On American Sustainability
—Anatomy of a Societal Collapse

Introduction

"Once the population and economy have overshot the physical limits of the Earth, there are only two ways back: Involuntary collapse caused by escalating shortages and crises, or controlled reduction of throughput by deliberate social choice."[I-1] – Dennis Meadows et al

Original sin had nothing to do with a garden and an apple; it occurred the first time one of our hominid ancestors used a nonrenewable natural resource.

I initiated my research on American sustainability during the spring of 2006, before I had ever heard the term "sustainability" or knew that my research would culminate in an "opus" on the subject. At the time, the US housing market was booming, the US economy was booming, and Americans were spending money like there was no tomorrow.

I had been concerned for some time about our ability to continue our seemingly endless binge of economic growth and prosperity, but, like most Americans, I had been too busy with my day-to-day activities to look into the details. That spring, however, I decided to investigate our economic situation.

My initial research was haphazard; I was not sure where to look, nor was I sure exactly what I was looking for. Various government and mainstream websites informed me that while we were depleting our economic asset reserves, incurring debt, and underfunding our future financial obligations at historically high levels, the US economy was fundamentally sound and its perpetual growth would enable us to address any conceivable future financial challenge.

I was beginning to think that my concerns were unfounded when, quite by accident, I encountered a group of economic analysts who argued that we were living far beyond our means economically, and that both our current economic behavior and our current economic prosperity were unsustainable—and they presented compelling evidence to support their arguments. So I dug deeper.

During the summer of 2006, again quite by accident, I encountered several entirely different groups of analysts who claimed that we were also living far beyond our means ecologically—we were using natural resources at levels exceeding those at which they were being replenished, and we were degrading natural habitats at levels exceeding those at which they were being regenerated. These analysts presented compelling evidence that both our current ecological behavior and our American way of life were unsustainable as well.

Since that time, my goals have been to quantify the extent to which we in America are living beyond our means, both ecologically and economically, and to articulate the cause, implications, and resolution associated with our situation. After three years of research, feedback, soul searching, and countless iterations I believe that I have accomplished my goals.

My findings on American sustainability, which are presented in the following pages, will shock most Americans.

As America enters the new millennium, we find ourselves in a "predicament".[I-2] We are living hopelessly beyond our means, ecologically and economically, at a time when available supplies associated with many of the critical ecological resources and economic resources upon which we depend will soon be insufficient to enable our American way of life. Global demand for these resources is enormous and is ever-increasing, while supplies available to the US are becoming increasingly scarce—due to both market factors and geological factors.

As a result, our American way of life—300+ million people enjoying historically unprecedented material living standards—is unsustainable; it must and will come to an end, soon. The inescapable conclusion is that we are about to experience the inevitable consequence associated with our predicament—societal collapse.

The primary purpose of this paper is to substantiate America's predicament—to present conclusive evidence of its existence, its significance, its magnitude, and its imminent and inevitable consequence. The secondary purpose of the book is to put forth the only rational solution to our predicament—an American Cultural Revolution—a solution that we will never adopt.

The paper presents a message of reality, but not of hope—for America, there can be no happy ending. Perhaps however, with the benefit of advanced warning, we will collapse gracefully.

Contents

Chapter 1: America's Predicament—Societal Overextension

"In nature, the over-extension of a population upon a resource which diminishes is well known, and the results tend to be disastrous."[1-1] – Walter Youngquist

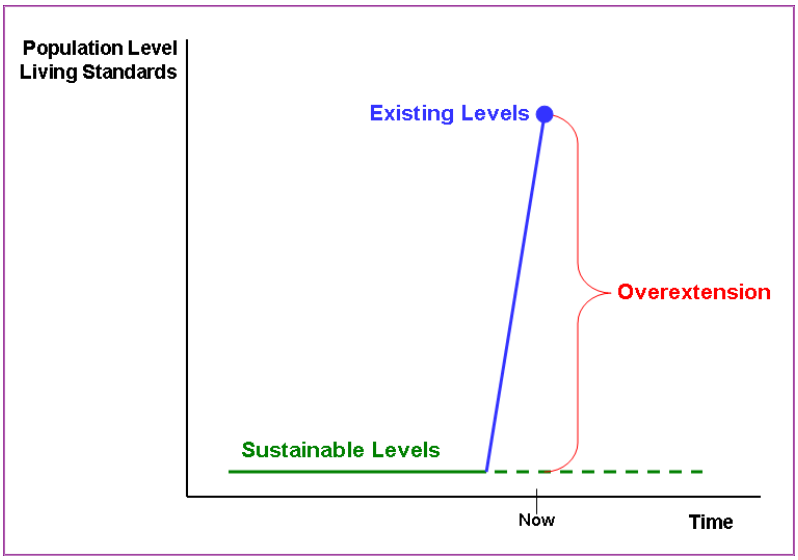
Our American society is irreparably overextended—we are living hopelessly beyond our means ecologically and economically, at a time when many of the critical resources upon which we depend are rapidly approaching limits—available resource supplies will no longer be sufficient to enable our American way of life.

As a result, our American way of life—300+ million people enjoying historically unprecedented material living standards—is unsustainable.

The only rational solution to our "predicament"—transitioning voluntarily to a sustainable lifestyle paradigm—is obvious and straightforward. However, because we lack the collective will to adopt this solution, our society and our American way of life will collapse—quite probably within the next 25 years.

1.1 Societal Overextension

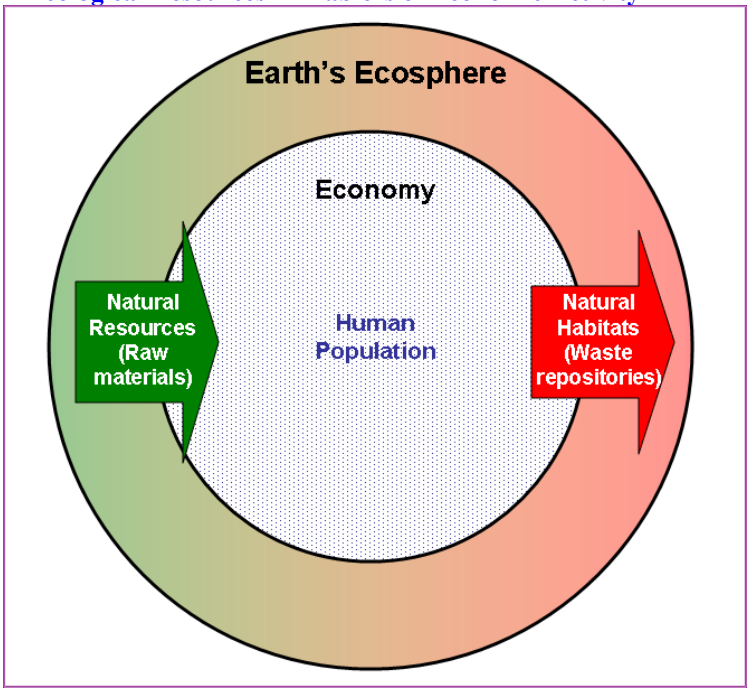
Societal Overextension



"Societal overextension" (overextension) is a condition in which a society is living beyond its means ecologically and economically. The significant consequence associated with societal overextension is that the society's population level and material living standards are unsustainable.

Overextension occurs when a society's lifestyle paradigm, its "way of life", is enabled by the persistent overexploitation of ecological resources and economic resources.

Ecological Resources—Enablers of Economic Activity



In industrialized societies, ecological resources are the raw materials (natural resources) and waste repositories (natural habitats) that enable economic activity—the production, provisioning, and utilization of manmade goods and services.

Ecological resource overexploitation occurs when a society:

- Persistently utilizes renewable natural resources that are critical to its existence—such as water, croplands, grazing lands, wildlife, and forests—at levels exceeding those at which Nature[1-2] can replenish them;
- Persistently utilizes nonrenewable natural resources that are critical to its existence—such as oil, natural gas, coal, minerals, and metals—which Nature does not replenish; and/or
- Persistently degrades atmospheric, aquatic, and terrestrial natural habitats that are critical to its existence, at levels exceeding those at which Nature can regenerate them.

Economic resources such as income, savings, and debt provide the "purchasing power" [1-3] that enables people to procure natural resources and the manmade goods and services derived from those natural resources. Economic resource overexploitation occurs when a society:

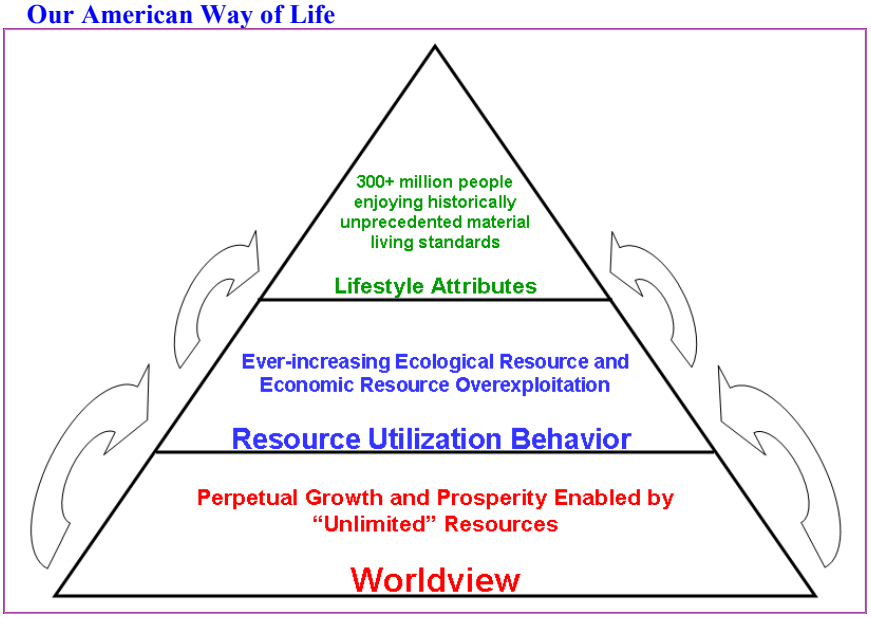
- Persistently depletes its previously accumulated economic asset (wealth) reserves;
- Persistently incurs intergenerational debt, which it has neither the capacity nor the intention to repay; and/or
- Persistently underfunds investments critical to its future wellbeing.

An overextended society is unsustainable, and will inevitably collapse.[1-4]

1.2 American Societal Overextension

Our American way of life is enabled by a culture of persistent resource overexploitation[1-5] in which we live ever-increasingly beyond our means, ecologically and economically.

Our American Way of Life



At the foundation of our American way of life are a worldview that promises perpetual growth and prosperity enabled by "unlimited" resources, and resource utilization behavior that encourages our persistent overexploitation of both ecological and economic resources.

Our "predicament"—irreparable societal overextension—is the unintended but inevitable consequence associated with our distorted worldview and our dysfunctional resource utilization behavior.

1.2.1 America's Distorted Worldview

Most Americans believe that we can and will achieve perpetual population growth, living standard improvement, and economic growth through our ever-increasing utilization of the earth's "unlimited" natural resources.

Those who hold this belief fail to realize that we live within an enclosed planetary ecosystem in which resource supplies are finite. Except for sunlight and an occasional meteor, no additional resources enter earth's ecosphere—unlimited natural resource supplies are, therefore, physically impossible. And, because perpetual economic growth and prosperity are contingent upon unlimited natural resource supplies, perpetual economic growth and prosperity are physically impossible as well.

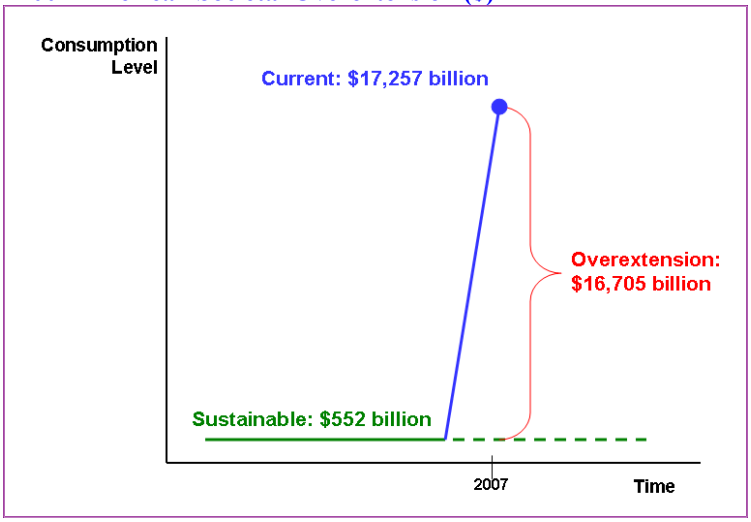
1.2.2 America's Dysfunctional Resource Utilization Behavior

Our prodigious use of ecological resources and economic resources has enabled spectacular increases in our production level, consumption level, population level, and material living standards over the past 200 years[1-6]—to levels far exceeding those attainable had we lived sustainably within our means. Unfortunately, the inescapable consequence associated with this resource utilization behavior is the systematic elimination of the resources upon which our way of life and our very existence depend. Such behavior has obvious limits.

1.3 American Overextension Quantified

The extent to which we are currently living unsustainably beyond our means is appalling.

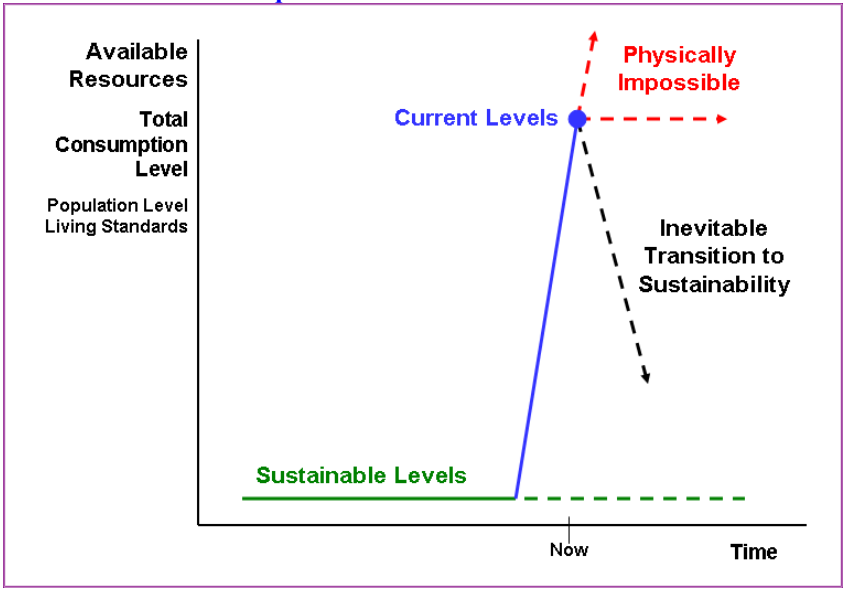
2007 American Societal Overextension ($)



In 2007, nearly 97% of our total consumption level was enabled by ecological resources and economic resources, the supplies of which are unsustainable.[1-7]

1.4 Consequence of American Overextension

The Inevitable Consequence of Societal Overextension



Our American way of life is absolutely dependent upon ecological resources and economic resources, the supplies of which will be utterly insufficient in the not-too-distant future to support our existing population level and living standards, let alone continued increases in either or both.[1-8] As a result, our American way of life—300+ million people enjoying historically unprecedented material living standards—is not sustainable; it must come to an end.

As the historically abundant and cheap resources upon which our American way of life depends become increasingly scarce and expensive, a scenario that is already in process, the total level of natural resources and derived goods and services available for our consumption will decline dramatically, as must some combination of our population level and material living standards.

Even under the most optimistic scenario, whereby we transition voluntarily to a sustainable lifestyle paradigm, our population level and living standard combinations attainable “at sustainability” will be substantially lower than those that we currently enjoy.

Absent immediate fundamental changes to both our distorted worldview and our dysfunctional resource utilization behavior, American society will collapse—not in 1000 years, or 500 years, or even 50 years; but almost certainly within 25 years. America, as we know it, will cease to exist well before the year 2050.[1-9] And while it may not be too late to avert societal collapse, thereby mitigating the horrific lifestyle disruptions associated with an apocalyptic transition to sustainability, it is, unfortunately, too late to avoid a painful transition—there can be no soft landing.

Chapter 2: The Origin of America's Predicament

"Industrial Civilization doesn't evolve. Rather, it rapidly consumes 'the necessary physical prerequisites' for its own existence. It's short-term, unsustainable."[2-1] – Richard Duncan

A society's worldview determines its resource utilization behavior, which determines its total consumption level, which determines its population level and material living standards. Our cornucopian worldview[2-2] and detritovoric resource utilization behavior[2-3] have enabled our extraordinary American way of life—300+ million people enjoying historically unprecedented material living standards.

The first human beings migrated to America over 40,000 years ago from Berengia, the "land-bridge" that spanned the Bering Sea between today's Northeast Siberia and Alaska at the time of the Wisconsin glaciation.[2-4] During the ensuing millennia, ancestors of these original Americans migrated to every habitable region in North, Central, and South America.

As was the case with human inhabitants in other regions of the world, Americans evolved through three lifestyle paradigms: hunter-gatherer, agrarian, and industrial. Each of the three paradigms has distinct attributes, which differentiate it from the other two in terms of the worldview, resource utilization behavior, and resulting lifestyle attributes associated with its human societies.

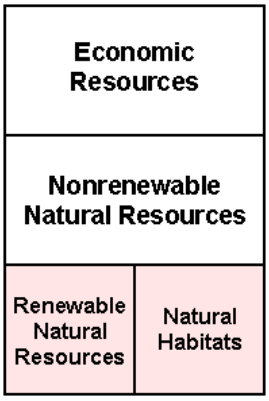
2.1 The Hunter-Gatherer Lifestyle Paradigm

The American hunter-gatherer (HG) lifestyle paradigm spanned more than 1,200 human generations, [2-5] from the time of the first Native American settlers in approximately 40,000 BC to approximately 10,000 BC. HG societies consisted of small nomadic clans, typically numbering between 50 and 100, that subsisted primarily on naturally occurring vegetation and wildlife.[2-6]

While the HG lifestyle was extremely uncomplicated and "free", it was also harsh by today's standards—daily existence was often precarious, and HG life expectancy barely exceeded 30 years.[2-7] The HG lifestyle was essentially subsistence living, as comparatively little human knowledge and technology were employed to improve upon "the natural state of things". Hunter-gatherers produced few manmade goods and accumulated no appreciable wealth surplus beyond the necessities required for their immediate survival.

The HG worldview revered Nature as the provider of life and subsistence; this view fostered a passive lifestyle orientation through which hunter-gatherers sought to live harmoniously within the context defined by Nature.

Hunter-Gatherer Resource Overexploitation



The HG resource mix consisted almost entirely of renewable natural resources such as water and naturally-occurring edible plant life and wildlife. A clan would typically overexploit one or more of these resources within a local area, then migrate to another area while Nature replenished the depleted resource or resources.

Because of their nomadic lifestyle and limited numbers—the maximum American human population during the HG epoch probably never exceeded several hundred thousand[2-8]—cumulative natural resource depletion and natural habitat degradation during the HG paradigm were negligible.

While periodic localized population "contractions" undoubtedly occurred during the HG paradigm, recoveries also typically occurred; the hunter-gatherer lifestyle proved to be essentially sustainable.

2.2 The Agrarian Lifestyle Paradigm

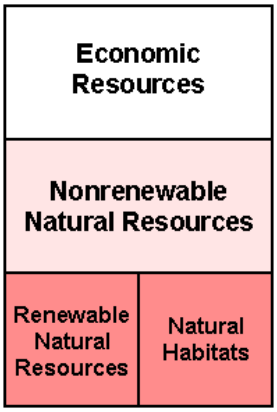
The American agrarian lifestyle paradigm commenced in approximately 10,000 BC and lasted until approximately 1800 AD, spanning nearly 500 human generations. American agrarian societies existed primarily by raising cultivated crops and domesticated livestock. As crop and livestock yields increased, agrarian societies became increasingly larger and more complex, often clustering around permanent settlements such as villages, towns, and small cities.

Agrarian societies also became increasingly stratified, with the emergence of religious, political, and military elites. Too, human technology and labor specialization and diversification became increasingly prevalent, as manmade goods, both essential and non-essential, were demanded by those who could afford them.

While small to moderate wealth surpluses were sometimes produced, Agrarian existence typically offered little more in the way of material living standards for most of the population than did the HG paradigm. Day-to-day life remained harsh by today's standards; and agrarian life expectances were only marginally greater than those of the hunter-gatherers.[2-9]

The agrarian worldview perceived Nature as something to be augmented through human effort, by domesticating crops and livestock. The agrarian lifestyle orientation was proactive in the sense that it sought to improve upon what Nature had provided.

Agrarian Resource Overexploitation



The agrarian resource mix consisted primarily of renewable natural resources—water, land, forests, and wildlife—which were increasingly overexploited by ever-expanding permanently-settled agrarian populations. As America's human population continued to increase—to over 5 million by 1800 AD[2-10]—and as agrarian cultivation and grazing practices became increasingly intensive, renewable natural resource reserves were increasingly depleted and natural habitats were increasingly degraded as well.

America's agrarian lifestyle paradigm was essentially self-sufficient, in the sense that most population clusters could exist in the absence of outside subsidization; but because our predecessors persistently and increasingly overexploited the renewable natural resources and natural habitats that enabled their existence, the agrarian way of life was not sustainable.[2-11]

2.3 The Industrial Lifestyle Paradigm

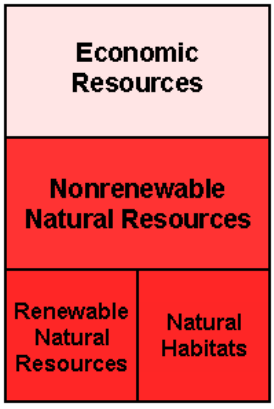
The inception of the industrial lifestyle paradigm occurred with England's industrial revolution in the early 18th century, less than 300 years ago. Today, approximately 18% of the world's population is considered to be "industrialized".[2-12] Industrialized societies are characterized by highly complex mosaics of interdependent yet independently operating human and non-human elements that mass produce a broad array of goods and services in centralized production facilities. The populations associated with industrialized societies are typically clustered in towns, cities, and mega-cities.

Industrialized societies are highly stratified, typically consisting of lower, middle, and upper classes—typically with multiple sub-classes comprising each of the three primary levels. Industrialized societies are also characterized by technical sophistication and by labor specialization and diversification, which enable such societies to produce and provision the myriad goods and services upon which they depend.

Tremendous wealth surpluses are generally produced by industrialized societies, enabling living standards well beyond the subsistence level for large segments of the population. The copious array of essential and non-essential goods and services in conjunction with sophisticated and pervasive support systems—i.e., food production, energy production, transportation, communication, law enforcement, healthcare, and waste management—enable human life expectancies well in excess of 70 years.[2-13]

The industrialized worldview perceives Nature as something to be harnessed, through industrial processes and facilities, in order to improve the human condition. It is an exploitive worldview that seeks to use natural resources and habitats as the means to promote human ends—namely, ever-increasing population levels and material living standards.

Industrial Resource Overexploitation



The resource mix associated with industrialized societies now consists almost exclusively of nonrenewable natural resources, which, in addition to renewable natural resources and natural habitats, have been increasingly overexploited since the dawn of the industrial revolution. It is precisely this persistent overexploitation of natural resources and natural habitats that has enabled the "success" associated with the industrialized lifestyle paradigm—success being defined here as continuous increases in both population levels and material living standards.

However, because industrialized societies have come to depend almost exclusively upon global sources of finite and dwindling nonrenewable natural resources and upon the manmade goods and services derived from these resources, such societies are neither self-sufficient nor sustainable.

2.4 America—A Unique Industrialized Society

Our industrial lifestyle paradigm, which commenced in the early 19th century, has existed for less than 200 years—less than 8 of the nearly 2,000 generations during which humans have occupied what is now the United States of America. America is a unique industrialized society—an extreme case with regard to our worldview, resource utilization behavior, and resulting lifestyle attributes.

2.4.1 America's Cornucopian Worldview

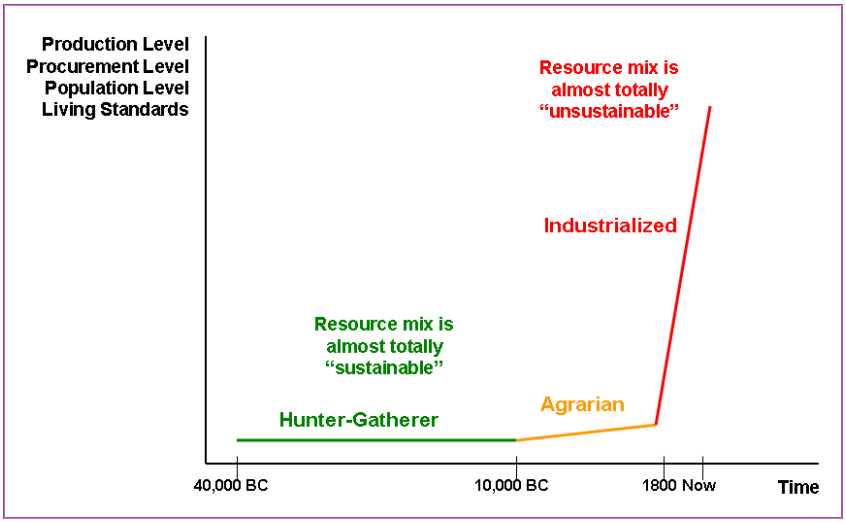
Most Americans believe that through their heroic efforts, determination, and resolve, American pioneers settled our vast, essentially uninhabited country and took control of its virtually unlimited natural resources. During the 500 years since Columbus "discovered" America, successive generations of Americans dramatically improved our level of wellbeing through hard work, innovation, perseverance, and courage—we "earned it".[2-14]

Most further believe that in the process of settling this bountiful land, we rightfully exploited Native Americans and Nature for our benefit, both through divine justification[2-15] and self-endowed justification.[2-16] We perceive ourselves to be "exceptional" people[2-17]—in fact, we are the Christian God's chosen people.[2-18] We see America as the greatest nation the world has ever known, and believe that it will remain so forever.

