

Reinventing Malthus for the 21st Century

A Bicentennial Event on Malthus' Original Population Essay

A presentation sponsored by
Negative Population Growth (NPG) and
The Federation for American Immigration Reform (FAIR)

Featuring:

Lester Brown

President, *Worldwatch Institute*

Rupert Cutler

Executive Director, *Western Virginia Land Trust*

John Rohe

Author, "*A Bicentennial Malthusian Essay*"

With Remarks by:

Sharon McCloe Stein

Executive Director, *Negative Population Growth*

Dan Stein

Executive Director, *Federation for American Immigration Reform*

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National Press Club, Washington, DC
July 14, 1997

*In 1798, Thomas Malthus first published his revolutionary work, **Essay on the Principle of Population**. Today the world continues to struggle to find ways to overcome the inherent biological limits of human population growth. What follows is a transcript of oral presentations and discussions at the National Press Club, July 14, 1997 – informal ruminations, if you will – on the life and implications of Malthus' ideas 200 years later. The discussion features a new book by John Rohe, **A Bicentennial Malthusian Essay: Conservation, Population and the Indifference to Limits**.*

-Sharon McCloe Stein

OPENING REMARKS BY SHARON MCCLOE STEIN EXECUTIVE DIRECTOR, NPG

I'd like to welcome you all here today. My name is Sharon McCloe Stein and I am the executive director of Negative Population Growth (NPG). NPG was founded in 1972 to warn the American public about the detrimental effects of overpopulation. I'm happy to see a number of NPG members here with us today.

NPG advocates a national population policy to halt and reverse US population growth and to achieve a sustainable U.S. population level of about 150 million. We are pleased to co-host this event with the Federation for American Immigration Reform and we are grateful to all of you for joining us for what I know will be an enlightening discussion.

We will hear first this afternoon from John Rohe, author of *A Bicentennial Malthusian Essay: Conservation, Population and the Indifference to Limits*. John is an accomplished attorney, author and legal scholar. A former Peace Corps volunteer, John now works with several land trusts and

conservation organizations in Michigan where he resides. Among his many credits, he authored the Model Conservation Easement as used throughout Michigan. I believe John has done an incredible service to the population movement by bringing Malthus and his seminal work to the attention of a broader public. And I am sure each of you will enjoy reading John's excellent book, which we are here to discuss today.

Following John is a man well-known to all of you. Lester Brown has been described as one of the world's most influential thinkers and the guru of the global environmental movement. In 1974, Lester founded the Worldwatch Institute, and now serves as its president. Among his many publications is the annual *State of the World*, which is considered the bible of the environmental movement. He is the recipient of many honorary awards. He is a McArthur Fellow award winner; he has received the 1987 United Nations Environmental Prize, and the 1994 Blue Ribbon Panel Prize. And I am sure his research in drafting *Who Will Feed China* will provide us a present real-life illustration of Malthus' worse fears.

Our final speaker is Dr. Rupert Cutler. Rupert holds a Ph.D. from Michigan State Univer-

sity and his career in environmental policy has spanned 42 years. He is the former president of the Defenders of Wildlife and has served as President Carter's Assistant Secretary of Agriculture for Conservation Research and Education. In 1997, Rupert became the founding executive director of the Western Virginia Land Trust, a nonprofit association created to preserve the natural scenic heritage of western Virginia.

We are grateful to each of our distinguished panelists for being with us today and before we begin we would like to hear a few words from the executive director of the Federation for American Immigration Reform, Dan Stein, who will explain what we hope to achieve today.

**REMARKS BY DAN STEIN
EXECUTIVE DIRECTOR
FEDERATION FOR AMERICAN IMMIGRATION REFORM**

Thank you, Sharon, and thank you all for coming. As we work on many important environmental issues around the country, including population and immigration, it's extraordinary to find that immigration and population issues – population issues in particular – seem to be the most influential, undiscussed components of American public policy today. John Rohe's new book, *A Bicentennial Malthusian Essay*, may change that. We hope that this discussion will provide an important beginning of a framework as the country and the world observes the two hundredth anniversary of Malthus' original population essay. John Rohe has provided us with an easy-to-read, comprehensive understanding of the meaning of Malthus. Perhaps today, in the course of our discussion, we can consider what those ideas and lessons teach us as we move into the twenty-first century. I want to thank NPG for helping us cosponsor this, as well as U.S. Inc. in Michigan for its financial support of this event. And with that, I would like to turn the microphone over to John Rohe.

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**REMARKS BY JOHN ROHE
AUTHOR, *A BICENTENNIAL MALTHUSIAN ESSAY***

Thank you very much Sharon, Dan Stein, FAIR, NPG. Let me read a quote. "Men and nature must work hand in hand. The throwing out of balance of the resources of nature throws out of balance also the lives of men." I had the privilege of encountering this quote yesterday while touring the new Roosevelt Memorial in downtown Washington, D.C. Balance is what we are here to discuss today and balance is the big issue confronting mankind. In this conference, we are inaugurating what I believe to be a bicentennial debate. It's a debate on whether principles of two hundred years ago – that were very revolutionary and controversial – have any relevance whatsoever to the modern world.

In 1798, Thomas Robert Malthus wrote perhaps the most provocative essay in western thought. To understand this setting, it's important to look at what these times were like in 1798. England, where this was written, was still perhaps reeling from the American Revolution, while the French Revolution took place not too long before that. Mobilization was principally by foot or by horseback. It wouldn't be until 1812 that the steamship was in common use and the first Trans-Atlantic steam crossing would have taken place in 1827. In 1825, we had our first passenger trains. The world population in 1798, when Malthus wrote this essay, was about nine million people. Of course we are now about to touch upon six billion people on the face of the earth. The year 1790 was the first US census. At that time we believed there were four million Americans in this country. And just two years before this Malthusian essay was written, a man named Jenner had discovered a vaccination for smallpox.

So that was the setting in which Thomas Robert Malthus wrote this essay. He emerged with this highly controversial essay. It was really a reaction; a reaction to a sense of optimism that was very prevalent at that time. This optimism was reflected in the writings of Godwin, Thoreau and Rousseau. Man at the time, was believed to be approaching a state of "perfectibility." This was the dawn of the industrial revolution. We were beginning to make things. We harnessed tools of an enterprise, and for some, that improved the comforts of life, but certainly not for all as evidenced in the writings of Charles Dickens. But for many, pros-

perity and wealth increased with the tools of production that we had been developing. And in this sense of optimism, there was a belief that if we make more stuff we would lead to more wealth and prosperity and if we had more people, we could make more and improve the lot of life for many. At the heart of this belief was the understanding that more people was a good thing. And it was in that context that Malthus came up with his insight.

