Cry, the Beloved Earth

{1} A Gift To Mankind

The real gift to mankind from the early efforts in the exploration of space, specifically the Apollo 17 mission in 1972, was not the view outward towards the stars. Rather it was the view back towards our earth.

In the photographs you see our planet hanging there against the black backdrop of space. The seas are so blue and with the fluffy white clouds the whole thing is so luminous. You can see the greens and rusty reds of the

continents. This is our home. This is where we live. It is a thing of heart-breaking beauty.

Yet even in the photograph you can sense that the beauty carries with it a fragility. Our earth is not something we can abuse and expect that it will remain the same. It carries the same innocence as a child and like that innocence, it can be destroyed in ways that can never be rebuilt.

{2} Summary of Damages

It is impossible to give more than a partial outline of the types of damages we inflict on earth. The details and documentation are beyond this brief listing. It is offered only as a very broad outline of the problem.

Water Pollution: The most obvious type is pollution by human sewage. But there are many other types of pollutants: (for example) agricultural waste, nutrient chemicals, oxygen demanding organic contaminants, eroded particulate matter, pesticides, metals, antibiotics, hormones, and more.

Air Pollution: Particulates, oxides of nitrogen and sulfur, acid rain, ozone, carbon monoxide, carbon dioxide, metals and inorganic materials are dumped in the atmosphere with little consideration of their effects on human health or the environment.

Solid Waste: In much of the world solid waste is just dumped someplace convenient, there to litter the landscape and pollute the water and air. In more developed countries it is more contained, at best in lined landfills. Yet even under the best circumstances it takes up our land, pollutes our air as it breaks down, and will pollute our waters when the relatively short lived liners break down.

Land Use: Land is being destroyed with little thought. Effective long term planning rarely occurs. Prime agricultural land is often used for “development” because it is easily worked. Soils from agricultural lands are being eroded and

impoverished of nutrients and organic matter. Timberlands, especially in the tropics, are logged with little consideration of environmental consequences.

Resource Depletion/Degradation: Non-renewable resources such as petroleum products, certain minerals, and agricultural lands are either lost or degraded or used up. Renewable resources such as timberland, surface and ground water, and air are poorly utilized and damaged, usually with little consideration for long term management and the likelihood that renewal will be able to occur.

Natural Habitat Loss/Degradation: Natural systems are being degraded or destroyed along with their ability to modify and mitigate other types of environmental damages. In consequence dependent plant and animal populations are greatly reduced.

Biodiversity Loss: Extinction rates are calculated to be 1000 to 10,000 times what they would be were it not for human activities. The consequences of this huge loss in the varieties of animals and plants living with us on the earth vary from the very practical to aesthetic and ethical.

Climate Change: The notion that climate is changing rapidly is accepted by almost everyone. And all scientists except for a few “hired guns” acknowledge that human activities, especially the release of large amounts of carbon dioxide into the atmosphere, is beginning a cascade of effects the outcome and ramifications of which we cannot yet predict. A tipping point in the cascade will come as thawing permafrost begins to decay and release large amounts of methane, a gas even more heat opaque than carbon dioxide. Changes are not limited to increases in the average temperature. It is increasingly recognized that phenomena such as sea level rises and coastal flooding and increasingly variable rain/drought cycles and catastrophic weather phenomena are involved.

Each of these changes in the earth and its biosphere interacts with many of the others.

{3} West-Running Brook

Two versions of an image pulled from the poem "West-Running Brook" by Robert Frost:

"The black stream, catching on a sunken rock, flung backward on itself in one white wave, …"

and

"… the brook in that white wave runs counter to itself."

You can (and politicians will) object to the above summary of the damages and destruction and claim that no credit has is been given for the progress we have made in correcting some of those problems. It is true that with certain types of problems in certain geographical areas there has been progress. It is with this in mind that I quoted the lines from the Robert Frost poem.

For example, some aspects of the quality of water (particularly pollution by sewage and oxygen consuming organic materials) in the freshwater ecosystems of the eastern and central United States have improved. It would be difficult to argue with that assertion. However, only some aspects have improved while others, such as heavy metals and nutrient pollution, continue to worsen. If you consider the world as a whole every aspect of water quality continues to decline. Rivers in most parts of the world are open sewers.