The American worldview perceives Nature as something to be conquered, as we seek to achieve perpetual population growth, living standard improvement, and economic growth through our ever-increasing utilization of the earth's "unlimited" natural resources. This distorted cornucopian worldview is the logical outgrowth of our misinformed historical perspective and our adversarial relationship with Nature.

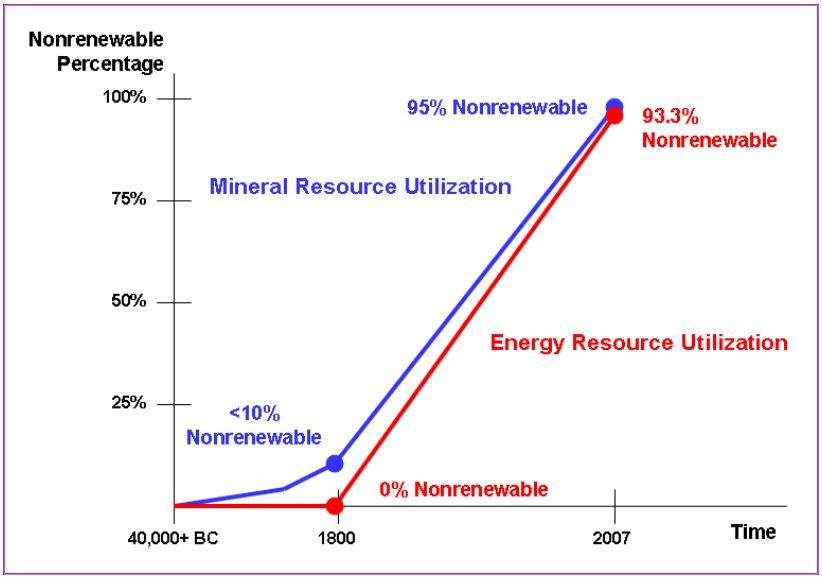
2.4.2 America's Detritovoric Resource Utilization Behavior

US Resource Utilization Shift



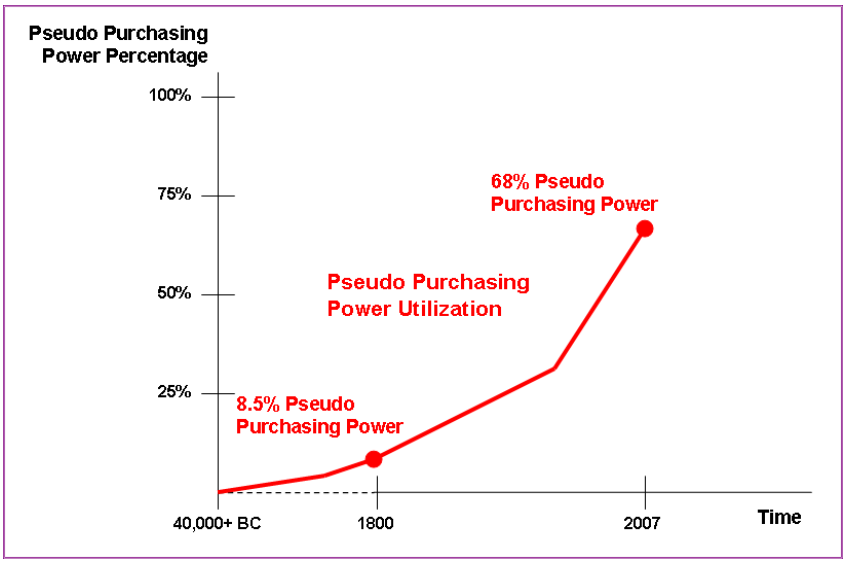
Our evolution from hunter-gatherer to agrarian to industrial has been enabled not by divine ordination or by American exceptionalism, but by fundamental "shifts" in our resource utilization behavior over time.

US Natural Resource Mix



During the past 8-10 thousand years, but especially since the inception of our American industrial revolution, our natural resource mix has shifted from "almost exclusively renewable" to "almost exclusively nonrenewable".[2-19, 2-20, 2-21, 2-22]

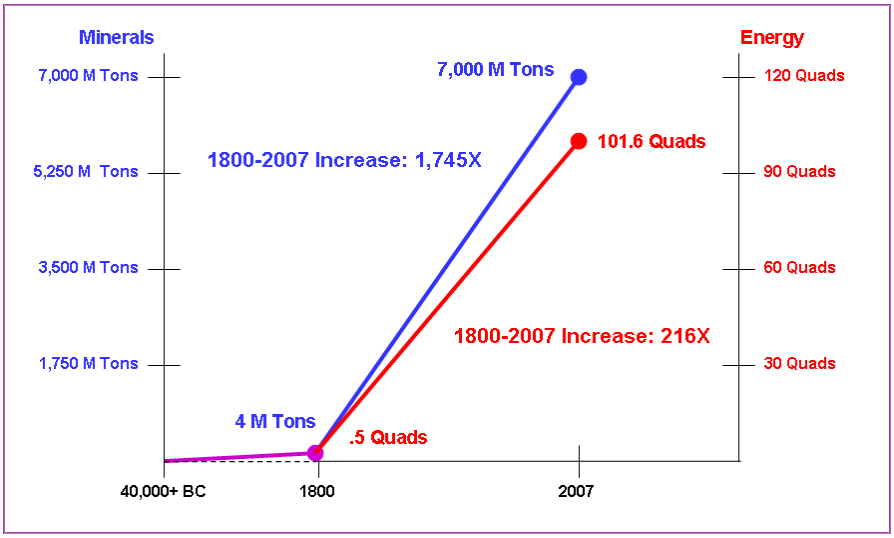
US Economic Resource Mix



Since the early/mid 20th century, as historically abundant-and-cheap natural resources have become increasingly scarce-and-expensive, our economic resource mix has shifted from "almost exclusively real purchasing power" to "almost exclusively pseudo purchasing power".[2-23, 2-24]

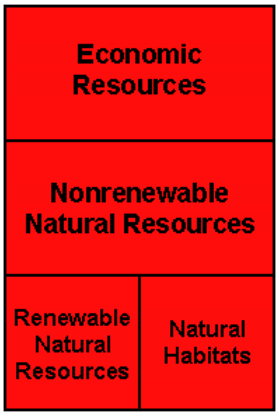
Pseudo purchasing power enables us to increase our "current" procurement level of natural resources and of the manmade goods and services derived from those resources, through fiscal imprudence—that is, by liquidating our previously accumulated economic asset reserves, by incurring ever-increasing levels of intergenerational debt, and by underfunding investments critical to our future wellbeing.

US Natural Resource Utilization Levels



The shifts in our resource utilization behavior have enabled us to continuously and dramatically expand both the mix and levels of natural resources and derivative goods and services available to us, thereby perpetuating our American way of life despite tightening resource supplies and ever-increasing global demand.[2-25, 2-26, 2-27, 2-28]

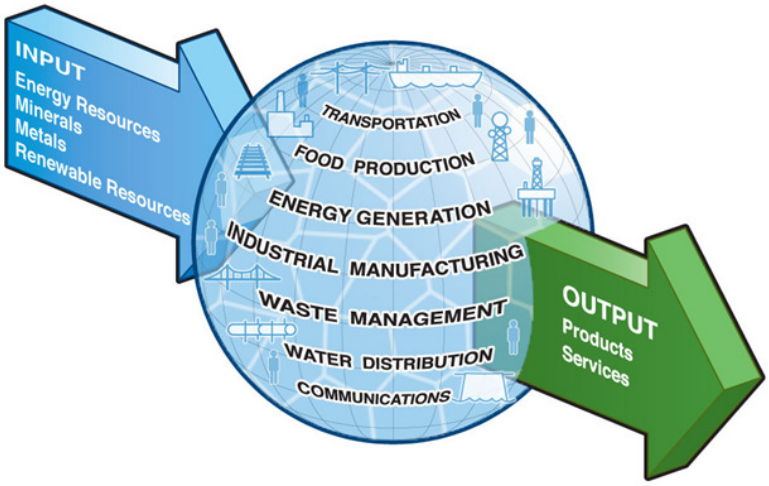
American Resource Overexploitation



While we have certainly experienced spectacular innovation, growth, and economic wealth creation since the inception of our industrial revolution, our "success", and our American way of life, have been enabled by our persistent overexploitation of both ecological and economic resources—specifically, nonrenewable natural resources and pseudo purchasing power—on both the national and global levels.[2-29]

2.4.3 America's Industrial Mosaic

America's Industrial Mosaic



An industrialized society is characterized by an incomprehensibly complex mosaic of interdependent yet independently operating human and non-human entities and infrastructure. This industrial mosaic converts natural resource inputs into the myriad goods and services that enable the industrialized society's way of life.

America's industrial mosaic consists of thousands of critical support systems that must function continuously, efficiently, and collectively at the local, regional, national, and global levels in order to perpetuate our American way of life. Examples include:

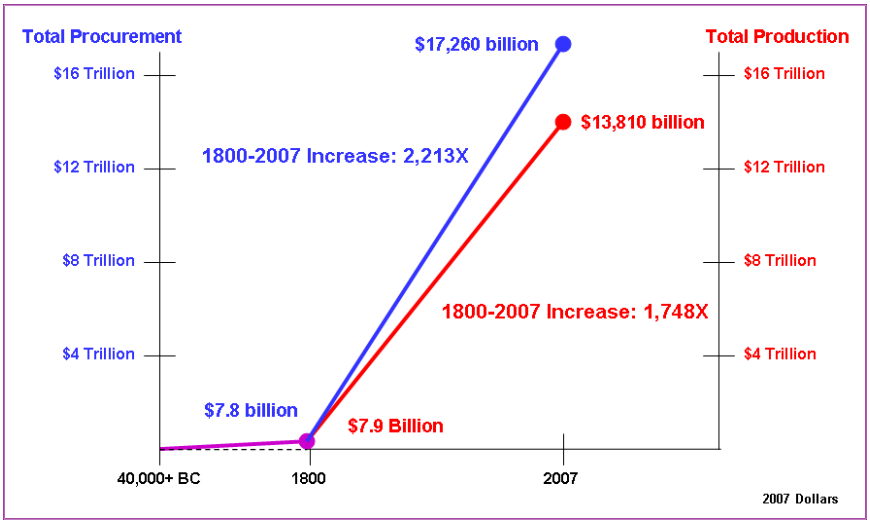
- Water retention, treatment, and distribution
- Food production, processing, and distribution
- Energy resource exploration, extraction, processing, and distribution
- Electricity generation and distribution
- Industrial manufacturing, processing, and distribution
- Waste management
- Healthcare
- Law enforcement
- Defense
- Education
- Telecommunications

Essential to the continuous and efficient operation of these and other critical support systems are enormous and uninterrupted inflows of ecological and economic resources; the coordinated efforts of millions of highly specialized and skilled people in developing, producing, provisioning, managing, and operating innumerable costly and complex physical assets and technologies; and a stable operating environment.

While our industrial mosaic has certainly enabled meteoric increases in our consumption level, population level, and material living standards over the past 200 years, its continued operation is predicated upon our uninterrupted access to sufficient supplies of critical ecological and economic resources. As a result, our industrial mosaic is extremely vulnerable to protracted shortages or disruptions associated with these critical resource inputs—and our American way of life is extremely vulnerable to impairments to the continuous and efficient operation of our industrial mosaic.[2-30]

2.4.4 America's Production and Procurement Levels

US Production and Procurement Levels



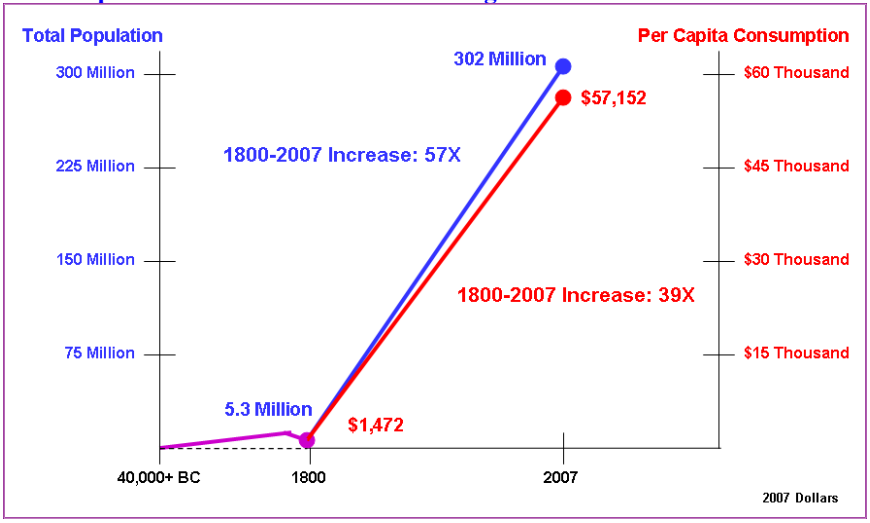
Between the years 1800 and 2007, the total value of goods and services produced in the US (GDP) increased nearly 1,750 times—from $7.9 billion/year to $13,810 billion/year.[2-31, 2-32]

During the same period, the total value of goods and services procured in the US increased over 2,150 times—from $7.8 billion/year to $17,260 billion/year.[2-33, 2-34]

The phenomenal increases in our production level and procurement level over the past 200 years are without historical precedent. However, because this meteoric growth was enabled by the fundamental shift in our resource mix from renewable natural resources and real purchasing power to nonrenewable natural resources and pseudo purchasing power, our current production level and procurement level are unsustainable.

2.4.5 America's Population Level and Material Living Standards

US Population Level and Material Living Standards



Between the years 1800 and 2007, the total US population level increased 57 times—from 5.3 million to 302 million.[2-35, 2-36]

During the same period, the average US material living standard (average annual per capita consumption level) increased 39 times—from $1,472/year to $57,152/year.[2-37, 2-38]

A society's level of wellbeing—the average material living standard enjoyed by its population—is determined by the society's total consumption level at any point in time. Because our current total consumption level—which is almost completely enabled by unsustainable ecological and economic resources—is unsustainable, our current level of societal wellbeing—300+ million people enjoying historically unprecedented material living standards—is unsustainable as well.

Chapter 3: The Magnitude of America's Predicament

"The 'developed' nations have been widely regarded as previews of the future condition of the 'underdeveloped' countries. It would have been more accurate to reverse the picture…"[3-1] – William Catton, Jr.

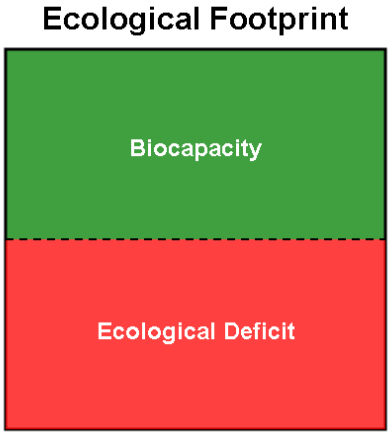
The extent to which American society is currently overextended—living unsustainably beyond our means ecologically and economically—is appalling.

3.1 Quantifying Societal Overextension

Only by quantifying societal overextension—that is, by measuring the extent to which we are currently living beyond our means ecologically and economically—can we appreciate the magnitude associated with our predicament, and estimate the extent to which our existing population level and material living standards exceed sustainable levels.

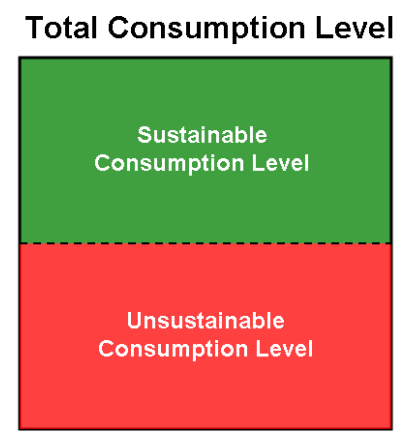
Quantifying overextension involves measuring the extent to which our current levels of resource utilization have diverged from sustainable levels. Two methods for quantifying overextension are considered below, the Ecological Footprint Analysis (EFA).[3-2] and the Societal Overextension Analysis (SOA).

Ecological Footprint Analysis Metrics



The Ecological Footprint Analysis measures societal resource utilization in terms of biologically productive global surface area; i.e., acres of land area and water area that produce the resources and absorb the wastes required to support human populations. In the EFA lexicon, a society's current total resource utilization level is referred to as its "ecological footprint"; its sustainable resource utilization level is referred to as "biocapacity"; and the difference between the two is referred to as its "ecological deficit" (in the case of America) or "ecological surplus".

Societal Overextension Analysis Metrics



The Societal Overextension Analysis measures resource utilization in terms of the total monetary value associated with the natural resources and derived goods and services consumed—i.e., produced and procured—by a society's population. Using SOA terminology, a society's total resource utilization level is referred to as its "total consumption level"; its sustainable resource utilization level is referred to as its "sustainable consumption level"; and the difference (in the case of America) is referred to as its "unsustainable consumption level".

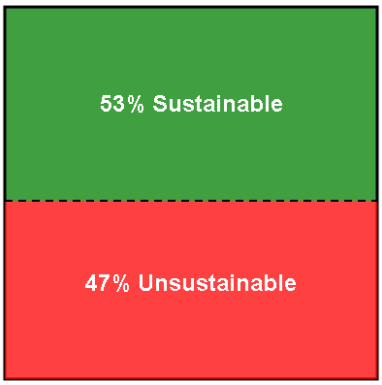
3.2 Ecological Footprint Analysis

The Ecological Footprint Analysis quantifies the extent to which America's annual ecological footprint—our total utilization of global natural resources and natural habitats—exceeds our annual biocapacity—Nature's capacity to replenish our domestic natural resource reserves and to regenerate our domestic natural habitats.

According to the Global Footprint Network (GFN), an ecological footprint "measures how much land and water area a human population requires to produce the resource it consumes and to absorb its wastes, using prevailing technology".[3-3] For example, in the year 2005 Iraq had a per capita ecological footprint of 3.3 acres, China 5.2 acres, India 2.2 acres, the UK 13.2 acres, and America 23.3 acres—the world average per capita ecological footprint was 6.7 acres.[3-4]

On average, 23.3 acres of planet earth's surface area were utilized to produce the resources consumed and to assimilate the waste products generated by every American during 2005. However, America's biocapacity, the domestic US surface area available to produce resources for consumption and to assimilate resulting waste products, was only 12.4 acres per capita—leaving a per capita ecological deficit of 10.9 acres.[3-5]

EFA Assessment of American Societal Overextension



According to GFN data, 47% of America's 2005 total resource utilization level, as defined by our ecological footprint, was unsustainable; that is, enabled by "importing biocapacity, liquidating existing stocks of ecological capital, or allowing wastes to accumulate and ecosystems to degrade".[3-6] Only 53% of our 2005 total resource utilization level was sustainable. Based upon the GFN analysis, America is overextended by a factor of 1.9 (23.3 acres of ecological footprint/12.4 acres of domestic biocapacity); that is, we are currently utilizing ecological resources at nearly twice the level at which they are available domestically on a sustainable basis.[3-7]

3.3 EFA Limitations

The Ecological Footprint Analysis methodology was the pioneering attempt to quantify the extent to which human populations are living beyond their means; it offers a "bottom-up" assessment of the extent to which current human utilization of specific renewable natural resources and natural habitats—cropland, pastureland, forests, fisheries, and carbon dioxide assimilation capacity—exceeds Nature's capacity to replenish these resources and regenerate these habitats on a sustainable basis.

However, by considering only renewable natural resources and by failing to consider explicitly the economic aspects of overextension, the EFA methodology tends to significantly understate societal overextension, especially in the case of industrialized societies such as America.

America's natural resource mix and our consequent overexploitation of natural resources are heavily skewed toward nonrenewable energy resources and mineral resources, which are not considered by the EFA method. Too, Americans have been able to augment the extent to which we live beyond our means ecologically, through our unsustainable economic resource utilization behavior, which is not explicitly considered by the EFA method.

While the EFA is well-suited to quantifying the level of overextension associated with non-industrialized societies, its failure to consider nonrenewable natural resource overexploitation and economic resource overexploitation causes it to significantly understate American societal overextension.[3-8] The Societal Overextension Analysis method attempts to address these EFA shortcomings.

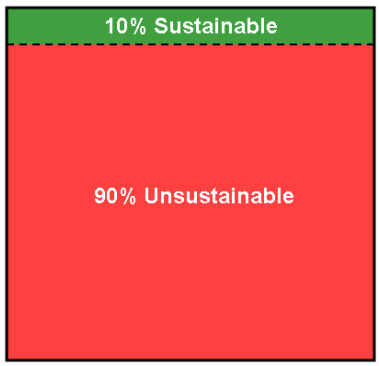
3.4 Societal Overextension Analysis

The Societal Overextension Analysis (SOA) quantifies American societal overextension by measuring the portion of our current total consumption level that is unsustainable; that is, the percentage by dollar value of goods and services that we currently produce and procure domestically through our unsustainable overexploitation of ecological resources and/or economic resources. Societal overextension is the synthesis of ecological overextension and economic overextension.

3.4.1 American Ecological Overextension

Ecological overextension measures the portion of our current ecological resource utilization level that is unsustainable—i.e., the value of goods and services produced domestically through our overexploitation of natural resources and natural habitats.[3-9]

2007 American Ecological Overextension



In 2007, we used approximately 7 billion tons of natural resources[3-10]—energy resources and non-energy mineral resources—to produce $13.81 trillion worth of goods and services[3-11] in America. Of these resources, at least 90% were nonrenewable natural resources, the ongoing use of which is unsustainable.

Specifically, in 2007:

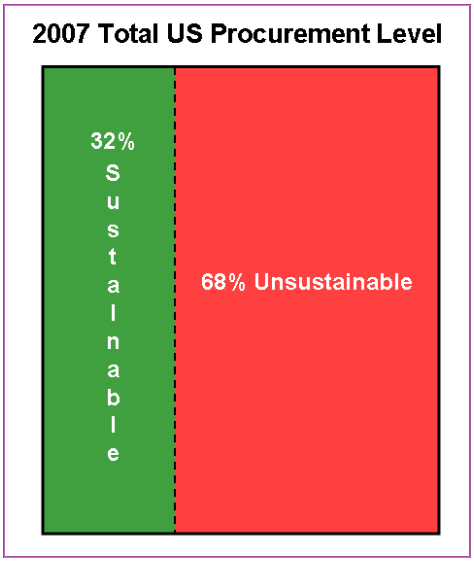
- 93% of our primary energy was produced from nonrenewable (unsustainable) natural resources; only 7% was produced by renewable (sustainable) energy sources;[3-12]
- 90% of our electricity was generated by nonrenewable (unsustainable) natural resources; only 10% was generated by renewable (sustainable) energy sources;[3-13]
- 87% of the non-energy minerals used as raw material inputs to the US economy were newly extracted (unsustainable); only 13% were either recycled (8%)[3-14] or renewable (5%)[3-15] [sustainable].

Given that supplies associated with at least 90% of the natural resources utilized in the US during 2007 were unsustainable, it is estimated that 90%, or $12.43 trillion, of the total value of the goods and services derived from those resources was unsustainable as well.[3-16]

3.4.2 American Economic Overextension

Economic overextension measures the portion of our current economic resource utilization level that is unsustainable—i.e., the value of goods and services procured domestically though our utilization of pseudo purchasing power: i.e., by liquidating our previously accumulated economic asset reserves, by incurring ever-increasing levels of intergenerational debt, and by underfunding investments critical to our future wellbeing.

2007 American Economic Overextension



In 2007, we procured goods, and services valued at $17.26 trillion. Of that total, approximately 68%, or $11.79 trillion, was procured through the utilization of pseudo purchasing power, the ongoing use of which is unsustainable.

Specifically:[3-17]

$11,794 (68%)**[3-18] **2007 US Procurements Using Pseudo Purchasing Power ($billion)

- $575[3-19] 2007 Economic asset liquidation ($billion)
- $4,411[3-20] 2007 New intergenerational debt ($billion)
- $6,808[3-21] 2007 Unfunded investments critical to our future wellbeing ($billion)

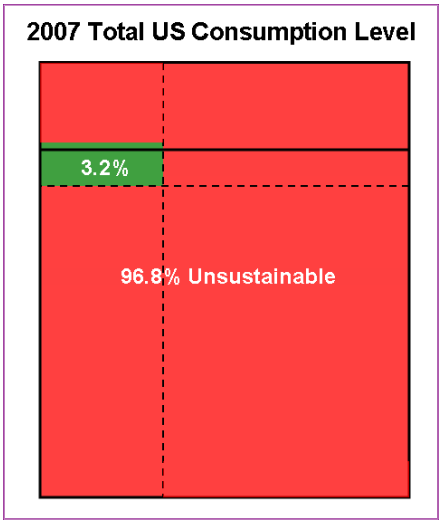
$5,463 (32%)**[3-22] **2007 US Procurements Using Real Purchasing Power ($billion)

$17,257 (100%) **2007 Total US Procurement Level ($billion)**

3.4.3 American Societal Overextension

Societal overextension measures the portion of our total consumption level that is unsustainable —i.e., the value of goods and services produced through our overexploitation of ecological resources, procured through our overexploitation of economic resources, or both. American societal overextension is represented visually as the intersection between American ecological overextension and American economic overextension.