Let's say that mom and dad have four children. And then those four children would also have four children each. So the population size of that family would proceed as follows: 2, 4, 8, 16, 32, 64, 128, 256, 512, 1,024. Soon this geometric progression has us through the roof. That was an amazing finding, it was revolutionary, and it contravened the common belief at the time. Today, it is very easy to overlook the significance of this finding. Many of us in this room understand the principles of exponential growth. But at the time, this notion of excess reproduction was absolutely astounding.

If you read the Malthusian essay, you will develop a sense that this man was unlocking one of nature's best kept and most formidable secrets. That is the secret of excess reproduction – every species in the animal and plant kingdom will reproduce more than its ecosystem will accommodate.

These ideas, by the way, inspired another Englishman in 1838 to think of how this system might work more fully. His name was Charles Darwin. It's reflected directly in his diary. In 1838, he read the Malthusian essay and the next day he reflected on the fact that he now had a way to explain what he was observing in the fossil record. Malthus pointed to our excess reproduction. There is more reproduction than the system can accommodate. Darwin took that one step further: who survives and who doesn't? Darwin then determined that it was fitness that led to natural selection.

Now Darwin kept that idea under wraps between 1838, when he stumbled across it by reading the Malthusian Essay, and 1859 when *The Origin of the Species* was published – twenty-one years. Perhaps he knew that by having developed a scientific basis for explaining how we got here and how the animal kingdom got here, he would be undermining the mystic revelations that had been very prevalent throughout our history. These revolutionary findings challenged the intellectual underpinning of every self-conscious society at the time.

Population was a big issue on Earth Day 1970 – and yet it is a forgotten cause on the Earth Days of the 90's.

Interestingly, the Malthusian Essay inspired another Englishman, Sir Russell Wallace to come up with the same idea of natural selection. As you recall Darwin and Wallace made a joint presentation of their ideas on natural selection at the time. The belief that more human beings aren't always necessarily a good thing would have been seen as a very dour view of mankind in 1789. In fact, interestingly, Malthus was the "grasping, squeezing, covinous old sinner" that Charles Dickens had written about in Scrooge. That was Malthus. This gives you some idea of just how these views were accepted at the time and just how revolutionary and controversial they were.

Well, here at the bicentennial it might be appropriate for us to ask whether Malthus was that squeezing, grasping, covetous old sinner or whether he had a message that retains some relevance to us in our modern world. And what is that modern world? Folks like Lester Brown have studied that exhaustively. We have about a billion people going to bed hungry every night. One out of six of us go to bed hungry. Now these scenes aren't necessarily visible to us when we sit in our breakfast nook, but they are playing themselves out on the planet. We have a few hundred thousand people that fall beyond the brink of malnutrition annually. And we have a total daily net population gain, that is total births minus total deaths of about a quarter million people. If a big city has a million people, we are replicating that big city every fourth day. Nevertheless, we remain optimistic, much like the optimists two hundred years ago. They were indifferent to limits. We remain indifferent to limits.

Population was a big issue on Earth Day 1970 – and yet it is a forgotten cause on the Earth Days of the 90's. Has the world expanded? Have we become less numerate? Are numbers too intimidating for us? Why is it that population is not on the national radar screen? Perhaps as a result of the bicentennial debate we will be able to restore population to its rightful place on the national agenda. Maybe we can start to lay the seeds for a nation to develop a population policy.

I would respectfully submit that if the great mind of Thomas Robert Malthus were with us today, he would not only be writing about population and our indifference to the limits of population – but today he would be writing about our indifference to the limits of economic growth.

Now as many of you know, population in this nation is not as great a problem as it is in the developing world. We basically, since Earth Day 1970, if you want to pick a date, have for the domestic population adopted a more or less a replacement level fertility. Of course that statistic is distorted dramatically by the massive influx of people under the post-1965 immigration laws. But as to the domestic population we have made a very responsible decision in this nation without any coercion to adopt a replacement level fertility. Nevertheless, we are indifferent to limits. The problem in this country is our indifference to the limits of growth. Economic growth, every economic forecast that you see, every time you turn on the TV and see the financial reports, every economist you talk to will assume that economic growth is good, and more growth is better. I would respectfully submit that if the great mind of Thomas Robert Malthus were with us today, he would not only be writing about population and our indifference to the limits of population. But today he would be writing about our indifference to the limits of economic growth. This notion plagues so many of our decisions. I see it as a lawyer in Michigan when I approach a zoning board. They don't understand it. They don't understand why someone might be opposed to a Walmart in a small town. They don't have a sense for limits. It doesn't just play itself out to a small town though. This is a national phenomenon. It is an unchallenged and unexamined conviction that plagues the mind set of I would say every economic report that you see. The belief that perpetual growth on a finite planet can continue is the mind set of a stark raving mad lunatic and yet this mindset governs all economic principles that we have.

Whatever happened to the common good in America? What happened to the notions of ac-

countability and responsibility? Where did our sense for this intergenerational assistance to the next generation stop? Why are we a shopping culture? Why is it that we are bent on immediate self-gratification? Why is it that shopping at a mall is now a form of recreation? If we search for the canyons of consumerism, I think we will find them in our frightful addiction to economic growth.

So here we are two hundred years later. Does this message have any relevance? Are we exempt from the laws of nature that Darwin and Malthus came upon? Are we exempt from these laws that say there will be an excess of reproduction and then something else sets in. By the way, from the Malthusian perspective that something else is called misery and vice. That is the population check that he identified – misery and vice. Vice is a form of human intervention that brings population back into check. Vice, by Malthusian terms, is war, infanticide, human intervention. Misery on the other hand is non-human intervention – famine, pestilence. Misery and vice... those are the two phrases. That is his "and then what?" if I can borrow a phrase from Garrett Hardin.

So, as we are poised at the threshold of this bicentennial debate and as we inaugurate this debate at this setting here in Washington DC, it is important for us to ask whether this human experiment of ours is such a finely crafted and finely tuned experiment that we just soar high above the laws of nature. Should we rely upon the physical limits of this planet to make our decisions for us? Or do we take some control ourselves? Are we exempt from the laws of nature? That's how we might define the debate at this bicentennial. And by the way this is a debate that I hope to lose. Nothing would please me more than to go home to my thirteen year old son at the end of this bicentennial and in his vernacular say, "You know Karl, we're just too cool, we are too awesome, we are the 'spiffy species.' These laws don't apply to us. This human experiment is such a finely crafted tool that you've got nothing to worry about."

So once again, as we inaugurate the bicentennial debate: Are we exempt?

Where did our sense for this intergenerational assistance to the next generation stop?

**REMARKS BY LESTER BROWN
PRESIDENT, WORLDWATCH INSTITUTE**

Thank you. I knew John was an excellent writer, but I hadn't heard him speak before. Wow!