As another example: it does seem as if the reduction in the use of ozone depleting chemicals has reduced the concentration of many of them in the stratosphere. Ozone levels in the stratosphere may eventually return toward their original levels (The return of the ozone may be hindered by climate change, which has the effect of reducing ozone in the stratosphere). Nevertheless, by almost any other measure air pollution, in the world as a whole, in all its many combined attributes continues to worsen.

While the fact that there has been progress in some areas cannot be denied, it also cannot be used to hide the fact that, on the balance, deleterious impacts have outweighed progress. On a world-wide basis the overall changes in environmental quality and pollution have been to the downside.

It is the best part in us as individuals and as a species that leads us to try to reduce these impacts. But, very simply, not enough is being done to outweigh the general trend. To return to the images from Robert Frost's poem, we can be heartened by the attempts of individuals and societies to try to correct the problems they cause, flinging back against the rushing water. But we also have to remember that the water flung backward ultimately gets drawn downstream.

{4} Solutions Are Technically Possible

The list of problems and the extent of the damage very briefly and sketchily outlined in {2} is staggering. But what is almost equally staggering and confounding is to realize that for almost all of these problems there are already technical solutions. The solutions may not be very elegant and may not be the most efficient possible. But there almost always exists a solution or one could be developed if it were desired.

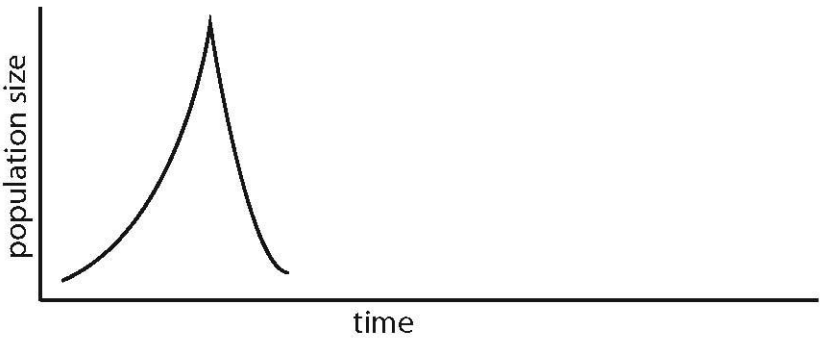
The overriding problem is that our society does not have the will to do anything about the impacts we are inflicting on the planet. In some cases we simply don't want to do anything. In other cases we simply don't want to pay the price involved. In many cases more economical solutions could be developed but in most cases there is no impetus to do this. It is unrealistic to think solutions which require any great sacrifice on our part are going to be carried out on the scale that would be needed to reverse the damage that is being done. The solutions are possible but we are unwilling to pay for them. We all seem to want all of the material goods we can possibly acquire. Damages to the environment don't seem to concern the majority of us and our politicians to

any real degree. Certainly not enough to take any significant action. In fact, environmental regulations are almost the first thing to be laid aside whenever other problems arise.

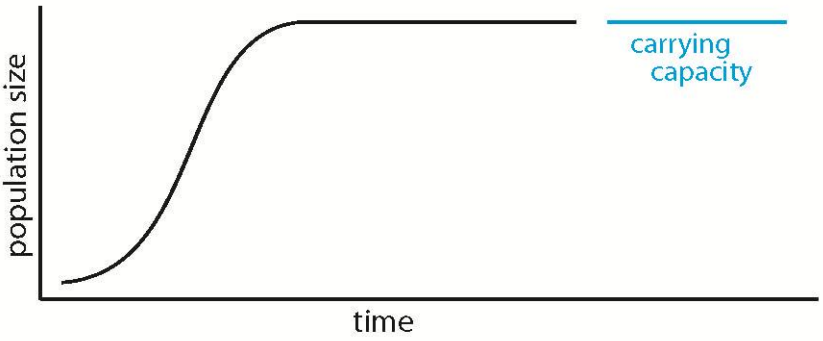
The sad probability is that we won't do anything significant. And there are so many of us and more to come.

