NPG Negative Population Growth, Inc.

CRUSHING BIODIVERSITY WITH THE WEIGHT OF THE HUMAN RACE

An NPG Forum Paper
by Leon Kolankiewicz

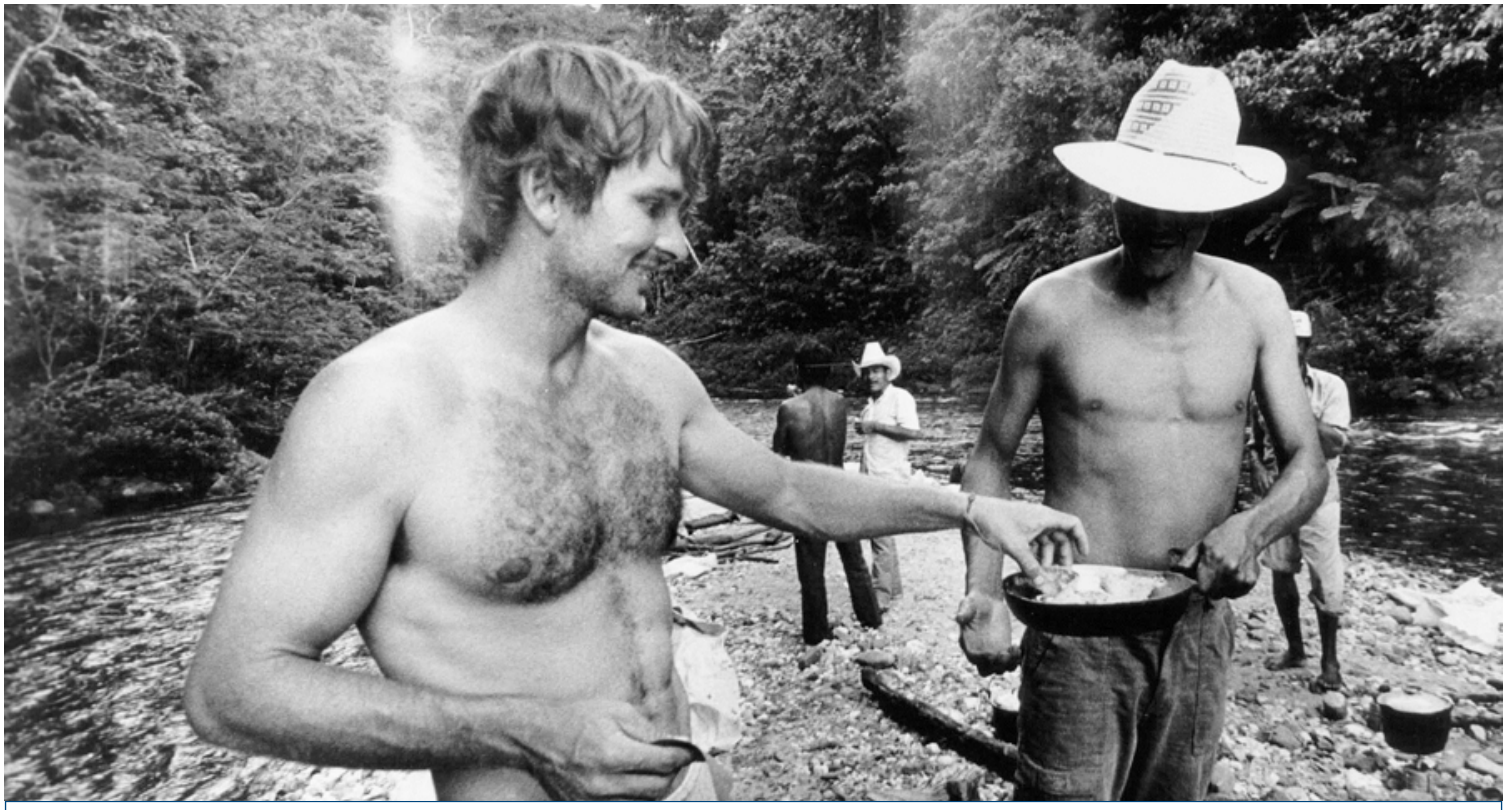
"…the world's gonna sink with the weight of the human race."
- English rock band The Who, "Had Enough," 1978

MAN'S WAR ON EARTH'S BIODIVERSITY – DISPATCH FROM THE FRONTLINES

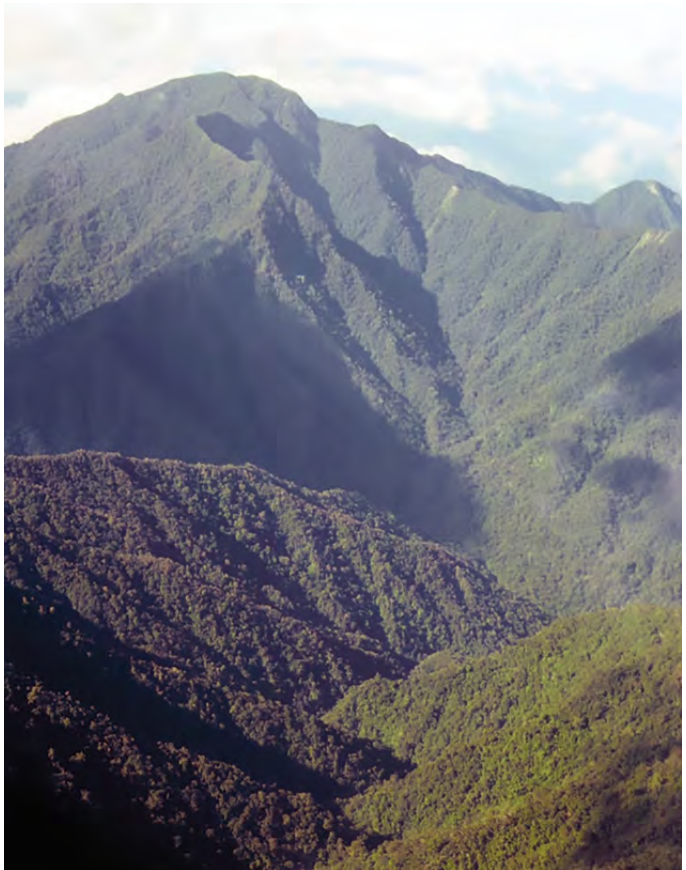
Some years ago, as a Peace Corps Volunteer in Honduras I was invited to help lead a fact-finding mission into the Río Plátano Biosphere Reserve. The Río Plátano (Plantain River) flows through the green, humid heart of an isolated region called *La Mosquitia* – the largest remaining rainforest wilderness of this ecologically-stressed Central American nation.

La Mosquitia had by far the lowest human population density in all of Honduras. Primitive subsistence settlements were separated by large, unbroken expanses of virtually uninhabited virgin tropical rainforest and pine savanna. This biological Eden still teemed with nearly pristine biodiversity – with jaguars, pumas, ocelots, scarlet macaws, toucans, harpy eagles, quetzals, tapirs, peccaries, anteaters, iguanas, howler monkeys, and manatees. These native jungle residents were all imperiled or extirpated elsewhere in overpopulated, over-exploited Central America.