We were talking earlier, John, about when we started the Worldwatch Institute in 1974. At that time, I had just finished a book called *By Bread Alone*. It was a background book for the World Food Summit held in Rome. When I got back from the conference, I was contacted by the Embassy of Tanzania asking if I would inscribe a copy for President Nyerere, which I happily did. I sent it to him, and sometime later I got a letter in which he noted a passage stating that probably not two political leaders in a hundred understand that a three percent annual rate of population growth means a twenty fold population increase in a century. He said, "However many there were before, there is now one more."

I mention this because I think so few people understand the insight that Malthus contributed on the nature of exponential growth. There are a lot of examples that are used to teach this to school children. One that the French use, and inspired the cover photograph on John's book, is the story of the lily pond – in which there is one leaf on the first day, two the second, four the third and so forth. The question to the students is, if the pond fills on the thirtieth day, when is it half full? And the answer is the twenty-ninth day of course. That is the nature of exponential growth and I don't think we've quite grasped it yet.

We are still trying to understand the magnitude of growth and its consequence, in part because the sort of growth we have experienced in recent decades has no historical precedent. When Malthus was writing the essay, the population growth that year must have been 0.2% or something like that. I mean it was almost negligible. Those of us born before 1950 have witnessed a doubling of world population growth. We are the first generation in history to have this experience. Stated otherwise there has been more population growth since 1950 than during the preceding four million years from when we first stood upright. I think it will be some time before we fully understand the consequence of what is happening.

When I think of Malthus' writings and his warnings of 200 years ago, I remember that the

official number that was used at the Food Summit last November of the number of hungry and malnourished in the world, was 800 million. The World Bank says there are 1.3 billion people in the world today who live on a dollar a day or less. The chances are that almost all of them are malnourished and hungry at least for part of the year. Although Malthus was controversial, he has not been dismissed as a person, as a thinker. His name has become a common adjective. I was trying to think of other people's names that have become part of our daily vocabulary. Christian obviously, Marxist, Platonic, are some of the ones that come to mind, but Malthusian is very much a part of our vocabulary.

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I'd like to talk about two things that Malthus missed in his present forecast. One is his underestimation of our capacity to raise land productivity. Since 1950, the world grain harvest has nearly tripled and most of that increase has come not from expanding the area, but from boosting land productivity. Some countries have tripled or quadrupled wheat yield per acre, corn yield per acre, or rice yield per acre. These are phenomenal advances. If we look at grain yields historically in this country going back to the Civil War, which is as far back as we have data, you see that from 1860 to 1940 wheat yield per acre and corn yield per acre are essentially flat. And then they both begin to take off and rise very rapidly. Now, wheat is beginning to level off again. In the efforts to raise land productivity, we have a long historical plateau, a rapid rise, and then a tendency, at least, to level off again.

Now there are a number of things that have contributed to the extraordinary rise in land productivity. One would obviously be the advances in genetics. Malthus was writing in 1798. Mendel was doing his work in the early 1860's when he established the basic principles

of genetics that set the stage for the exciting advances in plant breeding. In an article in the July/August issue of *Worldwatch Magazine* we analyze the grain yield trends for various countries in the world historically, and look at the sources

Aquifers are now being depleted; water tables are falling in the world's major food producing regions; including the southern great plains of the United States.

of the higher yields and try to get a sense of what we might expect in the future. What the scientists have done to raise yields, is to increase the share of the photosynthate, that is the product of photosynthesis, going to the seed. As the photosynthate is produced in the leaf, some of it is used by the leaf, some is used by the stem, some is used by the roots and some goes to seed. In the originally domesticated wheats, on the Anatolian Plateau in Turkey, roughly 20% of the photosynthate produced by the plant went to the seed. In today's modern high yielding variety over half of the photosynthate goes to seed. The upper limit is probably not more than 60%. You have to have some photosynthate for the roots, for the stem and for the leaves in order for the plant to function. So we are beginning to push against that limit and there doesn't seem to be any easy way to go beyond it. We have not been able to change the efficiency of the product of photosynthesis itself. That reduces to basic chemistry and physics. And so it comes as no surprise that the rise in land productivity is now losing momentum.

The two principal agronomic sources of higher yields have been fertilizer and water. Just a half century after the essay appeared, Von Liebig, a German chemist, demonstrated in 1847 that all the nutrients that plants take from the soil could be replaced in mineral form. That set the stage for what we now know as the fertilizer industry. In 1950, the world farmers used 14 million tons of fertilizer – nitrogen, phosphate, and potash, the famous NPK, the basic plant nutrients. By 1990, they were using 140 million tons, a ten-fold increase. The reason for using the fertilizer was to make sure that plants had enough nutrients to realize their full genetic potential. But after a point, more fertilizer doesn't make much difference. After the dramatic rise in fertilizer use in this coun-

try, fertilizer use has leveled off and actually declined somewhat since the early 1980's. In the mid-1990's, farmers in this country are using less fertilizer than in the mid-1980's. Fertilizer use has plateaued in Europe, the former Soviet Union, Japan and may now be about to do so in China. There comes a time when more fertilizer has very little effect on yield.

The other major agronomical source of additional output has been growth in irrigation. In 1950, there were about 94 million hectares in irrigation, today there are about 260 million hectares. The growth in irrigation expanded – until today about 40% of the world grain harvest comes from irrigated land. In Asia, of course, the overwhelming share of grain production is irrigated. But what we are discovering is that this enormous growth in irrigation is in part based on the unsustainable use of water. Aquifers are now being depleted; water tables are falling in the world's major food producing regions; including the southern great plains of the United States, the southwestern United States, several states of India including the Punjab, which is the bread basket of India, and much of central and northern China. Just to cite some of the more important examples.

If we had been a far sighted species, we would have been monitoring the water tables. When the amount of pumping began to exceed the recharge of the aquifers, we would have stabilized the pumping. But we didn't, so the pumping keeps going up – the irrigated area keeps expanding, the aquifer keeps falling, and eventually when the aquifer is depleted, the rate of pumping will necessarily be reduced to the rate of recharge. That's not a debatable point, that's a physical reality.

And we are beginning to see that happen in some countries now. In Saudi Arabia, a country that was pumping a fossil aquifer, grain production dropped 62% between 1994 and 1996. After a gradual increase since 1979 we saw a dramatic fall, a classic overshoot and collapse situation. Now that's much more dramatic than in most cases because that's a fossil aquifer, it doesn't recharge, once you pump it dry that's it. But it is an example of what will be happening in the years ahead, as we begin to deplete more and more of the major aquifers on which we now depend for irrigation water.