2007 SOA Assessment of American Societal Overextension

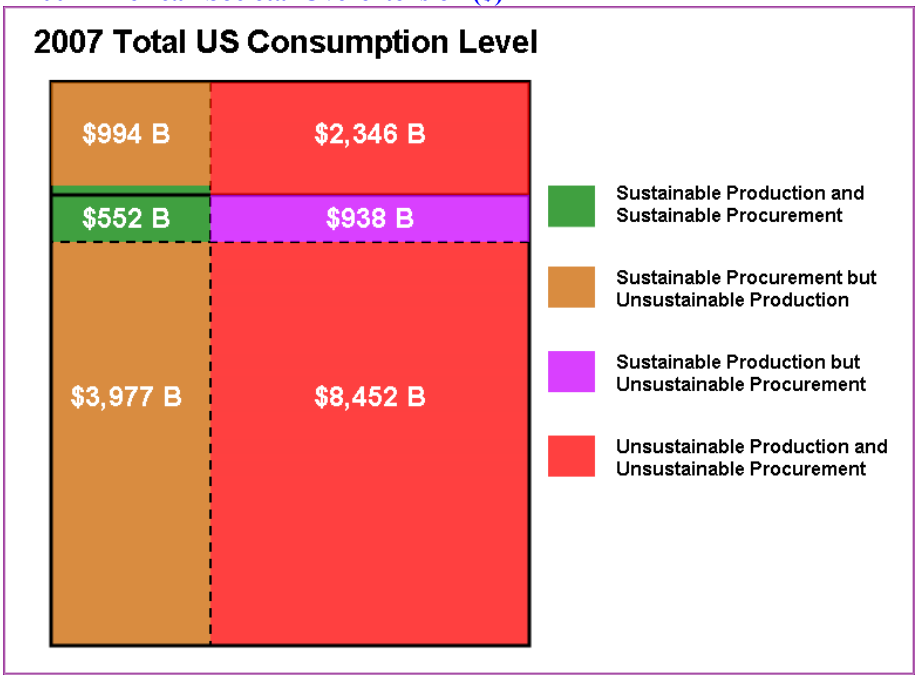


During 2007, 96.8% of our total consumption level was unsustainable—that is, enabled by:

- Our overexploitation of ecological resources—our utilization of nonrenewable natural resources and/or our unsustainable use (net depletion) of renewable natural resources;
- Our overexploitation of economic resources—our utilization of pseudo purchasing power; or
- Our overexploitation of both ecological resources and economic resources.

Only 3.2% of our total consumption level was sustainable—that is, enabled by our sustainable utilization of renewable natural resources and by real purchasing power.

2007 American Societal Overextension ($)



In dollar terms, $16.71 trillion of our 2007 total consumption level of $17.26 trillion was unsustainable. Only $552 billion of our total consumption level was sustainable.

Our 2007 total consumption level broke down as follows:

- **3.2% Sustainable ($552 billion)**: goods and services produced through our sustainable utilization of renewable natural resources, and procured through our utilization of real purchasing power.
- **23.0% Unsustainable ($3,977 billion)**: goods and services procured through our utilization of real purchasing power, but produced through our utilization of nonrenewable natural resources and/or our unsustainable use of renewable natural resources.
- **5.8% Unsustainable ($994 billion)**: goods and services procured through our utilization of real purchasing power, but imported (net imports) or produced domestically during a prior year through our utilization of nonrenewable natural resources and/or our unsustainable use of renewable natural resources.

- **5.4% Unsustainable ($938 billion)**: goods and services produced through our sustainable utilization of renewable natural resources, but procured through our utilization of pseudo purchasing power.
- **49.0% Unsustainable ($8,452 billion)**: goods and services produced through our utilization of nonrenewable natural resources and/or our unsustainable use of renewable natural resources, and procured through our utilization of pseudo purchasing power.
- **13.6% Unsustainable ($2,346 billion)**: goods and services procured through our utilization of pseudo purchasing power, and imported (net imports) or produced domestically during a prior year through our utilization of nonrenewable natural resources and/or our unsustainable use of renewable natural resources.

Based on the SOA, American society is overextended by a factor of 31.4 ($17.26 trillion total consumption level/$.55 trillion sustainable consumption level); that is, our current total resource utilization level—which enables our American way of life—exceeds the sustainable level by over 31 times!!

In an attempt to put the incredible magnitude associated with our predicament into perspective, it is as though we are currently spending $30.40 from a finite, one-time inheritance for each $1 of current income that we earn—almost 97% of our current spending comes from our dwindling inheritance. So while we have grown accustomed to living unsustainably on $31.40, we will have to learn to live sustainably on our $1 income—soon.

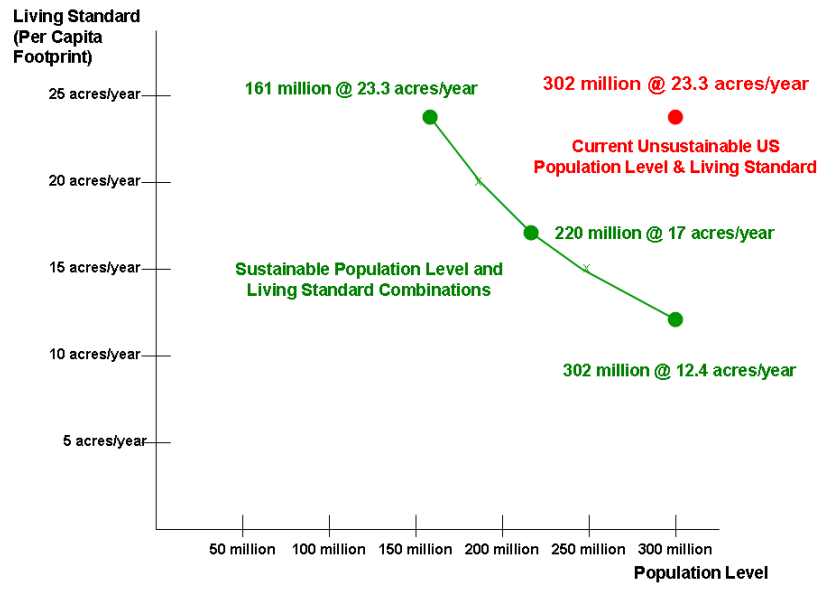
3.5 Consequences of American Societal Overextension

The extent to which our American society is currently overextended—living unsustainably beyond our means both ecologically and economically—is appalling. The corresponding lifestyle disruptions associated with our inevitable transition from our American way of life to a sustainable lifestyle paradigm will be appalling as well.

The following "population/living standard trade-off curves"[3-23] provide estimates[3-24] of the population level and living standard combinations that will be attainable within a sustainable American lifestyle paradigm.

3.5.1 Consequences of American Overextension per the EFA

EFA Estimated Sustainable US Population and Living Standard Combinations



According to the GFN EFA, should we choose to maintain our current population level of 302 million people, our average material living standard would fall to about half of our current level—approximating the living standards in Austria and Israel today.[3-25]

Alternatively, if we choose to maintain our current living standard, America could support a sustainable population of only 161 million people.

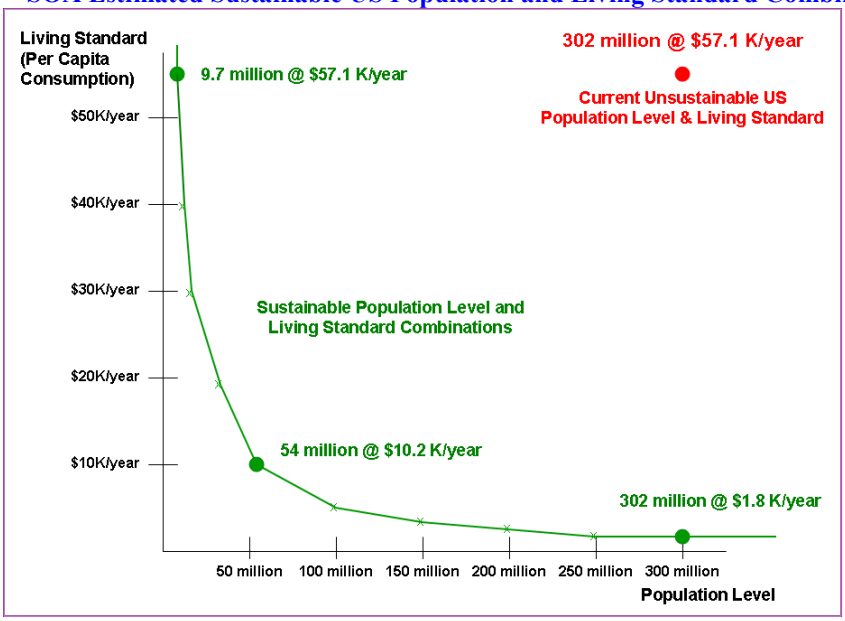
Or, we could choose to reduce our population level and our average living standards equally, by approximately 27% each. We could then expect a sustainable population of 220 million people with living standards comparable to those of Norway and Estonia today.[3-25]

Recall that the Ecological Footprint Analysis significantly understates the extent to which American society is overextended; the EFA also significantly overstates our sustainable population level and living standard combinations.

3.5.2 Consequences of American Overextension per the SOA

By explicitly considering our unsustainable utilization of both nonrenewable natural resources and pseudo purchasing power, the SOA offers a more accurate assessment of our sustainable population level and material living standard combinations.

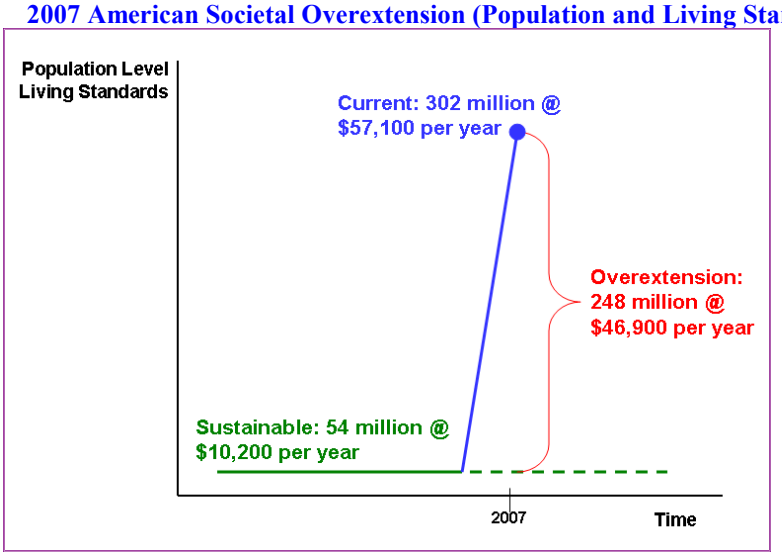
SOA Estimated Sustainable US Population and Living Standard Combinations



According to the SOA, should we choose to maintain our current population level of 302 million people, our sustainable average living standard would be approximately 3.2% of its current level—essentially that of Cambodia and North Korea today.[3-26]

If we choose instead to maintain our current average material living standard, America could support a sustainable population of only 9.7 million people.

2007 American Societal Overextension (Population and Living Standards)



Finally, by choosing to reduce our population level and living standards equally, by approximately 82% each, we could attain a sustainable population of approximately 54 million people with average material living standards comparable to those of Kazakhstan and Cuba today.[3-26]

Chapter 4: The Cause of America's Predicament

"Indeed, I would argue that unsustainability is an *inevitable* emergent property of the interaction of growth-bound, techno-industrial society and the ecosphere.[4-1] – William Rees

Our culture of persistent resource overexploitation, which has enabled our "success"—our extraordinary American way of life, has also caused our "predicament"—our unsustainable American way of life. Unless and until we acknowledge that we, all Americans, are responsible for our predicament, we will not be able to resolve it.

4.1 "We" are Responsible

Most Americans believe that "they" cause all of our societal level problems. "They" can be politicians, congress, big business, the system, the government, corporations, foreigners, or anybody who is not "us". To the extent that "we" share any responsibility at all for our predicament, we have forgiven ourselves because we are merely innocent victims of forces beyond our comprehension and control.

The reality is that "they" are, in fact, "us". All Americans past and present, but primarily those of us living since the inception of our industrial revolution, are responsible for our predicament. We are directly responsible through our individual overexploitation of the ecological resources and economic resources upon which our American way of life depends. More importantly, we are indirectly responsible as the ever-so-willing beneficiaries of resource overexploitation perpetrated on our behalf by those who provision, operate, and maintain the critical support systems that comprise our industrial mosaic.

For example, during 2007 total US mineral resource utilization approximated 7 billion tons, or over 46,000 pounds per capita.[4-2] While no individual American used 46,000 pounds of minerals during the course of his or her daily life in 2007, 46,000 pounds of minerals, 95% of which were nonrenewable, were utilized on behalf of each of our 302 million citizens in order to perpetuate the lifestyle that we take for granted—our American way of life.

At the end of the day, it is our total resource utilization level that is significant from Nature's perspective, not what we perceive to be our individual resource utilization levels. And as the SOA clearly demonstrates, our current total resource utilization level exceeds the sustainable level by at least 30 times!

4.2 Unintended—But Real—Consequences

It is difficult to argue that "industrialized man" in general and "industrialized Americans" in particular are inherently evil with respect to our resource utilization behavior. Over the course of many millennia, we have simply used our ever-expanding knowledge and technology to improve our condition—first from hunter-gatherer to agrarian, then from agrarian to industrial. In the process, we created our American way of life—300+ million people enjoying historically unprecedented material living standards—a lifestyle paradigm to which we now feel entitled.

Unfortunately, our culture[4-3] of persistent resource overexploitation, through which we have improved our condition and created our American way of life, is self-destructive. Our distorted, cornucopian worldview and its consequent dysfunctional, detritovoric resource utilization behavior, which have enabled our "success", are also simultaneously eliminating the resources upon which our American way of life and our very existence depend. As a result, neither our American way of life nor its existing lifestyle attributes is sustainable.

The reality associated with our predicament is that despite our possibly-justifiable naïveté during our meteoric rise to “exceptionalism”, and despite the fact that societal overextension was undoubtedly an unintended consequence of our efforts to improve our condition; our American society is irreparably overextended as a result of the same resource utilization behavior that has enabled our “success”—and It will collapse horrifically in the not-too-distant future in the absence of immediate and drastic mitigating action.

Chapter 5: The Resolution of America's Predicament

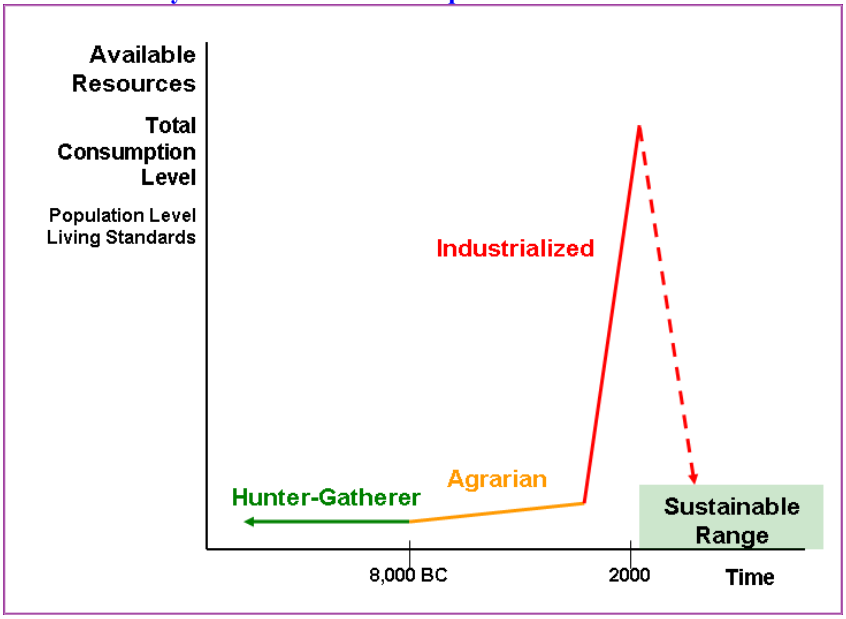
"…collapse isn't inevitable, but depends on a society's choices".[5-1] – Jared Diamond

There is only one rational solution to our predicament, and it involves fundamental cultural change and drastic action. We must, as a society, transition quickly and beginning immediately to a sustainable lifestyle paradigm, one in which we live completely within our means ecologically and economically—forever. All alternative courses of action will culminate in societal collapse.

5.1 Sustainability is Inevitable

Most Americans believe that any conceivable problem can and will be resolved through some combination of American ingenuity, technical innovation, hard work, and perseverance. "They", presumably a different "they" than the "they" who cause all of our societal level problems, have always developed timely solutions to our problems in the past—and they always will.

Sustainability: The Inevitable Consequence

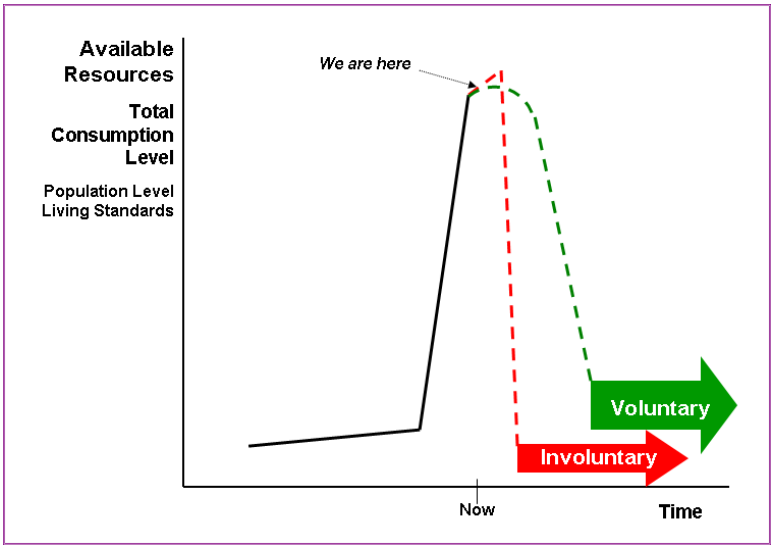


The reality is that our American way of life cannot be perpetuated through ingenuity and technical innovation; nor can it be perpetuated through hard work and perseverance—it cannot be perpetuated, period. Our American way of life is not sustainable—it must and will come to an end in the not-too-distant future.

Our predicament—irreparable societal overextension resulting from our persistent overexploitation of the increasingly scarce ecological and economic resources that enable our very existence—cannot be resolved within the context of our existing inherently overexploitive lifestyle paradigm, which is responsible for our predicament in the first place. No amount of ingenuity, innovation, or effort can create unlimited resources on a finite planet.

5.2 America's Choice: Voluntary or Involuntary Transition to Sustainability

American's Choice



Our choice is not whether we "wish to be" sustainable; our choice involves the process by which we "will become" sustainable. We can transition to a sustainable lifestyle paradigm voluntarily, thereby mitigating our consequent population level and living standard reductions. Or, we can refrain from taking preemptive action and allow Nature to orchestrate our transition through societal collapse, thereby causing us to experience catastrophic reductions in our population level and living standards.[5-2]

There are no other alternatives—we "will be" sustainable, either voluntarily or involuntarily; and we will be sustainable soon. Our maximum attainable population level and living standards at sustainability will be determined by our transition process.

5.3 American Cultural Revolution (ACR)

The only rational solution to our predicament is an American Cultural Revolution (ACR), during which we transition voluntarily, quickly—within 25 years—and beginning immediately, from our unsustainable American way of life to a sustainable and self-sufficient[5-3] lifestyle paradigm—a lifestyle paradigm in which we will live within our means ecologically and economically, forever.

Among the most salient ACR requirements: we must change fundamentally both our existing worldview and our existing resource utilization behavior; we must use remaining resources to facilitate our transition process, rather than waste them on futile attempts to perpetuate our unsustainable American way of life; and we must all participate—an ACR is an all-or-nothing proposition.[5-4]

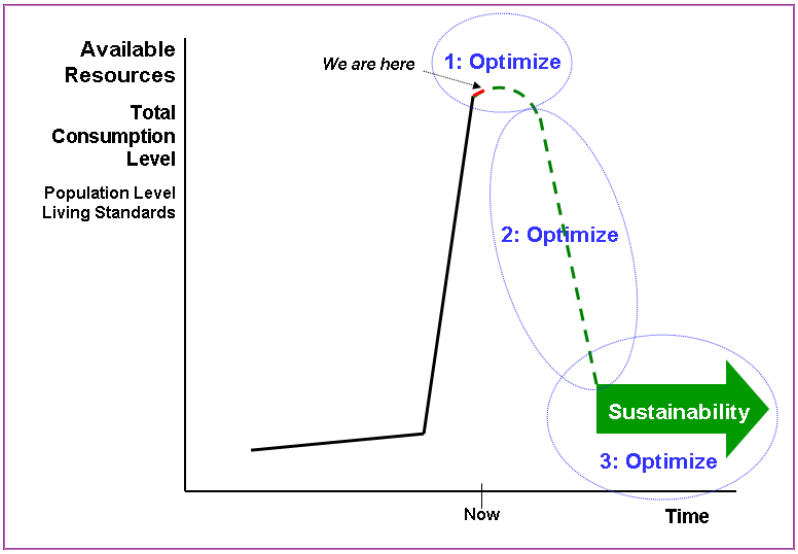
An ACR offers three benefits over societal collapse—control, cooperation, and compassion—which will enable us to minimize lifestyle disruptions during our transition process and to maximize our societal wellbeing—our attainable population level and material living standards—at sustainability.

5.3.1 ACR Goals, Objectives, and Initiatives

The main ACR goal is to optimize both the resources available to us and our capacity to effectively utilize those resources throughout our transition process, which will enable us to continuously optimize our total consumption level, which will enable us to continuously maximize our population level and living standards. All ACR goals, objectives, and initiatives must contribute toward the achievement of this main goal.

5.3.1.1 ACR Goals

American Cultural Revolution Goals



The ACR transition process consists of three distinct phases, each of which has a corresponding primary goal.

1. **Optimize the "Peak":** reverse generations of culturally-instilled, physically-impossible-to-achieve expectations regarding an ever-increasing total consumption level and ever-improving societal wellbeing, during our transition from "more and more" to "less and less".
2. **Optimize the "Decline":** adopt fundamental and universal changes in our living arrangements, our vocational endeavors, and our daily routines during our period of continuous "less and less".
3. **Optimize "Sustainability":** maximize our societal wellbeing—achieve the highest possible average material living standard for the greatest number of people—within the context of a sustainable lifestyle paradigm.

5.3.1.2 ACR Objectives

Each ACR objective contributes toward achieving one or more of the primary ACR goals, it contributes toward fundamentally modifying our current worldview and resource utilization behavior, and it minimizes the lifestyle disruptions associated with our transition process.

ACR objectives provide the framework for our "Roadmap to Sustainability by 2034",[5-5] by defining 1) our societal preference regarding the trade-off between attainable material living standards and attainable population levels going forward, 2) the expected mix and levels of natural resources available to us during our transition period and at sustainability, and 3) the optimum mix and maximum levels of goods and services that we can produce, and therefore consume, through the utilization of available resources.

- **Population/Living Standard Trade-off Objective**: determine our desired average material living standards—annual average per capita consumption levels—during our transition period and at sustainability. This metric, in combination with our total production level during any time period, will determine our maximum attainable population level during that period.
- **Resource Availability Objective**: identify all available natural resources, including nonrenewable natural resources, that could comprise our "transition resource mix", and all available renewable natural resources that could comprise our "sustainable resource mix"; and forecast the maximum available level per resource per annum.
- **Resource Optimization Objective**: identify all knowledge and technology that will enable us to optimize our utilization of available natural resources, which will be available to us during our transition period and at sustainability.

- **Total Production/Consumption Level Optimization Objective**: determine the optimum mix and maximum levels of goods and services that we can produce annually, and therefore consume, during our transition period and at sustainability, given available natural resources, knowledge, and technology.
- **Production Scheduling Objective**: forecast the mix and levels of goods and services that we expect to produce annually during our transition period and at sustainability.
- **Population/Living Standard Adjustment Objective**: forecast our annual attainable population level and average material living standard (average per capita consumption level), given our Population/Living Standard Trade-off Objective and our forecasted annual production/consumption mix and level.
- **ACR Objective Review and Revision**: continuously reassess resource availability throughout the ACR implementation period and modify annual our ACR objectives accordingly—always retaining 2034 as the year by which sustainability is achieved.

