Connecting the Dots between Species Extinction, Overpopulation, and the Use of Resources

By Marshall Marcus

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After teaching chemistry at Transylvania College in Lexington, Kentucky, he worked as a polymer research chemist, first with DuPont and then with Firestone.

His interest in industrial hygiene led to employment by the State of Virginia as a state OSHA supervisor. After being awarded national certification as a Certified Industrial Hygienist, he worked for 29 years as a safety and health consultant for corporations, school districts and the federal government, retiring in 2010.

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His paper was presented at the Richmond Torch Club on April 1, 2014.

Species extinction is not new. Since childhood we have heard about the disappearances of wooly mammoths, saber-tooth tigers, Neanderthal man, and passenger pigeons. Now emerging, however, is information that world-wide mass species extinction is happening, accelerated by the Industrial Revolution. Once these species are extinct, it will take millions of years of evolution for replacements to appear. Extinction is happening at an exponential rate, a rate that in another century may result in destruction of the biological diversity adequate to support us.

Biological diversity gives us the raw materials for our economies, provides us our food, recycles our waste, prevents erosion, and protects us from solar radiation. Losing that diversity will reduce the earth's carrying capacity to support *Homo sapiens.* Exceeding carrying capacity will mean a massive die-off of humans. There is clear evidence that the main driving forces behind loss of biological diversity are world overpopulation and the wasteful use of resources required to support overpopulation.

The total number of species on earth may be between 10 and 30 million. The natural or "background" loss of species is somewhere between 0.1 and one species per million per year, depending on whose research is being cited. Assuming there are ten million species and not counting unclassified species, a normal extinction level is between 1 and 10 species lost per year. But, since about 1900 we have become aware that during a period of time measured not in millions of years but in decades, many more than ten species per year have become extinct or are facing extinction.

The terms "threatened" and "endangered," as defined in the U.S. Endangered Species Act of 1973, help in understanding the process of extinction. *Threatened* means a species is still abundant but, because of declining numbers, is likely to become endangered in the near future. *Endangered* means a species is in danger of extinction in all or a significant part of its range. The *Red List* of the International Union for Conservation of Nature (IUCN), headquartered in London, lists thousands of currently threatened, endangered, and extinct species. Examples of the latter in the U.S. include the Ivory Billed Woodpecker, the Carolina Parakeet, and the Eskimo Curlew, millions of which used to fly along the west coast, wintering in the Arctic and flying to South America for the summer.

The beautiful Monarch butterfly, now a threatened species, is a case in point. The fall migrations of the Monarchs take them to nesting sites along the west coast of North America and into Mexico. After steep and steady declines in their numbers at nesting sites in Mexico for the three years prior to 2013, that year found these black-and-orange butterflies covering only 1.6 acres, compared to 2.9 acres in 2012. They covered more than 44.5 acres at their recorded peak in 1996. Major contributors to their decline are believed to be loss of habitat and a decrease in milkweed growth in Canada, the U.S. and Mexico. The loss of milkweed, a primary source of food

for the Monarch, may be the result of the widespread use of Roundup, a Monsanto herbicide sprayed on genetically modified wheat, corn, and soybean crops in the U.S.

Most extinctions result from loss of habitat as human population has increased; other causes include hunting for profit and food. Decimation in Africa of rhino and elephant herds for body parts is well known, as is killing for "bush meat," such as killing tapirs for food in South America. Species extinction is also being driven by the importation of invasive species, such as the Argentine Tegu lizard introduced into Florida. Introduction of massive amounts of pesticides and herbicides into the world environment, as in the example of the Monarch butterfly, is another driver.

Far northern habitats are being lost as more heat from the sun is absorbed by the open Arctic sea, instead of being reflected back into space by snow-covered ice. Extra energy absorbed is so great that it measures about one-quarter of the heat-trapping effect of atmospheric carbon dioxide (Cory). Devastation of habitats by oil extraction and strip mining of coal and tar sands is well known. Examples in North America range from the waste ponds of the Canadian tar sands, to BP's 2010 catastrophe along the Gulf Coast, to the 1.1 million gallon oil spill in 2012 along the Kalamazoo River in Michigan. The same devastation occurs in the mining of copper, gold and other minerals.