{5} Human Population Is Growing

Ecologists think of population growth as having two theoretical scenarios. In the first the organisms reproduce at the maximum rate, the death rate is minimal, and the number of individuals in the population climbs rapidly. Then some non-renewable resource runs out and reproduction is no longer possible and/or mortality increases greatly. When this occurs the number of individuals in the population declines rapidly. This gives a "J-shaped" growth curve:

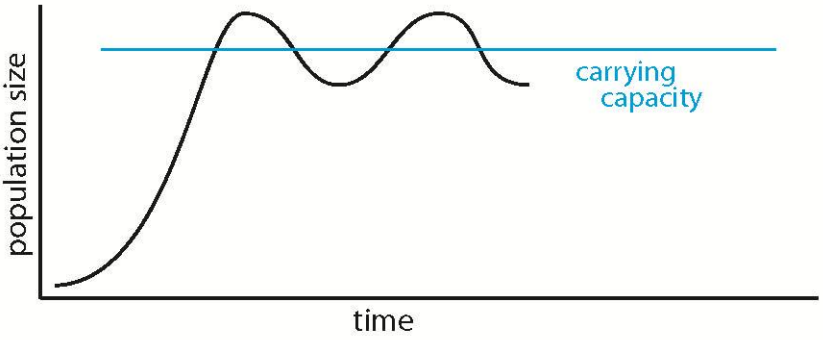


In a second scenario the organisms initially increases at a high rate with high reproduction and low mortality. However, as growth continues some renewable resource becomes increasingly scarce. As this happens the increase in the population gradually slows down. When the environment causes the mortality and reproduction to be equal the number in the population is stable and the population is said to have reached the "carrying capacity" of the environment. This gives a "S-shaped" growth curve.



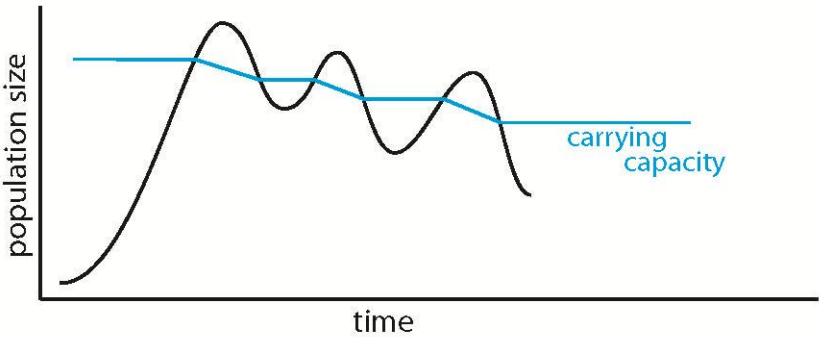
These two scenarios can be considered as the extremes of how populations might grow. They are end points in a range of possibilities. In real life there are some cases of populations of organisms that are similar one or the other of these curves, but most organisms show growth curves that are somewhere in between.

In a typical growth curve, especially for a large mammal, the numbers increase then begin to slow down as the carrying capacity is approached. But because of lag factors the number overshoots the carrying capacity, then declines and the number falls below the carrying capacity. After which it increases again and so on. Because of the time lags and the fact that the environment is never constant the number wobbles around an average carrying capacity.



In a variant of this when the organisms approach or surpass the carrying capacity they damage the environment and permanently reduce the carrying

capacity. The numbers wobble around as before but on a generally downward path as each “boom” in the population progressively damages the environment.



These curves are derived partly from theoretical considerations and partly from the observation of natural populations of organisms. The question we need to ask ourselves is “What type of curve do we have? How do we fit into this?”

Modern humans (true *Homo sapiens*) are thought to have had a minimum population of around 2,000 – 20,000 at one point about 70,000 years ago. We probably came very close to dying out as a species. But from there we came roaring back and a few hundred individuals left Africa and spread out over the rest of the world. Humans reached a total population of 1 billion (1,000,000,000) around 1800. Our numbers have increased rapidly since then, reaching 7 billion by 2011 and now, in 2015, we are at about 7.3 billion, adding another 75 million each year.

This past is fairly straightforward. We are on the upward part of the curve. The question is where will the numbers go from here. To predict the future you have to make certain assumptions and, depending on which assumptions you make, you get different results. Sort of middle of the road assumptions estimate that the population will reach about 10.9 billion by the year 2100. Some think this is too low and that the population will grow more rapidly and reach 11 billion by only 2050, which is a much faster rate of

growth. In both cases it is predicted that the population will still be growing though at a slower rate. Still others think the middle of the road estimate is too high and some have predicted that the population will peak and/or stabilize at about 9 billion by 2050.

My personal sense is that the middle of the road estimates are too low. In the past middle of the road estimates have almost always underestimated population growth. The reason for the underestimate usually lies in assumptions about something called the “demographic transition”.

