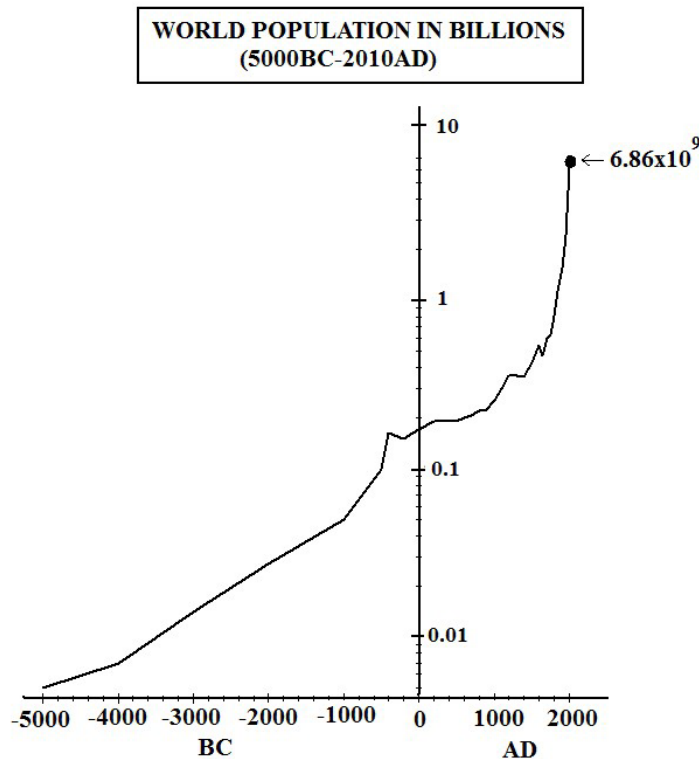


## WAS MALTHUS RIGHT?

A little over two-hundred years ago the Anglican clergyman Thomas Malthus (1766-1834) published his famous book *“An Essay on the Principles of Population”*. In it he pointed out that (1) human population will increase with an increase of subsistence resources, (2) that such an increase will inevitably produce a population over shoot, and (3) that this will lead to a decrease in population levels until it falls below the subsistence level. After that the process repeats itself. There is no question that he was right although he clearly did not anticipate the increase in food productivity brought about by modern farming techniques including the massive use of fertilizers and pesticides. I remember during my public school years, when the large increases in agricultural productivity were taking place, that we were taught that Malthus was wrong and that we could always meet subsistence demands for a rapidly increasing world population. Today this view is changing. **Perhaps Malthus is right after all.** Let me present my thoughts on this. We begin by looking at the semi-log graph I constructed from the best estimates for world population starting in 5000BC and running through today in 2010AD.



One sees at once that the population was growing at an exponential rate from 5000BC through about 1750AD and after that took off at a much faster growth rate and really accelerated after about 1930AD. At the present growth rate the world's population is doubling in about 45 years (3.3 billion in 1965 to 6.8 billion in 2010) and this number may become even shorter in the future. One can attribute the rapid population growth in the last two hundred years to the increasing use of fossil fuels for manufacturing and later

for the production of fertilizers and pesticides which made the green revolution possible. Also improvements in hygiene and the development of vaccines for many common diseases have contributed to this population growth. Today, however, we are starting to see a slowing down of the increasing subsistence level trend. This is being characterized by an increase in fertilizer and food prices, the limits on the use of additional fertilizer on plant growth, limits on new arable lands available, and changes in weather patterns.

**Although the calorie intake in developed countries is still considerably above needed for survival, one can envision a day in the near future when this will no longer be true and the population indeed will have outrun its ability to further raise subsistence levels** . This will produce, as Malthus correctly stated, to a decrease in the growth or even a reversal of population levels. In developed countries this will be accomplished by a combination of voluntary effort, by government mandate, and possibly disease and famine. The immediate effect of the world population exceeding carrying capacity will be a decrease in wage levels, an increase in resource prices, and a decrease in family size. If handled in a controlled manner this inability of resources to keep up with population growth will produce some hardships but should not be catastrophic before things again improve with additional increases in technology such the use of electricity generated by nuclear plants to produce fresh water and hydrogen from saltwater and making extensive use of concentrated solar energy to run aqua farms for kelp and fish production. **It quite clear that the best use of solar energy at the moment and into the foreseeable future will remain the growth of food producing plants via photosynthesis.**