

# PLANTASIA *gala*

2016

## **Global Steward Award**

*November 12, 2016*

*John McDonnell's Remarks*

I want to say how humbled and honored I feel to receive the Global Steward Award, especially since the only previous recipient is Bill Danforth, who is my role model and the exemplar of how we should live our lives. I also want to thank all of you for being here and now listening to my attempt to provide some meaningful insights about global stewardship.

For the first time in Earth's almost 5 billion year history, a self-aware natural force is shaping the present and future of our planet. In the past 100 years, humans have essentially taken over the planet and appropriated almost all of its resources for our uses. Since the First World War the human population has exploded, more than quadrupling to 7.3 billion people today, unsustainably faster than at any time in the history of human existence. At the same time the median buying power per person has also more than quadrupled. The World Bank projects an additional more than doubling of buying power by the middle of this century, and the UN estimates a further 25% increase in population by then. And yet we are already consuming Earth's resources at a rate greater than the Earth's ability to replenish them. I have seen estimates of resource consumption at the rate of anywhere from 1.5 to 3 Earths – in other words, 1.5 to 3 times as fast as Earth can replenish them. So how can we possibly accommodate our growing appetite for consumption while actually cutting back on the resources being consumed?

Before I lay out humanity's global predicament and, hopefully, how we are going to resolve it without destroying our planet, I have a disclaimer. I will be throwing around a number of statistics and forecasts about human longevity and use of the Earth's resources. I do not guarantee their individual accuracy because I have drawn them, or constructed them, from a number of sources, but I do stand behind the overall picture.

Today, humans represent almost 30% of the total mass of all land vertebrates. Almost all the rest of the world's land vertebrate mass is made up of animals domesticated and engineered to be our pets, our beasts of burden, and especially our food. All wild species account for less than 3% of the total. In other words, we now are, or control for our use, over 97% of all land animals on the planet.

Agriculture already occupies over one-half of all potentially arable land, which encompasses all non-mountainous terrain which is ice and desert-free.

The greenhouse gases that we have emitted in the past 70 years have helped increase the heat trapping gases in the atmosphere by about 40%, breathtakingly faster than at any time in Earth's history.

For better or for worse we are in the process of fully taking over the planet.

Despite our seemingly dire over-exploitation, the two greatest aspirations of all nations and people world-wide are longer life and rising living standards, both of which will put greater pressure on Earth's finite resources.

Since the beginning of the 20th century the U.S. life expectancy at birth has increased by 60% from 47 years to 79 years of age. Comparable increases have occurred in the world as a whole. Today more than two-thirds of all people who have ever reached the age of 65 years are still alive, and that percentage continues to climb. Furthermore, it is likely that one-half of all children born today in the developed world will live to be 100 years old. In fact, because of indications that some new medicines in development may slow the aging process, a small coterie of researchers who study aging is beginning to say that serious life extensions could become a reality within the lifetimes of current adults. Others think that over the next few centuries it is quite possible that nearly every tissue in the body may be able to be replaced. The implication of these life extending advances is that the human population will continue to increase tremendously unless the birth rate is cut way below replenishment rate, which would have its own negative social and economic implications.

The other great aspiration of modern civilization – rising living standards – is equally as dangerous to the sustainability of our planet, and therefore to us. The World GDP per capita – a reasonable proxy for increasing living standard – has been rising at about 1.0% per year. At that rate each human being on average will be consuming about 130% more per year by the end of this century. If the developing world – mainly China and India – continues to grow rapidly, that figure could be conservative, especially if African countries get their acts together. On the other hand, restraining growth is dangerous because as Sir Angus Deaton, Nobel Laureate in economics says, "Politics becomes more difficult with slowing growth. With a growing pie, everyone can have more, but if the pie is fixed, I can only benefit at your expense."

Our two great aspirations of modern civilization – longer life and increasing living standard – therefore present us with a dilemma relative to our planet's future because they both require greater and greater use of Earth's resources.

Let me say, however, that I do not believe our species is necessarily doomed to destroy our planet. Many times in the past knowledgeable experts have forecast exhaustion of Earth's resources only to be proven wrong – most notably Thomas Malthus and the Club of Rome.