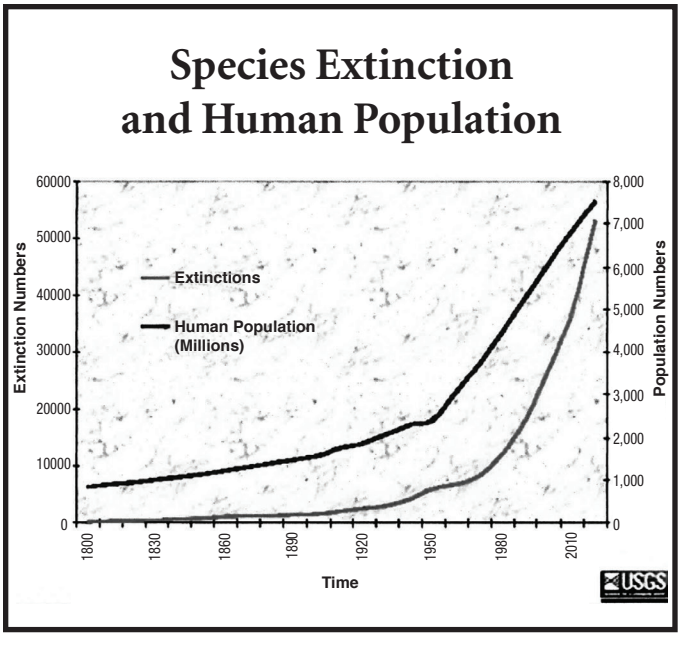
The problem is not caused by the number of *Homo sapiens* on earth alone; our habits of consumption and waste generation add to it. Our waste products pollute the ground, the oceans, the aquifers and rivers from which we draw our drinking water and the air we breathe. Among the causes of the die-off of corals in the oceans, for instance, is the extinction of ocean-dwelling species by air pollution from carbon dioxide. Airborne carbon dioxide reacts with dissolved carbonate ion (CO3−2) in seawater to form bicarbonate ion, HCO3−1. This removes carbonate from seawater, and carbonate is the building block of many crustaceans and corals. Removing carbonate from seawater slows the process of calcification and threatens the survival of a multitude of aquatic species.

This reduction of available carbonate is not the only outcome; in the process the oceans become more acidic. Normally seawater is slightly alkaline on the pH scale, at pH = 8.1, where pH = 7 is neutral (neither acidic nor alkaline). A recent study concludes that at atmospheric carbon dioxide levels of 500 to 650 parts per million (ppm), negative effects of increased ocean acidity outweigh positive ones for corals, mollusks and fish, but not for crustaceans (Wittmann and Poertner). Above that level, all sea creatures are harmed. At 650 ppm of atmospheric CO2, ocean acidity will drop to a pH of approximately 7.8. That is about where corals stop growing. Most other ocean species that use carbonate will also slow or cease their uptake of carbonate. They then begin an accelerated die-off.

How close are we to 650 ppm? We are now approaching a world-wide level of 400 ppm. Data from the National Oceanographic and Atmospheric Administration show that between 1959 and 1999, atmospheric CO2 increased 1.3 ppm/year (Tans). Between 1999 and 2014, CO2 increased 2.0 ppm/year. This could be an indicator that not only the increase itself, but the *rate* of increase is also becoming exponential. As the rate of increase in atmospheric CO2 becomes exponential, it may easily average more than 3.0 ppm per year in the next 80-90 years, causing atmospheric levels to exceed 650 ppm.

Scientists already have enough preliminary data to show the connection between the world-wide increase in human population and species extinction. The data have been available for years, but have not been widely publicized. Extinction is being faced by every species in the taxonomic system of classification, including us in the long term.

In 2008, the U.S. Geological Survey's Idaho Cooperative Fish and Wildlife Service Research Unit at the University Of Idaho published the attached graph summarizing what was known then about species die-off (Scott). The graph shows two curves, the top one reflecting population in billions of *Homo sapiens* and the bottom one the estimated species extinctions in thousands worldwide. Both curves rise slowly until the Industrial Revolution and then shoot up exponentially as the earth's human population approaches seven billion by 2010.



Assuming a base of ten million species, and leaving out unclassified bacteria and Archaea species, results like these indicate that in the 100 years from 1810 to 1910, the world lost possibly 1,200 species, about one per million, equivalent to perhaps ten per year. Between 1910 and 2010, the projected loss worldwide was 32,000 species, most of that occurring between 1980 and 2010, as species losses became exponential. From these earlier data, some researchers put the loss rate after 2008 at about 2,500 times pre-Industrial Revolution background (Myers). Researchers with more recent data put the background species extinction rate somewhat lower, at about 1,000 times the pre-Industrial Revolution rate (Pimm, Jenkins). In either case, huge numbers of species are disappearing. Once gone, they are gone forever. We can only assume a proportional loss of unclassified species, ones that will never be known to science. Only millions of years of future evolution can replace lost species.

Many will ask: Aren't some extinctions part of the natural order of things? Haven't there been extinctions before? Yes, starting with the Ordovician extinction 440 million years ago, there have been at least five major previous mass extinctions. Paleontologists have clues in the geologic record as to causes. The Ordovician mass extinction, for example, appears to have been caused by glaciation. At that time most life was in the sea, and some 85% of all sea life perished. Even more extensive was the Permian extinction 251 million years ago, also probably due to glaciation, in which perhaps 96% of species disappeared. All life now on earth has descended from the remaining 4%. However, no evidence exists that any of the five major extinctions was caused by the activity of one species, as is the case now.

Science journalist Elizabeth Kolbert's *The Sixth Extinction,* which mirrors the ideas of Harvard paleontologist Niles Eldridge, author of a 2001article of the same title, describes how a sixth mass extinction began to accelerate with the Industrial Revolution. Her excellent book describes the *symptoms* of the current extinction but does not explore in detail the main underlying cause, namely world overpopulation and how to deal with it.