5.3.1.3 ACR Initiatives

ACR initiatives are the specific tasks that we must perform in order to accomplish ACR objectives. While the definition of specific ACR initiatives is not possible prior to the establishment of quantified ACR objectives, critical areas in which ACR initiatives must be defined include the following:

Sustainable Infrastructure Development: we must use our remaining supplies of nonrenewable natural resources to replace or modify existing critical support systems and infrastructure in such a way that they can be operated, maintained, upgraded, and replaced through the exclusive utilization of renewable natural resources at sustainability. Critical support systems and infrastructure include:

- Water treatment and distribution
- Energy generation and distribution
- Manufacturing
- Law enforcement
- Communication
- Governance
- Food production, distribution, and preparation
- Housing
- Waste management
- Transportation
- Healthcare
- Education

Production Mix Optimization: we must obtain or produce the life sustaining necessities that will maximize our societal wellbeing both during our transition and at sustainability. Critical vocational sectors include:

- Water Management
- Energy Generation
- Forestry/Woodworking
- Farming/Agriculture
- Hunting/Fishing/Gaming
- Mineral/Metal Recycling

Population Reduction: we must reduce our population level during our transition period, as required,[5-6] in order to achieve population levels consistent with our material living standard preferences and the total level of goods and services available for our consumption. Among the population reduction methods that must be considered:

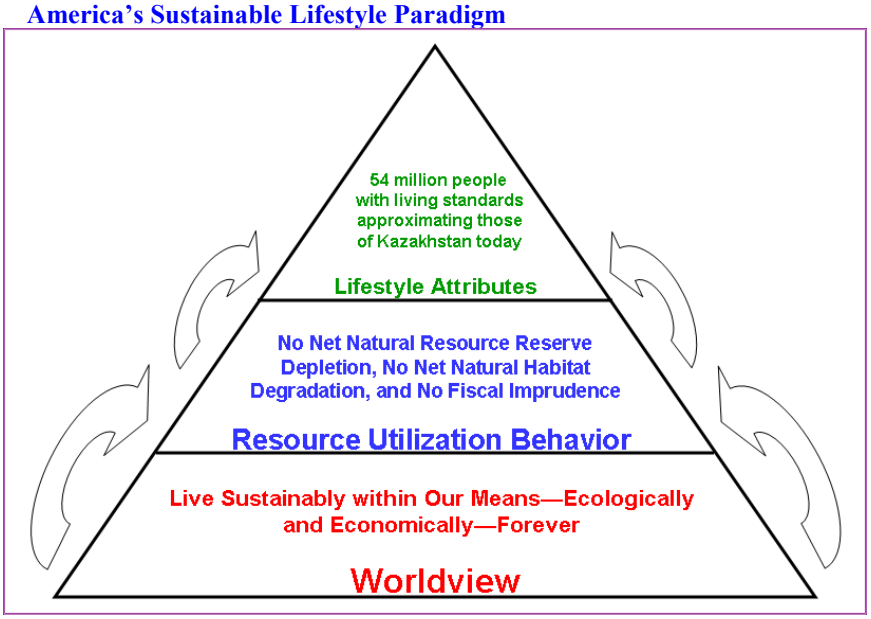
Birth Rate Decrease
- Birth control
- Sterilization
- Abortion
- Infanticide

Mortality Rate Increase
- Suicide
- Assisted suicide
- Euthanasia
- Elimination of “life support” systems and medications

Immigration Elimination
- Terminate further immigration
- Deport illegal immigrants

5.3.2 Sustainable Lifestyle Paradigm Attributes

America's Sustainable Lifestyle Paradigm



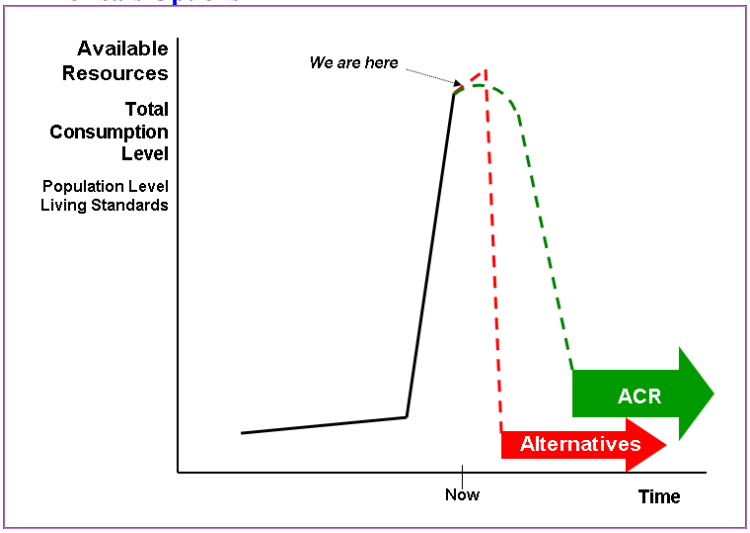
We must refrain from further attempts to make ecological and economic reality conform to our cornucopian worldview and detritovoric resource utilization behavior, and adopt a worldview and resource utilization behavior that conform to ecological and economic reality.[5-7]

Our new worldview and resource utilization behavior must reflect the reality that our total production/consumption level and our resulting population level and material living standards must be constrained by sustainable supplies of ecological resources and economic resources—forever.

Our new resource mix must consist entirely of domestic renewable natural resources, domestic recycled nonrenewable natural resources,[5-8] domestic natural habitats, and real purchasing power; and our new resource utilization levels must involve no net depletion of natural resource reserves and no net degradation of natural habitats—ever.

Because our total resource utilization level and our total consumption level will be significantly lower following our transition to a sustainable lifestyle paradigm than they are today, our maximum sustainable population level and material living standards will be significantly lower as well. However, the lifestyle disruptions associated with an ACR pale in comparison to those that await us if we fail to act and allow Nature to orchestrate our transition to sustainability.

America's Options



Our transition to a sustainable lifestyle paradigm is inevitable. An ACR will enable us to optimize both our transition process and our lifestyle attributes at sustainability. All alternative courses of action will culminate in societal collapse.

5.4 Societal Collapse

Unlike an ACR, which employs a controlled and methodical transition to a sustainable lifestyle paradigm, societal collapse involves an unstructured and chaotic transition orchestrated by Nature; the associated lifestyle disruptions will be catastrophic.

5.4.1 Economic Contraction versus Societal Collapse

An economic contraction—a recession or depression—is a cyclical phenomenon characterized by a temporary reduction in societal purchasing power, which results in material living standard reductions for some or all of the society's population. An economic contraction is typically caused by fiscal imprudence, a temporary shortfall in the supply of a critical ecological resource,[5-9] or a temporary decrease in economic output.

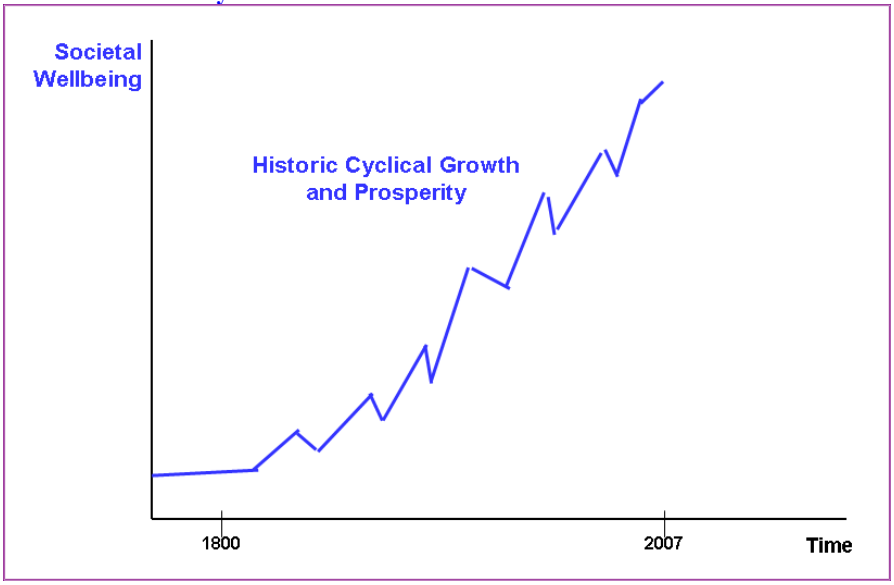
While the living standard reductions associated with an economic contraction may be severe, they are temporary. Economic recovery occurs, all else being equal, as supplies of the resources that enable the society's way of life again become sufficient to restore the society's total consumption level to its original level.

A societal collapse is a cascading array of catastrophic lifestyle disruptions caused by a permanent shortage or disruption in the supply of one or more of the critical ecological resources that enable the society's way of life. It is a one-time phenomenon characterized by permanent reductions in a society's total consumption level, population level, and material living standards to sustainable levels—from which "recovery" to previous levels is impossible.

While societal collapse can be human-induced or Nature-induced, the result in either case is a permanent disruption in the society's capacity to provide one or more of the life sustaining necessities—water, food, energy, shelter, and clothing—to most or all of its population. Recovery from a societal collapse is impossible because the supply of the critical ecological resource or resources that precipitated the collapse remains permanently insufficient to enable a rebound in the society's production and consumption levels.

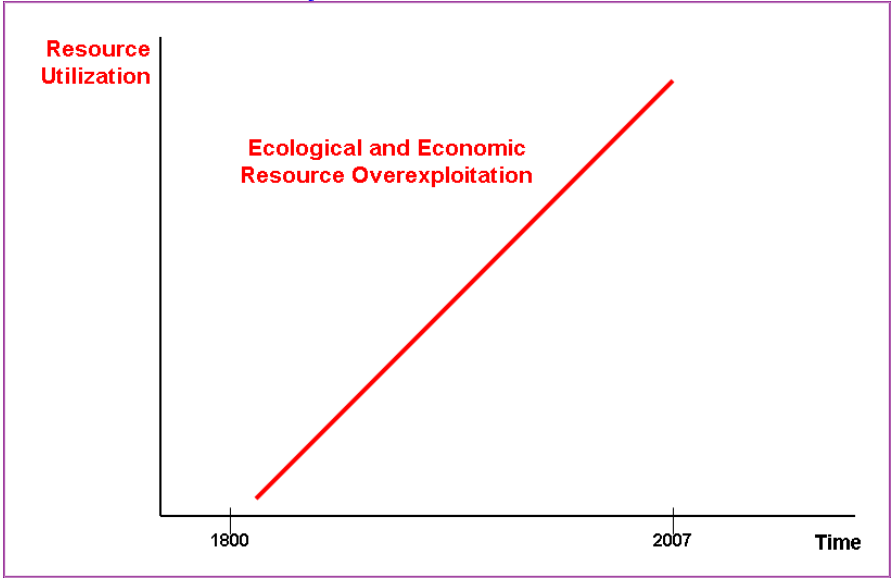
5.4.2 The Myth of "Perpetual Cyclicality"

The Economic Cycle



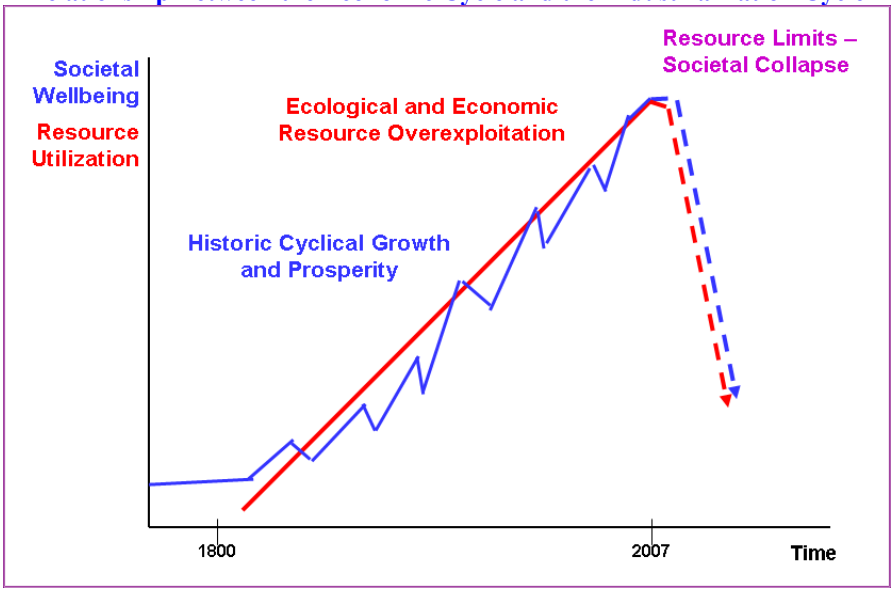
Over the past two centuries, industrialized societies have come to expect periodic economic contractions—and corresponding "better-than-ever" economic recoveries; hence our prevailing belief in the myth of "perpetual cyclicality". Economic recoveries always follow contractions; and our societal wellbeing improves with every recovery—always.

The "Industrialization Cycle"



In reality, our upward trending economic cycles over the past 200 years have been enabled by the rising edge of a one-time "industrialization cycle",[5-10] which itself has been enabled almost exclusively by our ever-increasing, yet unsustainable overexploitation of ecological and economic resources, especially nonrenewable natural resources and pseudo purchasing power.

Relationship Between the Economic Cycle and the Industrialization Cycle



Because an increasing number of the most critical of these resources are rapidly approaching limits—i.e., available resource supplies will no longer be sufficient to enable an industrial lifestyle paradigm—the societies that depend upon these resources to enable their industrial lifestyle paradigms are approaching societal collapse.[5-11]

5.4.3 Collapse of an Industrialized Society

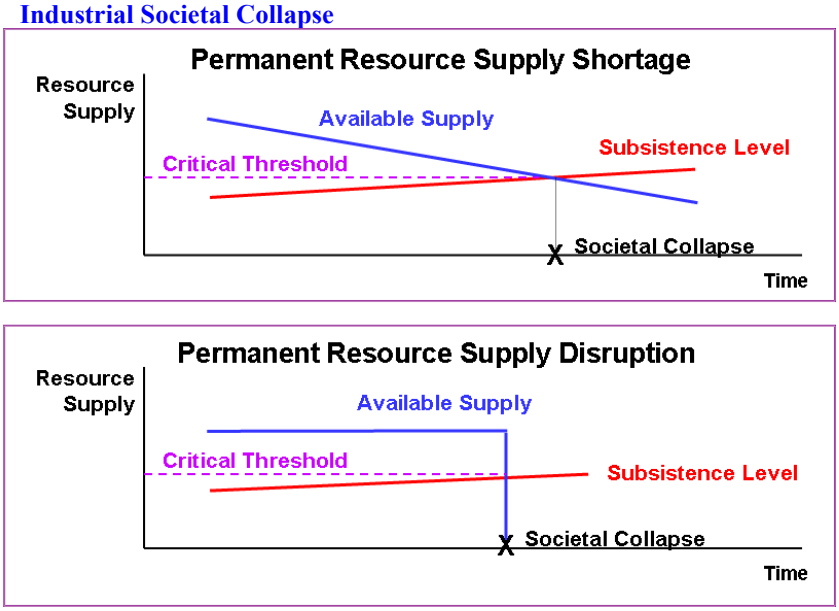
The industrial lifestyle paradigm is a historically unprecedented phenomenon; to date, notwithstanding periodic economic contractions, industrialized societies have experienced only "success". Industrial societal collapse will be historically unprecedented as well.

Hunter-gatherer and agrarian societies have collapsed throughout history, typically as the result of protracted shortages or disruptions in the supply of one or more critical renewable natural resources.[5-12] In many cases, partial or even complete recoveries have been achieved as sufficient supplies of the triggering natural resource or resources again became available.

Given their overwhelming dependence upon nonrenewable natural resources, industrial societies are more likely to collapse from permanent shortfalls in the supply of one or more critical nonrenewable natural resources.

In an industrialized society, each critical nonrenewable natural resource enables the utilization of countless other natural resources, which, in turn, enable the production and provisioning of innumerable goods and services—some of which are life-sustaining necessities. A permanent shortfall in the supply of a critical nonrenewable natural resource for an industrialized society is equivalent to a permanent shortfall in the supply of a critical nutrient for a living organism—the organism dies, even if the supplies of other enabling nutrients remain plentiful.[5-13]

Industrial Societal Collapse



A permanent shortfall in the supply of a critical nonrenewable natural resource will occur when its available supply drops permanently below its critical threshold—the absolute minimum supply level necessary to perpetuate the society's existing lifestyle paradigm—either through a permanent supply shortage or through a permanent supply disruption. At that point the society will collapse.

During the collapse of an industrialized society, the society's industrial mosaic will experience an array of rapid and simultaneous cascading breakdowns; it will fail like a cracking car windshield. From that point forward, the industrial mosaic will be permanently unable to provide sufficient life sustaining essentials to most or all of the society's population.

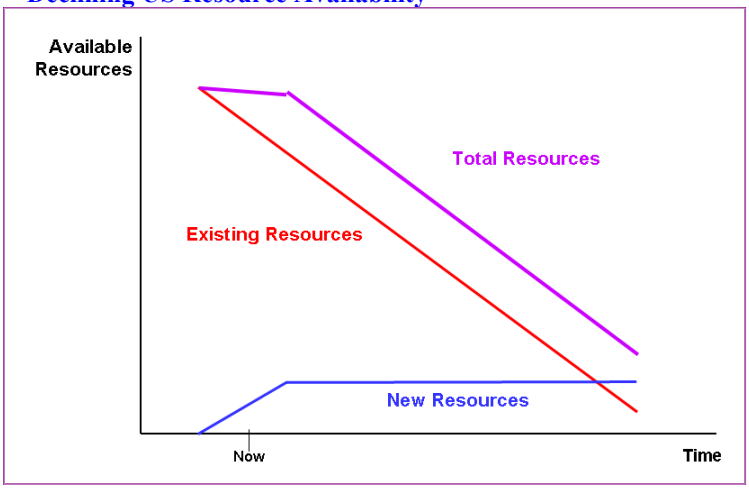
5.5 Other Courses of Action

Because courses of action other than an ACR attempt to resolve our predicament within the unsustainable context of our inherently overexploitive culture, they cannot possibly succeed.

5.5.1 Business as Usual

Presuming or hoping that new natural resources, natural habitats, and economic purchasing power will somehow become available on an "as needed" basis and seamlessly displace the overexploited resources that currently enable our American way of life—thereby enabling us to perpetuate our existing lifestyle paradigm indefinitely—is delusional.

Declining US Resource Availability



At best, we will identify a limited number of new resource supplies and resource substitutes, thereby partially offsetting the continuous declines associated with our existing resource supplies. Unfortunately, the combined contributions of all yet-to-be-identified resource supplies and resource substitutes will not begin to completely offset the increasingly scarce resource supplies that currently enable our American way of life.

Betting on a series of 11th hour miracles as our "Plan A" is societal suicide.

5.5.2 Irrelevant Initiatives

Initiatives promising to move our society "toward sustainability" will only defer societal collapse—at best. "Green" initiatives, "sustainability" initiatives, and "conservation" initiatives are either shameless public relations schemes perpetrated by businesses and other organizations in an attempt to convey an image of social responsibility, or totally inconsequential attempts by social activists to "make a difference", without making "the necessary difference".

None of these initiatives, either individually or in combination, will ever bring about our transition to anything faintly resembling a sustainable lifestyle paradigm. Such initiatives are actually counterproductive because they create the impression of meaningful action, when in fact they will never achieve sustainability—only deferred societal collapse. They simply waste increasingly scarce time and resources on futile attempts to perpetuate our unsustainable American way of life.

Renewable energy initiatives, while essential to our sustainable future, must be presented, evaluated, and assessed objectively—from the perspective of their economic return on investment (ROI), their energy return on investment (ERoEI), and their scalability. While it is true that renewable energy sources will provide **all** of the energy in our sustainable future, it is also true that renewable energy sources will never supply more than a small fraction of the total energy to which we have become accustomed and upon which our American way of life depends.[5-14, 5-15]

Initiatives seeking to stabilize or reduce existing population levels or economic growth also miss the point. Stabilizing or even reducing our population level or our economic output level is irrelevant in the absence of fundamental cultural change. For example, an instantaneous 50% reduction in our population level, absent the elimination of our detritovoric resource utilization behavior, would merely double the time between now and our Societal Collapse—to 50 years at the outside, from 25 years at the outside. The same logic holds true for proposed reductions in our economic output level.

Nature does not offer "partial credit"; a society is either sustainable or it is not—and we are not even close. The only rational solution to our predicament is an ACR, which is straightforward and unambiguous. It is our incessant attempts to evade, avoid, and circumvent this solution that are complicated, convoluted, and ultimately suicidal.

Chapter 6: America's Destiny—Societal Collapse

"We can evade reality, but we cannot evade the consequences of evading reality."
– Ayn Rand

Our culture of persistent resource overexploitation is responsible for both our "success"—our extraordinary American way of life—and our "predicament"—irreparable societal overextension. And, since we are unwilling to voluntarily relinquish our success in order to resolve our predicament, our culture of persistent resource overexploitation will also be responsible for our inevitable demise—societal collapse.

6.1 The Inevitability of America's Societal Collapse

6.1.1 America's Paradox

The cause of our "success" will be the cause of our demise…

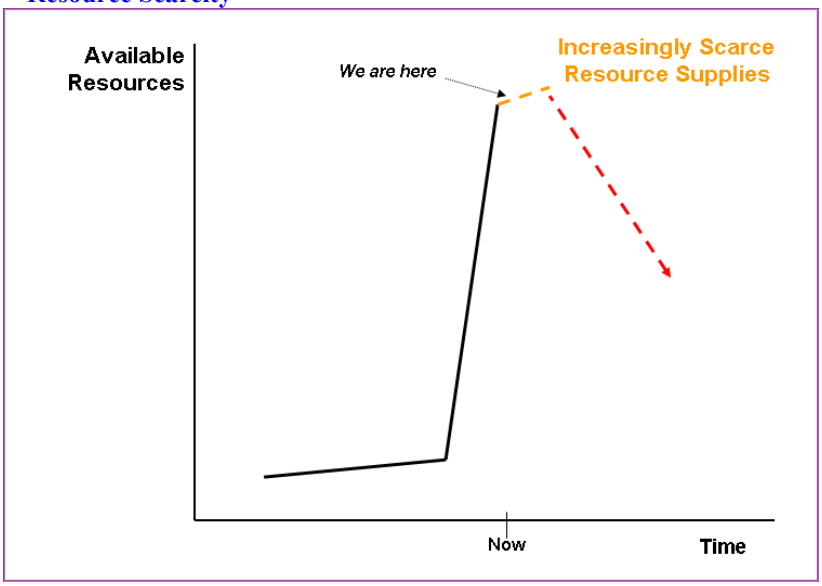
America's culture of persistent resource overexploitation—as manifested by our cornucopian worldview and our detritovoric resource utilization behavior—has enabled our historically unprecedented "success"—our American way of life. Unfortunately, our culture of persistent resource overexploitation has also caused our predicament—irreparable societal overextension. And even more unfortunately, our culture of persistent resource overexploitation will cause our inevitable demise—societal collapse.

The ultimate irony is that the more quickly we deplete remaining domestic and global resource reserves in futile attempts to perpetuate our American way of life, the more quickly we will reach a resource limit and trigger our Societal Collapse.

6.1.2 America's Conundrum

Our American way of life is enabled almost exclusively by our ever-increasing utilization of nonrenewable natural resources; yet available supplies associated with these resources are finite and are becoming increasingly scarce.

Resource Scarcity



It is only a matter of time until the supply associated with one of the most critical of these resources becomes insufficient to enable our way of life. At that point, our irreparably overextended society will collapse.

Unfortunately, the only rational solution to our predicament, an ACR, is an impossible solution…

A vast majority of us are "culturally incapable" of acknowledging our predicament, much less taking meaningful action to resolve it—we suffer from societal cognitive dissonance.[6-1] While we acknowledge that "we have our problems", we consider the idea that our American way of life is unsustainable to be utterly preposterous. America will continue to grow and prosper forever—because we say it will. Our vested interest in the continued success of our American way of life is simply too great to permit us to consider any argument or evidence to the contrary.[6-2]

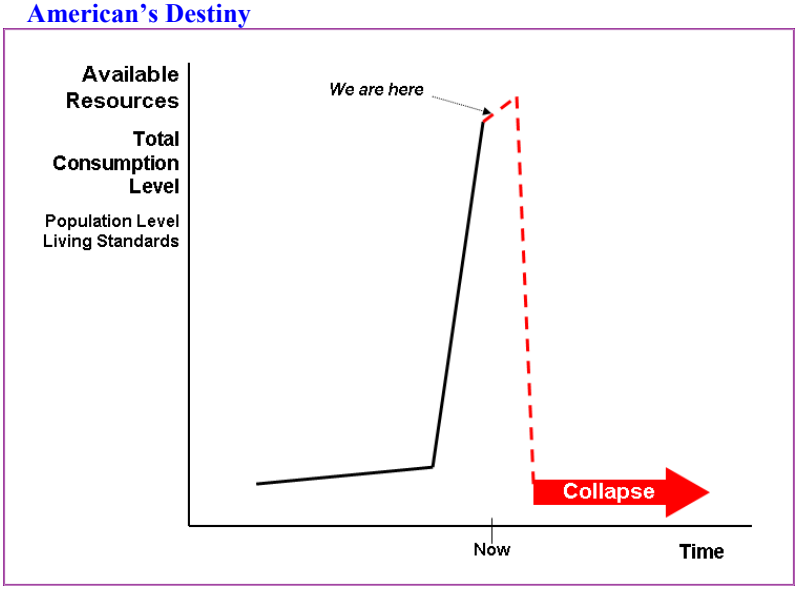
The minority who do acknowledge the reality of our predicament will continue to insist that "they"—our political and economic representatives—"fix it"; when, in fact, we ourselves are responsible for "it", and for the fact that it cannot be fixed—because we will not allow it to be fixed.[6-3] Fixing our predicament would require that we live sustainably within our means forever—a "sacrifice" that we consider to be totally unacceptable.

We will, therefore, not take preemptive action to mitigate the consequences associated with our predicament. We will not choose to modify voluntarily our distorted, cornucopian worldview and our dysfunctional, detritovoric resource utilization behavior through an American Cultural Revolution.

We will instead continue to use the remaining ecological and economic resources available to us in futile attempts to perpetuate our American way of life—behavior that will become increasingly desperate as we encounter increasingly severe resource supply shortages and disruptions.

We will continue to cling to the deluded belief that we can somehow substitute hope, faith, determination, technical ingenuity, and additional investment for the finite and dwindling resources that enable our unsustainable American way of life.