At the end of the 18th century Thomas Malthus – an English cleric, scholar, and economist – predicted that population would outgrow the food supply, causing famine, disease and, if not checked, a catastrophic collapse of civilization.

More recently in 1972 the Club of Rome, a group of European scientists, economists, and industrialists, commissioned a study that predicted that during the first half of this century the human ecological footprint would stop growing – either through catastrophic "overshoot and collapse" or through well-managed "peak and decline." At about the same time Paul Ehrlich, a Stanford professor of biology and environment predicted population would outstrip the food supply very quickly causing mass starvation in the 1970's and '80s.

In each case, new technologies have come to our rescue. In the 19th century the industrial revolution intervened, and in the second half of the 20th century the green revolution saved us.

Today we are faced with growing crises of land and water usage and reliance on non-renewable, polluting, and climate-changing energy sources. But there are some encouraging trends. The population explosion that occurred in the 20th century is abating. Primarily caused by improvements in sanitation and reduction of infectious diseases, the explosion is now being counteracted by a declining birth rate across most of the world – both in developed nations as well as in many developing countries. Much of Europe and Japan have declining populations. Developing countries such as Bangladesh, Indonesia, and Iran have had rapid decreases in fertility. China, of course, has had low fertility – partially mandated – for a long time. Only in many African countries does the fertility rate remain high, but that seems to be related primarily to unstable governments. Last year the UN predicted that the world population will stabilize at about 9 billion people by the middle of this century – and then fluctuate modestly. One cautionary note is that forecast is based on the assumption that we will have a gradually slowing increase in longevity. If the length of our lifespan accelerates, as some scientists think possible, it could result in a considerably larger population.

The second encouraging factor is that the looming crisis in fresh water availability may be solvable with improving technology – both in usage of water and generation of new water supplies. Agriculture accounts for over 80% of all the water consumed globally, so modest improvements in water usage in agriculture can make a big difference in our burgeoning needs. In addition, since only 1% of all water on Earth is fresh surface water (lakes, rivers, and captured rainfall), there is a huge untapped reservoir of currently unusable salty water which we could use if we are able to develop clean, sustainable, cheap energy sources to desalinate it, or if we could develop food crops which could tolerate it.

Third, the rising consumption of goods per capita as the world population becomes richer does not necessarily mean a comparable amount of depletion of Earth's resources. As people's income rises, relatively more of their spending is for services rather than material goods. Also, with advancing technology the amount of materials used tends to decline. Case in point is the digital revolution – computers used to be big and bulky. Now vastly more computer power is contained in a tiny chip requiring very little material resources. Automobiles, airplanes, and even buildings, are becoming lighter but more capable. It is reasonable to expect this trend to continue across most of the products of our daily lives.

The bottom line is that I am an optimist that humans will once again be able to overcome the existential challenges that we face, but it will not be automatic. Nor will it be easy. It will require another revolution in food and energy production – a revolution that builds on the green revolution in agriculture and on the fossil fuel revolution in energy. Those two revolutions have provided abundant, cheap food and energy, but at a cost of considerable pollution and damage to our planet. The next revolutions must provide an even greater abundance of cheap food and energy but in a manner, that is less taxing on our planet and is sustainable as our requirements continue to increase.

An important element in both revolutions will be better engineered, more efficient, more productive plants which deliver more nutrition or energy per unit of Earth's resources required to produce it.

Guess what! At the center of that effort is exactly what the Donald Danforth Plant Science Center is doing. The Danforth Center is not the whole solution, but it and its research partners are an indispensable piece of what it will take for humanity to once again demonstrate its adaptability and intelligence to keep our fragile home a place of bounty and beauty. Truly we are living in a new age in which for the first time in Earth's history a self-aware natural force – namely us – is shaping the present and future of our planet – for better or for worse.

I once again want to thank the Danforth Center for the Global Steward Award, which has given me the chance to attempt to articulate my view of what our opportunities and challenges will be as we shape the future of our planet and of ourselves.



D O N A L D D A N F O R T H  
P L A N T S C I E N C E C E N T E R  
D I S C O V E R Y | C O M M U N I T Y | I M P A C T