I think one of the most underrated resource issues in the world today is water scarcity. Deforestation was easy. You could film the burning rain

forest. You could have graphic photographs of clear-cuts in the northwest. Everyone understood deforestation. But falling water tables are not very photogenic. And so most people are just not aware of the extent to which the world is now depleting underground water supplies. We are postponing the difficult decision for the next generation – when the over pumping will be even greater and the number of people will be even larger.

I was, over the weekend, making a list of postponed decisions that our generation is doing and leaving for the next generation. Once you begin to make that list, you have to start worrying. When water becomes scarce and the competition between cities and countryside intensifies – as it is doing in China today, and throughout the Middle East and North Africa – then cities pull water away from agriculture. The irrigated area is reduced and countries have to import grain to offset the loss of irrigation water. To import a ton of wheat is to import a thousand tons of water. Water scarcity is now beginning to shape international grain trade patterns in the same way that land scarcity did historically. So water is emerging as a major constraint. And in ways I don't think most people realize. As a result of beginning to approach the maximum amount of photosynthate that can go to seed, the maximum amount of fertilizer that plants can use and of pushing against water limits, we find that the rise in land productivity that had been so rapid for most of this last half century is now beginning to slow. Now that's not to say that we will not further raise land productivity. We will certainly in most of the world. But it is becoming much more difficult. This is why world grain stocks are now at the lowest level on record. It is why all the land that was idled under commodity programs in this country is back in production. We still have some land idled in the Conservation Reserve Program and some of that could be farmed sustainably with the right practices, but we are seeing a tightening of the world food situation and one that is likely to continue in the years ahead, for some of the reasons I have mentioned.

So one of the things Malthus missed was this rapid rise in land productivity – but I fear that we have come to take it for granted and to assume, as most economists do, that the trends of the last forty years are going to continue for the next forty years. As one trained in the natural sciences I can assure you that will not be the case, but I don't think most political leaders are aware of how tight things could become. Biotechnology would be great except that the biotechnologists have yet to develop

a single high yielding variety of wheat, rice, or corn. And the reason is that traditional plant breeders have done almost everything they can think of to do. We are already pressing against the level of photosynthate availability for seed formation in large areas of the world.

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The second point that Malthus missed was the effect of rising affluence on the demand for food. He talked about population growth and demand for food. People often say population growth is expected to double over the next half century, and therefore we will have to double food production. Rising affluence is now becoming a major factor.

There is a big difference between how much grain is consumed per person in India and in the United States. In India, it's about 200 kilograms a year, or roughly a pound a day. When you have only that much grain, you can't convert a lot into animal protein; you have to consume almost all of it directly. In this country we consume, largely in the form of livestock products, 800 kg of grain per year, or about four times as much. We consume it in the form of pork, poultry, eggs, beef, cheese, milk, and yogurt – all the things we like. But that's 800 kg of grain per year. The problem now is that the Chinese want to live like us; this is putting enormous pressure on the earth's resources. China is not only the world's most populous country, but during the 1990's, it has been the world's fastest growing economy. Let me just cite the annual growth rates for the last five years: 12 percent, 14 percent, 11 percent, 10 percent, and last year *only* 9 percent. The United States was about 3 percent as I recall. This means that incomes in China have gone up 60 percent in the last five years. Much of this additional income goes to diversify diets, to get away from overwhelming dependence on one starchy staple, say rice, for most of one's food supply. People do like a more diverse diet. And so the Chinese are eating more pork, poultry, eggs and beef, and drinking more beer. And it takes an enormous amount of grain. I tell my colleagues at the Institute that multiplying 1.2 billion times anything is a lot. Whether its

another egg per person or another beer per person, it translates into a lot of grain. The official goal in China is to raise egg consumption from 100 eggs per person in 1990 to 200 eggs per person in the year 2000. By that time there will be 1.3 billion Chinese. That's 260 billion eggs. How many chickens does it take to lay 260 billion eggs? The numbers are so huge they are humorous. But they are real, and the real question is how much grain will it take to produce 260 billion eggs. John points out in his book that it will take as much grain as Canada exports to get from 100 eggs to 200 eggs in China. There is no precedent for the growth in demand for grain that is occurring today in Asia. I've talked about China because it's leading the region.

India is also beginning to move up the food chain. Poultry production is expanding by 15 percent a year, egg production I think 3 percent, and milk production by maybe 4 percent. There are 970 million Indians beginning to move up the food chain. We forget Indonesia, it only has 200 million people. It sort of gets lost in Asia. But the broiler industry in Indonesia is doubling every six years. So we are seeing an enormous movement of 3.1 billion people up the food chain in one region. Excluding Japan the regional economy has grown by 8 percent a year on average for the last five years. So affluence is also becoming a powerful source of additional demand for grain in the world. When we went through the rapid shift to a grain-based livestock economy in this country, there were 160 million of us in the early years after World War II. In Europe there were 280 million, but in Asia there are 3.1 billion and they are moving up the food chain faster than we ever did. This is one point that Malthus missed, but it is an important one.

As we monitor trends around the world – soil erosion, climate change, deforestation, aquifer

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depletion, population growth, and rising affluence, my sense is that the slack is going out of the system. I don't think business as usual is going to continue for much longer. We have this infatuation with technology, which is understandable, whether it's exploring Mars or the internet and all the things one can do now in the telecommunications field. It's fascinating, it's exciting, but it doesn't solve the food problem. And it doesn't bring about the balance that we need between our continuously expanding numbers and the earth's resources, which have not changed very much since the time of Malthus. We still have basically the same land area, the same water resources to work with.

Thank you very much.

**REMARKS BY RUPERT CUTLER
EXECUTIVE DIRECTOR
WESTERN VIRGINIA LAND TRUST**

Good afternoon. Some of you may remember me from when I was Assistant Secretary of Agriculture in the Carter administration where I had the opportunity to initiate the National Agricultural Land Study. Lester Brown remembers the last thing I wrote from that product. It was an op-ed page piece in the *New York Times* the last line of which stated "asphalt is the land's last crop." I think he has used that a few times since and I'm glad he has. I'm glad to see that perpetuated.

Currently, I am executive director of a new land trust based in Roanoke Virginia. Land trusts exist to save local landscapes through voluntary agreements like conservation easements and, in the case of our organization in Roanoke, we are looking at open space from Roanoke to the Cumberland Gap, trying to get private landowners to protect views along the Blue Ridge Parkway, the Greenway trail networks, wildlife habitats and historic sites. So that's just my way of a commercial you can turn off the slide projector and we can get on to why Malthus was right.