American's Destiny



And we will continue to adhere blindly and steadfastly to our misguided perception that we are entitled to our unsustainable American way of life, until the instant that Nature intervenes to resolve our predicament for us, horrifically, through famine, disease, and pestilence—unless we annihilate ourselves in the meantime through domestic and international resource wars.

6.2 America's Societal Collapse Scenario

6.2.1 Resource Limits

Many of the critical ecological resources and economic resources upon which our American way of life depends are rapidly approaching limits—that is, the available supplies associated with these resources will soon be insufficient to enable our existing lifestyle paradigm.

Reaching a critical economic resource limit will trigger our Last Depression, a permanent economic contraction that will shake the foundation of our American way of life. Reaching a critical nonrenewable natural resource limit will trigger our Societal Collapse, a permanent ecological contraction that will destroy the foundation of our American way of life.

6.2.2 America's Last Depression

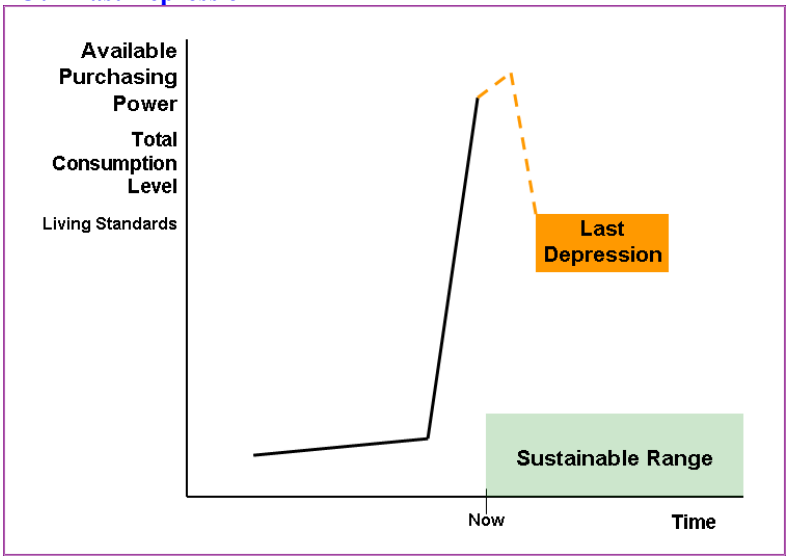
We are able to maintain our current total consumption level only through our ever-increasing utilization of pseudo purchasing power. That is, it is only through our persistent liquidation of our previously accumulated economic asset reserves, assumption of ever-increasing levels of intergenerational debt, and underfunding of investments critical to our future wellbeing that we are able to procure sufficient supplies of the critical natural resources and derived manmade goods and services that enable our American way of life.

As is the case with all finite resources, available pseudo purchasing power supplies are subject to limits. At some point, our accumulated economic asset reserves will become severely depleted, devalued, or exhausted; our creditors will refuse to extend additional credit or to carry our existing debt; and the currently underfunded investments in our future wellbeing will come due—the future will "arrive".[6-4]

Reaching one or more major pseudo purchasing power limits will trigger a historically unprecedented American economic contraction—our Last Depression—which will "wring out" from our economy the excesses associated with our generations of fiscal imprudence.

Our Last Depression will be characterized by significant, permanent,[6-5] and society-wide demand destruction caused by a permanent decrease in our aggregate purchasing power level, which will result in a permanent and significant reduction in our capacity to procure natural resources, goods, and services. If we are fortunate, sufficient real purchasing power will remain to afford us our life sustaining necessities—clean water, food, energy, shelter, and clothing—but the material living standards enjoyed by most Americans will decline substantially, forever.

Our Last Depression



While the purchasing power reduction associated with our Last Depression will certainly cripple our economy and our society as a whole, it will not cause our Societal Collapse. So long as available supplies of critical nonrenewable natural resources remain sufficient to perpetuate our industrialized lifestyle paradigm, our society will not collapse completely.

6.2.3 America's Societal Collapse

Our ability to obtain sufficient supplies of critical nonrenewable natural resources is being negatively impacted by shifting global market dynamics. Specific supply-side factors that are limiting the availability of critical nonrenewable natural resources to the US include:

- **Nature**—many nonrenewable natural resources have reached or will soon reach their geological peak production levels. Post-peak production levels decline continuously—forever—thereby reducing resource supplies available to the US.
    - Global resource production peaks impose worldwide geological supply limits, thereby reducing resource supplies available to all consumers, including the US.
    - Domestic resource production peaks impose national geological supply limits, thereby forcing the US to rely more heavily on imported resources or to reduce our usage levels in conformance with domestic supply levels.

- **Declining Exports**—traditional foreign natural resource suppliers are curtailing their exports to the US for various reasons:
    - Some are increasing internal resource utilization levels in order to facilitate domestic economic growth;
    - Others are increasing exports to competitive importing countries;
    - And others are husbanding increasingly valuable resources for future use.

- **Declining Resource Return on Investment (RROI)**—in the case of almost every nonrenewable natural resource, the easily accessible, high quality deposits have been exploited; leaving only the less accessible, lower quality deposits for current and future use. Less accessible, lower quality natural resource deposits:
    - Require more energy resources and non-energy resources to locate, extract, and process, thereby leaving fewer residual resources for uses other than resource acquisition; and
    - Yield lower total resource supply levels per unit time because useable quantities extracted from less productive unconventional resource deposits fail to offset declining quantities extracted from more productive conventional deposits.

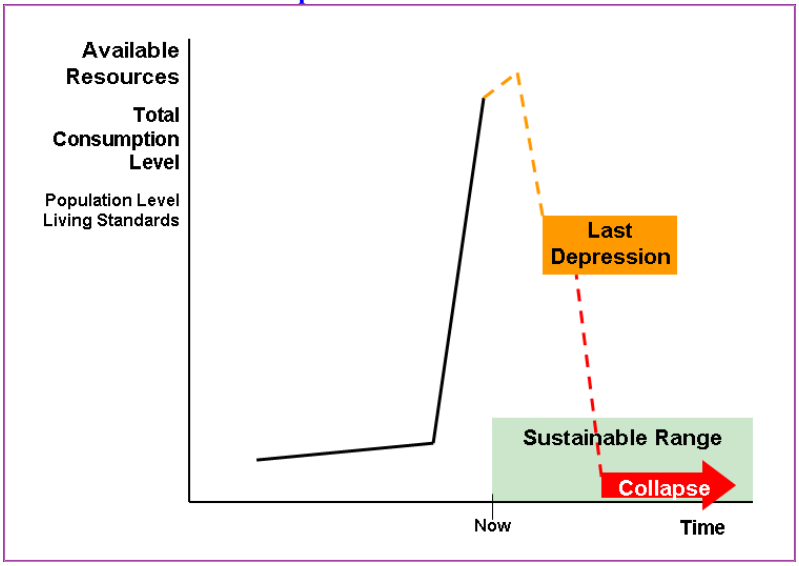
  The result is a "double whammy" for Resource Return on Investment: ever-increasing quantities of existing resources are required to obtain ever-decreasing quantities of new resources.

But while supplies associated with most nonrenewable natural resources are becoming increasingly scarce for the US, global demand for these resources is increasing, especially from countries such as Brazil, Russia, India, China, and the petroleum rich countries of the Middle East.

This supply/demand "squeeze", which is curtailing supplies of critical nonrenewable natural resources available to the US, will become more acute going forward. Resource scarcity will evolve into resource shortages, which will evolve into resource disruptions—possibly intermittent initially, then permanent—which will trigger our Societal Collapse.

Our Societal Collapse will be characterized by significant, permanent, and society-wide supply destruction, caused by a permanent shortage or disruption in the supply of one or more of the critical nonrenewable natural resources[6-6] upon which our American way of life depends. This permanent resource supply shortfall will permanently disenable the operation of our industrial mosaic.

America's Societal Collapse



From that point forward, we will be unable to produce and provision some or all of our life sustaining necessities—water, food, energy, shelter, and/or clothing—at sufficient levels, if at all.[6-7] Our total consumption level will plummet, as will our population level and material living standards. American society will collapse; and recovery will be impossible due to permanently insufficient supplies of critical natural resources.

Global demand for the critical ecological resources and economic resources that enable our American way of life is enormous and is ever-increasing, while supplies available to the US are becoming increasingly scarce, and will become even more so in the future. In the absence of an almost inconceivable series of 11th hour miracles, our Societal Collapse could possibly occur within the next 5 years, will probably occur within the next 15 years, and will almost certainly occur within the next 25 years.[6-8]

Chapter 7: Evidence of America's Imminent Societal Collapse

"The overshoot and collapse of industrial civilization was assured once humanity became dependent on the rapid exploitation of nonrenewable resources on a finite planet."[7-1] – Richard Duncan

Available supplies associated with the following critical economic resources and ecological resources are currently sufficient to enable our American way of life. Overwhelming evidence indicates that this will not long be the case, and that the inevitable result will be the end of our American way of life.

Impending resource limits, which have the capacity to trigger our Last Depression and our Societal Collapse, are highlighted below. In each case:

- The resource is critical to perpetuating our American way of life;
- The resource supply is "finite", either in an absolute sense in the case of nonrenewable natural resources, or in a practical sense in the case of pseudo purchasing power;
- Global demand for the resource is increasing;
- Supplies of the resource available to America are becoming increasingly scarce; and
- No viable substitutes for the resource exist.

7.1 Impending Limits to America's Pseudo Purchasing Power Supplies

"…if a country lives significantly beyond its means now, it is likely to have a lower standard of living in the future than would otherwise have been attainable. In recent years, we in the United States have arguably been spending beyond our means."[7-2] – Federal Reserve Bank of Boston

Approximately 68% of the goods and services that enable our American way of life are procured unsustainably using pseudo purchasing power—that is, by liquidating our previously accumulated economic asset reserves, incurring ever-increasing levels of intergenerational debt, or underfunding investments critical to our future wellbeing.

Unfortunately, our pseudo purchasing power supplies are subject to limits: our economic asset reserves will become severely depleted, devalued, or exhausted; debt will become unaffordable, unavailable, or called-in; and/or the underfunded investments in our future wellbeing will become "due".

Reaching a pseudo purchasing power limit will cause a reduction in our societal purchasing power level, thereby reducing our total consumption level and our material living standards. Reaching a critical pseudo purchasing power limit will cause a significant and permanent reduction in our purchasing power level, total consumption level, and material living standards—it will trigger our Last Depression.

The following US pseudo purchasing power supplies are rapidly approaching limits that are capable of triggering our Last Depression. While it is impossible to know precisely when these limits will be reached, the relevant timeframe is almost certainly within the next 25 years.

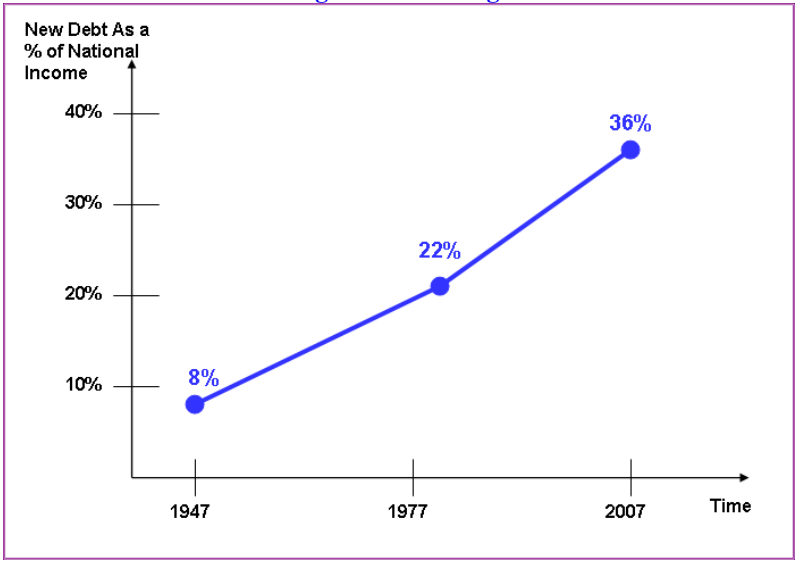
7.1.1 Limits to America's Purchasing Power Derived from Irreparable Debt

"Continuing on our current unsustainable fiscal path will gradually erode, if not suddenly damage, our economy, our standard of living, and ultimately our national security."[7-3] – David Walker, US Comptroller General of the United States

At the end of 2007, total US debt owed by all individuals, corporations, and governments stood at $49,882 billion.[7-4] This amount equaled 361% of our 2007 Gross Domestic Product (GDP),[7-5] the common measure of the size of our economy. To put this percentage into perspective, our total debt immediately prior to our "Great Depression" in 1929 stood at "only" 260% of our GDP.[7-6]

Our new debt incurred in 2007—incremental borrowing minus outstanding loan repayments—totaled $4,411 billion,[7-7] or 36% of our total national income.[7-8] In order to perpetuate our American way of life in 2007, we had to borrow 36 cents in addition to every dollar that we earned.

Annual US Net Borrowing as a Percentage of US National Income



And our borrowing levels are increasing continuously. US net borrowing as a percentage of our total income has increased steadily during this decade from 19.6% in 2000 to 36% in 2007. Our current borrowing level also far exceeds historical levels—our net borrowing as a percentage of our total income was 22% in 1977 and only 8% in 1947.[7-9]

It is obvious that neither our current annual borrowing level nor our current total debt level is sustainable; much less can they continue to increase. At some point in the not-too-distant future, our lenders will refuse to extend additional credit and/or refuse to continue to carry some or all of our existing debt. At that point we will experience a reduction in purchasing power equal to the amount of incremental debt denied plus the amount of existing debt called-in.

In the event that we experience a societal level "run on the bank", during which many of our creditors simultaneously refuse to extend additional credit and/or decide to call-in their existing loans, our multi-trillion dollar "debt bubble" will burst and our Last Depression will commence. Given our questionable financial status—the US is technically bankrupt[7-10]--and the fact that ever-increasing debt levels are an essential enabler of our American way of life, such an eventuality could easily occur any day.

7.1.2 Limits to America's Purchasing Power Derived from Underfunded Social Entitlement Programs

"…**the greatest threat to our fiscal health comes from unsustainable growth in entitlement programs such as Social Security and Medicare."**[7-11] – George W. Bush, President of the United States

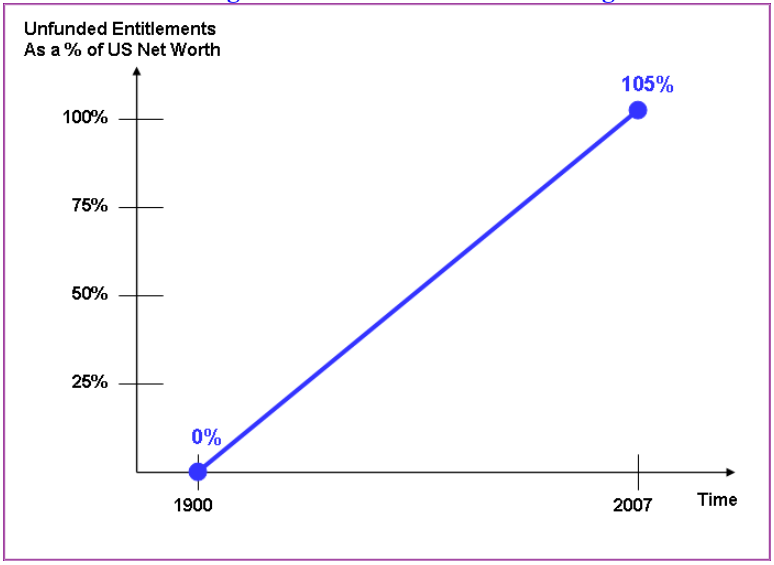
While touted as "trust funds", our "big three" social entitlement programs—Social Security, Medicare, and Medicaid—are actually "pay-as-you-go" programs, for which today's receipts are used to fund today's benefits—any surplus of receipts over disbursements is "borrowed" by the US Treasury and spent on other programs through the federal government's general fund.

So there is no accumulating pool of cash awaiting tomorrow's expectant entitlement program beneficiaries; there is only an accumulating pool of government IOUs.

Further, and even more discouraging, is the fact that the accumulating pool of IOUs—assuming the government ultimately repays them—plus the total projected payroll tax payments by tomorrow's workers, will fall far short of covering the total projected benefits promised to tomorrow's expectant beneficiaries.

In fact, the magnitude of our social entitlement "fiscal gap"—the present value of the total amount by which the three programs are currently underfunded—exceeded $77 trillion ($77,388)[7-12] at the end of 2007— $68 trillion of which was attributable to Medicare and Medicaid. And our $77+ trillion fiscal gap increases by $2.7 trillion every year that we fail to take action to eliminate it.[7-12]

Unfunded US "Big Three" Social Entitlement Obligations as a Percentage of US Net Worth



To put our $77 trillion fiscal gap into perspective, our total national net worth—the difference between the total assets and total liabilities associated with all US individuals, corporations, and governments—was only $73 trillion in 2007.[7-13] We could conceivably sell everything we own and still not be able to fully fund our future social entitlement obligations.

Our only options for resolving our social entitlement dilemma are to increase payroll taxes by over 100%, from 15.3% to 33.3% of earnings, immediately and forever;[7-14] to cut all social entitlement benefits by at least 50%, immediately and forever; to cut all non-entitlement federal government spending by 77.8%, immediately and forever;[7-15] or some combination thereof.

The inescapable consequence associated with our fiscal gap is a permanent and significant reduction in purchasing power—for future program beneficiaries, future workers, or future recipients of non-entitlement federal government spending. And the future starts now, as the 78 million "baby boomers" who expect to receive social entitlement benefits far in excess of their total contributions, begin to reach retirement age.[7-16]

The difference between cash receipts and cash disbursements for the Medicare Trust Fund (HI) was projected to go "cash negative" in 2008; the Social Security Trust Fund (OASDI) will go cash negative in 2017.[7-17] Beginning in 2009 for Medicare and in 2018 for Social Security, the government will no longer be able to "borrow" yearly trust fund surpluses, and must actually begin to repay its IOUs to the trust funds through borrowing, taxation, or printing money.

Going forward, as the actual net payout amount associated with the "big three" diverges increasingly from the projected net payout amount, purchasing power for a large portion of our population will erode continuously as entitlement benefits are reduced continuously and/or payroll taxes are increased continuously.

This persistent erosion in purchasing power associated with the unraveling of our social entitlement programs will be sufficient to trigger our Last Depression—in the not-too-distant future.

7.1.3 Other Limits to America's Pseudo Purchasing Power Supplies

"What we've got going here are the elements of a perfect storm, a potent mix of ignorance, apathy, and inaction throughout large parts of American society. Our current indifference to fiscal discipline and these other major challenges can't continue. If it does, a crisis isn't a matter of "if" but "when" and "how bad."[7-18] - David M. Walker, Comptroller General of the United States

US pseudo purchasing power supplies derived from secondary sources are also rapidly approaching limits. While reaching the limit to a secondary pseudo purchasing power supply is unlikely to trigger economic collapse by itself, the resulting purchasing power reductions will certainly hasten and exacerbate our Last Depression.

- **Net Sales of US Assets to Foreigners**—as recently as 1980, total foreign ownership of US assets stood at 3.1% of our total US asset base; by 2000, this percentage had increased to 9.9%; by 2007 it had soared to 17.6%.[7-19] Obviously we can sell only 100% of our assets; but foreign entities will obtain a controlling interest in the US long before we have sold out completely.
- **Other Underfunded Investments Critical to Our Future Wellbeing**
  - **Underfunded Pensions**—the total unfunded obligation associated with US government, state government, and corporate pension plans was approximately $5 trillion in 2006.[7-20]
  - **Aging Physical Infrastructure**—from airports to bridges to dams to the power grid to railroads to roadways to waterways, "America's Infrastructure GPA" is a "D", and the estimated cost to fix the problem is $2.2 trillion.[7-21]
- **Depleting and Devaluing Economic Assets**
  - **Devaluing US Currency**—using the year 1900 as a baseline, each US dollar provided $1 worth of purchasing power in 1900. By 1950, the purchasing power associated with each US dollar had declined to 33.3 cents—one third of its value in 1900. By 2007, the purchasing power of a US dollar had further declined to 4.6 cents, less than 5% of its value in 1900.[7-22] The continuous and significant erosion of our currency's value seriously undermines our viability both as an economic superpower and as a solvent financial entity.
  - **Declining Home Equity**—in 1950, the total equity interest in American homes was 81.5% of total US real estate value; that is, the average American homeowner owned 81.5% of his or her home. By 1980, this percentage had declined to 68.5%, and by 2007 it had further declined to 47.5%—the average American homeowner now owns less than 50% of his or her home.[7-23] By "cashing out" the equity in our homes and by mortgaging our homes at, near, or over 100% of their value, we have seriously undermined the viability of America's primary long term investment.

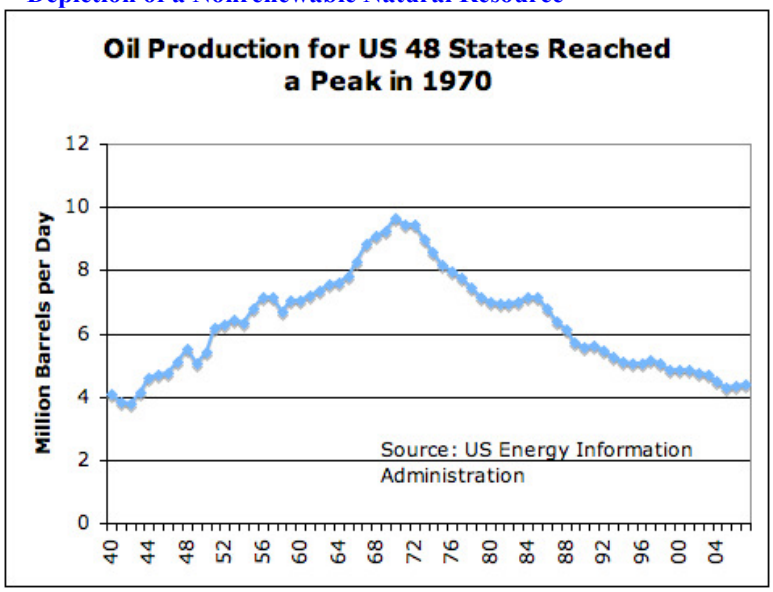
7.2 Impending Limits to America's Nonrenewable Natural Resource Supplies

"This shock is very different (from the oil shocks of the 1970s). It is driven by resource constraints, not politics. It is not a temporary interruption but the onset of a permanent new condition. The warning signals have been flying for a long time. They have been plain to see, but the world turned a blind eye and failed to read the message."[7-24] - Dr. Colin J. Campbell, founder of ASPO (Association for the Study of Peak Oil and Natural Gas)

Over 90% of the goods and services that enable our American way of life are produced unsustainably using nonrenewable natural resources—nonrenewable energy resources and nonrenewable mineral resources. Each of these natural resources is subject to an absolute geological limit—its supply is finite.

7.2.1 Nonrenewable Natural Resource Depletion

Depletion of a Nonrenewable Natural Resource



The depletion function associated with a nonrenewable natural resource approximates a bell curve.[7-25] The depletion function for US oil production, which peaked in 1970, offers a representative example.[7-26]

In a practical sense, the available supply associated with a nonrenewable natural resource experiences a period of "continuously more and more" leading up to its peak production level, followed by a period of "continuously less and less" after it reaches peak production. Specific production volumes and timeframes vary per resource, but the approximate bell-shaped depletion function is the same in all cases.

We are at the point in our history when several critical nonrenewable natural resources are at or near their peaks in terms of available supply. As the "peak" is passed in each case, the supply associated with the resource will decline continuously and remorselessly forever, thereby steadily reducing available supplies both globally and domestically.

7.2.2 "Peak Availability" of Nonrenewable Natural Resources to the US

The relevant natural resource peak supply level and post-peak decline rate from the US perspective are those that apply to us specifically, and are determined by several factors:

- The timing and level of global peak resource production, and the corresponding decline rate;
- The timing and level of domestic US peak resource production, and the corresponding decline rate;
- Global resource demand;
- US dependence upon resource imports;
- Continued exporter ability and willingness to export resources to the US; and
- Ease of resource "exportability".

Continuous reductions in the post-peak supplies of nonrenewable natural resources will result in increasing resource scarcity and lifestyle disruptions—some combination of population level and living standard reductions. The more critical the resource and the greater its post peak-decline rate, the greater will be the corresponding lifestyle disruptions.

7.2.3 Limits to America's Nonrenewable Natural Resource Supplies

While it is impossible to know with certainty the exact US peak supply date and post-peak decline rate associated with any nonrenewable natural resource, available data pertaining to resources that have already surpassed their peak production levels provide valuable insights.

This information offers compelling evidence that available US supplies associated with the following critical nonrenewable natural resources are rapidly approaching limits. A permanent supply shortfall associated with any of these resources has the capacity to trigger our Societal Collapse.

