Our Plundered Planet and a Future of Less

BY WALTER YOUNGQUIST

INTRODUCTION

WALTER YOUNGQUIST is a veteran observer and commentator on world and U.S. resource and population trends, and the precarious balance between them. Youngquist draws on lengthy professional experience as a petroleum geologist which has taken him to over 70 countries.

His title here, *A Future of Less*, is characteristically counter-culture — rejecting the prevailing faith that perpetual economic growth and ever-rising prosperity are permanent entitlements of Americans. He does not try to bring his readers — or their children — cheer or reassurance about their future affluence.

The author bases this piece on his vast personal experience and his deep familiarity with the works of such experts as: Chris Clugston on rising scarcity of nonrenewable resources (NNRs), Lester Brown on world food production that now lags population growth, and NPG author and advocate Lindsey Grant on the now-peaking production of fossil fuels (Grant, 2005: *The Collapsing Bubble: Growth and Fossil Energy*, Seven Locks Press).

Walter Youngquist

Youngquist's conclusion: "We are headed toward a future of less for every single nonrenewable resource that we have known in history." His analysis goes beyond just minerals and fuels, including resources that are nonrenewable in the lifetime of humans — like top soil (lost to erosion and acidification from overuse of nitrogen fertilizers) and fresh water (through depletion of snowmelt and squandering of massive ancient aquifers).

Seconding NPG, Youngquist urges prompt reduction of population to an ecologically sustainable size and a transition to a no-growth, steady-state economy. He finds that if present trends in consumption persist, reduction of human population may come about by nature's harsher method of pruning: starvation and disease amid social turmoil.

Significantly, Youngquist's essay was completed in May 2014, as the U.N. Environmental Program (UNEP) was releasing its own analysis on resource depletion: *Humanity Can and Must Do More with Less: UNEP Report*. That report mirrors and expands on many of the grim trends in world resource consumption cited by Youngquist and by Clugston.

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Since humanity emerged from the hunter-gatherer economy (a time when the only resources used were the annual incremental dividend from renewables), people have been imbued with the concept of "*more and more*." Our expansion into the "New World" of North and South America reinforced this concept, as there ***was*** *more and more* — more land to be occupied and more natural resources to be exploited.

Economic growth is the idol of both political bodies and industrial organizations. For the former, when the economic pie grows the political promise of "*more and more* for everyone" seems achievable and keeps the citizenry happy. For the latter, it is the mark of a successful company that both sales and profits grow — and if that does not happen, the market shuns the corporation. Quarter by quarter, these measures are applied to corporations and are intensively watched and reported on by market analysts.

For much of the world, the future has involved a hopeful expectation of *more and more*. The Industrial Revolution promoted an unprecedented growth in world population. New nonrenewable resources were continually being discovered, and they were hastily processed to meet the rising hopes and demands of that growing populace. World population stood at just over 800 million as recently as 1800, and for several generations the pursuit of *more and more* seemed an obtainable goal.

But within just my own lifetime, world and U.S. populations have more than tripled. The United Nations projects that our current world population of 7.1 billion will pass 10 billion by 2100. Harvard ecologist Edward O. Wilson, viewing the impact of human population growth upon all aspects of the environment, called this growth "the raging monster upon the Earth." More people use more resources. Carrying capacity and the preservation of our environment are now becoming inversely related to population growth.