Now let's consider the effects of human population growth on one particular place in America – a place whose residents by and large don't think they have a population growth problem. After almost seven years as a resident of Southwest Virginia's Roanoke Valley, I'm convinced of two things: One, that most of my neighbors would say they're satisfied – I'm tempted to say smugly satis-

It's the connection between those local or regional problems and human population growth that hasn't been made in many residents' minds.

fied – with the quality of life they enjoy in “The Capital of the Blue Ridge” and, two, that very few of them would agree immediately with the proposition that too-rapid human population growth, locally or in the United States, is impairing their mental or physical health, their cultural and natural heritage, or their freedoms.

Roanoke City's population, you see, has been stuck at about 100,000 for years. Even the metropolitan area's quarter-million population is growing relatively slowly, though some neighboring rural “bedroom community” counties' populations are booming. This slow regional rate of population growth, residents fear, puts our part of the state at a disadvantage relative to the faster-growing parts of the Old Dominion. Why? Because congested Northern Virginia and the other parts of the state's “Golden Crescent” stretching southeast through Richmond to Norfolk are in fact gaining political clout in Richmond and Washington at Roanoke's expense.

So considerable effort currently is being devoted to creating industrial parks, small business incubators, and other incentives to attract new businesses with attendant new jobs (and families) to the Roanoke Valley and to the larger region surrounding it – the so-called “New Century Region” extending from Covington to Wytheville.

There's a vocal segment of Roanoke society that believes that family size is no one's business but the family's. The Blue Ridge Chapter of Planned Parenthood constantly is on the defensive for providing family planning information and abortion services. And there's a well-attended local annual celebration of the important contributions that recent immigrants from all around the world have made to the economic and social vitality of the Roanoke Valley, called “Local Colors.” So, while you and I know that the nation's population has doubled since Pearl Harbor Day, and is growing every year by the equivalent of two cities the size of Detroit, still, in Roanoke, Virginia, the terms population control and immigra-

tion control are viewed by many as impolite and unwelcome words.

However, local citizens' expressions of concern *are* frequently heard in the Roanoke news media and on the street regarding a variety of problematic developments that stem directly from population growth. It's the connection between those local or regional problems and human population growth that hasn't been made in many residents' minds.

Take the heavy truck and car traffic on Interstate 81. Increasingly long convoys of semis ferrying commodities between the West and the populous Northeast have caused the 45-mile commute between Roanoke and Virginia Tech at Blacksburg – which hundreds of university workers make twice daily – to become a major pain in the neck. This traffic growth helps justify construction of additional lanes and wider bridges on the interstate highway, as well as a research project called the “Smart Road” which will pave over productive farmland in a beautiful rural valley located between Virginia Tech and Roanoke. The Smart Road will be a test bed, designed to find ways to increase the safe carrying capacity of our highways through automated car controls, while also providing a new auto route cutting 10 minutes off the drive between Tech and our “Star City of the South.”

Won't that be fun, when the road takes over control of our cars? It's seen as needed to cope with envisioned future highway congestion.

Hundreds of millions of dollars will be spent just in the Roanoke region to address population growth-caused traffic jams. Soon to come in our back yard are north-south Interstate 73, supplementing U.S. 220, and the east-west Trans-American Highway, supplementing U.S. 460. These two mega-roads may intersect in downtown Roanoke, both using already-congested I-581 there. What a mess that's going to be.

But do we often relate these highway-capacity problems to population growth? Do we even see them as problems? Road- and bridge-construction firms see profitable work ahead, the state transportation department sees big contracts to administer, and the research university sees a stream of research grants coming to help support its graduate students and faculty. We are about to pave over more of our beautiful region, inviting more vehicles to our airshed where their exhaust emissions will further pollute the air and harm hu-

man health and the health of the natural ecosystem on which we depend for so many free services such as oxygen-production.

Is provision of less-polluting, more efficient alternative transportation modes seriously being considered, such as rail passenger service, expanded public bus service, or making commuting to work by bicycle easier? Not really. That would take thinking outside the box.

As polluted gray air and housing developments degrade the view along a growing number of miles of the Parkway in Virginia, surely we are killing the goose that lays our tourism golden egg.

Take the increasingly poor visibility from the 470-mile-long Blue Ridge Parkway, the Nation's most-visited National Park System unit. Take the urban sprawl construction along that Parkway near Roanoke, where unfettered development has rendered views from the Blue Ridge Parkway in our valley no different from that along any other road. The Blue Ridge Parkway brings millions of affluent tourists through the Roanoke Valley every year. Tourists driving the Parkway in Virginia spend \$340 million a year in neighboring towns like Roanoke. As polluted gray air and housing developments degrade the view along a growing number of miles of the Parkway in Virginia, surely we are killing the goose that lays our tourism golden egg.

Critics blame the American Electric Power Company, whose coal-fired plants in the Ohio River Valley spew toxic oxides of carbon, nitrogen and sulfur that prevailing winds carry our way, for the air quality deterioration. They say spineless local government officials and greedy developers are to blame for the conversion of pastoral vistas to acres of cookie-cutter subdivision housing and huge industrial and commercial buildings.

Some would deny the population connection. But what's a power company in a coal-rich region to do when required to provide dependable electric power at controlled rates for a growing population? What are local governments and developers to do when people need homes and jobs? It is popu-

lation growth, together with a blithe willingness to spend public money to build roads anywhere to accommodate growth and a reluctance on the part of county boards of supervisors to direct where and how growth occurs, that is to blame for our smog and sprawl.

And, speaking of our local electric power company, American Electric Power, what but envisaged population growth – a greater future “load” – could possibly justify current plans to build a new 765 kilovolt power transmission line with its attendant towers and cleared right of way from AEP's Ohio and West Virginia power plants through the heart of the scenic Jefferson National Forest in western Virginia and across the popular Appalachian Trail to Roanoke? Already several of the area's most prominent ridgetops – Tinker Mountain and Poor Mountain, for example – are littered with towers for electric power, television, radio and telephone transmission. Power line and gas pipeline transmission line rights of way already slash their arrogant way across many otherwise pristine mountainsides in the region.

They were built – and more are planned to be built – to serve the needs of a growing human population. And when the debate focuses – as it does today – on which side of the mountain to build the new power line on, the side seen by the most people or the side that's less seen but part of a quasi-wilderness area, the battle seems almost lost.

A growing urbanized human population requires more electric power, which leads not only to more coal-fired electric generation plants, transmission towers, and cleared rights of way, but also to more dams for hydroelectric power, such as Smith Mountain Lake – and there go our free-flowing rivers and streams, together with migratory fish runs and recreational canoeing and rafting opportunities. Expensive dams also are required to provide more potable water for our growing population, supplementing, in Roanoke's case, inexpensive natural springs and wells that once were adequate. Thus we now have to pay for the construction of the vast Spring Hollow Reservoir in Roanoke County and divert into it part of the historic flow of the Roanoke River, a tremendously productive aquatic environment with several endemic (unique) fish species and other aquatic creatures. Their well-being is at risk not only from reduced flows but from the chlorine used to treat the waste water at our regional sewage treatment plant. The extremely high cost of increasing the capacity and thoroughness of treatment at the Roanoke Regional Waste Water Treatment Plant – absolutely

necessary because of regional population growth and industrial expansion, particularly in downstream Bedford and Franklin counties where Smith Mountain Lake (on the Roanoke River) soon will be used for drinking water – recently was described by the Chairman of the Board of the Roanoke County Board of Supervisors as “high enough to gag a maggot.”