Prior to the industrial revolution, which dragged along with it an agricultural revolution and a public health revolution, life for most humans was nasty and short. The only way we survived as a species facing a high death rate was to have an even higher birth rate. But then, as public health and food supplies improved, the death rate declined. However, the birth rate, which is more dependent on cultural and religious considerations, remained high. This meant the gap between births and deaths increased and this meant the population would grow at a faster rate. This accounts for the faster jumps in numbers from the 1800’s on.

In European countries and North America the birth rate began to fall in the generations after the death rate declined. After this had happened the birth rate and death rate, relative to each other, were about the same as before the industrial revolution and population growth slowed down. This sequence of events (high birth/high death $>$ high birth/low death $>$ low birth/low death) is known as the demographic transition.

Built into most of the population projections is the assumption that the same demographic transition that occurred in Europe and North America will also occur in other parts of the world as they become more developed and the death rates decrease. This assumption may be unwarranted. While the transition does seem to be occurring in some areas (much of South America

and some parts of Southeast Asia) there are other areas where it does not seem to be occurring.

In the much of the Middle East, India, Africa, and other parts of Southeast Asia the predicted drop in the birth rate has not, to date, occurred. In these areas birth rates remain high and the rate of population increase remains high. Unless the cultural and social dynamics of these areas change they will likely contribute more to the growth of the total world population than most models predict and cause the models to under-predict population numbers.

In addition to the increase in total number of human beings, there is an additional consequence to the continued high birth rates in these areas: it leads to local populations with a large proportion of young people. These societies usually cannot absorb these young. They have few opportunities and, without meaningful work, little to occupy their time. They have no useful place in their society, and as they realize and experience this, are ripe for anger and social unrest.

{6} Constraints on Population Growth

For human beings what are the environmental constraints most likely embodied in the concept of carrying capacity? What is it that is ultimately likely to slow our increase in numbers. It seems most likely that a key factor will be the food supply. Of course food supply is interconnected with a number of other factors.

Using the middle of the road estimate on population growth, by the end of the century we may have 10.9 billion people on the earth. This is an increase of 50 % from the 7.3 billion we now (2015) have. And by some estimates we will have even more than that. That means the amount of food the world produces will have to increase by that same 50 %. And that is just to maintain what is already a level of nutrition that for perhaps a billion of us is already inadequate.

How can we possibly do that? In the past the answer was to increase the amount of land being farmed. We can no longer do that – almost all farmable land throughout the world is already being used. Since the 1970's and 80's the potential crisis has been averted (or at least ameliorated) by the "green revolution" that introduced more productive strains of the major grain crops. But there is a price incurred with the use of these grains. They require more pesticides, more fertilizers, and more water than those they replaced. Already agriculture uses 70% of the world's fresh water.

The food supply problem is complicated with many interacting factors. As an example of the type of problem that can occur consider rice, a grain forming a substantial part of the diet of many of the world's people. Rice tends to uptake and accumulate inorganic arsenic. Some of this arsenic comes from natural sources but much of it comes from pesticides. The levels of inorganic arsenic in some varieties of rice grown in certain regions in the US and in other parts of the world is already so high that scientists recommend that children not consume such rice and that adults limit their exposure to once or twice a week. Ironically, brown rice, long the darling of natural foods advocates, is worse than white rice because the arsenic tends to accumulate in the outer portion of the rice kernel, which is the portion removed when rice is polished to turn it into white rice.

Part of a future increase in food supply will probably come from genetically modified organisms (GMOs). Already in use in some parts of the world they have the potential to increase the amount of food produced. To date most scientists think that there have been no documented effects on human health from the GMOs. Whether this will hold true in the future is unknown and the possibility of unintentional consequences remains. There are, however, environmental consequences. Many of these GMOs, while more productive and/or nutritious, require more fertilizers, pesticides, and water than the crops they replace and so decrease the amount of water available for other uses while

simultaneously increasing the nutrients and toxic chemicals that run of into the water that remains. They may also interact with wild plants and animals in ways that are impossible to foresee.

Although GMOs will almost inevitably be used to increase the world's food supply there is a limit to how much can be accomplished with them.

At some point in the future the growth rate will decrease. This is as certain as the fact that the sun will come up in the morning. The question for humanity is how (and when) this will occur. Will it be through a reduction in the birth rate, bringing it low enough to just match the death rate in a population that has a modicum of material prosperity, an adequate diet, adequate health care, and a reasonably satisfactory life on a healthy planet?