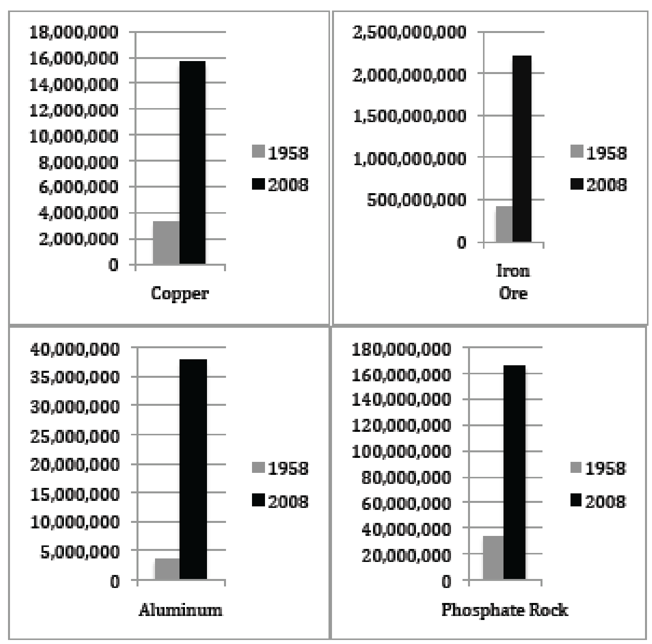
NATURAL RESOURCES

In the United States, for thousands of years the hunter-gatherer Amerindian societies exemplified a low-resource standard of living — even with some rudimentary agriculture. At that stage, North America was already a "full house," sustainable because of a small population and limited consumption. But to those who came from crowded foreign lands, the hope of *more and more* was inescapably alluring — particularly the great expanses of virgin fertile lands which lay before them. Most of the world was engaged in agriculture, and such pristine land was the primary resource prize.

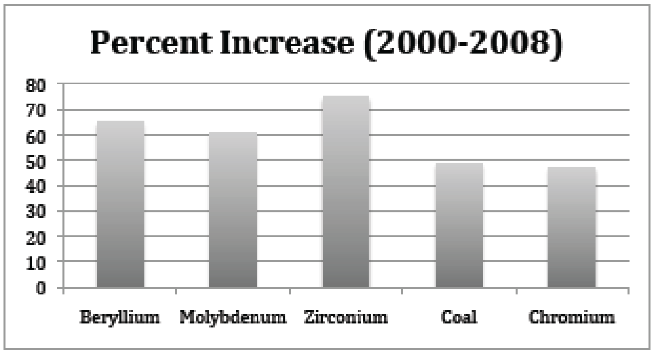
To the new industrial societies emerging around 1750, North America was an empty continent — but it contained a remarkable spectrum of natural resources. This was done by many advancing technologies of the time: mining, Earth resource processing, and finally manufacturing. The result was that from a virtual wilderness, in the span of about 300 years the United States rose to have the world's highest standard of living. That high-quality, high-consumption lifestyle made us the envy of much of the rest of the world – the reason why each year, America receives more immigrants (legal and illegal) than any other nation on earth.

People want to enjoy the "good life," made possible almost entirely by the increasing exploitation of nonrenewable natural resources (NNRs) — and the over-exploitation of renewable ones. In his important book, *Scarcity: Humanity's Final Chapter*, Christopher Clugston has extensively analyzed world trends in NNR availability. He defines "scarcity" as when the cost of a given resource rises faster than the rate of inflation. By this definition, 63 of the NNRs most used to sustain our modern industrial economies were scarce globally by 2008. Clugston states: "Within the context of our industrial lifestyle paradigm, human prosperity – as defined by economic output and material living standards – is enabled by [NNRs]." But our increasingly industrialized societies require *more and more* NNRs. We are pushing our world farther and farther out on a limb of NNRs, which is increasingly fragile.

With the growth in population and related industrial demands, the global extraction rates have become exponential. During the period of 1958 to 2008, the following extraction increases occurred (in metric tons):



From just 2000 to 2008, the following extraction increases occurred (by percentage):



NNRs now comprise 95 percent of the raw material inputs of the U.S. economy. As such, our historical prosperity is unsustainable — a fact for all industrialized economies. We are now on a dead-end road, and we will inevitably have to change course. Weaning our dependency on NNRs will be a change of monumental proportions, causing great shifts in world economic structures as we know them today. Related social turmoil is likely — but it cannot be as damaging as the end result of our refusal to change at all.

RESOURCES: CONSUMPTION VERSUS SUPPLY

The great expansion of wealth in industrialized countries, made possible by Earth resources, has fostered the idea that continuous growth will lead to perpetual prosperity. In a recent meeting of the G-20 nations, growth was mentioned 9 times — whereas resource limitations and population expansion were *never* mentioned. We have embedded in essentially all world economies the theory that only continual growth can establish the foundation for providing *more and more* things to *more and more* people.