Not only is the Roanoke River which bisects the city of the same name being used as a water supply and a waste sink, but its natural banks and flood-absorbing floodway are about to be straightened and channelized by one of those classic U.S. Army Corps of Engineers flood control projects which sends the flood water problem downstream while turning part of the river in the city – a tree-lined linear park and bona fide trout habitat now – into an ugly paved ditch. For the same amount of money the structures to be protected by this flood reduction project – structures built in the wrong place in the first place – could have been moved out of harm's way permanently.

Take the silt load that appears in the Roanoke River and its tributaries, covering valuable fish habitat, with every heavy rain. Where do you suppose that silt pollution comes from? Some, of course, is topsoil from farmers' corn fields and other croplands where the owners have been slow to convert to no-till or low-till plowing practices, and some comes from sloppy logging operations too close to streams. But most of the silt is coming from soil disturbance accompanying road construction and home-site preparation associated with urban sprawl, despite sedimentation-control laws and regulations. Should we blame the farmers, who produce the food we need, or the loggers, who produce the wood we need, or even the developers, who build the homes we need? Or should we identify and address the real culprit – population growth?

Take the clear cutting that goes on, on both public and private forest lands in western Virginia. It's demand-driven, and the demand for wood products comes from human population growth. Don't blame Westvaco or the Forest Service; the public wants its paper and its lumber, and the only choice forest landowners have is whether to get all of the wood from one large spot at a time or to build more roads to enable the trees to be cut “selectively.” Sometimes the road-building causes more soil loss than the logging, so it can be six of one and a half-dozen of another as far as the environmental impact of clear-cut logging or selective logging is concerned. The point is that trees will

be harvested to meet the growing population's needs – if not in western Virginia, then somewhere else in the world, where the environmental impact may be even worse.

Take the clear cutting that goes on, on both public and private forest lands in western Virginia. It's demand-driven, and the demand for wood products comes from human population growth.

Take the steep decline in the average size of a farm in the Roanoke Valley and the rapid conversion of once-extensive apple and peach orchard lands there to industrial and residential uses. Farms, because they are accessible flat land, are easily and cheaply developed. If every community adopts the same attitude mine has – that we can easily continue to obtain sufficient fresh vegetables, fruit and dairy products from somewhere else – many American communities soon will be importing most of those kinds of perishable foods... and hoping that those other fruit and vegetable growing countries' pesticide residue-level regulations and their enforcement are the equivalent of ours. As American Farmland Trust President Ralph Grossi wrote in the *Roanoke Times* recently, 80 percent of America's fruit, vegetable and dairy products come from counties in and around urbanizing areas, and almost 50 acres of this unique land is being destroyed every hour.

I'm going to miss being able to go to Roanoke's historic farmers' market for locally grown fresh vegetables and to a nearby orchard for fresh cider and crisp apples every fall. The attitude of the county staff in the county losing the most orchard acreage in the Roanoke Valley, however, is that the conversion of their county's farms and orchards to population growth-induced industrial development and housing subdivision is a positive sign indicating that their county is “growing up” and not remaining a rural backwater. Botetourt County wants to be Fairfax County, I guess.

We could consider the large amount of open space and other resources being devoted in the Roanoke Valley now just to burying the tons of trash our people generate every day – a new railroad spur line called the Trash Train has been cre-

ated just to transfer our garbage to an expensive new landfill at Smith Gap – or we could look at the deteriorated condition of Roanoke's inner-city housing stock and the abandonment of industrial sites in the City, while both homes and industries engulf scenic rural areas on the urban fringe. Both are signs that anti-environmental incentives are at work to discourage the recycling of both our trash and our inner-city housing and industrial sites. But we're out of time to look in detail at every population growth-related phenomenon in my region.

So I will conclude by expressing my conviction that Parson Malthus was on the right track 200 years ago and that John Rohe is right on target in his new book, *A Bicentennial Malthusian Essay*. One line of Rohe's I particularly like is the following:

"If we remain indifferent to the limits of visual abuse on interior viewscapes, then we will sacrifice not only a prime natural resource, but we will also diminish ourselves in the process."

Thank you for your attention.

AUDIENCE QUESTION

The projections must be apparent to our policy makers having computers and other information, why don't they do something about it?

RESPONSE FROM LESTER BROWN

I was actually thinking about this over the weekend. My thoughts went back to a book by Robert Ornstein and Paul Ehrlich – maybe a decade or so ago – in which they talked about us as a species. Most of our existence as a species – about 99 point something percent – has been as hunter gatherers. We are trained to respond to immediate, obvious threats. But in our hunter-gatherer mode of existence there was no incorporation of long term concerns translating into short term actions. And so anything that happens gradually, – whether it is population growth, soil erosion, rising levels of atmospheric carbon dioxide – is happening slow enough that there is always the temptation to put it off to the next term of office or next corporate annual report or to try to delay it. Dealing with some of these problems is difficult. I don't know what the answer to your question is.

The political leadership in this country has access to all the information that we have been talking about.

We are trained to respond to immediate, obvious threats. But in our hunter gatherer mode of existence there was no incorporation of long term concerns translating into short term actions.

Whether it's the local problems that Rupert was talking about or the global problems like the China things. I can say that some people, that some of the better informed people in both the political and corporate world are becoming concerned. I've seen this manifest in different ways, and I've seen it particularly in the last two years. It comes in the form of political leaders, often heads of state wanting to meet and discuss these issues. It comes with corporations inviting me to speak to their boards, for example, or their senior management teams. And I find that encouraging.

There are three or four things that are beginning to affect their thinking and underlie their wanting to talk about these things. One is the realization that we have probably hit the wall in oceanic fisheries. And that even though population growth will continue the fish catch won't, so the per capita supply will be going down. This sets up all sorts of problems in managing fisheries, conflicts, competition, seafood prices, etcetera.

The second thing is that water scarcely in one way or another is beginning to encroach on the consciousness of more and more people. I mean water tables are falling in some surprising places in the world, like the Netherlands. Someone said where do they fall to? But the reality is that fresh water aquifers in Belgium and the Netherlands are falling and saltwater is beginning to come in.