THE RÍO PLÁTANO COURSES THROUGH THE HEART OF THE UNESCO MAN AND BIOSPHERE PROGRAM RESERVE THAT BEARS ITS NAME



BREAKFAST AT A CAMPSITE ON A GRAVEL BAR IN THE RÍO PLÁTANO. MISKITO INDIAN GUIDE ALLEN RIVENS OFFERS FRIED IGUANA EGGS TO AUTHOR KOLANKIEWICZ



FROM THIS – MOUNTAIN RANGES CARPETED WITH UNBROKEN TROPICAL RAINFOREST…

Unfortunately, the chainsaws, axes, machetes, explosives, bulldozers, logging trucks, guns, bullets, and hammers – as well as the humans who brandish these destructive tools – were rapidly encroaching on this sanctuary. The population bomb had detonated in Honduras and all of Central America. The number of Hondurans was growing by 3.5% annually: a doubling time of 20 years and a quadrupling time of 40. The demographic pressures resulting from this population explosion would soon subjugate or lay waste to every last wild landscape in Honduras.

Our mission was to investigate rumors that illegal loggers and squatters were invading the supposedly-protected core zone of the 975,000-acre Biosphere Reserve, which had been established in 1980 under UNESCO's Man and Biosphere Program in cooperation with the Honduran government. The 13 of us who set out into the wilderness – and the 12 of us who returned (tragically, one of our *compañeros* lost his life) – witnessed firsthand, in a microcosm, the unfolding tragedy of humanity's unrelenting and accelerating assault on the Earth's remaining wilderness, wildlife, natural habitat, and biodiversity.

As we advanced deeper into the jungle, the rumors of destruction became disturbing facts on the ground. We saw

…TO THIS – BLACKENED STUMPS AND MOUNTAINS SCRAPED BARE OF FORESTS – IN SCARCELY TWO GENERATIONS

unchecked penetration by illegal logging roads into the Biosphere Reserve's core zone – officially protected, but obviously on paper only. We also encountered massive migration along these new access routes by mestizo *campesinos* (i.e., Spanish-speaking, non-indigenous, rural peasants) from heavily-populated southern Honduras to the reserve's sparsely populated *tierras vírgenes* (virgin lands).

The most powerful family in the region was building the logging roads, so they faced little resistance. Mahogany and other valuable, exportable tropical hardwoods were luring illegal logging operations ever deeper into the rainforest. The few pathetic boundary posts of an unguarded reserve offered no defense.

The Honduran government and society lacked the resolve, interest, or means to deal with *reforma agraria* (land reform), logging, or unauthorized settlement and clear-cutting – and it certainly wasn't taking on the powerful Catholic Church. Opposition by the Church and its political allies forced the government to reject a large grant from the United Nations Population Fund, which would have implemented a population education program in public schools nationwide. A Catholic spokesman claimed the country's resources could easily support double or triple its then population. (He doubtless had no grasp of how rapidly exponential population growth would accomplish just that.)

We observed a defaced boundary post – and behind it, within the reserve, stretched a vast clearcut of sterile stumps where only a year before had stood exuberant rainforest. We encountered a truck, accompanied by well-armed bosses, hauling massive mahogany logs out of the reserve. Whole families of *campesinos*

THE DISAPPEARING EMERALD FOREST AND ITS WILDLIFE, REPLACED BY PASTURE AND CATTLE

INDISCRIMINATE SLAUGHTER OF WILDLIFE IN THE BIOSPHERE RESERVE WAS TAKING PLACE; HERE LIES A DEAD SPIDER MONKEY (*ATELES GEOFFROYI*) – A NURSING MOTHER – ALONGSIDE THE WEATHERED .22 CALIBER RIFLE USED TO SHOOT HER OUT OF A TREE

were marching into the area on foot, many had already cleared forest and planted subsistence crops. One logging boss estimated that some 8,000 migrants had already settled here in the five years since the road first penetrated this territory. Our Miskito Indian guide, who had explored this area seven years earlier, was shaken at just how quickly the clear-cutting and unauthorized settlement had encroached upon the very heart of the Biosphere Reserve.

A veritable massacre of the area's wildlife was well underway. Herbivores like deer and monkeys were being hunted for food, and carnivores like the jaguar shot dead because they were a perceived menace to livestock and children. We observed *campesinos* fishing with homemade dynamite – a highly destructive, indiscriminate method. Unsurprisingly, they complained that the fish harvest was diminishing.

I visited the rudimentary shack of one very friendly young man in his twenties. On the hills all around were corn stalks sprouting among blackened tree stumps. A year earlier, this all had been virgin rainforest. Stretched on the wall of his hut – home to a growing family of five – were the spotted hides of several jaguars and ocelots that had ventured within shooting range of this pioneer and his rifle. It was a poignant testimonial to what was happening in this region: all-out extermination. Ever more numerous human beings were displacing and replacing ever less wildlife.

In essence, the vulnerable *tierras vírgenes* of the Río Plátano Biosphere Reserve served as an escape valve for a society unwilling or unable to resolve its own internal contradictions. One species, *Homo sapiens*, was expanding at the expense of most other creatures – and bankrupting biodiversity in the process.

WHAT IS "BIODIVERSITY"?

Biodiversity, short for "biological diversity," is the variety of living organisms, populations, and communities on Earth (or some subsection of the planet). But it is much more than just a raw count of the number of species present in an area. Biodiversity occurs on multiple scales; it also refers to genetic diversity within given species, to the number of species within a given genus, to the number of genera within a given family – as well as to the diversity within and between entire habitats, ecosystems, and biomes. (Biomes are the major types of living communities – including tropical rainforest and dry

forest, savanna, grasslands/prairies, steppes, deserts, temperate deciduous forests, coniferous forests, boreal forest, taiga, tundra, and permanently frozen areas.)

Estimates of the total number of species of flora and fauna on Earth range from three million all the way up to 100 million. Over the past two centuries or so, taxonomists have already identified and named some 1.7 million species – and many species are driven extinct even before they can be classified.