President George W. Bush (2002) stated: "We need an energy bill that encourages consumption." This is exactly the *wrong* thing to do, and illustrates how political "leadership" can be oblivious to the facts of our existence. There is little evidence that the U.S. Congress knows better, from the ongoing ways in which they — as well as the executive branch and the industrial complex — encourage continually growing consumption of Earth resources. As Congress represents the people, it may be that they represent the situation described by Clugston:

> Most people are completely unaware of the fact that our industrial lifestyle paradigm and our industrialized economies are enabled almost exclusively by enormous and ever-increasing quantities of finite, non-replenishing, and increasingly scarce NNRs. They cannot, therefore, possibly understand that ever-increasing NNR scarcity is responsible for our current economic malaise, and more importantly the imminent demise of our industrialized way of life.

Bush also stated: "the American way of life is non-negotiable." Yet the rapid depletion of NNRs is already in the process of renegotiating that way of life for our existing population of 318 million people, and growing. For many, the sheer numbers of our population will preclude any viable hope for a better future. We are reaching a great turning point in human history, when the concept of *more and more* is increasingly shown to be invalid and replaced by "*a future of less*."

OIL — OUR DOMINANT ENERGY RESOURCE

Earth resources that support populations are most likely to be the cause of the shift in our economic paradigm from *more and more* to *a future of less*. Energy is the key that unlocks all other resources — and the largest single source of energy, and the most critical to growth today is oil. Thus, above all other resources, oil is critical to continued growth.

The many uses of oil provide the foundation for much of today's living standard around the world. Oil provides nearly all fuel for transportation, and agriculture (the basis of food production and survival for all levels of society) is very much dependent on petroleum — both for cultivating large areas of arable land and for providing the chemicals and fertilizers used. Today's industrialized economies depend on a steady and increasing input of energy, as well as renewable and nonrenewable natural resources.

Since the drilling of the Drake well in 1859, oil demand and production have mounted — and the world now consumes about 30 billion barrels/year. Numerous predictions have been made as to the time of "peak" world oil production. Fairly certain, however, is that world oil production *will* peak early this century (if it hasn't already) — and many countries are now *past* their peak in production. Of the world's 63 oil-producing nations, 53 have passed their peak and are now in decline. (The 2 other important fossil fuels, coal and natural gas, will also inevitably peak in production.)

World oil discovery (in terms of amount/year) peaked in 1965, as did the discovery of giant oil fields — those with over 500 million barrels of recoverable oil. Today, we consume 4 barrels of oil for every 2 barrels discovered. Cumulative world oil consumption has exceeded 1.2 trillion barrels, about half of the estimated total world reserves — and 50 percent of this oil has been consumed since 1988. In 2005, the late professor Albert Bartlett (author of the groundbreaking lecture "Arithmetic, Population and Energy") calculated that the discovery of *1 billion barrels of oil would push back the peak of world oil production just 5 and a half days*.

In 1950 the United States was the world's largest oil producer, but by the mid-1960s production could not keep up with demand and we became a net oil importer. Just as M. King Hubbert predicted (and was widely ridiculed for) in 1956, the peak of U.S. oil production came in 1970.[1] Despite additional production from the new technology of fracking, America is now only producing about half the amount of oil it did in 1970. To increase the seriousness of our predicament, the current oil-exporting countries are experiencing increasing domestic demand — and are gradually decreasing their exports.

Production is also declining in oil-exporting countries around the world. Saudi Arabia once claimed it could produce 15 million barrels of oil per day for 50 years. This has been replaced by a projected peak production of 12.5 million barrels/day, and this only for an unspecified time period. The mainstay of Saudi oil production is the Ghawar oil field. Discovered in 1938, this supergiant field measures 19 miles wide and 170 miles long. Its production is now maintained by the injection of over 7 million barrels of seawater per day. Another important import source of oil for the U.S. has been Cantarell, Mexico's mainstay oil field — now in steep production decline. Mexico may itself become a net oil importer within a decade.