A third thing that is beginning to concern people is the more and more extreme climatic events – whether its floods, or droughts or storms, hurricanes typhoons. And this is beginning especially to effect the insurance companies. It is probably the first major industry to feel the economic effect of climate change, and they are running scared. As you may know, some 60 insurance CEO's around the world have signed a statement urging governments to reduce CO₂ emissions. When you think about it this is rather remarkable because

one major industry is asking government to reduce the outputs of another major industry. I think they are beginning to engage the issue because their backs are against the wall. And then we have things like the heat wave in Chicago in July 1995 where 365 people died of heat stress – this is a modern industrial city – that's not suppose to happen.

The fourth thing that's beginning to effect people is one of the thing that I was talking about this morning is the realization that 1.2 billion Chinese moving up the food chain at an unprecedented rate is probably going to affect food prices for everyone before too long.

So I see that as encouraging, but I do not yet see it in most cases translating into policy, though occasionally as with the insurance industry and British Petroleum as you may know made a major statement on the west coast, the CEO, John White, at Stanford said that British Petroleum, as an oil company was taking global warming seriously and they were beginning to invest in understanding it. To think about efficiency, alternative sources of energy and so forth. It was a big jump for big oil, but it was only one company. We still have a long way to go yet. So here and there one can see some encouraging signs. But still the gap between what we need to be doing and what we are doing is widening. And that really is the basis for your concern, it still exists. And my guess is it's going to take a scare of some kind to wake us up and to get us to do the things that we know we ought to do but that politically we have not been able to do.

RESPONSE FROM JOHN ROHE

Very briefly, I might comment that I emphatically agree with Lester Brown that there may have been a Darwinian experiment that has rendered profits extinct. Imagine yourself years ago during the hunter-gatherer society that Les mentions here. If someone was thinking about the next two-hundred-year volcano cycle or the next two-hundred-year flood cycle – if this person focused their resources on computing these things rather than dealing with the immediate problem, I suspect that they might have been rendered extinct by the lion that's waiting for them to become lunch around the next bend. We react to the short term. Also, there is probably a fear that we might replicate the history of Malthus and if someone comes out and takes a rather dour view of human protoplasm and more human protoplasm they run the risk of becoming the grasping, squeezing old sinner. That's not a very politically

acceptable posture to be in. So at this juncture I think it's a matter of issues identification. It's a matter of opening some eyes, it's a matter of getting people to ponder whether or not we are exempt.

RESPONSE FROM RUPERT CUTLER

I'd like to just say one thing on his question that has to do with the role of the national environmental organizations who for the most part have been silent on the most important environmental issue of our time, population growth. And I would urge all individual members of any national environmental association to contact the leadership of that association and ask them why population growth, population policy, immigration policy aren't higher on their agendas.

It reminds me of back in the late 1960 when the late Senator Jackson was interested in the environment and moving the National Environmental Policy Act along, NEPA. I was here at the time, I was working for the Wilderness Society. None of the national environmental organizations took a very active role in supporting NEPA. None of us had a clue as to its implications or future significance, its importance. I'll never know why Henry Jackson decided to move it along, but thank goodness he did. Population policy probably is going to be the same. It will require some inspired leadership coming from somewhere. You can't expect busy members of Congress to invent some new legislative initiative out of nothing. It has to be a grassroots groundswell of support. If that groundswell begins, hopefully environmental groups will get the message and begin to offer some leadership, some long-needed leadership in population policy.

RESPONSE FROM SHARON STEIN

Following up on what John said, at the risk that Negative Population Growth, Inc., becomes that grasping, squeezing Scrooge – we believe that people should consider having smaller families, that we should have incentives, and that we should have this debate – but people don't seem to be ready to talk about these things unless we can put them into a quality of life issue or similar context for them. It's very, very difficult to get on the political radar. We want to have a dialogue with the environmental organizations. Our membership is about 17 to 18 thousand. You look at Sierra Club, Audubon I know they have some representatives here. Population growth has got to be put on the agenda from our standpoint as an environmental issue first and foremost.

AUDIENCE QUESTION

Is part of the problem that you are talking to the converted and not getting the message where it needs to go? Who is talking to the young people?

RESPONSE FROM SHARON STEIN

Although we are a 25-year-old organization with deep roots, we recently have kicked off a new outreach program for exactly the reasons that you say. There is the issue of what I call inter-generational equity. I come from the shorter end of the stick – where the sense is that one generation had a number of kids and now many of us are coming along telling the *next* generation it has to limit itself. That's a very hard message to sell to the next generation. I look at my parents' generation and say, have you all been good stewards of this country and set an example of what we should be doing for the next generation? But it gets back to policy makers or to young people. It's a matter of "let's get mine now" and let the problems work themselves out – and that's going to lead to disaster.

AUDIENCE QUESTION

What are specific proposals on what might be done to bring the population down?

RESPONSE FROM JOHN ROHE

The issue of what can be done has to follow an examination of what the issue is. I have a sense that in this nation we don't even know what the issue is. And none of the solutions will make any sense at all until we illuminate in a broad perspective what the issue is. Until people beyond those who come to these conferences begin to appreciate the effects of this mindless addiction to growth – be it economic growth or population growth and the indifference to limits – until we can get this out in the mainstream, none of the solutions will make any sense. Certainly public policy is not likely to be influenced if the general business community has an unexamined conviction that they cling to like we cling to romantic mystique of the frontier, that says growth is good and more growth is better. We first have to deal with that. And once we do, then I think a solution can begin to emerge.

In the interval, if you are interested in making a contribution yourself, I think we can make private policy decisions. But we are probably still a step away from making public policy decisions. Private policy is to have your 2.1 children per family. You can personally opt out of being shoved around by the advertising industry that tells you that you must consume, you have to be a good consumer to keep this thing afloat. We can resist those efforts on a personal level. But as far as public policy is concerned, I believe we need to just understand what and how frightful this issue really is.

RESPONSE FROM SHARON STEIN

I'm not a tax lawyer, but I will tell you as one of the few groups that has lobbied to get rid of the \$500 child tax credit, not the Republicans, not the Democrats, not the independents, no one was interested in standing up and saying let's do away with the tax credit for children. I will say that I've almost got eaten alive presenting that. You're going into the buzzsaw there – these are just not things that the political leaders are ready to hear, notwithstanding the long-term consequences of the track we are on.

RESPONSE FROM RUPERT CUTLER

There is another important and influential community, that of organized religion. If you were to ask me what was the main difference I felt between the social ambiance of the Washington D.C. area and the Roanoke area when I moved from one to the other seven years ago, I have to tell you it was in the area of religion. People's first question was what church are you a member of? Church, religion is a very heavy-duty concern and activity "outside the beltway" as they say. There is certainly a responsibility on the part of the leaders of the churches of our country and our world to address the ethical and moral as well as the environmental consequence of the continued rapid human population growth. I guess I'd add to my list of major kinds of institutions that need to take this one on much more effectively, in addition to the environmental community, the religious community.