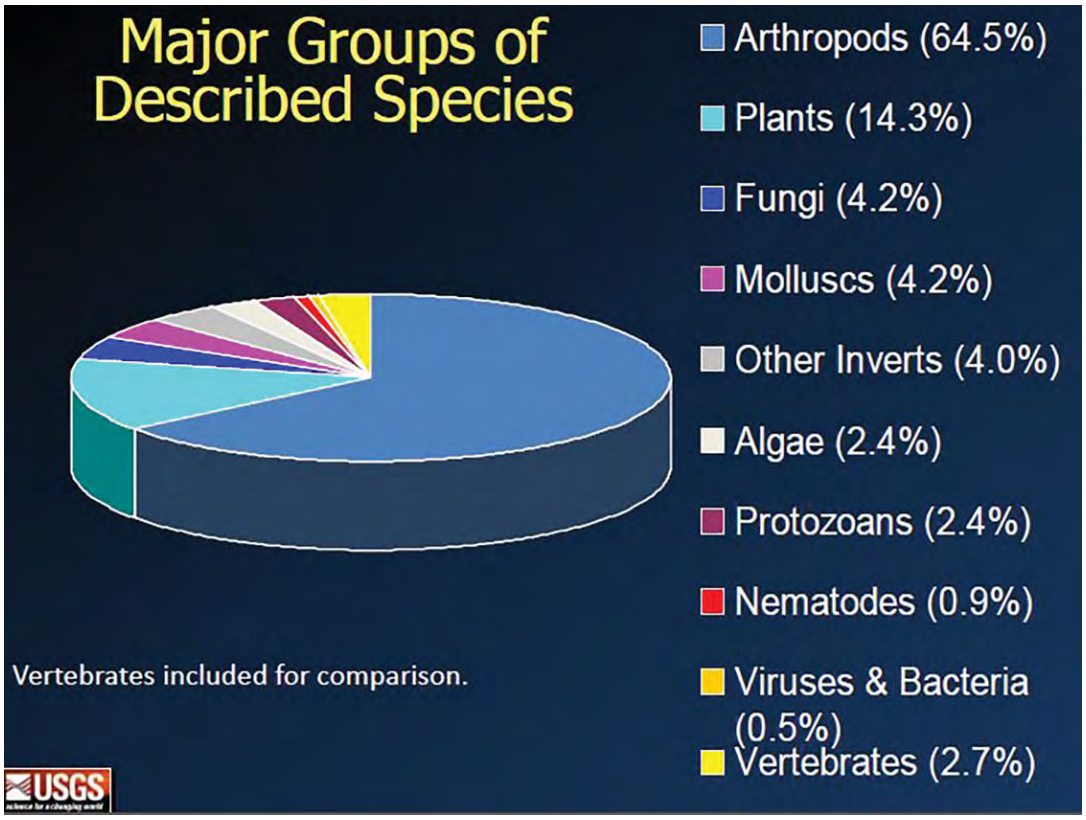


FIGURE 1. MAJOR GROUPS OF SPECIES DESCRIBED BY TAXONOMISTS

Figure 1, from the U.S. Geological Survey (USGS), shows the major groups of described species in our biosphere. Arthropods – the most numerous – include insects, crustaceans, arachnids (spiders), millipedes and centipedes. Vertebrates – which include mammals, birds, amphibians, reptiles, and fish – comprise only about 62,000 species, or 2.7% of all species identified and named on Earth.

THE IMPACT OF HUMAN POPULATION GROWTH ON BIODIVERSITY

Since the dawn of history, the multiplication of man's numbers – and our expansion into virtually every habitat on Earth – has occurred to the great detriment of countless other organisms. The assault on biodiversity began in pre-history even before the advent of agriculture, it accelerated under the agricultural revolution, and it exploded with the industrial revolution and accompanying human population boom.

As of September 2016, there are more than 7.3 billion people on Earth and 324 million in the United States – and those population sizes are growing by roughly 80 million and 2.5 to 3 million every year, respectively. Yet it is not just these numbers that adversely impact wildlife and biodiversity. For it is not only the presence of billions of human beings – but also what all of these billions *do* in the process of surviving and thriving – that together cause such damaging impacts.

At the most fundamental level, each living human being imposes a load on our surrounding ecosystem – and on the complex web of biotic (living) and abiotic (non-living) features which comprise it. We each extract energy and matter from environmental resources, and we each emit waste into the land, water, and atmosphere. Merely pursuing the most basic functions of animal life – breathing, obtaining food and water, moving, reproducing, and securing clothing and shelter – entails a rash of environmental consequences. Every single living human being inevitably impacts his or her environment, though the magnitude of those impacts is highly variable.

In the beginning, there were two main ways humans harmed other animal species: directly, by killing them outright, and indirectly, by modifying or destroying their habitats or homes. Both ways have caused catastrophic reductions in wildlife numbers and led to numerous extinctions. Even primitive hunter/gatherers living lightly on the land can profoundly alter surrounding ecosystems by using

fire to manipulate vegetation and habitats – benefiting certain species of flora and fauna, while hurting others. Paleo-humans also caused direct mortality of wildlife, hunting them for meat, hides and other useful body parts, or eliminating them as rivals or threats. When we killed off creatures that served as the prey of other predators, those predators too would suffer as their food source decreased or disappeared.

Figure 2, which is based on the work of University of Manitoba ecologist Vaclav Smil, dramatically illustrates just how thorough human civilization has been at crushing or displacing all other creatures. Humans and domesticated animals (the handful of species we selected explicitly to serve us) co-opt space, land area, habitat, solar energy, fertile soils, and water – all at the expense of every other wild vertebrate on the Earth's land areas. It has been estimated that humans (plus our dogs, cats, pigs, cattle, goats, sheep, and chickens) now account for more than 90% of total terrestrial vertebrate biomass.

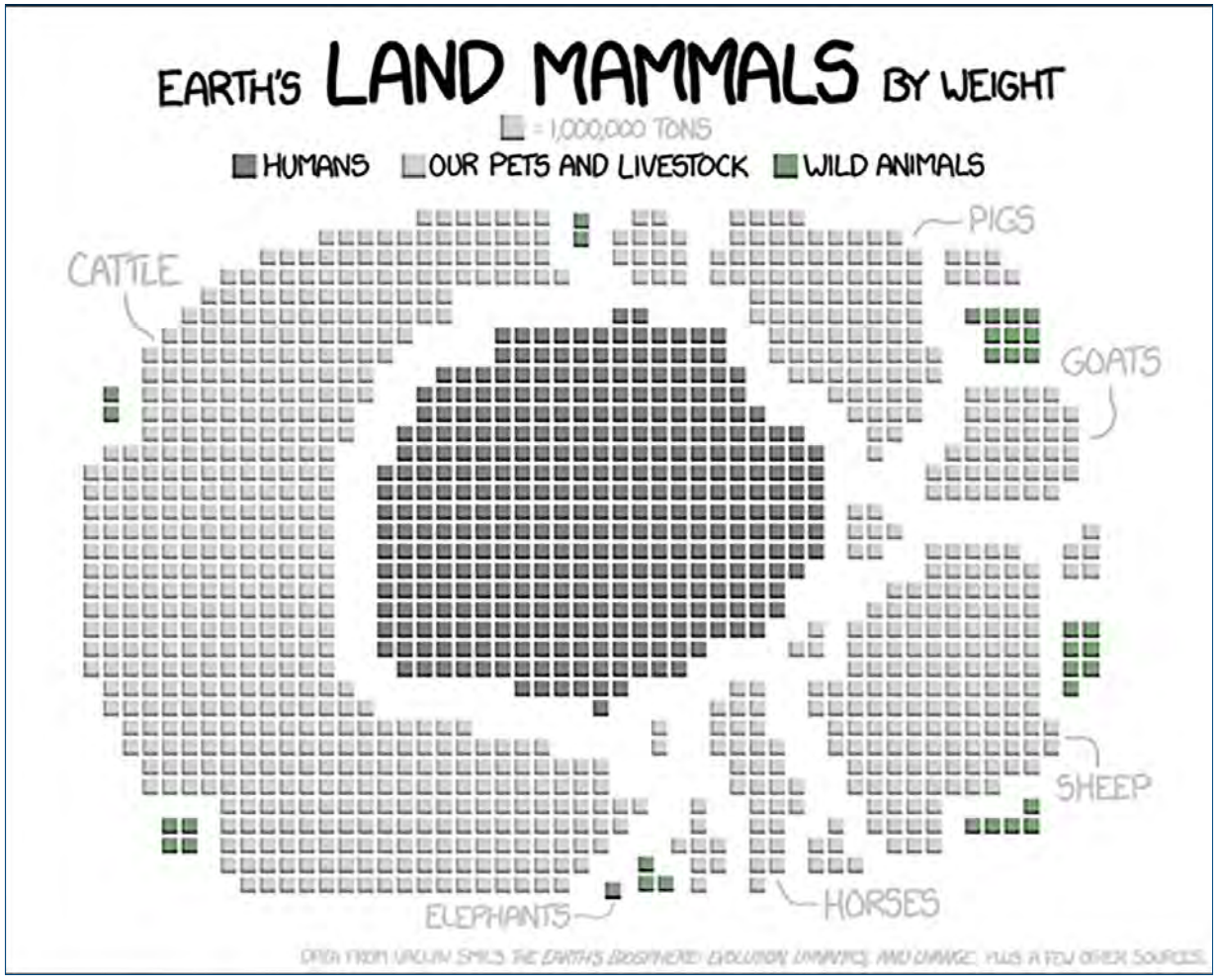


FIGURE 2. RELATIVE WEIGHTS OF EARTH'S LAND MAMMALS – HUMANS, PETS AND LIVESTOCK, WILDLIFE

Humans appropriate most of the biosphere's ecologically productive zones, leaving little for the other tens of thousands of vertebrates to survive on. This is why so many other species are suffering drastically reduced numbers – or are even threatened with extinction on a global scale.

