

Human population overshoot–what went wrong?

There are seven billion people on earth now. I originally thought that the primary reason for the recent human population explosion was that fossil fuels enabled a larger food supply and better medicine, and thus a higher population.

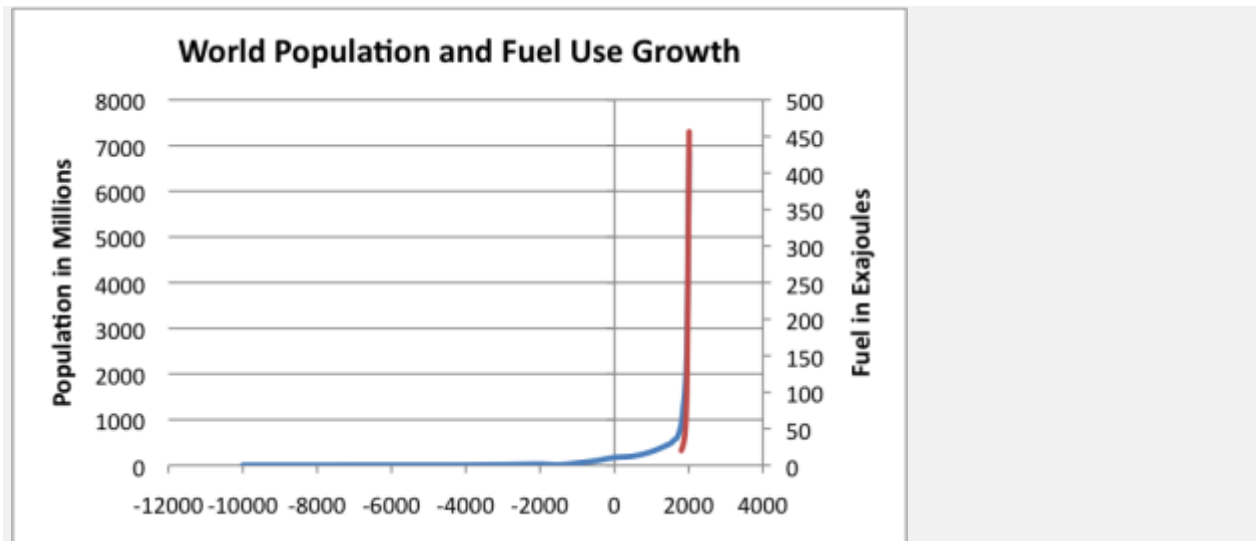


Figure 1. World population from US Census Bureau, overlaid with fossil fuel use (red) by Vaclav Smil from *Energy Transitions: History, Requirements, Prospects*.

While the addition of fossil fuels is part of the story, after reading Craig Dilworth's [Too Smart for Our Own Good: The Ecological Predicament of Mankind](#), I realized that there might be another contributing factor. Animals of all types (presumably including humans) have instincts and learned behaviors that prevent population from rising without limit.

Dilworth talks about an experiment in which a few Norway rats were put into a cage of 1,000 square meters and provided plenty of food and water for 28 months. If they had produced as many offspring as theoretically possible, there would have been 50,000 of them at the end of experiment. If they had maxed out at the 0.2 m² allowed for caged rats in laboratories, there would have been 5,000 of them. What actually happened is that the population stabilized at less than 200.

As I read about the mechanisms for keeping the population of most animals down, it struck me that there seem to be parallels in humans. Dilworth talks about many species being "territorial," and how aggression among groups is one of the first approaches to keeping population down. When that fails (as with humans')

globalization), social power structures and hierarchies become more important. This seems to happen with humans also:

Paul Buchheit, from DePaul University, revealed, "From 1980 to 2006 the richest 1% of America tripled their after-tax percentage of our nation's total income, while the bottom 90% have seen their share drop over 20%." Robert Freeman added, "Between 2002 and 2006, it was even worse: an astounding three-quarters of all the economy's growth was captured by the top 1%."