7.2.3.1 Limits to America's Oil Supply

"Shell estimates that after 2015 supplies of easy-to-access oil and (natural) gas will no longer keep up with demand."[7-27] – Jeroem van de Veer, CEO of Shell Oil Company

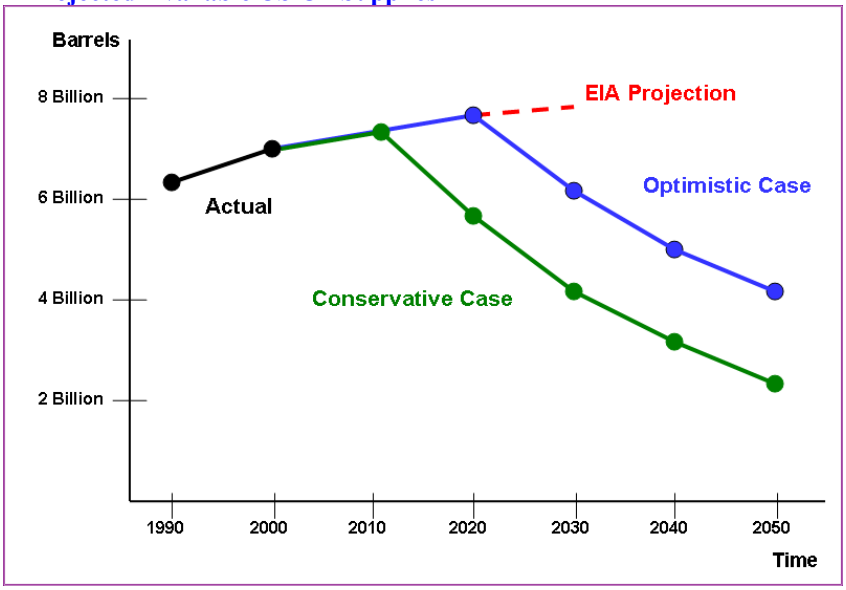
In 2007, the US used over 7.5 billion barrels of oil[7-28], 66% of which was imported.[7-29] Although our population represents less than 5% of the world total, we consumed nearly 25% of the 2007 world oil supply.[7-30] Oil supplied over 39% of our primary energy[7-31] and over 97% of our transportation fuel during the year.[7-32]

The US Energy Information Administration (EIA) expects annual US demand for oil to increase from 7.5 billion barrels in 2007 to 7.9 billion barrels in 2030—an increase of 5%;[7-29] they forecast annual global demand to increase from approximately 31.5 billion barrels in 2007 to 41 billion barrels in 2030—an increase of over 30%.[7-30] They further assume that supply will be sufficient to meet demand—it will not even come close.

Global oil supply has plateaued between 31 and 32 billion barrels per annum, as increasing supplies from countries with incremental production capacity are barely able to offset declining supplies from countries already past peak production.[7-33] Under the most optimistic scenario, the supply plateau might maintain a slight upward bias over the next ten years and peak at approximately 35 billion barrels per year. It is equally likely, however, that global oil production will never exceed 32 billion barrels annually.[7-33]

The supply of oil available to the US, most of which is imported, has also plateaued at approximately 7.5 billion barrels per year, as nonconventional sources—offshore, deep water, natural gas plant liquids, tar sands, heavy oil, and biofuels—temporarily displace declining sources of conventional onshore crude. It is unlikely that the total supply of oil available to the US will ever increase again, given ever-increasing demand by emerging nations with ample foreign exchange and ever-decreasing amounts of surplus oil available from traditional exporting countries.[7-33]

Projected Available US Oil Supplies



US oil supply is likely to begin its terminal decline sometime between 2011 and 2020, from a peak of 7.5 to 7.7 billion barrels annually, at an average annual rate of between 2% and 3% per year.[7-33] By 2030, our available supply of oil will probably range between 4.2 and 6.3 billion barrels, far below the EIA's projection of 7.9 billion barrels, and far below the level required to perpetuate our American way of life.[7-33]

7.2.3.2 Limits to America's Natural Gas Supply

"Gas production has peaked in North America."[7-34] – Lee Raymond, CEO of ExxonMobile Corporation

In 2007, the US used over 23 trillion cubic feet of natural gas,[7-35] 21% of the world total,[7-36] of which approximately 16% was imported—mostly from Canada.[7-35] Natural gas supplied over 23% of our primary energy in 2007,[7-37] providing heat to 51% of all US homes (70% of newer US homes)[7-38] and generating 17% of our electricity during the year.[7-39]

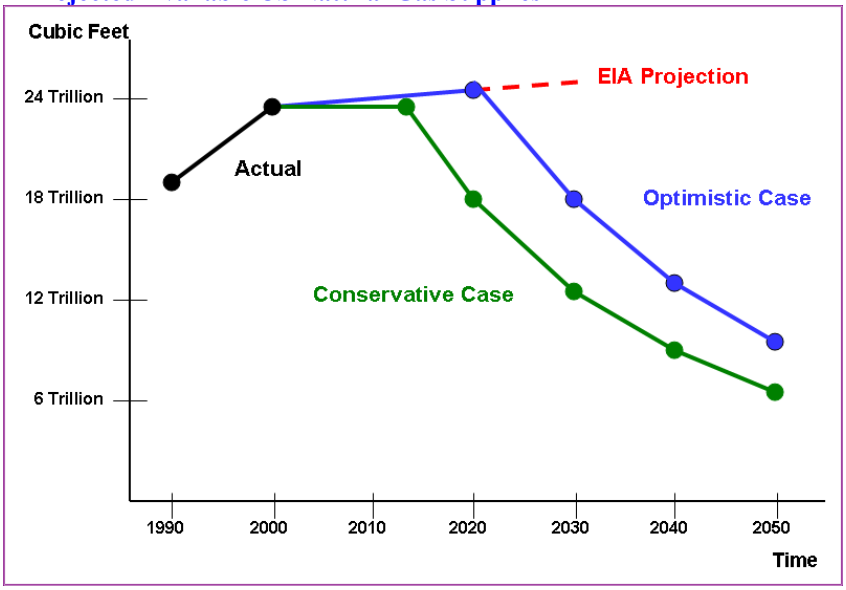
The US Energy Information Administration (EIA) expects annual US demand for natural gas to increase from 23.05 trillion cubic feet in 2007 to 24.4 trillion cubic feet in 2030—a 6% increase;[7-35] they forecast annual global demand to increase from approximately 110 trillion cubic feet in 2007 to 158 trillion cubic feet in 2030—an increase of 44%.[7-36] They also assume that supply will be sufficient to meet demand—it will not be in the case of the US.

The potential for additional growth in worldwide natural gas production still exists over the next decade or so, as new fields are brought online in the Middle East, Asia, and Africa. Annual global natural gas production could reach or exceed 140 trillion cubic feet in 2025, before going into terminal decline.[7-40]

The annual supply of natural gas available to the US has plateaued, however, in the 23-24 trillion cubic feet range, and is unlikely to exceed 25 trillion cubic feet ever again.[7-40] Domestic US production has peaked, as has that of Canada—and our ability to import natural gas from overseas is extremely limited. Unlike oil, which is easily transported internationally via tanker ship, natural gas is difficult and expensive to transport except by pipeline.[7-40] We are therefore unable to import large quantities of natural gas from countries other than Canada, even though global supplies may remain relatively plentiful for the next 10-15 years.

Under the most optimistic circumstances, our natural gas plateau might be maintained for another decade, as nonconventional domestic sources such as coal bed methane, tight sands, gas shales, and offshore fields temporarily offset our declining supplies of conventional onshore natural gas.[7-40]

Projected Available US Natural Gas Supplies



Our available supply of natural gas is likely to go into terminal decline, however, sometime between 2013 and 2020, from a peak of 23.5 to 24.2 trillion cubic feet per annum, at an average annual rate of 3% to 4.5%.[7-40] By 2030, our available supply of natural gas will probably range between 12.8 and 17.8 trillion cubic feet, far below the EIA;s projection of 24.4 trillion cubic feet, and far below the level required to perpetuate our American way of life.[7-40]

7.2.3.3 Limits to America's Coal Supply

"…it is very likely that bituminous coal production in the US has already peaked, and that total (volumetric) coal production will peak between 2020 and 2030."[7-41] – The Energy Watch Group

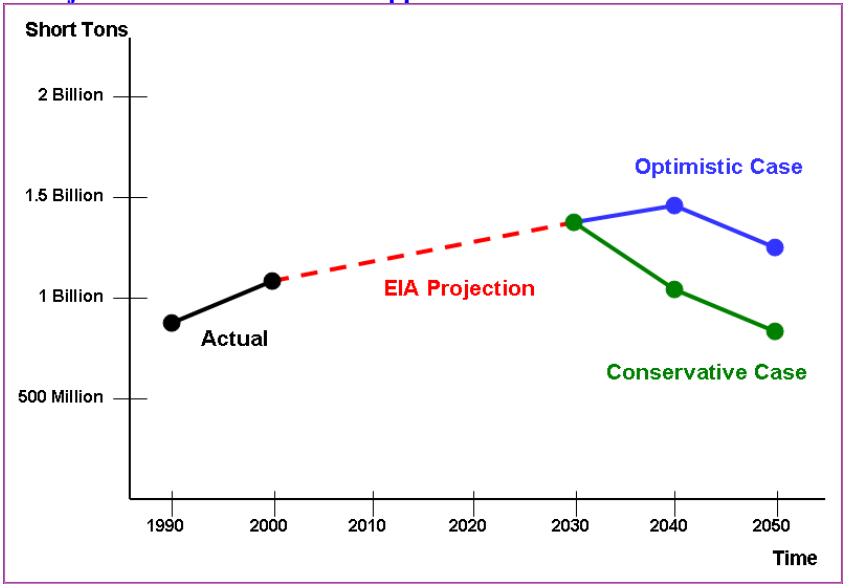
In 2007, the US used over 1,100 million short tons of coal,[7-42] approximately 16.5% of the world total,[7-43] most of which was extracted domestically. Coal supplied almost 23% of our primary energy,[7-44] generating 51% of our electricity during the year.[7-45]

The US Energy Information Administration (EIA) expects annual US demand for coal to increase from 1,129 million short tons in 2007 to 1,358 million short tons in 2030—an increase of 20%;[7-42] they project annual global demand to increase from approximately 6,900 million short tons in 2007 to 10,590 short tons in 2030—an increase of 53%.[7-43] As is the case with oil and natural gas, they assume that coal supply will be sufficient to meet demand—it may be in terms of volume, but it is doubtful that the US coal supply will meet demand in terms of "energy content".

On a global level, coal is likely to be the last of the three fossil fuels to reach peak production, although "peak coal" will occur much sooner than historically projected.[7-46] Despite past projections of hundreds or even thousands of years of remaining coal reserves, global peak coal production is likely to occur between 2025 and 2035, at between 8,500 and 11,000 million short tons.[7-46]

While the US ranks first in terms of coal reserves worldwide, our remaining reserves must be understood in terms of their quality as well as their quantity. US anthracite production peaked in 1914, US bituminous production peaked in 1990, and US coal production peaked in terms of "energy content" in 1998.[7-46] While we will certainly extract larger volumes of domestic coal over the coming decades, the mix will shift increasingly toward lower quality subbituminous and lignite. We will be required to extract increasingly greater amounts of coal to achieve the same amount of usable energy.

Projected Available US Coal Supplies



It is likely that US peak volumetric coal production will occur after global peak production—between 2030 and 2040—at 1,350 and 1,450 million short tons; post-peak production should decline at an annual rate of 1.5% to 2.5% thereafter.[7-46] While our available coal supply in 2030 should be sufficient to meet EIA projections, it is questionable whether the heat content associated with that coal will be sufficient to satisfy our 2030 energy requirements.[7-46]

7.2.3.4 Limits to America's Non-energy Mineral Supplies

"…we were greatly surprised to find that approximately three-fourths of the metals have apparently already peaked in production rate in the United States and one-fourth of the world metals have peaked."[7-47] – Dr. David Roper, author of "Where Have All the Metals Gone?"

The US uses a vast array of minerals and metals to produce and provision the goods and services that enable our American way of life. While no single non-energy mineral appears to be as critical to perpetuating our existing lifestyle paradigm as the three fossil fuel energy resources—oil, natural gas, and coal—a permanent shortfall in the available supply of any critical non-energy mineral will contribute significantly toward our Societal Collapse.

In 2007, the US imported 100% of 19 critical minerals, between 50% and 99% of 23 more, and between 1% and 49% of 17 more.[7-48] Some of these minerals are used in critical high technology applications; others are available only from a limited number of sources, some of which are potentially adversarial; others have no viable substitutes in one or more critical applications; and others can be considered "scarce" in the sense that global peak production has already occurred or remaining global reserves will last for less than 50 years at current usage rates.[7-49]

US Critical Mineral Profiles

Mineral	Percent Imported	Hi-Tech Applications	Limited or Unreliable Sources	Viable Substitutes	Scarce
Aluminum	26%	Yes			
Bauxite	100%	Yes	Yes	No	
Cadmium	N/A	Yes		No	Yes
Chromium	62%	Yes	Yes	No	Yes
Cobalt	78%	Yes	Yes	No	
Copper	37%	Yes			
Diamond	88%	Yes	Yes		
Fluorspar	100%				
Gallium	99%	Yes	Yes	No	Yes
Germanium	>80%	Yes		No	Yes
Gold	N/A	Yes			Yes
Graphite	100%	Yes	Yes	No	
Indium	100%	Yes	Yes	No	Yes
Lead	N/A	Yes		No	Yes
Lithium	>50%	Yes	Yes		
Magnesium	57%	Yes	Yes		
Manganese	100%	Yes	Yes	No	Yes
Nitrogen (Ammonia)	44%			No	
Nickel	17%	Yes			
Niobium	100%	Yes	Yes	No	Yes
Phosphate Rock	17%		Yes	No	Yes
Platinum Group	94%	Yes	Yes	No	Yes
Potash	81%		Yes	No	Yes
Quartz	100%	Yes			
Rare Earths	100%	Yes	Yes	No	
Rhenium	86%	Yes	Yes	No	Yes
Selenium	N/A	Yes			Yes
Silicon	56%	Yes	Yes		
Silver	56%	Yes			Yes
Strontium	100%	Yes		No	
Sulfur	24%			No	
Tantalum	100%	Yes	Yes	No	
Tellurium	N/A	Yes		No	Yes
Thallium	100%	Yes	Yes	No	Yes
Titanium	82%	Yes	Yes	No	
Tin	79%	Yes	Yes		Yes
Tungsten	70%	Yes	Yes	No	
Vanadium	100%	Yes	Yes	No	
Zinc	58%	Yes			Yes

As is the case with fossil fuel resource deposits, most of the large, high quality, and easily accessible non-energy mineral deposits have already been exploited, leaving only the smaller, lower quality, more expensive, and more energy-intensive deposits to meet future requirements. In the case of each preceding mineral, we are vulnerable not only to this immutable geological limit, but to an instantaneous human-induced limit caused by the unwillingness or inability of our current foreign suppliers to continue to meet our demands.

7.2.3.5 Limits to America's Food Producing Mineral Supplies

"According to Matthews, investors should focus on potash over oil or gold. Its production has peaked, and it is critical for food."[7-50] – Dr. Vince Matthews, Director of Colorado's Geological Survey

In conjunction with diesel powered farm equipment and petroleum based pesticides and herbicides, commercial fertilizers are fundamental enablers of the US "agricultural revolution", which has enabled us to feed our ever-increasing population an ever-expanding array of nutritional food products. The three primary components of commercial fertilizers are nitrogen, potassium, and phosphorous.[7-51]

- Fixed nitrogen from ammonia, 44% of which is imported, is derived from natural gas, which is at or near its domestic peak supply level.
- Potassium (potash), 81% of which is imported, peaked in terms of global production in 1989, and has no substitutes.
- Phosphorous (phosphate rock), 14% of which is imported, also peaked in terms of global production in 1989, and has no substitutes.

In the absence of commercial fertilizers, current US crop yields would decline by 30% to 50%, to levels far below those required to support our American way of life.[7-52]

7.3 Impending Limits to America's Other Critical Ecological Resource Supplies

"At the heart of this assessment is a stark warning. Human activity is putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted."[7-53] – United Nations "Millennium Ecosystem Assessment"

While our Societal Collapse will be triggered almost certainly by a permanent shortage or disruption in the supply of one or more critical nonrenewable natural resources, our persistent overexploitation of renewable natural resources and domestic natural habitats will contribute significantly to the severity associated with our permanent ecological contraction.

7.3.1 Limits to America's Renewable Natural Resource Supplies

While the US has been the fortunate beneficiary of substantial renewable natural resource reserves, we continue to utilize many of these resources at levels exceeding those at which Nature can replenish them. The consequence associated with this behavior is obvious.

- **Water Depletion**—approximately 200 trillion gallons of groundwater were depleted from US aquifers during the 20th century[7-54]—enough to fill over 8.3 billion backyard in-ground swimming pools.
- **Soil Erosion**—water and wind erosion on US soils during 2003 totaled over 1.7 billion tons—roughly equivalent to 350 million truckloads; 28% of US cropland was eroding above soil loss tolerance rates.[7-55]
- **Overfishing**—of the 267 major US fish stocks, 20% are either overfished, experiencing overfishing, or are approaching an overfished condition.[7-56]
- **Forest Loss**—the US lost over 4100 square miles of primary forest per year between 2000 and 2005—an area larger than Delaware and Rhode Island combined; we rank number 7 worldwide in annual primary forest loss—worst among developed nations.[7-57]

7.3.2 Limits to America's Domestic Natural Habitats

Our waste emission levels have also consistently exceeded Nature's capacity to assimilate, the result being persistent net degradation of our domestic natural habitats. Given Nature's limited regenerative powers, the consequence associated with persistent habitat degradation is obvious as well.

- **Water Quality**—approximately 40% of US streams, 45% of US lakes, and 50% of US estuaries are not clean enough to support uses such as swimming.[7-58]
- **Air Quality**—2% of all US deaths can be attributed to air pollution.[7-59]

- **Soil Quality**—soil on the average US farm is 85% depleted of its essential nutrients as compared to 100 years ago.[7-60]
- **Fishery Quality**—approximately 23% of US estuarine areas are impaired for fishing or supporting marine species.[7-61]
- **Wetlands**—during the past four centuries, over half of all US freshwater and saltwater wetlands—more than 110 million acres (an area larger than California)—have been lost to development.[7-61]

Any of the preceding economic resource limits will trigger or exacerbate our Last Depression; any of the preceding ecological resource limits will trigger or exacerbate our Societal Collapse—and the sampling of impending limits discussed above is by no means all-inclusive. We are approaching countless limits to our dysfunctional, detritovoric resource utilization behavior; reaching any of them will cause catastrophic lifestyle disruptions or terminate our American way of life completely.

We could take self-limiting action through an ACR to avoid reaching an externally imposed limit—thereby implementing, in essence, a controlled societal collapse. Although devastating, an ACR would minimize the lifestyle disruptions associated with our inevitable transition to sustainability.

Because we not implement an ACR, however, our society will reach one or more limits to our unsustainable resource utilization behavior in the not-too-distant future, and collapse. We are the hapless perpetrators of our own demise: we are driving full speed on the self-chosen "industrialization" highway toward a minefield of lethal limits to our existing lifestyle paradigm; yet we are culturally incapable of stopping or of exiting from the highway.

Chapter 8: Facing Reality

"When confronted with ever-declining resources, the preservation of social order requires more and more cooperation, but individuals are genetically programmed to reduce cooperation and seek advantage. This genetic legacy sets up a positive feedback loop: declining common resources cause individuals to reduce cooperation even more, which reduces common resources even faster, which leads to collapse even faster."[8-1] – Jay Hanson

Even the most pessimistic assessments of our future typically end on a positive note. They conclude that while we are certainly on the road to disaster—ecologically, economically, or both—it is not too late to alter our course. If we choose immediately to become more responsible by making unpleasant—but not too unpleasant—and significant—but not too significant—changes in our behavior, we can still live happily ever after.

This is not one of those assessments—for America, there can be no happy ending.

Our American way of life is unsustainable; it must and will end, almost certainly within the next 25 years. While uncertainty exists regarding the precise timing and specific circumstances associated with our Societal Collapse, collapse is inevitable. We are, quite literally, the unwitting victims of our own success.

Responses to this reality will range from disbelief to panic; neither of these extreme responses is appropriate. The logical response is to acknowledge our predicament and its inevitable consequences, watch for warning signs of impending disaster, and attempt to prepare if you would choose to live in a post-collapse society.

8.1 The Real "Inconvenient Truth"

Most Americans believe that we are "exceptional"—both as a society and as a species. We believe that America was "ordained" through divine providence to be the societal role model for the world. And we believe that through our superior intellect, we can harness and even conquer Nature in our continuous quest to improve the material living standards associated with our ever-increasing population.

The truth is that our pioneering predecessors drifted, quite by accident, upon a veritable treasure trove of natural resources and natural habitats, which they wrested by force from the native inhabitants, and which we have persistently overexploited in order to create and perpetuate our American way of life. The truth is that through our "divine ordination" and "superior intellect", we have been persistently and systematically eliminating the very resources upon which our way of life and our existence depend.

We now find ourselves in a "predicament". We are irreparably overextended—living hopelessly beyond our means ecologically and economically—at a time when the supplies of many critical resources upon which we depend will soon be insufficient to enable our American way of life. We are about to discover that we are simply another unsustainable society subject to the inescapable consequence of our unsustainable resource utilization behavior—societal collapse.

8.2 Sustainable Lifestyle Attributes

Clearly of greatest concern to Americans who expect to be alive during the next several decades are the significant reductions in our lifestyle attributes that will accompany our Societal Collapse. While our maximum attainable population level and average material living standard at sustainability are impossible to know with certainty, reasonable estimates can be derived from existing data.

Recall from Chapter 3 that GFN Ecological Footprint Analysis data imply a sustainable US population level of approximately 220 million, assuming an average material living standard approximating that of Norway and Estonia today. However, because the EFA significantly understates the extent to which America is overextended, it also significantly overstates our sustainable population and living standard levels.

Societal Overextension Analysis data project a sustainable US population level of approximately 54 million, assuming an average material living standard approximating that of Kazakhstan and Cuba today. While the SOA does consider our overexploitation of nonrenewable natural resources and economic resources, it quite probably overstates our sustainable post-collapse population level and living standards as well—the SOA assumes a controlled transition to sustainability through an ACR, rather than an apocalyptic transition through societal collapse.

Perhaps the best estimate of our maximum sustainable post-collapse population level and material living standards can be derived from historical data. Three historical reference points are of interest in this regard: pre-agricultural (~10,000 BC), pre-Columbian (~1500 AD), and pre-industrial (~1800 AD).

- Archeological evidence confirms the existence of Amerindian settlements throughout the US dating back to 10,000 BC and earlier.[8-2] America was quite probably widely, although sparsely, settled at that time. Assuming an actual pre-agrarian US human population of 100,000 to 200,000, and assuming very optimistically that the US could support up to ten times that population range under optimum circumstances, the maximum sustainable US hunter-gatherer population is 1 million to 2 million.
- At the time of America's "discovery" by the Europeans in approximately 1500 AD, estimates of the Native American population north of Mexico ranged between 8 million and 12 million, with one estimate as high as 18 million.[8-3] Assuming that 90% of these North American inhabitants resided in today's United States, as is the case today,[8-4] the pre-Columbian American human population probably ranged between 7 million and 16 million, most of whom lived an agrarian existence.
- The official US Census counted 5.3 million US inhabitants in 1800 AD, which included whites and African slaves but not Amerindians. Assuming an additional 1-2 million remaining Native Americans at the time, the total number of human US inhabitants probably ranged between 6 million and 7 million in 1800, most of whom lived a non-mechanized agrarian existence.

Assuming that we reduce our population in the absence of excessive downside "overshoot", we should be able to maintain a post-collapse American agrarian population of 15-20 million for several decades or even centuries following our collapse. As we inevitably deplete our croplands and pasturelands of their remaining essential nutrients through over-farming, however, the US population will ultimately contract to between 1 million and 2 million hunter-gatherers.[8-5]

8.3 Warning Signs of Impending Disaster

As of March 2009, our American way of life is still "working"—supplies of the economic resources and ecological resources that we have increasingly overexploited during the preceding centuries still remain available at sufficient levels. Signs that this will not long be the case are becoming increasingly apparent.

We are experiencing increasingly frequent, severe, and protracted economic contractions, both nationally and globally; and we and competitor nations are engaged in continuous international conflicts and political maneuvering to ensure adequate future supplies of increasingly scarce resources.

Although these phenomena are certainly early warning signs of the disasters to come, they are not sufficiently severe to trigger our permanent economic and ecological contractions. Our Last Depression and our Societal Collapse cannot occur until our American way of life stops working—that is, when the available supply associated with a critical resource becomes "permanently insufficient" to enable our American way of life.

8.3.1 Signs of Imminent Last Depression

So long as sufficient supplies of pseudo purchasing power remain available, we will be able to "buy" economic recoveries following our periodic economic downturns—thereby deferring the onset of our Last Depression. Our Last Depression will occur only when we experience a permanent pseudo purchasing power shortfall—i.e., when a major source of pseudo purchasing power is no longer willing or able to support our continued fiscal imprudence.

Indicators that such a limit is being reached include:

- A global "run on the US bank"—domestic and foreign lenders refuse to extend additional credit and refuse to rollover our existing debt, which triggers an international cascade of US individual, corporate, and government defaults and bankruptcies.
- Hyperinflation—our federal government continues to implement policies that create currency rather than wealth; it ultimately "monetizes" its debt (the US Treasury borrows from the Federal Reserve Bank)—because credit from all other sources is either unavailable or too expensive—in order to fund its ever-burgeoning array of programs and deficits; the US dollar loses its status as the world's primary reserve currency, experiences significant devaluation, and ultimately collapses.
- Social entitlement program unraveling—the government attempts to close the ever-widening fiscal gap by continuously increasing payroll tax increases and/or reducing benefits; workers, beneficiaries, or both experience continuous and significant reductions in purchasing power and living standards.
- Private sector failure—the government assumes direct control over failing US financial institutions, corporations, pension funds, and other privately held physical and economic assets; government inefficiency and incompetence completely destroy any remaining asset value.
- Foreign control—foreign US debt holders exert increasing control over US economic resource utilization behavior at the government, corporate, and individual levels; they ultimately act collectively to "put us on a budget".
- Major physical infrastructure failure—historically underfunded investments in US critical support systems render them increasingly suboptimal and inefficient; physical infrastructure failure impairs the performance of our industrial mosaic.