Conventional world oil production — both onshore and offshore (produced from drilling in water less than 500 meters deep) — reached its peak in 2005. Beyond that, unconventional world oil production (to the present rate of approximately 89 million barrels/day) comes from: deep-water oil, oil sands (Alberta, CA and Venezuela), polar oil (north of the Arctic Circle), minor amounts from biodiesel and ethanol (both produced from agricultural sources), and from hydrofracking of organic rich shales (a technology largely confined to the U.S.).

Oil produced from fracking suffers from a high decline rate (64 percent to 75 percent the first year of production), and it is necessary to continue a high rate of drilling to offset this. The largest oil production by fracking comes from the Lower Bakken/Upper Three Forks interval in the Williston Basin of North Dakota and Montana. But just to maintain the production rate, 94 wells have to be completed *each month* at an average cost of approximately $8 million/well. The additional oil fracking provides to America's conventional supplies will not come even close to making us oil independent. We are on track to become independent of foreign oil only by default — when the last barrel of oil available for import is used.

Is Shale Oil the Answer?

The so-called oil shales (such as those in the lake basins of Utah, Colorado, and Wyoming) were reputed to contain 2 trillion barrels of oil. In fact, they have no oil at all. The shales contain kerogen, a precursor to oil. The extraction process is not cost-effective, nor simple to carry out. (One particular obstacle is the need for huge amounts of water to process the shales — which are typically located in arid regions with water supply problems.) The huge theoretical amount of oil that *might* be produced from shales has enticed some companies to continue efforts, but the various technological attempts to economically extract oil from these deposits have so far been futile. As such, most large-scale oil companies have abandoned this method.

Coal — Past Peak Production

Coal is our most abundant fossil fuel, but the United States — with the world's largest deposits — has largely mined out the highest grade coal (anthracite). In terms of British Thermal Units (BTUs), America has now passed peak production. The lower grades of coal, bituminous and sub-bituminous, are now the chief coals mined. China, also with large coal deposits, is projected to reach peak production by the year 2025. Great Britain, whose Industrial Revolution was fostered by a wide variety of metal and coal deposits, peaked out in coal production in 1920.

Diminishing Returns

Other energy sources (such as firewood, wind, solar, and ethanol) encounter the problem — as do fossil fuels — of Energy Returned on Energy Invested (EROEI). All fossil energy sources now appear to have a declining EROEI. Expert Charles Hall notes that in the U.S., oil EROEI was about 100:1 in 1930. Today, it is approaching 5:1. Worldwide, helped largely by the great oil fields of the Middle East, oil production now has an estimated EROEI of about 18:1. Ethanol barely — if at all — has an EROEI of 1:1. (Depending on how wide you draw the circle of energy inputs for production of ethanol, its EROEI may even be negative.)

For a vibrant and viable economy to function there must be a surplus of energy produced over the costs of producing that energy. When the EROEI of all energy sources is just 1, then the whole of industrial civilization as we know it disappears. It has been estimated that an EROEI of 7 may be required to keep developed economies viable, and this would require very efficient use of what energy is available. The decline of surplus energy from EROEI ensures that the future will be less productive than it has been to date — and this means *a future of less*.

Metal and Non-Metals

The other factor in current world economies is the need for a steadily increasing flow of non-energy natural resources. They have become indispensable for our modern standards of living — even our "greener" technologies make use of them. A 3-megawatt wind turbine, as now designed, requires 9.9 tons of copper — which means the blasting, loading, transport, and processing of 1,980 tons of rock.

Copper is the workhorse metal of the electrical industry, and it has more widespread applications than any other metal. Its conductivity of electricity is exceeded only by silver. Its ability to withstand corrosion makes it useful in car radiators and in plumbing. Copper combined with tin forms the alloy bronze, and combined with zinc it forms brass. It has also been extensively used in coinage. In the United States, it was first discovered by the Native Americans in the Keweenaw Peninsula of Michigan. These rich deposits were later exploited by several mining companies in the late 1800s and much of the 1900s.