Or will it be through an increase in the death rate, bringing it high enough to match the birth rate in a population that has little material wealth, routinely experiences poor diet and starvation, has inadequate health care and the resultant diseases. This path will certainly resultant in increased competition and overt strife, making any orderly transitions even more difficult. And all will lead to a generally unsatisfactory life on a despoiled planet.

Which should we choose?

The answer we should make seems mind-numbingly obvious. But it is not the alternative we seem to be choosing. There are reasons that come from our evolutionary/cultural heritage that push us toward having more and more children. These are embedded in so many cultures and religions around the world and there is little will to challenge them. And so it seems likely that we will by default choose the second alternative. Doing nothing makes the second alternative inevitable.

There are also political reasons that population growth is encouraged and these have to deal with the fact that governments use population growth as type of Ponzi scheme.

{7} Population Growth As A Ponzi Scheme

A Ponzi scheme is one designed to entice an ever-increasing number of individuals to contribute to a fund. Investors are attracted by the promise that the fund will pay out high dividends. Dividends that are beyond what any reasonable person might expect to receive from an investment.

In the scheme the first people to join contribute to the fund. As others begin to contribute to the fund their input is used to provide the first people who signed up their outsized dividends. The apparent success of the fund encourages more and more people to join and their contributions continue to provide dividends for the stakeholders who joined earlier. But the scheme works only as long as the number of people investing in the fund continues to increase. When growth stops it means that as many people want to take money out of the fund as want to contribute to it. And so there is no longer a continually increasing volume of money from which to pay the dividend. At that point the scheme collapses.

Before looking at population growth as a Ponzi scheme I want to look at another interrelated Ponzi scheme: the social security system in the United States.

The social security system takes money from the younger workers and is supposed to eventually return it to them when they are older and retired. This “taking” is sometimes described as an “investment in your future”, at other times as a “tax”. Supposedly, the money is to be invested in a social security fund and will earn interest that, along with the initial investment, will be paid back to the individual in the future.

Of course it doesn't work that way. Congress has long used the fund as a piggy bank, drawing money from the fund as loans to the rest of the government that pay little or no interest. The loans are IOU's that the government now has no intention of or ability to repay. As it now works the scheme is stable only so long as the number of younger workers continues to increase and provide the revenues to pay off the older people withdrawing money from the scheme. And so, by definition, it is a Ponzi scheme. As our population ages and the ratio of those taking money out of the system comes closer to the number putting money into the system a shortfall between what's coming in and what's going out is becoming critical. As in any such scheme there is a danger that the whole thing might collapse.

The government's response, of course, is that benefits must be cut so that the fund remains viable. The government is running a Ponzi scheme on us. (There is another way to keep the scheme viable for a while longer. And we'll see below that it ties in with the next Ponzi scheme.)

An even more pernicious Ponzi scheme is population growth. In the view of most policy makers having more and more young people in the population is a good thing and something to encourage. In their view there are short term advantages if there are lots of young people in the population so that they form a large percentage of the population.

An expanding society eases the burden on society of taking care of all the older people. Most governments provide some sort of grants for the elderly. In our country these are called Social Security and Medicare. If, as described before, there are lots of people contributing to the Ponzi scheme relative to the number withdrawing from it, the system is easier to sustain.

Another short term advantage to population growth is that if there are more young people then there are more workers entering into the workforce. The

ever increasing number of workers increases the competition for jobs and allows employers to keep wages artificially low. In a kleptocracy such as ours this is a good thing for the wealthy and powerful even though it isn't particularly good for the middle class who have to contend with the increasing shortfalls in income and/or stagnant growth in real income levels.

For the people in charge of policy decisions short term population growth solves or at least puts off dealing with problems and thus has real short term benefits. It allows us to kick the can down the road. Unfortunately, in the real world policy decisions are usually based only on such short-term considerations: for example, the next election cycle. Policy decisions are not on the long-term future of our species or our planet.

As an aside, another way of obtaining young workers in order to keep the ratio of young to old in the system high is to encourage immigration. Immigrants are typically younger on average than the receiving population and tend to have higher birth rates. In this way immigrants help to prop up the Ponzi scheme. One argument used in support of such immigration is that these incoming people will do jobs most of the native born will not accept. That may be true but it ignores the fact that many native born people would accept these jobs if they paid a living wage. A pool of impoverished and somewhat desperate immigrants is a boon to the business community. It can help keep profit margins high and stockholders happy by using the presence of a labor supply manipulated to be inexpensive. Simultaneously, it provides tax revenues to fund the payouts of the social security system.