With respect to biodiversity, North America was already "depauperate" – biologically bereft – millennia before the growing European and Euro-American populations migrated across the Atlantic. (And in the wake of that migration we expelled or exterminated any indigenous inhabitants, human and non-human alike.) North America once boasted iconic Ice Age megafauna such as mammoths, mastodons, giant sloths, giant beavers, giant condors, giant polar and grizzly bears, dire wolves, saber-toothed cats, and others before the appearance of the first *Homo sapiens* – Paleo-Indians – roughly 15,000 years ago.

In recent decades, circumstantial evidence has mounted that strongly supports what is known as the Pleistocene Overkill Hypothesis. This hypothesis implicates Paleolithic migrants to North America – as well as to Eurasia, South America, Australia, and New Zealand – who can be directly linked to the well-documented extinctions of mammalian and avian megafauna.

According to a 2001 paper in the journal *Science*, more than half of large mammals vanished in an unrivaled "cataclysmic extinction wave" toward the close of the Pleistocene era – wiping out a level of biodiversity which had persisted for millions of years. The Pleistocene Overkill Hypothesis implies that this giant "die-off" was due to the direct effects of human predation. Evidence is growing that for ages, these large, hardy mammals had adjusted to epochal shifts in the climate – but the great shaggy beasts could not adjust to the spears, strategies, and supreme tenacity of a resourceful, cunning new predator called man.

As *The New Yorker* staff writer Elizabeth Kolbert puts it in her 2014 book *The Sixth Extinction: An Unnatural History*:

> *The Anthropocene [proposed name for a new geological era dominated by human agency] is usually said to have begun with the industrial revolution, or perhaps even later, with the explosive growth in population that followed World War II. By this account, it's with the introduction of modern technologies – turbines, railroads, chainsaws – that humans became a world-altering force. But the megafauna extinction suggests otherwise. Before humans emerged on the scene, being large and slow to reproduce was a highly successful strategy, and outsized creatures dominated the planet. Then, in what amounts to a geologic instant, this strategy became a loser's game.*

This terrible and permanent loss of biodiversity (in North America and many other places) happened at a time when the multipliers of human impact – population, affluence, and technology – were all miniscule by comparison to today. Yet given enough time, our primordial ancestors were still apparently capable of wreaking havoc on biodiversity. Doing what comes naturally to any organism, humans were pursuing immediate survival imperatives rather than strategies of long-term stewardship and sustainability. But never had there existed an organism this powerful and lethal in the 3.5 billion year history of life on Earth.

THE TRAGIC CASE OF THE PASSENGER PIGEON – A CAUTIONARY TALE FOR OUR TIMES

On September 1, 1914, a legendary species of bird – the passenger pigeon (*Ectopistes migratorius*) – vanished for all time from the face of the Earth. A female named Martha, the very last surviving member of her species, died in the Cincinnati Zoo that day – and thusly, the passenger pigeon was officially declared an extinct species.

In November 1907, Martha and two male companions were the only known surviving passenger pigeons left in the entire world. One of those companions died in April 1909, the other in July 1910. Martha thus lived the final years of her life as an "endling," an individual that is the last living specimen of a subspecies or entire species. When an endling dies, a unique genome that has survived and evolved across thousands or millions of generations dies out with it. No passenger pigeon had been observed in

MARTHA, THE LAST SURVIVING PASSENGER PIGEON, WHOSE TAXIDERMIED REMAINS ARE PRESERVED AT THE SMITHSONIAN MUSEUM OF NATURAL HISTORY IN WASHINGTON, DC

the wild for some years before Martha, and none was ever seen afterward.

Each of the creatures humans have erased from existence was unique in its own fashion, but the passenger pigeon was especially exceptional. That's because half a century before they all disappeared, passenger pigeons were by far the single-most abundant bird species in America – if not the entire world. There were an estimated 3-5 billion of them; roughly one out of every four birds north of Mexico was a passenger pigeon.

The sheer size of their flocks was the stuff of legend. It could take hours for a single gargantuan flock to pass, darkening the sky and numbering in the hundreds of millions. One flock took several hours to pass over Columbus, Ohio, in 1855 – blotting the sun from the sky and causing horses to bolt, children to shriek, and adults to drop to their knees and pray. In 1813, naturalist and painter John James Audubon documented another flock that took *three days* to cross over the Ohio River.

In the 1700s and 1800s Euro-American settlers arrived on the scene, first by the thousands and then by the millions. They came armed with guns, saws, axes, plows, and a high fertility rate – and the passenger pigeons plummeted. After the Civil War, the advent and expansion of telegraph lines and railroads facilitated the emergence of a commercial pigeon industry that butchered the birds by the billions. Vast areas of primeval forests were cut down to make way for farms to house, employ, and feed the burgeoning human population.

By the 1880s, the passenger pigeon was in deep trouble – and even as their numbers dropped precipitously, there was virtually no organized effort to save them. Naturalist Joel Greenberg noted: "People just slaughtered them more intensely. They killed them until the very end." Yet regrets over the passenger pigeon's stunning demise helped motivate the nascent wildlife conservation movement at the start of the 20th century. And throughout the century just passed, the tragic fate of this bird has served as a cautionary tale for biologists and policymakers alike: even numbering in the billions does not guarantee a species' survival.

Zoologists estimate that about 320 species or subspecies of land vertebrates have been driven extinct since 1500. Like the passenger pigeon, virtually all of these extinctions were due to human actions related to overpopulation: habitat fragmentation and destruction, uncontrolled hunting or poaching, and – to a smaller extent – invasive species (including introduced diseases), pollution, and pesticides.

CRUSHING BIODIVERSITY WITH THE WEIGHT OF THE HUMAN RACE

A 2008 conference presentation by J. Michael Scott of the USGS – titled "Threats to Biological Diversity: Global, Continental, Local" – provides a good overview of the intensifying assault humans are waging on other species. Figure 3, taken from that presentation, depicts the broad correlation between rising human population and the number of extinctions on a global scale.

Dr. Jeffrey McKee of Ohio State University notes: "There is now a growing body of academic literature… establishing a scientific link between human population density and growth and increased extinction threats for plants and animals, yet this key footprint remains on the outskirts of conservation dialogue." In 2012, ***McKee found that increasing human population density accounted for 90% or more of increasing numbers of threatened species***. Gross national product (GNP, or what environmentalists call "consumption") accounted for less than 10%, and all other variables – such as agricultural land use practices – amounted to little more than "statistical noise."