In Butte, Montana, what was once heralded as "the richest hill on Earth" is now the Berkeley pit, filled with toxic water. The copper smelter in nearby Anaconda is now abandoned. Copper mining persists in Utah at the Bingham Canyon pit, but there the ore is just 0.4 percent copper. The copper mine pits at Ruth and Yerington, Nevada, are now abandoned. There is active mining yet in Arizona, but the mines at Bisbee are now tourist attractions and those at Prescott are abandoned. The United States is now an importer of copper, most of it lower-grade and originating from Chile and Peru.

IRON — LESS QUANTITY AND LOWER QUALITY

In terms of amount of metal mined, iron is by far the most significant. At one time, the United States was a leading producer of high-grade hematite iron ore from the Iron Range of northern Minnesota. Most of it was open pit mining, but a rich deposit of hematite was pursued at depth by an underground mine at Soudan. It is now a State Park, allowing visitors to descend into its abandoned workings. The 60 percent iron hematite of the Iron Range is gone, and now the lower-grade taconite — just 30 percent iron — is being mined.

EXTRACTION IS HISTORY

Throughout the American West, thousands of abandoned mines and many "ghost towns" illustrate the transitory nature of exploiting nonrenewable minerals. The once vibrant towns of Wallace and Kellogg (in the Coeur d'Alene mining district of northern Idaho) are now quiet communities, with just the Hecla Mine still operating. The famous Sunshine silver mine is closed, as well as the Bunker Hill lead and zinc mine and the adjacent smelter. At the southern end of the Idaho Batholith, the once important Hailey silver mining district has no mines operating. The Pine Creek "Mine in the Sky" near Bishop, California, was once America's largest tungsten mine – it is now abandoned, along with its mill. Nevada's silver deposits have been exhausted, and the mines have long since gone. Now the precious metal chiefly mined in the former "Silver State" is gold.

The United States did an excellent job of extracting its abundant variety of metal and energy resources, but that abundance is now history. For American citizens, it has been a great ride — while it lasted. We are now seeing the end of those nonrenewable times of affluence. And this reality may already be evident by the current economic malaise, which worries both the political body and economists.

For much of the world the story is much the same, although there are some mineral deposits still being discovered and developed. However, all such riches are nonrenewable and destined to be exhausted — likely during this century. Globalization of trade has resulted in the entire world becoming the "commons" for exploitation of mineral and energy resources — largely by countries that have exhausted their domestic supplies (or had few initially).

The deepest mine in the world is a gold mine in South Africa. At a total depth of 12,500 feet, temperatures reach 140°F and violent "rock bursts" make for hazardous conditions. We are now working in ocean depths of 10,000 feet, drilling for oil located another 10,000 to 15,000 feet beneath that ocean floor. And even after drilling several thousand feet down, wells have been drilled laterally as far as 7 miles. In the pursuit of shale oil, wells are routinely drilled 2 miles laterally.

Worldwide, we have gone to great lengths — and depths — to exploit the natural wealth of the planet. It seems the world is willing to do anything necessary to continue this exploitation, but willing to do very little to change our present course. We are headed towards *a future of less* for every single nonrenewable resource we have known in history. And as our population grows, we exhaust our planetary supply at an ever-increasing rate.

SOIL AND WATER — RUNNING SHORT

It is the combination of fertile soil and fresh water that makes our life-supporting agriculture possible. But in his epic study *Dirt: the Erosion of Civilizations*, geomorphologist David Montgomery states that worldwide we are losing topsoil 10 times as fast as it is naturally produced — which no amount of money can duplicate. Soil, in the time scale of human lifetimes, is nonrenewable. In the United States, half the topsoil of Iowa (once dubbed "the breadbasket of the world") is now in the Mississippi River delta. The Yellow River of China is so named from the sediment it carries from the cultivated lands of its west. Elsewhere, notably in Haiti and the foothills of the Himalayas, steep hillsides have been cultivated — with a disastrous loss of soil.

