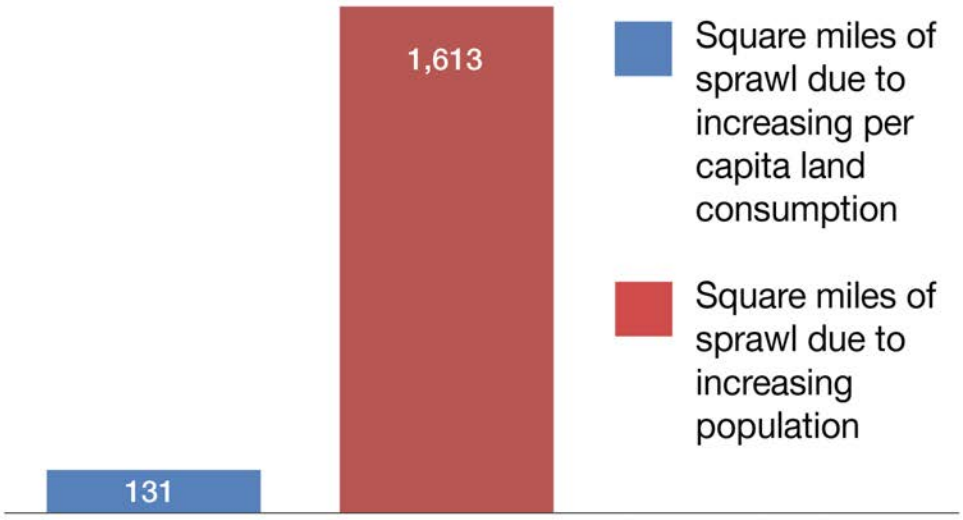

Figure ES-4. Rural Land Lost to Per Capita Sprawl vs. Population Growth in Arizona Counties, 1982-2017

In *Section 4.2.1*, we discuss a number of ways that local and state officials can first stop enticing people to move to Arizona from other states and, secondly, discourage the migration.

- By a 49-33 margin, Arizona citizens like the idea of making it "difficult for people to move to Arizona from other states by restricting development."

In the short term, this could provide for a greatly reduced pace of habitat and farmland destruction while at the same time slowing down the increased congestion in citizens' lives.

Beyond the short term, though, local Arizona 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-plus million additional residents each year.

These 20-25 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 Arizona and create pressure to undo measures to stabilize the state's population.

The current national population growth of about 20 million a decade is mostly the result of federal immigration policies that, whether intended or not, operate as a forced U.S. population growth program. Federal immigration policies account for nearly all U.S. population growth.

Thus, long-term population growth in the United States and Arizona is in the hands of federal policy makers. It is they who have increased the annual official intake and settlement of immigrants from one-quarter million in the 1950s and 1960s to over a million since 1990. The total of new arrivals, though, fluctuates between one million and nearly two million, once net illegal immigration is included. Until the numerical level of national immigration is addressed, even the best local plans and political commitment will be unable to stop or arrest sprawl.

That is why President Clinton's Council on Sustainable Development in 1996 recommended: "This is a sensitive issue, but reducing immigration levels is a necessary part of population stabilization and the drive toward sustainability."

Informed in this study's survey that the government currently "allows one million legal immigrants each year," Arizonans by a 47-38 margin favored reducing immigration.

Any serious efforts to halt the loss of open space, farmland, and wildlife habitat in Arizona must include reducing the volume of population growth, which requires lowering the level of immigrants entering the country each year, unless Americans and new immigrants decide to move toward a one-child per woman average.