This sounds exactly like the kind of hierarchical behavior observed in the animal kingdom when social species get stressed. If there is not enough to go around, resources that are available are concentrated in the hands of those at the top of the pyramid, marginalizing those at the bottom of the pyramid. If total resources are inadequate, population at the bottom of the pyramid is reduced, leaving those at the top untouched.

In this post, I discuss some of the issues raised by Dilworth and the parallels I see with humans. I also add a perspective of hope.

Craig Dilworth's Theory: Too Smart for our Own Good

I won't be able to do justice to all of the ideas in this fairly academic 500 page book, but let me try to explain some of Dilworth's ideas.

Types of Species

Dilworth distinguishes between two types of species:

***K-selected species:** Species selected for Krowding tolerance. Their members are characterized by large size, slow growth and reproduction, few offspring with low mortality, parental care, relatively constant population size, and existence which is easily jeopardized by a new predation threat. Most mammals are K-selected, as are trees.*

***r-selected species:** Characterized by small size, rapid growth and reproduction, short lives (less than 1 year), numerous offspring with high mortality, little or no parental care, and lack of territoriality, and populations characterized by exponential growth followed by crashes. Insects and annual plants are typical r-selected species.*

With these definitions, humans are K-selected. Because humans are K-selected, they theoretically should have a stable population size.

Territoriality and other Mechanisms for Holding Population Down

In K-selected species, territoriality tends to hold down population size by restraining the number of breeding pairs. The territories chosen by instinct are large enough to ensure that populations do not grow to such a size that they undermine their own resource base. Thus, if territoriality is working properly, there is no problem with tragedy of the commons (excessive use of shared resources), because the territory selected by the male for his family group is large enough to feed the family, with much available food left over.

There are really two mechanisms at work in K-selected species: food availability and adequate territory. It really is Liebig's Law of the Minimum that leads to adequate territory usually being the limiting factor for K-selected species. Liebig observed that if a crop needs several types of inputs (such as nitrogen fertilizer, phosphorus fertilizer, and potassium fertilizer), the crop yield would be determined by the *scarcest* resource, not by the total amount of resources. Thus, additional nitrogen fertilizer cannot substitute for some other type of fertilizer. In the case of K-selected species, such as primates, there are both food and territory requirements, but the limit on territory is usually reached first.

There are a number of mechanisms for keeping K-selected populations in balance with the rest of the ecological system. For example,

- Too high population tends to cause stress and leads to violence against neighboring groups. The winner gets more territory; the losers typically are killed.
- Infants may be killed, to keep the population in line with resources.
- Learned behaviors or instincts may limit when mating takes place.
- High population will tend to attract predators (germs, in the case of humans)
- If population is too high, hierarchical behavior may appear or increase. Because individuals who do not need resources get a disproportionate share of the total, there is less for those at the bottom of the hierarchy, helping to reduce population size more quickly than if resources are shared equally. Those at the top are spared.

With social animals, altruism becomes important, because the instinctual drives that keep the population in check must not be allowed to operate at too high a level within the family group. Therefore, within the home territory, social instincts tend to override more basic sexual or survival instincts. Groups of the same species often share resources, look after young, and protect injured individuals.

In most instances, populations with these (and other) checks and balances will tend to remain in "dynamic equilibrium" with the rest of the ecosystem. One exception to this rule is in "pioneering" situations, when both food and territory increase, or when predators are removed. Human's use of stored energy (both wood and fossil fuels) is in

a way a type of pioneering behavior, because it allowed us to expand our food supply and eliminate predators.