8.3.2 Signs of Imminent Societal Collapse

So long as sufficient supplies of critical nonrenewable natural resources remain available, we will be able to produce sufficient life sustaining necessities to perpetuate our American way of life, thereby deferring the onset of our Societal Collapse. Our Societal Collapse will occur only when a permanent shortage or disruption in the supply of a critical nonrenewable natural resource permanently disenables our industrial mosaic.

Indicators that such a limit is being reached include:

- Persistent price increases—ever-increasing resource scarcity manifests itself in continuously rising “real” price levels; life sustaining necessities become unaffordable for an ever-increasing segment of the population.
- Rationing—as resource scarcity evolves into increasingly protracted shortages and disruptions, life sustaining necessities must be rationed.
- Industrial mosaic “sputtering”—the critical support systems comprising our industrial mosaic become increasingly less reliable and predictable; both the systems and our mosaic ultimately fail.
- Social upheaval—increasingly prevalent social unrest becomes more difficult to control as a confused, frustrated, and angry American mainstream becomes aware of our predicament and its inescapable consequences.

From the perspective of mainstream America and our “thought leaders”, both our Last Depression and our Societal Collapse will “arrive without warning” and will “catch us totally by surprise”. We will continue to misconstrue the early warning signs associated with our two impending disasters as “normal cyclical economic activity”.

Rather than sounding alarms and attempting to take meaningful mitigating action, we will instead persist in our futile attempts to remedy the consequences associated with our past overexploitive resource utilization behavior with ever-increasing levels of current and future overexploitive resource utilization behavior. These measures will, at best, defer our inevitable collapse—they will not “fix” that which cannot possibly be fixed.

8.4 Preparation Strategies

Your preparation strategy will depend upon your expectations regarding the nature of our Societal Collapse and our post-collapse society. Those who foresee a relatively gradual collapse scenario followed by relative peace and harmony, a “fizz”, will choose a benign preparation strategy. Those who foresee a catastrophic freefall followed by apocalyptic chaos, a “pop”, will employ a more aggressive preparation strategy.

Note that most Americans will not prepare at all, either because they believe that societal collapse is impossible, or because they believe that preparation is futile—i.e., tantamount to standing at ground zero during a nuclear blast and wearing sunglasses to protect ones eyes from the light.

For those who believe that your survival probabilities and living standards during and after our Societal Collapse will be optimized through some type of preparation, you might consider one of the following strategies.

- **Educate Yourself**: learn where and how to secure, produce, obtain, and/or create sufficient life sustaining necessities—clean water, food, energy, shelter, and clothing—to last for the remainder of your life, in the complete absence of any output from our industrial mosaic. The upside to survival awareness is that you will be self-sufficient; the downside is that you will be competing for dwindling supplies of remaining resources with 300+ million desperate and hungry Americans—at least for the short term.
- **Store Provisions**: stock sufficient life sustaining necessities to enable your survival for at least several months. The upside to a resource storehouse is that it will provide a buffer during the onset of difficult times; the downside is that some of the 300+ million desperate and hungry Americans will almost certainly find you and your storehouse, and attempt to remove its contents by force.

- **Arm Yourself**: stockpile guns and other weapons in order to protect yourself from the 300+ million desperate and hungry Americans. The upside to armaments is that you will be able to defend yourself; the downside is that you will eventually run out of bullets, encounter somebody with a bigger gun, or sleep.
- **"Relocalize" into a Self-sufficient Community**: this is the group living strategy employed by those who expect a "fizz" type collapse and post-collapse scenario. The upside is that you and your self-sufficient companions will be capable of obtaining and producing your life sustaining necessities for an indefinite period of time; the downside is that those lacking such capabilities will find you, and your community will be an easy target.
- **Erect a Compound**: this is the group living strategy employed by those who expect a "pop" type collapse and post-collapse scenario. The upside is that you and your trustworthy companions will be temporarily self-sufficient; the downside is that you will be subject to attack both from the outside, by the 300+ million desperate and hungry Americans, and from the inside, by your trustworthy companions.
- **Stay Mobile**: travel, scavenge, and maintain a low profile during the collapse until the initial major die-off from thirst and starvation, which should occur within the first month or so in a "pop" collapse scenario. The upside is that you will be a moving target, more difficult to hit than a stationary target; the downside is that you may still succumb to the initial die-off, due to a lack of sufficient remaining resources, or to the second major die-off resulting from disease epidemics spread by initial die-off victims.

You would do well, in any event, to keep your survival strategy and its particulars to yourself—and remember that "human decency" is directly proportional to resource availability.

"The American way of life is not negotiable."[8-6] – President George H. W. Bush

"George who?" – Nature

Appendix A: Additional Information

A.1 Official Information

The following websites provide "official" statistical information and forecasts pertaining to ecological and economic resources and issues.

- US Department of Agriculture: http://www.usda.gov/wps/portal/usdahome
- US Census Bureau: http://www.census.gov/
- Congressional Budget Office (CBO): http://www.cbo.gov/
- US Bureau of Economic Analysis (BEA): http://www.bea.gov/
- US Energy Information Administration (EIA): http://www.eia.doe.gov/
- International Energy Agency/Agency (IEA): http://www.iea.org/
- US Environmental Protection Agency (EPA): http://www.epa.gov/
- US Federal Reserve: http://www.federalreserve.gov/
- US Geological Survey (USGS): http://www.usgs.gov/
- United Nations Statistics Division: http://unstats.un.org/unsd/default.htm
- Statistical Abstract of the United States: http://www.census.gov/compendia/statab/
- US Department of the Treasury: http://www.ustreas.gov/
- The World Factbook (US CIA): https://www.cia.gov/library/publications/the-world-factbook/

A.2 Other Information

The following websites provide news, statistics, analyses, and perspective on critical ecological and economic resources and issues that often receive incomplete or biased coverage by the American mainstream media.

- Al Jazeera: http://english.aljazeera.net/
- Almost Daily Rant: http://rainman.typepad.com/almost_daily_rant/
- Alternet: http://www.alternet.org/
- American Free Press: http://www.americanfreepress.net/
- Angry Bear: http://angrybear.blogspot.com/
- Anonymous Monetarist http://anonymousmonetarist.blogspot.com/
- Ashes Ashes All Fall Down: http://ashizashiz.blogspot.com/
- Asia Times: http://www.atimes.com/
- Association for the Study of Peak Oil and Gas (ASPO): http://www.peakoil.net/
- The Automatic Earth: http://theautomaticearth.blogspot.com/
- The Big Picture: http://www.ritholtz.com/blog/
- Boom2Bust: http://www.boom2bust.com/
- Calculated Risk: http://www.calculatedriskblog.com/
- Charles Goyette http://www.charlesgoyette.com/
- China Daily: http://www.chinadaily.com.cn/
- Clusterfuck Nation: http://jameshowardkunstler.typepad.com/
- Clusterstock: http://clusterstock.alleyinsider.com/
- The Coming Depression: http://thecomingdepression.blogspot.com/
- Commodity Online http://www.commodityonline.com/
- Counter Punch: http://counterpunch.com/
- Crossing Wall Street: http://www.crossingwallstreet.com/
- Cryptogon: http://cryptogon.com/
- The Daily Bail: http://dailybail.com/home/
- Daily Mail: http://www.dailymail.co.uk/home/index.html
- Decline and Fall of Western Civilization: http://declineandfallofwesterncivilization.blogspot.com/

- The Energy Bulletin: http://www.energybulletin.net/
- Eye No Stuff: http://eyenostuff.blogspot.com/
- Financial Armageddon: http://www.financialarmageddon.com/
- The Guardian: http://www.guardian.co.uk/
- The Independent: http://www.independent.co.uk/
- Infectious Greed: http://paul.kedrosky.com/
- InflationData.com http://inflationdata.com/inflation/
- Info Wars: http://www.infowars.com/
- In These Times http://inthesetimes.com/
- Life After the Oil Crash (LATOC): http://www.lifeaftertheoilcrash.net/breakingnews.html
- Market Harmonics: http://www.market-harmonics.com/
- The Market Ticker: http://market-ticker.org/
- Market Watch: http://www.marketwatch.com/
- Mineral Information Institute (MII): http://www.mii.org/
- Minyanville: http://www.minyanville.com/
- Mish's Global Economic Trend Analysis: http://globaleconomicanalysis.blogspot.com/
- Money and Markets: http://www.moneyandmarkets.com/
- Moon of Alabama: http://www.moonofalabama.org/
- The Motley Fool http://caps.fool.com/blogs/
- MuseLetter: http://www.richardheinberg.com/museletter
- Oil Depletion Analysis Centre (ODAC): http://www.odac-info.org/
- The Oil Drum: http://www.theoildrum.com/
- Online Journal http://onlinejournal.com/
- Open Secrets: http://www.opensecrets.org/
- Shadow Government Statistics: http://www.shadowstats.com/
- SmallGovTimes: http://www.smallgovtimes.com/
- Some Assembly Required http://ckm3.blogspot.com/
- Strike at the Root: http://www.strike-the-root.com/
- The Telegraph: http://www.telegraph.co.uk/
- Truthdig http://www.truthdig.com/
- When Giants Fall: http://www.economicroadmap.com/
- World Clock: http://www.poodwaddle.com/worldclock.swf

Appendix B: Glossary

American Cultural Revolution (ACR): the only rational solution to our "predicament" (societal overextension), in which we choose to transition voluntarily and beginning immediately, to a sustainable lifestyle paradigm by the year 2034; involves fundamental changes to both our worldview and resource utilization behavior, whereby we elect live sustainably within our means ecologically and economically, forever.

American Exceptionalism: a culturally-ingrained American self-perception whereby we consider ourselves to be superior to the people of other societies and to other living species.

American Way of Life: 300+ million people enjoying historically unprecedented material living standards; presumed by mainstream America to be an inalienable birthright.

Available Resource Supply: the total amount of an ecological resource or an economic resource accessible to a society at a given time, irrespective of the society's current or future requirements for that resource.

Critical Ecological Resource: a renewable natural resource, a nonrenewable natural resource, or a natural habitat that enables the sufficient supply of one or more life sustaining necessities—water, food, energy, shelter, or clothing—to a society's population, and for which there is no viable substitute. A permanent shortfall in the supply of a critical ecological resource is equivalent to a permanent shortfall in the supply of a critical nutrient for a living organism—the organism dies, even if supplies of other enabling nutrients remain plentiful.

Critical (Resource) Threshold: the level at which the available supply of an ecological resource or an economic resource just equals its subsistence level—i.e., the absolute minimum resource supply necessary to perpetuate a society's existing lifestyle paradigm. In any society, when a resource supply drops permanently below its critical threshold—a resource shortfall—lifestyle disruptions will result. In the case of the US, when a critical economic resource supply drops permanently below its critical threshold, our Last Depression will occur; when a critical nonrenewable natural resource supply drops permanently below its critical threshold, our Societal Collapse will occur.

Culture: the societal attributes that determine the society's worldview and its resource utilization behavior—including its value system, beliefs, traditions, norms of behavior, customs, and habits.

Culture—American: a culture of persistent resource overexploitation, within which we live increasingly beyond our means both ecologically and economically; an inherently overexploitive culture.

Detritovoric: in human terms, dysfunctional resource utilization behavior in which a society's population systematically eliminates the resources upon which the society's way of life and existence depend.

Ecological Footprint Analysis (EFA): a method for determining the extent to which a society's resource utilization behavior, population level, and material living standards are sustainable or unsustainable—i.e., the extent to which the society's population is living within its means ecologically; the EFA is optimally suited for non-industrialized societies.

Ecological Resource: a raw material (natural resource) or waste repository (natural habitat) that enables human economic activity—that is, the production, provisioning, and utilization of manmade goods and services—in an industrialized society; also, a fundamental enabler of human existence in all societies.

Ecological Resource Overexploitation: persistent utilization of natural resources at levels exceeding those at which they can be replenished by Nature, and persistent degradation of natural habitats at levels exceeding those at which they can be regenerated by Nature.
Economic Activity: the processes—production, provisioning, and utilization—by which the population in an industrialized society obtains and uses natural resources and the manmade goods and services derived from those natural resources.

Economic Contraction: traditionally, a cyclical economic phenomenon characterized by a temporary reduction in societal purchasing power, which results in temporary material living standard reductions for some or all of the society's population; an economic recession or depression.

Economic Resource (Purchasing Power): the capacity to procure natural resources and the manmade goods and services derived from those resources; economic resource sources are income, debt, and economic asset depletion; in the US, purchasing power is denominated in UDS ($).

Economic Resource Overexploitation: a society's persistent depletion of previously accumulated economic asset (wealth) reserves; persistent assumption of incremental intergenerational debt, and persistent underfunding of investments critical to future wellbeing; fiscal imprudence.

Energy Return on Energy Invested (ERoEI): the ratio of the total amount of energy obtained from a process to the total amount of energy used in the process of obtaining that energy (Energy Obtained: Energy Used); also Energy Return on Investment (EROI).

Industrialized Society: a post-agrarian society characterized by extensive reliance upon nonrenewable natural resources, pseudo purchasing power, automation, and mass production to continuously improve societal wellbeing—i.e., to continuously increase population levels and material living standards.

Industrial Mosaic: the complex of interdependent yet independently operating human and non-human entities, systems, and processes that convert natural resource inputs into the broad array of manmade goods and services that enable an industrialized society's way of life.

Last Depression—American: a permanent economic contraction characterized by significant, permanent, and society-wide demand destruction, caused by a permanent decrease in aggregate purchasing power; will result in permanent reductions in our total consumption level and material living standards.

Lifestyle Attributes: a society's population level and average material living standard.

Lifestyle Paradigm: a society's "way of life" or living arrangement, characterized by its population level and average material living standard.

Life Sustaining Necessity: a basic commodity that is essential to the survival of a society's population—i.e., clean water, food, energy, shelter, and clothing.

Limit: see "Resource Limit".

Material Living Standard: in the SOA, a society's average annual per capita consumption level, denominated in USD ($); in the EFA, a society's per capita ecological footprint.

Natural Habitat: an area of land, water, or atmosphere that supports life; also a "sink" or repository for wastes generated by humans and other living species.

Natural Resource: an organic or inorganic substance that supports life; also a “source” or raw material input to human economic activity.

Nature: the inestimable number of physical, chemical, and biological processes and phenomena that define the physical world in which we live; neither consciousness nor a physical manifestation is attributed to “Nature”.

Nonrenewable Natural Resource: an organic or inorganic substance—such as oil, natural gas, coal, minerals, and metals—which Nature does not replenish from the perspective of a human lifetime.

Predicament—American: irreparable societal overextension—living hopelessly beyond our means ecologically and economically, at a time when available supplies associated with many of the critical resources upon which we depend will soon be insufficient to enable our American way of life; the unintended but inevitable consequence associated with our distorted worldview and our detritovoric resource utilization behavior.

Pseudo Purchasing Power: the capacity to procure natural resources and the manmade goods and services derived from those resources through fiscal imprudence—that is, by liquidating previously accumulated economic asset reserves, by incurring ever-increasing levels of intergenerational debt, and by underfunding investments critical to our future wellbeing; enables a society to increase its immediate total consumption level by living off the past, living off the future, or by shortchanging the future; unsustainable economic resource utilization behavior.

Real Purchasing Power: the capacity to procure natural resources and the manmade goods and services derived from those resources by using the portion of currently earned income that is properly allocable to current consumption; sustainable economic resource utilization behavior.

Renewable Natural Resource: an organic or inorganic substance such as water, croplands, grazing lands, wildlife, and forests, the reserves of which are periodically replenished by Nature.

Resource (Sufficiency) Limit: the point at which the available supply of an ecological resource or an economic resource drops permanently below its subsistence level—i.e., the available resource supply becomes insufficient to perpetuate a society’s existing lifestyle paradigm. Reaching a resource limit will cause lifestyle disruptions in any society. In the case of the US, reaching a critical economic resource limit will trigger our Last Depression; reaching a critical nonrenewable natural resource limit will trigger our Societal Collapse.

Resource Return on Investment (RROI): the ratio of the total amount of resources obtained from a process to the total amount of resources used in the process of obtaining those resources (Resources Obtained: Resources Used).

Resource Shortfall: a permanent shortage or disruption in the available supply of an ecological resource or economic resource, which results when the available supply of the resource drops permanently below its critical threshold—i.e., the level at which the available supply of an ecological resource or an economic resource just equals its subsistence level—either through a permanent supply shortage or through a permanent supply disruption. A resource shortfall will cause lifestyle disruptions in any society. In the case of the US, a resource shortfall associated with a critical economic resource will trigger our Last Depression; a resources shortfall associated with a critical nonrenewable natural resource will trigger our Societal Collapse

Resource Utilization Behavior: the mix and levels of ecological resources and economic resources used by a society’s population; a society’s resource utilization behavior is governed by resource availability and by the society’s worldview.

Resource Utilization Behavior—American: detritovoric resource utilization behavior characterized by our systematic elimination of the resources upon which our American way of life and our very existence depend.

Societal Cognitive Dissonance (SCD): avoidance on a mass scale—through denial, rationalization, or faith-based justification—of an unpleasant reality that runs counter to the society's prevailing worldview or conventional wisdom; refusal to consider challenges to the prevailing worldview despite overwhelming countervailing evidence.

Societal Collapse: a permanent ecological contraction characterized by significant, permanent, and society-wide supply destruction, caused by a permanent shortage or disruption in the supply of one or more critical resources upon which the society depends; results in an uncontrolled, apocalyptic transition to sustainability.

Societal Overextension—American: living hopelessly beyond our means ecologically and economically at a time when available supplies associated with many of the critical resources upon which we depend will soon be insufficient to enable our American way of life; our "predicament".

Societal Overextension (Overextension): a condition in which a society is living beyond its means ecologically and economically; the significant consequence associated with societal overextension is that the society's population level and material living standards exceed sustainable levels.

Societal Overextension Analysis (SOA): a method for determining the extent to which a society's resource utilization behavior, population level, and material living standards are unsustainable—i.e., the extent to which the society's population is living beyond its means ecologically and economically; optimally suited for industrialized societies such as that of the US.

Societal Wellbeing: the material living standards enjoyed by a human population; societal wellbeing is enabled by the mix and levels of ecological resources and economic resources utilized by the society.

Subsistence (Resource) Level: the absolute minimum supply of an ecological resource or an economic resource necessary to perpetuate a society's existing lifestyle paradigm at a given time; the lowest tolerable resource level.

Sufficient Resource Supply: an amount of an ecological resource or an economic resource available to a society at a given time that exceeds the absolute minimum supply necessary to perpetuate the society's existing lifestyle paradigm—i.e., a resource supply that exceeds its critical threshold.

Sustainable: can exist in perpetuity.

Sustainable Lifestyle Paradigm: a living arrangement—characterized by sustainable resource utilization behavior—in which a human population of a given size can exist in perpetuity at a given average material living standard.

Sustainable Resource Utilization Behavior: using a resource mix consisting entirely of domestic renewable natural resources, domestic natural habitats, and real purchasing power; and resource utilization levels involving no net depletion of natural resource reserves and no net degradation of natural habitats—ever.

Total Consumption Level: the dollar value of the natural resources and manmade goods and services produced and procured by a society over a defined period of time, typically one year (the primary Societal Overextension Analysis metric).

Total Procurement Level: the dollar value of the natural resources and manmade goods and services procured by a society over a defined period of time, typically one year; equals the real purchasing power level plus the pseudo purchasing power level (the Economic Overextension metric).

Total Production Level: the dollar value of natural resources and manmade goods and services produced domestically by a society over a defined period of time, typically one year; equals GDP (the Ecological Overextension metric).

Unsustainable: cannot exist in perpetuity.

Unsustainable Lifestyle Paradigm: a living arrangement—characterized by unsustainable resource utilization behavior—in which a human population of a given size cannot exist in perpetuity at a given material living standard.

Worldview: the manner in which a society's population views itself and its relationship with the populations of other societies and with Nature.

Worldview—American: our distorted belief that we can and will achieve perpetual population growth, living standard improvement, and economic growth through our ever-increasing use of the earth's "unlimited" ecological resources.

Endnotes

Introduction

(I-1) From "GeoDestinies" by Walter Youngquist, National Book Company, Portland, OR, 1997, pg. 486; originally from Meadows, D. H., et al., "Beyond the Limits - Confronting Global Collapse - Envisioning a Sustainable Future"; Chelsea Green Publishers, Post Mills, Vermont, 1992, pg. 300.
(I-2) Adapted from William Catton's "Overshoot", University of Illinois Press, Chicago, IL, 1982, in which he described our "predicament" in ecological terms; also considered here are the economic aspects and implications associated with our predicament.

Chapter 1

(1-1) From "Geodestinies" by Walter Youngquist, National Book Company, Portland, OR, 1997; pg. 158.
(1-2) The term "Nature", as used here, refers to the inestimable number of physical, chemical, and biological processes and phenomena that define the physical world in which we live; neither consciousness nor a physical manifestation is attributed to "Nature".
(1-3) Purchasing power is an attribute of societies such as the US that employ "money economies". Purchasing power enables the acquisition of natural resources and the manmade goods and services derived from those resources, through the transfer of currently earned income, previously earned income (savings), or the promise of future earned income (debt), rather than through the direct transfer of goods and services, as is the case in a "barter economy".
(1-4) For details regarding the relationship between resource overexploitation and societal collapse, see Jared Diamond's "Collapse-How Societies Choose to Fail or Succeed", Penguin Books, NY, NY, 2005; Joseph Tainter's "The Collapse of Complex Societies", Cambridge University Press, Cambridge, UK, 1988; and Richard Duncan's "The Olduvai Theory-Sliding Toward a Post-Industrial Stone Age", 1996 - http://www.dieoff.org/page125.htm.
(1-5) We have become extremely adept at increasing our immediate consumption level by living off the past, by living off the future, and by short-changing the future. We live off the past by depleting nonrenewable energy resource reserves, by depleting nonrenewable mineral reserves, and by depleting our accumulated economic asset (wealth) reserves. We live off the future by incurring ever-increasing amounts of intergenerational debt, by persistently "mining" renewable natural resource reserves, and by persistently degrading natural habitats. We short-change the future by underfunding investments in essential infrastructure, by underfunding social insurance and retirement programs, and by persistently eliminating life-enabling biodiversity.
(1-6) Between the years 1800 and 2007, our population level increased by 57 times—from 5.3 million to 302 million. During the same period, the size of our economy, as defined by annual US Gross Domestic Product (GDP), increased by over 1700 times—from $8 billion to $13.8 trillion (2007 dollars)! As a result, our average annual per capita GDP increased by a phenomenal 30 times—from $1,500 to $45,700 (2007 dollars)—despite our 57X growth in population! -http://www.measuringworth.com/.
(1-7) See pgs. 19-21 for details.
(1-8) The newly extractable levels of peaking nonrenewable natural resources and persistently "mined" renewable natural resources are declining and will continue to decline in absolute terms. Too, increasing internal use by traditional natural resource exporters, increasing natural resource demand by developing countries, and increasing husbanding by foreign owners of increasingly valuable natural resources will also continuously reduce the supplies of natural resources available to the US. Unfortunately, this supply-demand dynamic is occurring at a time when America's position as the undisputed "world superpower" is coming into question, as is our ongoing capacity to compete globally for resource supplies sufficient to perpetuate our American way of life. See Chapter 7 for details.
(1-9) Richard Duncan is one of many scholars who have argued compellingly that the collapse of industrial civilization is imminent—certainly by the middle of the 21st century; see "The Olduvai Theory-Sliding Toward a Post-Industrial Stone Age", 1996 - http://www.dieoff.org/page125.htm.