The Tucson-based Center for Biological Diversity concurs with McKee, stating:

> *The current mass extinction differs from all others in being driven by a single species rather than a planetary or galactic physical process. When the human race – Homo sapiens sapiens – migrated… waves of extinction soon followed. The colonization-followed-by-extinction pattern can be seen as recently as 2,000 years ago, when humans colonized Madagascar and quickly drove elephant birds, hippos, and large lemurs extinct.*

The Millennium Ecosystem Assessment (MEA), a comprehensive assessment of the impacts of human activity on the environment with some 1,300 contributing authors from 95 countries, concluded ominously in 2008:

- Human actions are fundamentally, and to a significant extent irreversibly, changing the

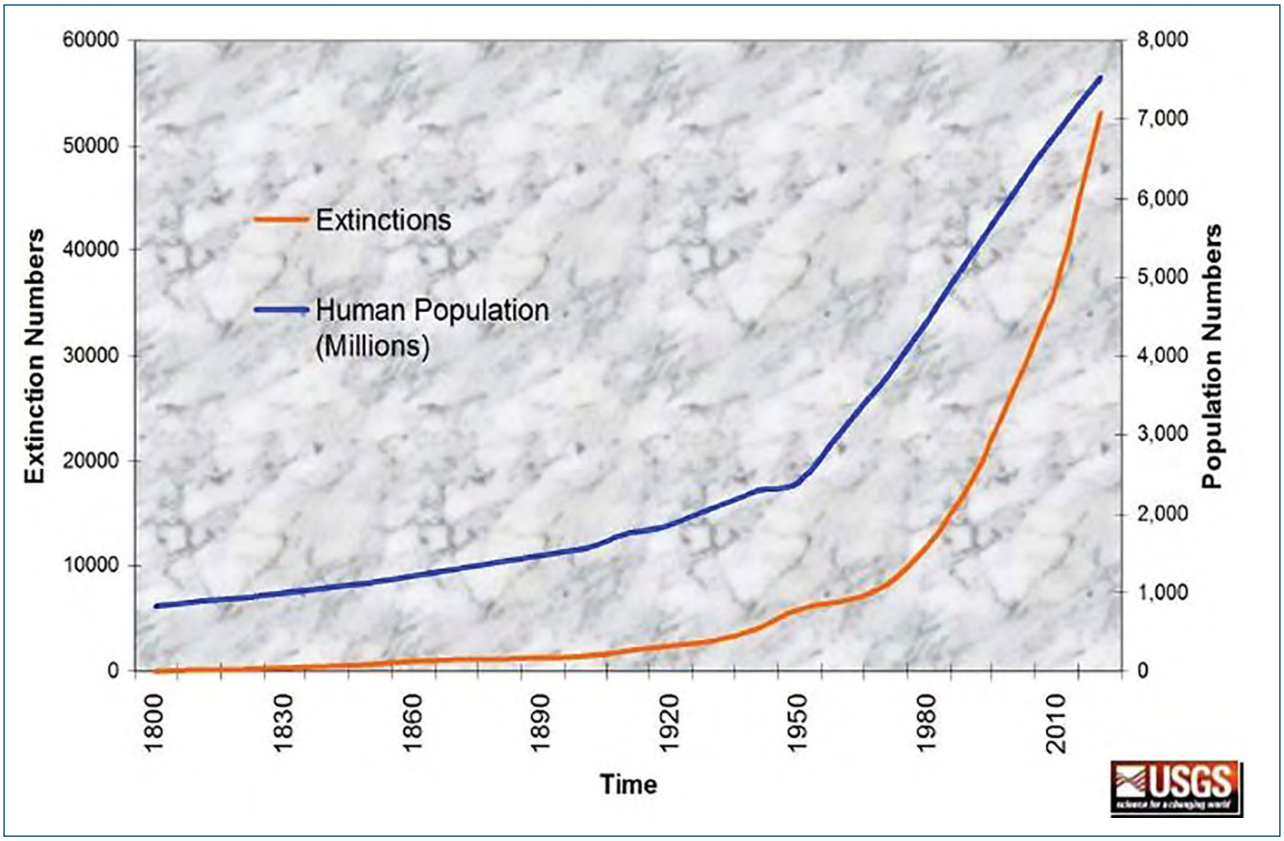


FIGURE 3. SPECIES EXTINCTION AND HUMAN POPULATION ON A GLOBAL SCALE

diversity of life on Earth, and most of these changes represent a loss of biodiversity.

- Changes in important components of biological diversity were more rapid in the past 50 years than at any time in human history. Projections and scenarios indicate that these rates will continue, or accelerate, in the future.
- The current extinction rate is estimated at approximately 1,000 times the normal rate of extinction.
- 10-50% of mammals, birds, amphibians, conifers, and cycads (an ancient group of woody plants) are threatened with extinction.
- The extinction of roughly 10-15% of plant species globally could be expected by 2050 as a result of habitat loss.

More land was converted from natural habitats to cropland in the three decades between 1950 and 1980 than in the 15 decades between 1700 and 1850. Adding another billion people every 12-13 years (as the world has for the last several decades) only intensifies the pressure to convert more habitat area to farmland. The dire need to increase food production for a growing number of humans simultaneously works to eliminate ever-more-desperately needed habitat for wildlife.

As stated before, it is not only billions of human beings – but also what those billions of human beings *do* to survive and thrive – that stress biodiversity. Figure 4 shows the mechanisms of our assault on biodiversity. Many of these threats overlap and interact, and many imperiled species are affected by more than one cause.

California boasts more species of flora and fauna combined than any other U.S. state, as well as the highest number of endemics (species found nowhere else). Unfortunately, California also has more species listed as threatened or endangered than any of the 48 contiguous states – second only to Hawaii. California's extraordinary biodiversity is already stressed by the state's massive human population (nearly 40 million in 2016), and it is further threatened by continued population growth and development. This conclusion was echoed by the report *California Wildlife: Conservation Challenges* from the California Department of Fish and Game.

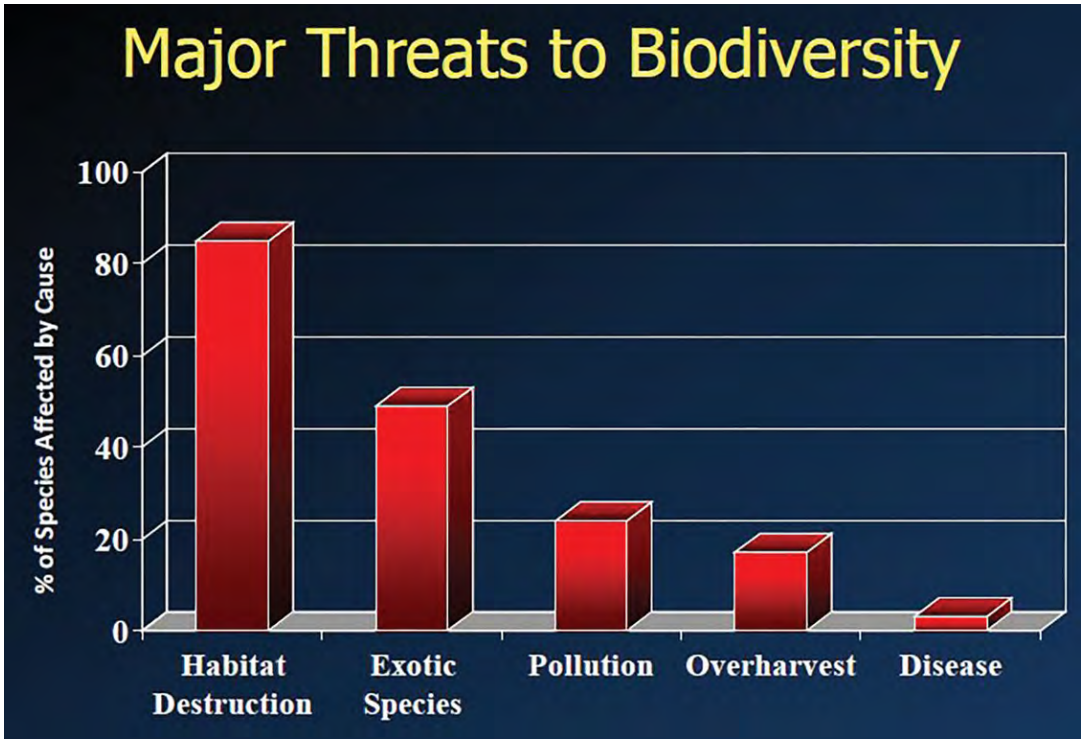


FIGURE 4. MAJOR CATEGORIES OF THREATS TO BIODIVERSITY (ACCORDING TO THE USGS)

More than 800 species in California are now at risk – including half of all mammals and one-third of all birds. Of these, 134 species are listed as threatened or endangered – facing a real possibility of extinction. *Conservation Challenges* identified the major "stressors" impacting California's wildlife and habitats, including: water management conflicts, invasive species, overgrazing, recreational pressures, and climate change. But the plan stated explicitly that: "Increasing needs for housing, services, transportation, and other infrastructure place ever-greater demands on the state's land, water, and other natural resources." Of course, continuous expansion of each of these types of development would not be necessary were it not for population growth.