For millennia, humanity lived without the use of oil — but they could not have survived without water, nor can we. In the arid American southwest, the slender Colorado River has more legal drafts against it than it has water to supply these demands. Snow packs and glaciers in the Rocky Mountains, which supply much of the headwaters of the Colorado River, are decreasing. All of the water in the great river Nile comes from outside Egypt, with headwaters in 7 countries — all of which are planning increased draws from the Nile to provide irrigation water for agricultural developments to feed their rapidly expanding populations.

About 40 percent of world food is produced by means of irrigation, making groundwater supplies of particular importance. Lester Brown has written extensively on groundwater and food production. In a 2013 article for *The Observer*, Brown noted: "As India's water tables fall, larger farmers are using modified oil-drilling technology to reach water, going as deep as 1,000 feet in some locations." And water tables are falling nearly everywhere. Brown coined the phrase "water-based food bubbles" to describe the 18 countries whose irrigation is chiefly fed by groundwater supplies — the largest of which are in India and China, whose populations are skyrocketing. Brown cited a World Bank study, which estimated that 175 million people are being fed in India — and 130 million in China — with grain produced from the unsustainable mining of groundwater.

The United States also has groundwater supply problems. The largest of the nation's aquifers is the Ogallala aquifer, stretching beneath the high plains of South Dakota to northern Texas. Due to a drop in the water table in the latter area, some 15,000 acres of agricultural production have been abandoned. The Ogallala water table is also dropping in other areas, as the recharge from rainfall in this semi-arid region is limited. Agricultural production in the area of this aquifer will inevitably decline.

The San Joaquin Valley of California produces about half the fruits and vegetables for the United States. Over-pumping of groundwater has now dropped the land surface in portions of the valley by as much as 29 feet, collapsing the aquifer beneath the valley floor. It cannot be recharged — it is lost forever. In the nearby Salinas Valley, similar over-pumping has caused an invasion of salt water from the west (as the aquifer terminates in the ocean). The same thing is happening to the aquifer beneath Norfolk, Virginia.

Due to the degradation of both soil and water supplies, food production in many parts of the world is being adversely affected. The great increase in food production attributable to the "Green Revolution" promoted by Norman Borlaug has now run its course. In his Nobel laureate address, Borlaug acknowledged that his Green Revolution simply bought time to stop population growth.[2] He noted: "There can be no permanent progress in the battle against hunger until the agencies that fight for increased food production and those that fight for population control unite in a common effort."

AGRICULTURE AND POPULATION GROWTH

As with all other organisms, an increase in food supply has caused an increase in human population. The past century of perpetually increasing crop yields, made possible by nitrogen fixation and Green Revolution technology, were rare historical events which we cannot expect to be repeated.

In food, there is the ominous warning that — despite the increase in agriculture R&D — the relative rate of yield gain for major food crops has decreased over time. The question is raised about the ability of current industrial agriculture to sustain food production for a growing world population — which is expected to reach 10 billion by the year 2100. Increasing affluence in some regions is increasing demand for meat. We now add an astounding 230,000 new mouths to the world's dinner table every day. Just to meet the anticipated food demand in 2050, food production would have to increase by 60 percent. This is very unlikely to happen. Nearly all the best farmland is in use, and food supply trends have flattened.

Food shortage riots have now occurred in a number of countries, most notably in Egypt. Ethiopia has already experienced 2 major famines, yet its population is predicted to nearly double — from the current 87 million to 165 million — by 2050. British naturalist David Attenborough stated: "I have never seen a problem that wouldn't be easier to solve with fewer people – or harder and ultimately impossible with more… We keep putting on [programs] about famine in Ethiopia; that's what is happening. Too many people there. They can't support themselves — and it is not an inhumane thing to say. It's the case."

This is true of the 27 countries on international food welfare — and that number is growing. Japan and the U.K. both pay for massive food imports, which amount to 70 percent of Japan's total food supply and 40 percent of Britain's. Even in the United States, food supply shortages are now causing a rise in food costs — and 47 million Americans now receive food stamps.

SCARCITY AND SOCIAL STRESS

We are faced with a combination of circumstances indicating that our world is entering turbulent economic and social times. The nonrenewable base of resources for modern industrial life is not sustainable. The renewable base for sustaining economies and societies – fertile soil – is not renewable within a human time frame. But world economies are based on the concept of continual growth of our consumption of Earth resources. The most basic support for humanity, food supply, is not increasing – but population size is.