So when you consider only short-term goals, population growth and immigration do look like a solution to some problems. Governments everywhere seem to be trying to encourage the growth of their populations. Sometimes it is a very overt offering of assistance or grants or tax incentives for producing children. At other times the incentives are more subtle. The idea of reducing population growth is not popular and usually actively disparaged.

The only government that ever actively discouraged growth was China with its “one child” policy. Given our pro-growth mind set it is hardly surprising that much of the world has deemed the policy a human rights abuse and criticized the Chinese government. And even in China the advantages of a pool of cheap young labor has caused the government to begin backing away from this policy.

But population growth only alleviates problems in the short term. In the long term it causes more problems than it solves because it means we need more and more resources to support that population and that causes more and more damage to the planet. And so we get right back to that problem of all of us wanting it all and there being so many of us and more coming all the time.

{8} Global Impact

There is a rough, mathematically imprecise, equation that can describe the impact on our planet:

Global Impact = Number of Individuals *times*
Resources Used By Each Individual

For each individual added the impact increases. And, for each additional amount of resources used per individual the impact increases. When both the number of individuals and the amount of resources each uses are increased, the impact increases as a power function.

We can modify this equation to include the effect of measures we put in place to reduce the impacts:

Global Impact = Number of Individuals *times*
Resources Used By Each Individual *times*
Mitigation Efforts to Reduce Deleterious Impacts
(ranges from 1 for no mitigation on downward for partial mitigation)

While it is theoretically possible to greatly reduce the global impact caused by increased population size and increased use of resources it is unlikely to happen to any great extent. Legislation and policies designed to protect the

environment are difficult to enact and are usually the first casualties of an economic downturn.

{9} Population Growth Is As Giant Antlers Were To Irish Elk

The Giant Irish Elk lived in northern Eurasia during the Pleistocene Era. Somewhat misnamed, *Megalocerus giganteus* was actually a deer rather than an elk. Its earliest fossils date from about 400,000 years BP (before present). The animal was notable, as were so many Pleistocene mammals, for its huge size – up to 1500 lbs. And for the remarkably large antlers, which were up to 12 feet wide and weighed up to 88 lbs.

There is commonly told tale in biology textbooks explaining the evolution of the large antlers and the eventual decline and extinction of the Irish Elk. The antlers, which are borne only by the males, were said to be used to fight with other males during the rutting season. The male with the largest antlers was more likely to win a female and so the male with the largest antlers ended up with the largest harem and impregnated the largest number of females and so passed more of his large antler genes on to succeeding generations. The Irish

Elk is often used by biologists as an example of sexual selection. In each generation there was the trap of a selective pressure for the antlers of the males to become larger and larger. The apocryphal story ends with the antlers eventually becoming so large that the males couldn't move through the trees without becoming entangled and so the species became extinct.

The truth was probably not quite that simple. It seldom is. One of the reasons the antlers were so large is probably just that the animals were so large. And the antlers were probably used more for impressing females than for actual combat with other males. This is not to say that sexual selection didn't have something to do with the evolution of the large antlers, only that it may not have been the only factor involved. The decline and extinction of the Irish Elk is also more complicated. Possibly hunting by early humans was involved, as it may have been with the extinction of other Pleistocene megafauna. And possibly the changing climate affected the types of forage available to the animals making it difficult for them to obtain adequate forage for their huge bodies and to obtain the calcium and phosphate minerals needed for their skeletons and, especially, their antlers. Toward the end many of the skeletons show signs of poor nutrition. The last populations died out about 7000 years ago.

So, the original story may not have been the whole story. But even if it is simplistic, it is still a story with an easily grasped point. And an analogy beween the story of the Irish Elk and its antlers on one hand and human population growth and environmental impact is worth thinking about. Sexual selection forced the Irish Elk into a lockstep in which increased antler size ultimately led to its demise. With humans the problem is not sexual selection but simply the arithmetic of continually having more births than deaths.

{10} Three Propositions:

(1) Population growth caused by high birth rates, because it is useful to solve short term problems and because it is such an integral part of our religions and of our evolutionary history, will continue. The number of people is increasing and it seems likely that in the near future (say the next hundred years) this will continue, although probably at a somewhat slower rate.

(2) Understandably, everybody desires a higher standard of living. So, more people are inhabiting the earth and each of them wants the benefits of using more and more resources. It is inevitable that there will be an increased potential impact on the environment.