Yet seemingly contradicting the foregoing litany of loss – due to overpopulation, arrogance, and ignorance – is the 20th century record of qualified success in wildlife conservation in the U.S. Our population has more than quadrupled from 76 million in 1900 to 324 million in 2016. The status of wildlife should have worsened considerably under those rising demographic demands, yet since President Theodore Roosevelt set aside Pelican Island National Wildlife Refuge in Florida in 1903, more than 550 national wildlife refuges have been established throughout the country, conserving more than 95 million acres under the motto "Wildlife Comes First."

A century ago, the whitetail deer had been all but extirpated from many eastern states, the wild turkey was scarce, and many species of waterfowl and wading birds were diminishing rapidly. Populations of birds like the trumpeter swan, whooping crane, California condor, and ivory-billed woodpecker were dropping – and the passenger pigeon had just gone extinct. The American bison had barely escaped this destiny, as railroads and ruthless gunners pushed westward. Mountain lions, wolves, and elk had been obliterated in the East, and the grizzly bear all but wiped out of California. The fabled and ferocious plains grizzly bear had already vanished, hunted to extinction. In the second half of the 20th century, the American bald eagle, peregrine falcon, brown pelican, and osprey were all threatened with oblivion from the widespread use of man-made insecticides.

Today, several decades after many pesticides were banned and ambient concentrations have diminished, these raptors have all rebounded. Whitetail deer have become so abundant that they are a pest to gardeners and a traffic hazard in many places. Protected wading birds (herons and egrets) and managed waterfowl are far more numerous and enjoy stable populations. Bison, grizzly, and wolf populations – while not regaining their former size and range – have at least stabilized and reclaimed some old haunts. Wild carnivores like coyotes and foxes roam Washington, DC's woodlands and other urban areas.

What a change a genuine commitment to conservation makes! Americans were moved by the powerful prose and pleas of revered naturalists, authors, and activists like Henry David Thoreau, John Muir, E. O. Wilson, and many others. And in the 20th century, as America grew wealthy and better educated – in good

part supported by our unsustainable dependence on non-renewable resources – specialized new fields like wildlife management and conservation biology were able to develop into full-fledged professions.

Here in the United States, the current status and future prospects for many species of wildlife have improved dramatically – even as the three main drivers of environmental degradation (population, affluence, and technology) have all expanded enormously. As stated above, the U.S. population has more than quadrupled between 1900 and today. If all population growth is detrimental to biodiversity, the status of wildlife should have deteriorated, not improved. What is going on? Is human population growth compatible with wildlife and biodiversity conservation after all?

Absolutely not. The bottom line is that, as demonstrated by the Pleistocene Overkill, we humans are capable of wiping out wildlife and trampling biodiversity even at quite low levels of population size, affluence, and technological power. More progressive attitudes about wildlife, as well as having economic and technical means, will provide greater levels of biodiversity protection and conservation. ***However, if population size and growth – both in the U.S. and around the world – are not reduced, all we will have succeeded in doing is buying time***. The entire edifice of wildlife and biodiversity conservation will collapse, if society itself collapses from ecological overshoot.

On a global scale, the situation is not as hopeful for wildlife and biodiversity as the above examples from the United States might imply. ***In fact, the situation overall is dire if not downright calamitous***. In *The Annihilation of Nature: Human Extinction of Birds and Mammals*, the authors lament: "We are destroying some of the most fascinating and beautiful creatures that nature ever designed…." On every continent, and especially in developing countries and the tropics, distinctive wildlife face a formidable array of threats – and those threats are escalating as human populations continue expanding.

"THE LITTLE THINGS THAT RUN THE WORLD"

This Forum paper has emphasized the ethical and aesthetic dimensions of overpopulation's negative

RECKLESS SLAUGHTER ALL BUT WIPED OUT THE AMERICAN BISON (*BISON BISON*) IN THE 19TH CENTURY, BUT POPULATIONS HAVE RECOVERED TO SMALLER BUT STABLE NUMBERS

GORILLAS, ENDEMIC TO AFRICA, ARE THE LARGEST LIVING PRIMATE AND ARE HIGHLY ENDANGERED BECAUSE OF HABITAT LOSS, HUMAN ENCROACHMENT, AND POACHING

impacts on biodiversity, but it would be remiss if it did not mention that there is also a strong element of human self-interest in preserving biodiversity. Entomologist, best-selling author, and two-time Pulitzer Prize winner E.O. Wilson has written eloquently on the importance and conservation of invertebrates (animals without backbones), those "little things that run the world."

In 1987, Wilson published a paper in the journal *Conservation Biology* by this very title. In it, he extolled the incredible intricacy of the narrow and tiny ecological niches occupied by invertebrates. Wilson explained:

> *The truth is that we need invertebrates but they don't need us. If human beings were to disappear tomorrow, the world would go on with little change. Gaia, the totality of life on Earth, would set about healing itself and return to the rich environmental states of a few thousand years ago. But if invertebrates were to disappear, I doubt that the human species could last more than a few months.*

Invertebrates and invisible microbes provide vital ecosystem services, which are essential for the survival and well-being of human societies. But the mind-boggling variety and profusion of invertebrates and microscopic organisms should not delude us into believing they are invulnerable or infinitely adaptable to whatever humans throw at them. In fact, they are every bit as vulnerable to the excesses of industrial civilization and overpopulation as the larger vertebrates are.

Beneficial insects may be susceptible to certain pesticides – for example, honeybees apparently are vulnerable to the widely-used neonicotinoid class of insecticides, contributing to honeybee colony collapse disorder. Many insects, especially in the tropics, have highly restricted ranges and may even go extinct when a single mountain or valley is deforested.

While it is true that past civilizations have endured for centuries and, in the process, undoubtedly harmed biodiversity on local and regional scales – perhaps without it coming back to haunt them – today's assault is global and interconnected. While it may be possible to lose a number of species without an entire ecosystem unraveling or changing irreversibly and to great detriment, at some point we may cross a threshold or tipping point.

Stanford biologist Paul Ehrlich and Sea Shepherd Conservation Society founder Paul Watson have both used the analogy of rivets. If someone pops too many rivets out of a plane's wing or a ship's hull, at some point it will fail. Captain Watson writes: "Every species on the planet is a living rivet in the living hull of the biosphere. If we lose one rivet too many, our life-support system will crash."

WHAT THEN MUST WE DO?

In 1886, Russian writer and philosopher Leo Tolstoy posed the profound question: "What then must we do?" Having reviewed the destructive

POLLINATION IS A CRUCIAL ECOSYSTEM SERVICE PERFORMED BY HONEYBEES AND OTHER INSECTS

effects of human population growth on biodiversity, we too can pose that question: what then must we as individuals, as Americans, and as "global citizens" do?

As individuals, we can try to make a difference in several ways. The personal choices we make – to become parents or opting not to, as consumers, and how we influence broader political and economic policies – could all help reduce anthropogenic impacts on biodiversity. First, we can choose to "walk the talk" and ***limit the size of our own families*** to one or two children at most. Even better, we could go childless. Second, we can be advocates and educators on behalf of ***stopping U.S. and global population growth, and then reducing overall population size to smaller, more sustainable levels***. Our personal decisions to have fewer or no children will make no difference at all, unless large enough numbers of people – a substantial majority – are willing to take similar action.