Sometime during this century, it is highly likely that worldwide depletion of natural resources will force an entire reorganization of social and economic structures, perhaps violently. The processes of doing this in a way that will not destroy the fabric of civilization is the unavoidable challenge before us. It all portends *a future of less*. Austerity has been the circumstance of humanity for most of our history — and it will likely return as a part of our future.

AFFLUENCE IS NONRENEWABLE

Although the degree of exploitation of Earth's resources differs from region to region, the basic story is much the same: in the span of just a few centuries, we will have left a plundered planet for all future generations. The affluence enjoyed by generations — from the time of the Industrial Revolution to the present — is nonrenewable, and it is coming to an end.

As we enjoy these great inheritances from the geological past, we seem unwilling to acknowledge the fact that nonrenewable means just that — *nonrenewable*. When gone, these resources are gone forever. However, as Aldous Huxley stated: "Facts do not cease to exist because they are ignored." The currently increasing tensions, resulting from population pressures against declining resources, are a portent. An economic malaise has set in, wherein the *more and more* philosophy of past decades seems less attainable. Austerity is becoming visible — both here and abroad.

If the ongoing tide of population growth can be reversed, the resulting smaller (and simpler) society could potentially enjoy a stable, satisfying future. This scenario is surely something to consider — pursuing a "Gross National Happiness" index to replace the Gross National Product (consumption) index. Think of what all the trillions *not* spent on non-essential consumption could do for the world.

As we consume increasing amounts of NNRs each day and degrade our renewables, we are ensuring that future generations will live in a much different world. Even in the short term of a century or less, the depletion of vital Earth resources will likely change the course of civilization. The industrial age, with its pleasantly high standard of living, will become a distant (and brief) page in world history. In parts of the world, many people cannot now live on "less." They are already at the margin of existence, and malnutrition is their common experience. But in the more affluent societies, *a future of less* will simply mean a sharp reduction in the physical standard of living.

Withdrawing from the age of affluence and reducing our population to an ecologically sustainable size (one that can exist on renewable natural resources and recycling of NNRs) will be a very challenging task. Preserving the elements of a civil society — and at least some of the technological advances we now enjoy — will be crucial to any sort of satisfying future. Implementing a steady-state (non-growing) economy and the diligent recycling of NNRs will likely be necessary — and successful — instruments for that new society's longevity.

However, if present trends persist, the preservation of many things we value may be impossible. Reduction of human population may only happen by nature's ultimate method of pruning unsustainable numbers: by starvation and disease. It has happened many times in the past. Given the demographic freight train of population growth today, this may prove to be the stark reality.

Of course, if our collective world soon realizes that we must stop and reverse population growth, perhaps there is some hope that we will survive with a smaller, truly sustainable population. I am reminded of my visits with human ecologist Garrett Hardin, author of several books (including *Living Within Limits: Ecology, Economics, and Population Taboos*) and numerous articles (the most famous of which is *The Tragedy of the Commons*). Hardin was very pragmatic in his approach to matters of population and Earth, but also compassionate and hopeful. We would discuss the world's ills at length, concluding that humanity's future appeared rather grim — but when I departed, he would always firmly grasp my hand and say "yes, but we must try."

And so we must. ■

***Dr. Walter Youngquist** has worked both as a petroleum geologist and a minerals geologist in the United States and abroad. He has visited more than 70 countries, observing the ongoing problem of continued population growth and declining supporting Earth resources.*

Endnotes

1. *Nuclear Energy and the Fossil Fuels*, M. King Hubbert. Publication No. 95, Shell Development Company: Exploration and Production Research Division, Houston, TX (June 1956).

2. Norman Borlaug's Acceptance Speech, Nobel Peace Prize Award Ceremony, Oslo (December 10, 1970). From *Les Prix Nobel en 1970*, Editor Wilhelm Odelberg, Nobel Foundation, Stockholm (1971).