Population growth has got to be put on the agenda as an environmental issue first and foremost.

AUDIENCE QUESTION

What does one do about the apparent reliance upon corporate philanthropy on private economic growth in pressuring environmental organizations to downplay consumption as an issue?

RESPONSE FROM LESTER BROWN

John was saying earlier, if Malthus were around today he would probably be dealing with this issue as well as population growth because as I noted on the food front, rising affluence is becoming an important source of additional demand. This is not to say that people should not move up the food chain. It is to suggest that as people move up the food chain we look where it is taking us. And what we discovered in this country is that it is taking us beyond the point where it is healthy. If one looks at life expectancy around the world, the longest life expectancy is not in the countries at the top of the food chain with 800 kilograms of grain per year, or those at the bottom, the Indians with 200 kg, it is those in between. For example in Italy, where grain consumption is at about 400 kg per year, life expectancy is longer than in the United States even though we spend far more on healthcare per person than do the Italians. The principal reason appears to be a difference in diet. The Italians consume livestock products but in much smaller quantities and they have a more diverse diet, more pasta, more fresh fruits and vegetable. And so we've had the evolution in the popular press now of the desirability of something called the so-called Mediterranean diet. Which is the Italian diet basically. If we were to move down toward the 400 kg instead of the 800 kg where we are most of us would be healthier. And we find that is happening, probably among many people in this room – the better educated and more aware segment of the population.

We have done a book entitled *How Much is Enough?* It was published a few years ago and one of the interesting finding is that when you ask people in a poll in this country in 1958 how happy they were, how satisfied they were with their lives, etcetera,

All of the things that we were buying that were suppose to make us happy really hadn't made very much difference.

I think the bottom line that is we need to ask ourselves "What are the things that are important to us?"

and that question was asked again in 1992 when our incomes had doubled or tripled, the percentage who were happy was essentially the same. And all of the things that we were buying that were suppose to make us happy really hadn't made very much difference.

I think the bottom line that is we need to ask ourselves "What are the things that are important to us? What are the things that are important to the next generation? and How are the things that we are doing now – whether it be family size decisions or consumption decisions – going to affect the world in which our children will live?"

And that's the question we are not doing a very good job of answering right now, and that's one reason I said with population – and it's certainly true with rising affluence – we still haven't grasped fully the significance of these enormous increases.

AUDIENCE QUESTION

I'd like to know why big corporations such as Nike and McDonald's aren't concerned with population problems ?

RESPONSE FROM SHARON STEIN

Well, I want to say that Nike is also in the business of selling shoes, so they want to have as many feet as possible to dress. That's the other side of the coin. What we like to say at NPG is that we are all in this together. People ask us why we work on U.S. population size as opposed to international. There is a sense for some of us that the population problem is so vast, and because of the population momentum, we may not be able to do anything about China, and some of these other countries. We continue to reach out to anyone who will listen about our population message, but you have to provide something to return to a company like Nike or McDonald's or any of these big companies that sit in their boardroom and simply say "how many burgers I sell is very much dependant on how many people there are – so we want to maximize our profit."

AUDIENCE QUESTION

What about new technologies, such as desalinization, to answer some of our problems as a hope for our future?

RESPONSE FROM LESTER BROWN

If someone could figure out how to reduce the cost of desalting sea water by a factor of 10, then we would open up some enormous new possibilities for expanding food production in desert areas that are in close proximity to the oceans. Unfortunately it doesn't appear to be in the cards. We are making a little progress here and a little bit there but we are a long way from getting these quantum jumps that we need to reduce the cost of desalting. Half of the water that is desalted in the world today is in Saudi Arabia, Kuwait, United Arab Emirates. Basically they are using oil money to do it. They can afford it; they are converting oil to water in a sense. But no one else can afford it. Particularly not for producing food. As I mentioned earlier a ton of wheat takes a thousand tons of water and when you think of desalting water on that scale it's just not there. So if someone came up with a dramatic breakthrough there it would make a difference.

In terms of other technologies, as long as we are dependant on photosynthesis, which we are today, then that becomes sort of the outer limit of how far we can go and how much we can convert. And as long as crops depend on water, some use water more efficiently than others but they all do, then the water supply itself is emerging as a major constraint. Water more important than land incidentally. If we had more water there is a lot more land that we could cultivate. But its those arid regions without water that can't produce much. As I mentioned I don't see the biotechnologists, although they are making some exciting progress in developing crop varieties that are resistant to particular insects and particular diseases, but in most cases that means that we can reduce the amount of pesticides used, which is a major plus but it doesn't increase production. And the basic technologies we have been using, which interestingly were all developed between 1840 and 1920. It was Von Ludvic in 1847 with fertilizers, and Mendel in the early 1860's with the basic principles of genetics, it was the Japanese in the 1880's dwarfing both wheats and rices and it was the University of Connecticut, Agricultural Experiment Station which by 1920 has successfully hybridized corn.

Those are the four big technologies that have lead to quantum jumps in the world grain harvest over the last half century plus irrigation which goes back five thousand years. But since 1920, there has not been a single technological advance in agriculture that could lead to a quantum jump. We might get 2 percent here or maybe even 5 percent there but not the big jumps. So the backlog of technology that farmers can draw upon is diminishing and its not being replenished. That is one of the reasons that the rise in land productivity has slowed so much during the 1990s.

RESPONSE FROM JOHN ROHE

There is maybe one brief thing I might like to add to that also. That is that somewhere along the way I think we have to start thinking of values. This isn't just a matter of how many people can we provide three bowls of rice to on a daily basis. Somewhere in here we have to think of values. Where in the scheme of things do we consider the amenities of the serenity of a placid walk in the woods with our dog. Somewhere that has to come into the equation. And I applaud and am incredibly benefitted by the efforts of Worldwatch Institute in terms of where these real food limits are. But how about values. If the issue is how many people be can stuff into a telephone booth, I think we've lost it. And the other side would point out that "hey, if we've got 12 people in the telephone booth we could just smash another twelve in there and somebody will come up with a solution with the overpopulation." Ingenuity and technology are worthy endeavors but somewhere in here I think we need values as well.

CLOSING REMARKS FROM DAN STEIN

I think that Malthus would look at the country today and say that there is no better demonstration of his philosophy than what occurs every time a new road is built in a community. A new road is built by our local authorities who tell us that the purpose of the road is to relieve traffic congestion, they say. The Malthusian principles operate to show us that within 6 months there is even more traffic on both roads that there was before.

[End of Transcript]





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