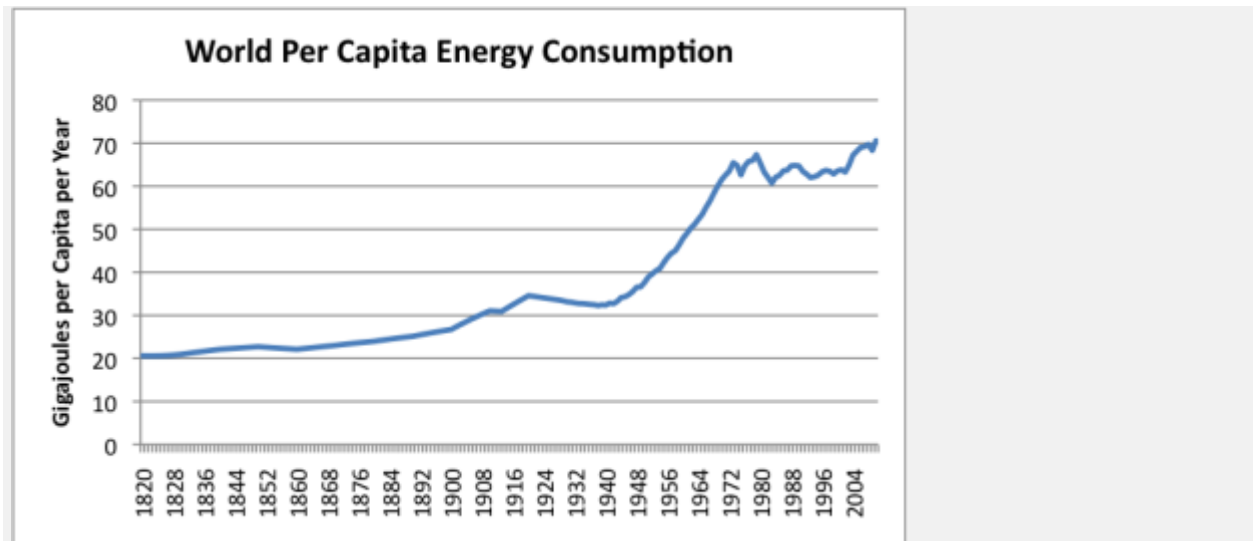


Figure 2. World per capita energy consumption is now at an all-time high, thanks to the increasing use of coal. (Based on energy data from Vaclav Smil's, "Energy Transitions" and BP Statistical Data; population from Angus Maddison)

Humans are also different from other species in that our intelligence has allowed us to substitute learning for at least part of instinctual behavior. This substitution of learning for instinct, together with the use of external energy, seems to have led to over-population.

There are currently 7 billion humans on earth; Colin McEvedy and Richard Jones in Atlas of World Population History estimate that human population would be expected to be in the 70,000 - 1,000,000 range, based on a comparison with gorilla and chimpanzee populations. Clearly human population now far exceeds its expected share of the ecological system, as one among many animal species.

My interpretation of Dilworth's theory applied to humans

Primitive Societies. Dilworth indicates that internal population checks (including abortion, infanticide, and prolonged abstention from intercourse) were almost universal in primitive societies. If twins were born, often one was put to death. If a second child was born before a mother was able to take care of it, it would be put to death. These population checks were helpful, but did not keep the population level. At least part of the problem was that new territory and food sources kept being added, because of humans' inventiveness. Humans began using fire about 125,000 years ago, and emigrated out of Africa and settled new lands about 90,000 years ago.

Religions. Religions have played a major role in encouraging altruism within their own groups, with teachings such as “Do unto others as you would have them do unto you,” and “Love your neighbor as yourself.” Religions are also a way of passing on traditions and building connectedness among members.

Modern religions have not done as well with population control, however. The command, “Be fruitful and multiply” is at counter-purposes with population control. When missionaries are sent to primitive groups who still practice infanticide, this has the effect of raising population. The practice of improving health care without providing free contraceptives and teaching about birth control also tends to raise population.

The “instinct” to fight those of other religions is helpful from a population control point of view, but most readers of this article wouldn’t find it an acceptable way to solve population problems. Unfortunately, if we were to try to parallel population control methods of animal species, death through wars with neighboring countries would need to become acceptable.

Hierarchical behavior. I mentioned that if population control doesn’t come by other means, hierarchical behavior may take over, to solve the problem. Hierarchical behavior was not known among hunter-gatherers, but once humans settled down and started accumulating property for agriculture, hierarchical behavior became more the norm.