We should support advocacy non-profit groups such as the Population Media Center, Population Institute, and International Planned Parenthood Federation – whose missions focus on family planning, reproductive health, women's empowerment, and international population issues. We should also focus on supporting efforts by groups like Negative Population Growth (NPG), whose mission is to gradually, comprehensively, and consciously reduce U.S. population size. We should also support the U.S. government's international family planning programs through the Agency for International Development and the United Nations Population Fund. By supporting this combination of groups and missions, we can potentially garner enough global and U.S. support to make a real change.

Third, we can ***conserve energy, resources, and water in our own personal consumption choices and actions***. It is the incessantly rising demand for resources that drives their increasing exploitation – which, in turn, impacts habitats. We can drive less, ride bicycles, take public transit, and walk more. We can drive smaller, more fuel-efficient cars. We can reduce, reuse, and recycle packaging and materials. We can replace incandescent lights with compact fluorescents, add thicker insulation, install rooftop solar photovoltaics, and purchase energy star appliances. We can eat less meat or none at all, as it takes 5-10 times the amount of water, energy, and land to produce the same number of calories or protein in meat as in plants and vegetables. We can turn down the thermostat in winter and turn it up in summer.

(It should be obvious that without addressing overpopulation simultaneously, all of the foregoing conservation efforts – however gallant, well-intentioned or widespread – will come to naught, because ***all progress will be offset by continued population growth***. Trying to preserve biodiversity with a growing human population is the ecological equivalent of trying to lose weight while still eating more calories and not getting any exercise!)

PROVIDING FAMILY PLANNING AND REPRODUCTIVE HEALTH SERVICES – AS WELL AS EMPOWERING GIRLS AND WOMEN IN DEVELOPING COUNTRIES – IS A WIN-WIN APPROACH

Fourth, ***at a political level, we must support more rational, responsible environmental and population policies*** and better stewardship of natural resources. Unfortunately, this is

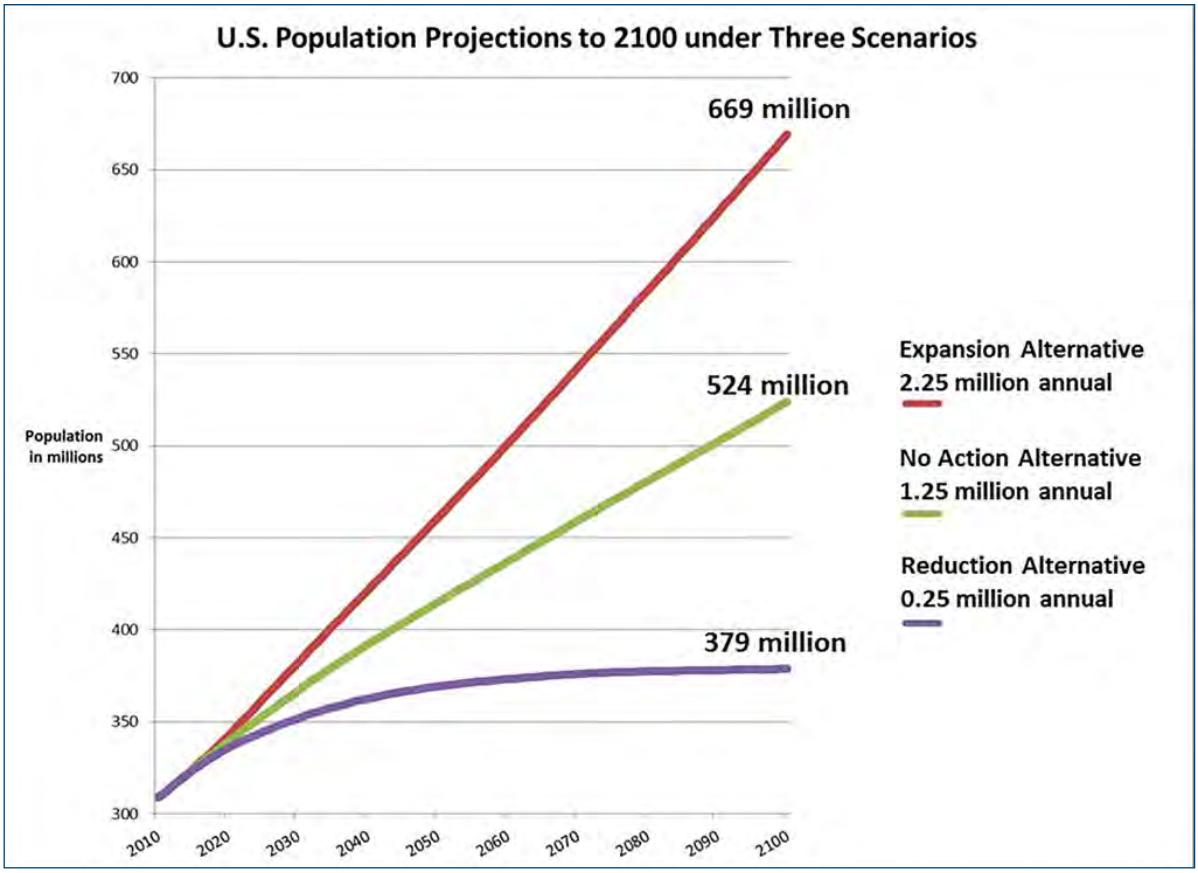


FIGURE 5. THREE IMMIGRATION AND U.S. POPULATION SCENARIOS
(FROM 2015 EIS, PREPARED BY PFIR)

almost impossible given today's highly-polarized political setting. Many politicians claim to support environmental conservation, family planning, and global population issues – but they are abysmal on reducing U.S. population and immigration. Others are strong proponents of lower population and immigration numbers, but reject any calls for environmental protection.

Most Americans support the goals of population reduction (nationally and globally), reduced immigration (especially illegal), and protecting wildlife and biodiversity – at least in theory. Yet voters are hard-pressed to find a single politician who embraces all of these majority-held views. Any who do are eliminated in the primaries, where rigid enforcement of ideological purity ensures toeing the party line. On both sides of the aisle, short-term, selfish, vested interests dominate American politics and politicians as never before.

This political polarization on the national level has led to paralysis in addressing relentless mass immigration – which is forcing U.S. population ever-upwards. Figure 5 is a graph showing three population growth projections from 2010 to 2100, which were developed for an Environmental Impact Statement (EIS) prepared in 2015 by Progressives for Immigration Reform (PFIR).

The highest curve, reaching a U.S. population of 669 million by 2100 and still growing rapidly, is what would happen if "comprehensive immigration reform" (such as the 2013 "Gang of Eight" bill S. 744) were to become law. Under this scenario, approximately 2.25 million immigrants would be admitted annually. It would be a disaster for biodiversity preservation in the U.S. and the environment generally.

Yet in a misguided effort to appear inclusive and ostensibly embrace ethnic and racial diversity at all costs, one prominent "environmental group" – the Sierra Club – actually endorsed S. 744. This was a betrayal of fundamental environmental principle so unconscionable that, as far as this writer is concerned, the Sierra Club has lost its standing as an environmental group and is guilty of "greenwashing" – propaganda spread by an organization so as to present an environmentally-

virtuous public image. Their actions were every bit as damaging as coal companies which proclaim the virtues of "clean coal," or those who tout the supposed environmental benefits of fracking for natural gas.