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Demographers, those who analyze population data, provide clues as to the outcome of steadily growing populations. One famous demographer, Thomas Malthus (1766-1834), argued that since populations increase geometrically while food and living space do not, life can be made tolerable only if births are limited, or by death and violence. The Malthusian operators of death and violence aren't working in the 21st century to decrease overpopulation. So, why not apply his other solution and limit births?

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There are pros and cons about limiting births. If you run a business that makes more profit as you sell to more people, exponential population growth may appear to be attractive, as may the prospect of bringing in new, young converts if you support a particular religion or ideology, as the population expands.

Some suggest that exponential population growth may even be beneficial. The argument goes like this: increased population will create pressure for entrepreneurial innovation; that will result in new technologies (e.g., fracking and genetically modified foods); those will allow a further increase in population; that, in turn will result in more innovation; and the cycle will repeat. Is that a good argument for increasing world population? You can draw your own conclusion.

Leave profit-taking, religion and ideology out of the discussion for a moment, and answer the following question:

What advantage does more than doubling the population of the world from 3 billion in 1960 to over 7 billion in 2014 offer to the hope for avoiding depletion of resources, improving the quality of human life world-wide and protecting the planet's biodiversity?

For the vast proportion of people on the planet, there appear to be no long-term advantages from an increasing population. To the contrary: the disadvantages far outweigh any supposed advantages. For example, overpopulation has created a surge in uneducated and unskilled workers subject to a chronic disadvantage with respect to jobs that pay a living wage. Aware of this and other problems created by overpopulation, some countries have made efforts to control population growth or make family planning a requirement for couples prior to marriage. China is an example of the former and Iran an example of the latter. Meanwhile, worldwide exponential human population growth continues with the world probably already well past its sustainable carrying capacity for humans.

The problem facing us is how to slow and reverse the 200-year trend of overpopulation and its consequence of mass species extinction. Can democracies survive overpopulation and lead the way to saving species like the Monarch butterfly? Science writer Isaac Asimov, for one, was skeptical,

once telling an interviewer, "Democracy cannot survive over-population. Human dignity cannot survive it. Convenience and decency cannot survive it. As you put more and more people into the world, the value of life not only declines, it disappears. It doesn't matter if someone dies. The more people there are, the less one individual matters."

Some cite the example of India, where increased education and a slowing birthrate, together with increased crop yields and an emerging middle class, all create optimism about the ability of the country to survive and prosper. Unfortunately, that example will fail as India's biodiversity is destroyed. A growing middle class is the tip-off: with the upward economic mobility of millions of Indians, there will be the accompanying growth of consumption. That means the loss of habitat to provide housing and food; the loss of more habitats will mean the destruction of more species.

There is a direct route to slowing population growth, but in many countries it is a very difficult route to establish. That route involves the four common methods used to control overpopulation around the world: contraceptives, abortion, voluntary tubal ligation, and voluntary vasectomy. All are remarkably effective but not equally desirable. Most common is the use of contraceptives, believed to be largely responsible for the drop in abortions in the U.S. and elsewhere. Globally, as women have become empowered and sex education more available, the methods mentioned to avoid abortion have become widespread.

It will be necessary to involve the world's religions and ideologies as part of the solution, admittedly a difficult task. Perhaps we could start by agreeing on the sources of objective information and accepting historical facts behind the impact of human overpopulation and excess consumption on the world's biodiversity. For example, scientists have established that the earth is 4.5 billion years old and that human beings originated some 6 million years ago (Dawkins). However, a Gallup poll in 2012 found that 46% of Americans believed that God created life on Earth within the last 10,000 years. I disagree, but for the sake of consensus we could let that difference go, if the same folks who believe in a more recent origin of the planet would agree that God also created some ten million plus species 10,000 years ago, and that they are now dying off at maybe 30,000 per year. With that basis, it may be possible for religions and ideologies to reach a consensus that overpopulation is the main reason for species die-off, and agree on what needs to be done to reach a sustainable level of population and heal the planetary devastation we have created. It may require decades and perhaps Malthusian operators, the equivalent of the Four Horsemen of the Apocalypse—conquest, war, famine and death—to nudge religious and business leaders to seek population stabilization, and then a reduction below our present seven billions of *Homo sapiens*.

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What plan, what paradigm, will give us some hope of slowing species extinction and loss of biodiversity? The simple answer is that we need a cultural change to something else, away from the culture of exponential population growth against a background of shrinking resources, away from a worldwide culture that equates GDP growth with success. If we in the U.S. take as a priority slowing and then stopping mass species extinction here and world-wide, and accept that our increasing populations and habits of consumption are the main sources of the problem, then the U.S. as a nation has a marvelous opportunity before it.

What can you and I do about the situation? We can let our concern about species extinction be known to our state and Federal elected representatives; we can push for our school boards to require that the history of species extinction be taught from elementary school on; and we can join a group that provides the public with educational materials on species extinction. Examples of such groups are the Center for Biological Diversity, the Nature Conservancy, the International Union for Conservation of Nature, and the World Wildlife Fund. I urge you do what you can to prevent the destruction of the world's biodiversity and prevent the Malthusian operators of violence and death becoming dominant in the world.

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The publication of this article is funded by The Torch Foundation