Hierarchical behavior has increased recently. Immediate causes of the shift would include such causes as:

- Greater specialization as processes become more complex. Jobs that are at the top of the hierarchy pay very well.
- Globalization. Jobs at the bottom of the hierarchy may compete with foreign labor or workers in countries where wages are low.
- More debt. Debt tends to transfer interest-related payments from those at the bottom of the hierarchy to individuals at the top of the hierarchy.
- Tax schemes. Modern schemes favor the wealthy and corporations.

Charles Murray recently wrote the book Coming Apart: The State of White America, 1960–2010. Murray explores the formation of classes that are different from those American has known in the past. The lower classes are losing many of the stabilizing influences they have had in the past—marriage; opportunity to attend schools with people of all classes; joining religious groups.

I might also note that economics, and the belief in economic growth as a savior for all, has become almost a new religion. If this “religion” is followed, there is little need for

other belief systems. Economic influences are not new, however. Trade was started very early, even before the days of Abraham and Isaac in the Old Testament. This tended to break down barriers among groups, reducing the effect of territoriality.

Another source of belief systems is television shows. These seem to portray how family life operates and explain what is truly important (more stuff!).

All of these new influences conflict with our instinctual behaviors to stay with our family groups, and not live lives that deviate too far from what we have known in the past.

Hope for the Future

Dilworth doesn't see much hope for getting out of our of current predicament well. He talks about the *vicious circle principle*. A particular lifestyle at some point ceases to provide enough food for a growing population, so we develop a new approach that is not really better—for example, farming instead of hunter-gathering, or applying chemicals for fertilizer instead of waiting for natural cycles to take their course. We end up with more people, but those people are not really better off, and we find ourselves further into overshoot.

I can think of a couple of possible mitigations for our apparently bleak future, or at least our response to it.

1. Higher Power Intervention.

If a person looks at how ecological systems work together, one cannot help but be impressed by how the whole system (except possibly for humans, which are out of synch) works together. Perhaps there is a Higher Power behind all of the religions of the world, who has devised the plan as a whole, and who has a continuing plan for humans. We cannot know this with certainty, but the hope can be helpful for some individuals.

2. Greater Flexibility and Focus on the Present.

I think of a letter I received from “Derek” who has spent considerable time in Kenya. I put up a letter from him on The Oil Drum in April 2009. He talks about a very different life there.

What I experience there [in Kenya] is a society that does pretty well with VERY little energy, all things considering. This wouldn't be 'pretty well' by any standard of the Western world, though. But survival - and happiness! - are pretty much possible. Oddly, a first-time visitor would think the Masai live quite horribly, but they are very happy people and wouldn't want to change a thing.

It's the mindset that makes most Kenyans experience a happiness most Westerners would not consider possible given the realities, as they see and experience them.

In Kenya, we do use electricity (hydro / diesel), if we can. We have constant power cuts. But that's not the only limit. In fact, the vast majority of us, even the so-called middle-class, build our lives around limits. Limits are the basis for every decision we make, business or otherwise. It is, you could say, a way of life that is happy when it is not done in, and not unhappy if things go wrong.

People there – including myself – would celebrate every day that was a good day. And a good day is one where we got by. I would say, for 95% of Kenyans, life there is very much focused on the hour, and hardly ever on the future.

One secret Derek points out is how this works out, when there is a great mishap, like a child dying.

. . . I have also been witness to a great many situations where people lost their children, cried for a week, and moved on, had new babies, weren't depressed – nor impressed. This is strange to me too, but that is the way it is. People in Kenya have a different view of things.

We have been led to believe that we can control our futures by going to the “right” colleges and getting the “right” degrees and investing in the “right” investments. It looks like these approaches are not going to work any more. Perhaps we need to have the flexibility to try new (to us) more traditional approaches. Along with this, we need the ability to move on, when things aren't working. If a child or spouse dies, we will somehow need to move on quickly.

Another piece of what needs to happen is that we need to find a way to get more connectedness and altruism back into society. This is part of what makes life in Kenya as positive an experience as Derek reports that it is. Religion has played a role in this in the past. It seems to be especially the marginalized groups of society that are losing this connectedness.

Source: <http://ourfiniteworld.com/2012/02/15/human-population-overshoot-what-went-wrong/>