(3) And, equally understandably, each of these people individually is going to be unwilling to sacrifice to any significant degree their higher standard of living in order to protect the environment. Yes, some people, especially in the more developed countries, will try to protect the environment. But for most people in most of the world the quest for food and material possessions and ease trumps the environment every time. Even in developed countries with good intentions environmental protections seem to be the first thing to be laid aside when the economy appears to be in jeopardy.

These three propositions are the lockstep that can only lead a continual increase in the total impact on the planet earth. Since population growth helps solve some immediate problems we are drawn into a self perpetuating cycle of using population growth to solve the problems created by population growth. By its very nature it is a vicious cycle that drags us toward what is probably an unappealing future.

And so, what does the future hold? It is difficult to imagine a realistic path that leads to a bright and happy future for us or for our planet. Rather than a future imagined as a wonderful place, an imagined future based on India seems more realistic.

India today is still a land of extreme poverty where the majority of the people still lead a crowded, hardscrabble, and fairly miserable existence. Of course some people are well off or even wealthy, especially with entry of the country into the global economy. But many are poor and can not obtain the food, shelter, education, medical care and other necessities for a life that most Americans would consider even marginally adequate. The gap between the rich and the poor widens and the middle class is not increasing in size relative to the population as whole. Although there are more and more people who would be considered well off, there are even more who are still impoverished.

India has a population of 2.71 billion (2015) and its growth rate is still 1.2% per year. It is projected that it will become the most populous nation in the world by 2025 when it surpasses China. All those people are squeezed onto just 2.4% of the world's land mass, making it one of the most densely populated nations.

If you look at the the environment in India as an ecologist there is little to be cheerful about. – water, air, natural habitat, biodiversity, etc. In none of these areas are things improving. In general they are getting worse and it seems likely that they will continue to get worse.

Thirteen of the twenty cities in the world with the worst air pollution are in India, a situation likely to worsen as India strives to double its coal production (for energy) by the year 2020. The major rivers of the country are little more than open sewers, to the extent that the ritual bathing in the Ganges comes with a definable health risk. Agricultural land is being lost or degraded and climate change makes the growing season increasingly one of either drought or flooding

You can see the same factors at work in our own country and in much of the rest of the world. Those of us that live in North America, in Europe, and some other areas will be better off in the short term. But in a globally

interconnected world these advantages will continually erode and we will move toward a global commonality that will apply both to our lives and to our planet.

In the natural world population control works in only one way: the birth rate is as high as natural selection can push it, and then it is balanced by a death rate that prunes down the population to what the environment can sustain. In the natural world there is no documented example of a population of organisms reducing its birth rate to the extent that it minimizes the death rate. Perhaps we cannot escape our biological background and the lockstep it seems to have imposed on us.

- One More Complication -

There is additional consideration that makes a humane, desirable outcome even less likely. As resources become increasingly scarce competition for them will increase. This competition will be resolved as it always has been: the stronger will take from the weaker. We will see this not only in relationships between individuals but also in our communities and in our larger political organizations such as nations and religions and corporations. It seems to me likely that we will increasingly become a society where might makes right and with increasing competition the conflicts that result will increase in severity and frequency.

The ability to implement technical solutions calling for any sort of self-sacrifice will be curtailed under such conditions and a seemingly inevitable increase in piety-ridden conservatism will make meaningful changes to all sorts of problems more difficult, if not impossible, to bring about. For example, it is sometimes claimed that providing more access to birth control will empower women and that this will bring about a reduction in birth rate. That might be so in the best of all worlds, but the real world is more likely to become a world in which women are increasingly dominated by a conservative mind-set that works to restrict their freedoms.

Perhaps an example of what is to come is seen in Turkey where a fairly free secular society is being replaced by a traditional and repressive one based on Islam.

It somehow seems as if time's arrow will point us in only one direction.

These conclusions, which I would have preferred not to have come to, give me great sadness and are a despair that has always overshadowed me. This sorrow is perhaps best expressed in this quote from Doris Lessing's novel "Shikasta":

> They watch a flight of birds, as they stand together at their windows, and it is as if they are sorrowfully saying goodbye, with a silent corrosive, tearing apology on behalf of the species they belong to: destruction is what they have brought to these creatures, destruction and poisoning is their gift, and the swerve and balancing of a bird does not delight and rest, but becomes another place from which they learn to avert their eyes, in pain.