The second or middle curve corresponds to current immigration levels, about 1.25 million annually, and shows the size U.S. population would reach if present trends continued to the year 2100: 524 million, an increase of 200 million from the 2016 American population of 324 million.

Finally the lowest curve, in which immigration would be reduced to 0.25 million (250,000) per year, shows that U.S. population would still reach 379 million in 2100 – an increase of 55 million from the present population. Under this scenario, the current annual immigration rate would be cut by 80% or by one million per year. (Sadly, in today's political climate this scenario is only a fanciful hope for those who promote reversing U.S. population growth and stabilizing our numbers at a much lower level.)

When evaluating the impacts of these three immigration scenarios on biodiversity, PFIR found that while the impacts of the reduction alternative would be less than the other two scenarios, they would still be "adverse, significant, and long-term." The EIS added that the reduction alternative:

> *…would likely be associated with the permanent loss of at least an additional 35-65 million acres (55,000 to 100,000 square miles) of wildlife habitat directly to development (sprawl and urbanization) – but this is much less than the predicted habitat losses of the No Action and Expansion alternatives. A still larger area of habitat… would be vulnerable to degradation from increased environmental pressures and stresses associated with a human population that is 23% larger than our present population.*

PFIR concluded:

> *In sum, if the American people and the federal government were to endorse the Reduction Alternative… impacts on habitat and biodiversity would still be significantly adverse and likely greater than they are at the present time. However, these impacts would be much*

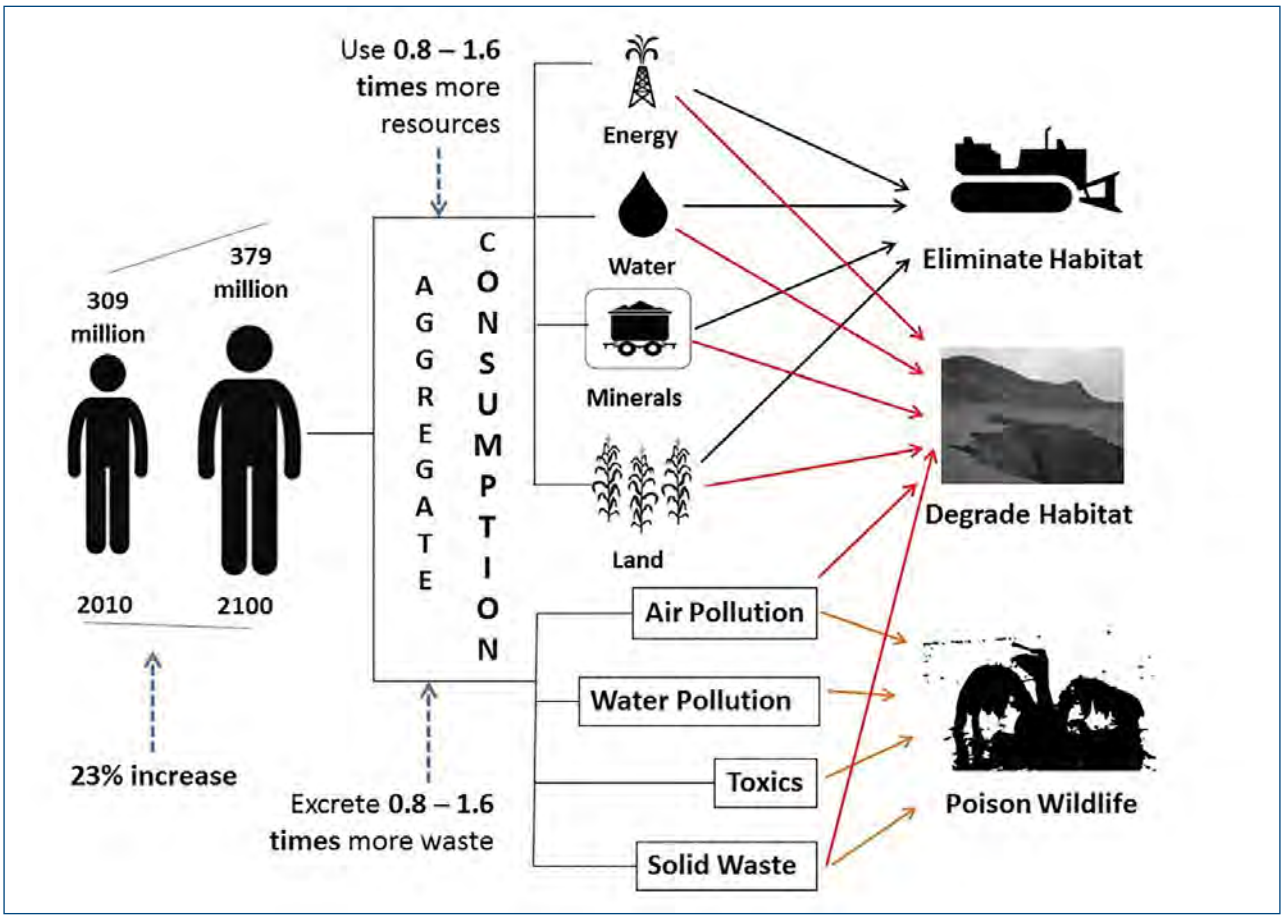


FIGURE 6. ILLUSTRATION OF PATHWAYS BY WHICH THE REDUCTION ALTERNATIVE WOULD ADVERSELY AFFECT HABITATS, WILDLIFE, AND BIODIVERSITY
(SOURCE: FIGURE 3-60, PFIR EIS, 2015)

less than those of the No Action Alternative or the Expansion Alternative. Furthermore, by 2100, the U.S. population would have stopped growing and stabilized under the Reduction Alternative, whereas under both the No Action and Expansion alternatives, it would still be growing rapidly with no end in sight.

However, assuming the birth rate is at or slightly below replacement level (as it has been for several decades) – even reducing immigration levels by 80% is insufficient to bring about gradual U.S. population reduction by the end of this century. ***Unless stronger measures are adopted, overpopulation's adverse impact on biodiversity in the United States will continue to worsen***.

As I remarked in my chapter of the 2012 anthology *Life on the Brink: Environmentalists Confront Overpopulation:* "Our species is unique because here and now, only we have the ability to destroy, or to save, biodiversity. And only we have the ability to care one way or the other…. Limiting human population will not guarantee success, but not doing so means certain failure."

In the current context of ecological overshoot, "limiting" is simply not enough. We must focus on reducing human population. The evidence is irrefutable that even our current numbers are already ecologically unsustainable and are doing incalculable damage to the myriad life forms that have existed on Earth for at least as long as we have.

The Earth's sixth major extinction episode, one caused entirely by humans, is now gathering force. Nationally and globally, humanely reducing overall population size is critical – if we ever hope to save large numbers of species and rescue biodiversity from the imminent prospect of a mass extinction event.

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About the Author: Leon Kolankiewicz is an "all-around ecologist" whose professional career spans three decades, three countries, and more than 30 states. He received a B.S. in forestry & wildlife management from Virginia Tech and an M.S. in environmental planning from the University of British Columbia (Vancouver, Canada). His career includes stints with the U.S. Fish and Wildlife Service, Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, National Marine Fisheries Service, University of Washington, University of New Mexico, Orange County Environmental Management Agency, Carrying Capacity Network, and as a Peace Corps Volunteer in Honduras. As an environmental consultant, Leon has written, edited and managed many environmental impact statements on a variety of projects for multiple federal agencies and prepared more than 40 comprehensive conservation plans for national wildlife refuges from Alaska to the Caribbean. He has also authored reports examining the role of population growth in aggravating pressures on natural resources and the environment.

NOTE: The views expressed in this article are those of the author and do not necessarily represent the views of NPG, Inc.

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