Chapter 2

(2-1) Duncan, Richard, "The Olduvai Theory: Sliding Towards a Post-Industrial Stone Age", 1996 - http://www.dieoff.org/page125.htm.
(2-2) For a general explanation of the cornucopian worldview see Wikipedia - http://en.wikipedia.org/wiki/Cornucopian; for a critical assessment of the cornucopian worldview see "The Cornucopian Fallacies" by Lindsey Grant - http://dieoff.org/page45.htm.
(2-3) On page 168 of "Overshoot", William Catton offers a general explanation of detritus ecosystems, in which organisms, detritovores, consume the finite food supply available within their habitat, bloom in the process, then crash (die-off) once the food supply becomes exhausted. He then goes on to explain detritovoric behavior as it pertains to humans, "It is therefore understandable that people welcomed ways of becoming colossal, not recognizing as a kind of detritus the transformed organic remains called "fossil fuels," and not noticing that Homo colossus was in fact a detritovore, subject to the risk of crashing as a consequence of blooming."; "Overshoot", page 169; also - http://dieoff.org/page15.htm.
(2-4) For an overview of the timing and circumstances associated with the original settlement of the US, see David Stannard's "American Holocaust – The Conquest of the New World", Oxford University Press, NY, NY, 1992; pgs. 9-11.
(2-5) A human generation is considered to be 25 years.
(2-6) "History of the Ancient World—Hunter-Gatherers", Peter Britton, 2007 - http://www.worldhistory.timemaps.com/ancient-history/hunter_gatherers.htm.
(2-7) Human life expectancy during the Upper Paleolithic (2.5 million BC to 10,000 BC) averaged approximately 33 years - http://en.wikipedia.org/wiki/Life_expectancy.
(2-8) The worldwide human population in 10,000 BC was approximately 4 million. Assuming that the same US percentage of worldwide population that existed in 1500 AD, 2.4%, also existed in 10,000 BC, the US human population in 10,000 BC was approximately 100,000 - http://delong.typepad.com/print/20061012_LRWGDP.pdf.
(2-9) Human life expectancy varied considerably during the agrarian epoch, ranging from 18 years, to the mid-20s, to approximately 36 years by the year 1800 (US) - http://en.wikipedia.org/wiki/Life_expectancy and - http://www-rcf.usc.edu/~shammas/hist350/u_s.htm.
(2-10) From "Demographics of the United States" - http://en.wikipedia.org/wiki/Demographics_of_the_United_States.
(2-11) For an explanation regarding the unsustainable nature of the agrarian lifestyle paradigm, see "Agriculture: Unsustainable Resource Depletion Began 10,000 Years Ago", Peter Salonius, 2008 - http://www.theoildrum.com/node/4628#more.
(2-12) Lawrence Smith estimates that 1.2 billion people currently reside in industrialized countries—a number that he expects to remain relatively constant through 2050; 1.2 billion is approximately 18% of today's 6.7 billion world population; from "Growth and Dispersal: A Planet on the Move", (The Population Institute), 2006 - http://www.populationinstitute.org/newsroom/pi-in-the-news/index.php?&id=47.
(2-13) Average human life expectancy in the top 139 countries worldwide (out of 221) exceeded 70 years during 2007; life expectancy in the top 15 countries exceeded 80 years; life expectancy in the US exceeded 78 years (from the CIA Factbook) - http://en.wikipedia.org/wiki/List_of_countries_by_life_expectancy.
(2-14) The vast majority of Americans have relied upon high school text books and Hollywood for their US history education—it is loosely based on a true story. The mainstream historical perspective is consequently naïve, simplistic, myth-based, faith-based, superficial, and generally misinformed. For a more realistic depiction of America's heritage, especially as it pertains to the relationship between European settlers, American pioneers, and Native Americans, see David Stannard's "American Holocaust". For a more realistic depiction of America's current "predicament" and its inevitable consequences, see William Catton's "Overshoot".
(2-15) Since the time of the Puritans, we have derived divine justification for our exploitive worldview and resource utilization behavior from the Bible: "And God said, Let us make man in our image after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth." Genesis 1:26

(2-16) Examples of European Settler and American pioneer self-bestowed justification for our exploitive worldview and resource utilization behavior abound; for a representative sample see John Winthrop's bio - http://en.wikipedia.org/wiki/John_Winthrop; John Cotton's sermon to Winthrop and his Puritans prior to their departure to the New World - http://www.spartacus.schoolnet.co.uk/USABmapM.htm; and the perspectives of Presidents Washington, Jefferson, and Jackson in David Stannard's "American Holocaust", pgs 119-124.
(2-17) Deborah Madsen offers an excellent explanation of the Puritan's view of American exceptionalism in "American Exceptionalism", pg 3 - http://books.google.com/books?hl=en&id=hOW1KB026LcC&dq=american+exceptionalism&printsec=frontcover&source=web&ots=i4rxAwjo5L&sig=aFA-SPBjbBcJS0moYd67XeH0ZYc&sa=X&oi=book_result&resnum=2&ct=result#PPA3,M1; see also the Wikipedia overview - http://www.google.com/search?hl=en&q=american+exceptionalism.
(2-18) See John Winthrop's "City upon a Hill" sermon: "wee shall finde that the God of Israell is among us, when tenn of us shall be able to resist a thousand of our enemies [Native Americans], when hee shall make us a prayse and glory, that men shall say of succeeding plantacions: the lord make it like that of New England: for wee must Consider that wee shall be as a Citty upon a Hill, the eies of all people are uppon us;" - http://www.mtholyoke.edu/acad/intrel/winthrop.htm; and notes 2-15 and 2-16 above.
(2-19) Estimated US nonrenewable materials (minerals) as a percentage of total US mineral utilization in the year 1800: US per capita mineral use in 1800 was ~1500 lbs. - http://www.mii.org/pdfs/Minerals1776vsToday.pdf. Total US energy consumption in 1800 was .47 quadrillion BTUs, all generated from biomass [wood] - http://www.eia.doe.gov/emeu/aer/txt/stb1701.xls. Given that the energy content of wood averages ~20 million BTUs per cord - http://hearth.com/econtent/index.php/articles/heating_value_wood, ~23.5 million cords of wood were used that year for "energy generation" purposes alone; this equates to ~4.43 cords/person on average, given an 1800 US population of 5.3 million - http://www.measuringworth.com/. A cord of hardwood weighs ~5000 lbs.; a cord of soft wood weighs ~3000 lbs - http://www.csgnetwork.com/logweight.html; assuming only 3,000 lbs./cord, the 4.43 cords/person equates to 13,300 lbs. of energy-related wood use per capita in 1800. The 13,300 lbs. figure does not include wood used for building and construction purposes; nor does it include agricultural material flows into the economy that year. Even so, the 1,500 lbs. of mineral use combined with the 13,300 lbs. of energy-related wood use produce a total of nearly 15,000 lbs. of material resources used per person in 1800, of which approximately 90% were renewable. It can be readily asserted that with the inclusion of "non-energy" wood use and agricultural material use, well over 90% of the material resources flowing into the US economy in 1800 were renewable; less than 10% were nonrenewable.
(2-20) Estimated US nonrenewable materials (minerals) as a percentage of total US mineral utilization in the year 2007: the 2006 percentage of renewable materials flowing into the US economy from the Wagner USGS study was ~5% (see "the Mineral Mountain" and pgs. 20-24); nonrenewables accounted for approximately 95% of the materials flowing into the US economy that year; "Economic Drivers of Mineral Supply", Lori Wagner et al., USGS, 2002 - http://pubs.usgs.gov/of/2002/of02-335/of02-335.pdf.
(2-21) Estimated US energy derived from nonrenewable sources as a percentage of total US energy use in the year 1800: 0%; .47 quadrillion BTUs (Quads) of total US energy consumption in 1800 (average of 1795 and 1805), all of which was derived from renewable primary energy sources (biomass) - http://www.eia.doe.gov/emeu/aer/txt/stb1701.xls.
(2-22) Estimated US energy derived from nonrenewable sources as a percentage of total US energy use in the year 2007: 93.3%; 101.6 Quads of total energy consumption, of which 94.8 Quads were derived from nonrenewable primary energy sources - http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_9.pdf.
(2-23) Estimated US pseudo purchasing power as a percentage of total US purchasing power in the year 1800: Total Purchasing Power equals Net Income plus Net Asset Liquidation plus New Debt; total US purchasing power in 1800 was ~$472 million ($432 million net income + $40 million new debt):

- 1800 National Income assumed to equal $432 million; BEA data indicate that National Income is typically approximately 90% of GDP - http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=43&ViewSeries=NO&Java=no&Request3Place=N&3Place=N&FromView=YES&Freq=Year&FirstYear=1929&LastYear=1947&3Place=N&Update=Update&JavaBox=no); 90% of 1800 GDP of $480 million is $432 million;
- 1800 Net Asset Liquidation assumed to equal $0;

- 1800 New Debt assumed to equal $40 million; year 1800 total US debt was approximately equal to year 1800 US GDP, per a chart in "America's Financial Joyride" - http://www.oftwominds.com/blogsept08/joyride9-08.html; US GDP increased by $40 million from 1799 to 1800 - http://www.measuringworth.com/, so new US debt in 1800 must have totaled approximately $40 million as well.

Total Pseudo Purchasing Power equals Net Asset Liquidation plus New Debt plus Underfunded Critical Investments; total US pseudo purchasing power in 1800 was $40 million:

- 1800 Net Asset Liquidation assumed to be $0;
- 1800 New Debt assumed to be $40 million (see above);
- 1800 Underfunded Critical Investments assumed to equal $0.

Total US Pseudo Purchasing Power as a percentage of Total US Purchasing Power in 1800 was ~8.5% ($40 million/$472 million.

(2-24) Estimated US pseudo purchasing power as a percentage of total US purchasing power in the year 2007: pseudo purchasing power accounted for over 68% of total US purchasing power in 2007; see pg. 19 for details.

(2-25) Estimated US total mineral utilization in the year 1800: per capita US mineral utilization in 1776 was about 1200 lbs./year - http://www.mii.org/pdfs/Minerals1776vsToday.pdf; I increased the per capita number to 1500 lbs. for the year 1800; so total US mineral utilization was 1500 lbs. times 5.3 million people, equals (3,975,000 tons) ~ 4 million tons.

(2-26) Estimated US total mineral utilization in the year 2007: per capita US mineral utilization in 2007 was ~46,270 pounds, per Mineral Industry Information, pg. 4 - http://www.mii.org/pdfs/Baby_Info.pdf; times 302 million people, equals (6.988 million tons) ~7,000 million tons total.

(2-27) Estimated US total energy use in the year 1800: .47 quadrillion BTUs; US EIA, "Estimated Primary Energy Consumption in the United States, Selected Years, 1635-1945" - http://www.eia.doe.gov/emeu/aer/txt/stb1701.xls.

(2-28) Estimated US total energy use in the year 2007: 101.6 quadrillion BTUs; US EIA, "Primary Energy Consumption by Source" (2007 figures), Annual Energy Review 2007 - http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_9.pdf.

(2-29) Since the early/mid 20th century, we have resorted increasingly to fiscal imprudence, pseudo purchasing power, as a means of "augmenting" our immediately available supplies of natural resources and derived goods and services. By liquidating our previously accumulated economic asset reserves, incurring ever-increasing debt that we have neither the intention nor the capacity to repay, and continuously failing to fully fund investments critical to our future wellbeing, we have been able to substantially increase our annual total consumption level since that time.

(2-30) Picture life in the absence of any critical support system for a day, a week, a month—permanently…

(2-31) Estimated US total procurement level in the year 1800:

Total Procurement Level equals Net Income plus Net Asset Liquidation plus New Debt; the US total procurement level in 1800 was ~$472 million ($432 million of national income + $40 million in new debt):

- 1800 National Income assumed to equal $432 million; BEA data indicate that National Income is typically approximately 90% of GDP - http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=43&ViewSeries=NO&Java=no&Request3Place=N&3Place=N&FromView=YES&Freq=Year&FirstYear=1929&LastYear=1947&3Place=N&Update=Update&JavaBox=no); 90% of 1800 GDP of $480 million is $432 million;
- 1800 Net Asset Liquidation assumed to equal $0;
- 1800 New Debt assumed to equal $40 million; year 1800 total US debt was approximately equal to year 1800 US GDP, per a chart in "America's Financial Joyride" - http://www.oftwominds.com/blogsept08/joyride9-08.html; US GDP increased by $40 million from 1799 to 1800 - http://www.measuringworth.com/, so new US debt in 1800 must have totaled approximately $40 million as well.

US total procurement level in 1800 was $472 million in nominal dollars, or $7.792 billion ($7.8 billion) in 2007 USD (using GDP deflator), from Measuring Worth - http://www.measuringworth.com/.

(2-32) Estimated US total procurement level in the year 2007: $17,260 billion; see pg. 19 for details.

(2-33) Estimated US total production level (GDP) in the year 1800: $480 million nominal; $7,924 ($7.9 billion) in 2007 USD using the GDP deflator; from Measuring Worth - http://www.measuringworth.com/.

(2-34) Estimated US total production level (GDP) in the year 2007: $13,810 billion - "Flow of Funds Accounts of the United States", US Federal Reserve, 2008, table F.6 - http://www.federalreserve.gov/releases/z1/Current/annuals/a2005-2007.pdf.
(2-35) Estimated US population level in the year 1800: 5.3 million; from Measuring Worth - http://www.measuringworth.com/.
(2-36) Estimated US population level in the year 2007: 302 million; from Measuring Worth - http://www.measuringworth.com/.
(2-37) Estimated US average annual per capita consumption level (material living standard) in the year 1800: total consumption level (equals total procurement level) of $7.8 billion (2007 USD) divided by 5.3 million people, equals $1,472.
(2-38) Estimated US average annual per capita consumption level (material living standard) in the year 2007: total consumption level of $17,260 billion (see pg. 20 for details) divided by 302 million people, equals $57,152.

Chapter 3

(3-1) From "Overshoot" by William Catton, pg. 175.
(3-2) See The Global Footprint Network (GFN) for details regarding the Ecological Footprint Analysis - http://www.footprintnetwork.org/en/index.php/GFN/.
(3-3) From "Footprint Basics – Overview" - http://www.footprintnetwork.org/en/index.php/GFN/page/footprint_basics_overview/.
(3-4) From 2008 GFN Overshoot Data (Ecological Footprints and Biocapacities); click on "2008 Data Tables" - http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/.
(3-5) From 2008 GFN Overshoot Data (Ecological Footprints and Biocapacities); click on "2008 Data Tables" - http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/.
(3-6) This quote was taken from the previous version of the GFN website.
(3-7) The ecological footprint analysis conducted by Redefining Progress (RP), an organization that employs an expanded ecological footprint definition, is even more alarming. RP calculated America's 2001 per capita ecological footprint to be 269 acres and our per capita biocapacity to be 50 acres—leaving a per capita ecological deficit of 219 acres. Based on RP's EFA analysis, American is overextended by a factor of 5.3 (269 acres of ecological footprint/50 acres of domestic biocapacity)—we are currently utilizing ecological resources at over five times the level at which they are available domestically on a sustainable basis; from Redefining Progress, "World Footprint Data" - http://www.footprintofnations.org/Excel/Sample.xls.
(3-8) GFN EFA data indicate that with the exception of the carbon emissions, existing US biocapacities equal or exceed our existing ecological footprints.

US GFN EFA Data (Global Hectares per Capita)

Metric	Footprint	Biocapacity	Ecological Surplus/Deficit
Cropland	1.38	2.30	.92
Grazing Land	.30	.29	0*
Forest	1.02	1.78	.76
Fishing	.10	.55	.45
Carbon FP	6.51	0	6.51
Built Up Land	.10	.10	0
Totals	9.4	5.0	4.4

*Close enough…

That is, according to the EFA, the amounts of domestically available cropland, grazing land, forest area, and fishing area are adequate or more than adequate to support our current US population at our existing living standards; only in the case of carbon emissions are we guilty of resource overexploitation—our current carbon dioxide emission level (footprint) far exceeds the sustainable level (biocapacity).

The conclusion to be reached from the GFN EFA data is that in the absence of our unsustainable carbon dioxide emissions, our American way of life—300+ million people enjoying our current living standards—would be sustainable. Nothing could be further from the truth! It is certainly not the case that if we could somehow eliminate our carbon dioxide emissions, then our current population level could exist sustainably at our existing material living standards, exclusively through the utilization of our existing mix and levels of renewable natural resources.

The problem is that the EFA fails to consider nonrenewable natural resource utilization and pseudo purchasing power utilization, both of which are unsustainable and both of which are fundamental enablers of industrialized societies such as the US. The EFA therefore significantly understates the extent to which our resource utilization behavior is unsustainable, and to which our society is ecologically and economically overextended.

The EFA is well suited to measuring the extent to which the populations of non-industrialized societies, which are typically heavily dependent upon renewable natural resources, are living beyond their means. It is much less effective in measuring the extent to which populations in industrialized societies such as the US, which are heavily dependent upon nonrenewable resources and pseudo purchasing power, are living beyond their means.

(3-9) The SOA does not consider natural habitat degradation explicitly, under the assumption that sufficient domestic natural habitat capacity exists to assimilate the wastes generated by the sustainable portion of US production activity—that is, goods and services produced totally from renewable natural resource inputs. It is assumed that sustainable renewable natural resource utilization will produce sustainable levels of natural habitat degradation.

(3-10) US total mineral utilization in the year 2007: per capita US mineral utilization was ~46,270 pounds, per Mineral Industry Information, pg. 4 - http://www.mii.org/pdfs/Baby_Info.pdf; times 302 million people, equals (6.988 million tons) ~7,000 million tons total.

(3-11) US total production level (GDP) in the year 2007: $13,810 billion - "Flow of Funds Accounts of the United States, US Federal Reserve, 2008, table F.6 - http://www.federalreserve.gov/releases/z1/Current/annuals/a2005-2007.pdf.

(3-12) "Primary Energy Consumption by Source" (2007 figures), US EIA, Annual Energy Review 2007 - http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_9.pdf.

(3-13) "(Electricity) Net Generation by Source" (2007 figures), US EIA, May 2008 - http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html.

(3-14) "Sociocultural and Institutional Drivers and Constraints to Mineral Supply", Brown, USGS 2002, pg. 41 (recycled metals) - http://pubs.usgs.gov/of/2002/of02-333/of02-333.pdf; and "Recycled Aggregates--Profitable Resource Conservation", USGS 2000, pg. 1 (recycled industrial minerals) - http://pubs.usgs.gov/fs/fs-0181-99/fs-0181-99so.pdf; note too that recycled nonrenewable natural resources are not truly sustainable because some material is lost during each recycling iteration, thereby causing eventual resource exhaustion.

(3-15) "Economic Drivers of Mineral Supply", Wagner, Sullivan, and Sznopek, USGS 2002, pg. 23 - http://pubs.usgs.gov/of/2002/of02-335/of02-335.pdf.

(3-16) It could easily be argued that since at least 90% of the enabling raw material input to our economy—natural resource utilization—is unsustainable, none of the corresponding product and service output from our economy is sustainable; the logic being that if any element of the input mix to a specific product or service is unsustainable, the entire product or service (output) is unsustainable. And it would be difficult to indentify an existing US product or service that is enabled entirely through the utilization of renewable natural resources.

(3-17) Our 2007 total procurement level of $17.26 trillion greatly exceeded our 2007 total domestic economic output level (GDP) of $13.81 (http://www.federalreserve.gov/releases/z1/Current/annuals/a2005-2007.pdf - table F.6) trillion because the sum of the elements comprising our total procurement level—national income, incremental credit market debt, and net asset liquidation—greatly exceeded the value of goods and services that we actually produced domestically during 2007. The variance between our total procurement level and our total production level is accounted for by our procurement of net imports and by our procurement of previously produced (used) goods.

(3-18) Over 68% of our total 2007 procurement level was enabled by pseudo purchasing power: net economic asset liquidation, new intergenerational debt, and the portion of our national income that should have funded investments in our future wellbeing but was instead allocated toward current consumption.
(3-19) 2007 economic asset liquidation consisted of **$244 billion** in net foreign purchases of US assets (2007 NIIP Change—BEA, table 2) - http://www.bea.gov/international/xls/intinv07_t2.xls; and **$331 billion** in currency (USD) inflation (2.7% [2007 GDP Deflator] of 2007 National Income of $12,271), from Measuring Worth - http://www.measuringworth.com/calculators/uscompare/result.php.
(3-20) 2007 incremental debt consisted of **$4,411 billion** in new credit market debt at the government, corporate, and individual levels; debt that we have neither the capacity nor the intent to repay (Federal Reserve, table F.1) - http://www.federalreserve.gov/releases/z1/Current/annuals/a2005-2007.pdf.
(3-21) 2007 deferred investments critical to our future wellbeing consisted of **$928 billion** in underfunded personal savings—the difference between our 2007 actual savings level of $54 billion (NIPA), and 8% of our 2007 Disposable Personal Income of $982 billion (Federal Reserve, table F.10) - http://www.federalreserve.gov/releases/z1/Current/annuals/a2005-2007.pdf, which is approximately our average historical savings rate (Employee Benefits Research Institute; "EBRI Databook on Employee Benefits", pgs. 4-5) - http://www.ebri.org/pdf/publications/books/databook/DB.Chapter%2009.pdf; **$1,009 billion** in unfunded Social Security, Medicare, and Medicaid obligations (derived from Gokhale and Smetters, pg. 1) - http://www.philadelphiafed.org/research-and-data/events/2005/fed-policy-forum/papers/Smetters-Assessing_the_Federal_Government.pdf; **$500 billion** in unfunded pension plan obligations—approximately $5 trillion total ($4.5 trillion federal, $284 billion state, and $140 corporate) spread over 10 years, National Public Radio broadcast from S&P report: June 2006 - http://www.npr.org/templates/player/mediaPlayer.html?action=1&t=1&islist=false&id=5454161&m=5454162; **$320 billion** in unfunded physical infrastructure investment—approximately $1.6 trillion spread over 5 years (2005 ASCE Report Card) - http://www.asce.org/reportcard/2005/page.cfm?id=103; and **$4,051 billion** in incremental credit market debt incurred in 2006 that was not repaid in 2007 (Federal Reserve, table F.1) - http://www.federalreserve.gov/releases/z1/Current/annuals/a2005-2007.pdf.
(3-22) Approximately 32% of our total 2007 procurement level was enabled by real purchasing power—the portion of our 2007 national income that was properly allocated toward current consumption ($12,271 billion 2007 US national income minus $6,808 billion in 2007 deferred investments critical to our future wellbeing, equals $5,463 billion in real purchasing power).
(3-23) At a given Total Consumption Level, there exists a "trade-off" between a society's population level and its average material living standard. A higher average material living standard necessitates a lower population level; a lower average material living standard enables a higher population level.
(3-24) Our actual sustainable population level and living standard combinations cannot be known with certainty at this point, because the factors that will determine these metrics—the specific mix and levels of natural resources available for our use at sustainability, and our capacity to effectively utilize those resources—cannot be known with certainty at this point.
(3-25) From "World Footprint", 2008 GFN Ecological Footprints and Biocapacities Data; click on "2008 Data Tables" - http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/.
(3-26) From "List of Countries by GDP Per Capita", 2007 per capita GDP data from the IMF, World Bank, and CIA Factbook (Wikipedia) - http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)_per_capita.

Chapter 4

(4-1) William Rees; "Is Humanity Fatally Successful?" pg. 72 - http://www.steadystate.org/HumanityFatallySuccessful.pdf.
(4-2) US total mineral utilization in the year 2007: per capita US mineral utilization was ~46,270 pounds, per Mineral Industry Information, pg. 4 - http://www.mii.org/pdfs/Baby_Info.pdf; times 302 million people, equals (6.988 million tons) ~7,000 million tons total.
(4-3) Culture refers to the attributes of a society that shape its worldview and its resource utilization behavior; these societal attributes include value system, beliefs, traditions, behavioral norms, customs, and habits—"the way of life for an entire society." See Wikipedia for definitions and details - http://en.wikipedia.org/wiki/Culture.

Chapter 5

(5-1) Jared Diamond; "Collapse: How Societies Choose to Fail or Succeed", pg 21.
(5-2) Our choice regarding the method by which we will become sustainable should not be perceived as a fork in the road, with a "pleasant prong" (happy ending) and a "painful prong" (unhappy ending); but rather as a highway leading to a minefield, with a series of exits at regular intervals. Each succeeding exit is closer to the minefield, the point at which we will experience societal collapse, and each succeeding exit involves increasingly painful lifestyle disruptions. Because we have been running full speed on the highway since the inception of our industrial revolution, we are well past the relatively painless exits. We can still exit the highway, and we certainly should in order to avert total collapse; but we can no longer avoid significant lifestyle disruptions—substantial reductions to some combination of our population level and material living standards are inevitable.
(5-3) A self-sufficient society exists exclusively on economic and ecological resources native to its local habitat. However, self-sufficiency does not necessarily imply sustainability. A self-sufficient society that overexploits its available resource reserves is still unsustainable. A sustainable society is both self-sufficient and non-overexploitive in its resource utilization behavior.
(5-4) Attempts to implement an ACR with less than 100% popular participation will fail, because those who support ACR goals and objectives and who voluntarily reduce their consumption levels will essentially subsidize the continued profligacy of those who do not. ACR participants will ultimately become frustrated and revert to their profligate behavior and the effort will dissolve.
(5-5) The envisioned implementation interval associated with our ACR is 25 years, commencing in the year 2009. Extending the interval merely increases the probability of societal collapse in the meantime.
(5-6) Our ability to optimize our population level and living standards during our transition period and at sustainability will depend upon our capacity to continuously optimize our utilization of available natural resources, which will enable us to continuously optimize the mix and maximize the level of goods and services available for our consumption. Accordingly, our population at any given time must consist exclusively of "producers"—that is, individuals possessing the knowledge, skills, and/or physical attributes necessary to optimize our utilization of available resources at that time and going forward.
(5-7) The roots of America's existing unsustainable worldview and resource utilization behavior are found in the Bible - Genesis 1:28 - "…subdue it [the earth]: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth". The worldview and resource utilization behavior to which Americans must subscribe if we wish to transition to a sustainable lifestyle paradigm must be consistent with the following Native American proverb - "We do not inherit the Earth from our Ancestors; we borrow it from our Children".
(5-8) Supplies of recycled nonrenewable natural resources are not truly sustainable, because some material is lost in the process of recycling, thereby causing eventual resource exhaustion.
(5-9) A critical ecological resource is a renewable natural resource, a nonrenewable natural resource, or a natural habitat that enables the availability of one or more of the life sustaining necessities—water, food, energy, shelter, or clothing—to most or all of a society's population; and for which there is no viable substitute.
(5-10) See Richard Duncan's "Olduvai Theory" - http://www.dieoff.org/page125.htm.
(5-11) The inevitable collapse of industrialized civilization will be an ecological phenomenon, which will result from shortages or disruptions in the supply of one or more critical ecological resources—natural resources or natural habitats—most probably from a permanent supply shortfall associated with one or more critical nonrenewable natural resources, upon which all industrialized societies are heavily dependent. While severe economic contractions have resulted and will continue to result from societal overexploitation of economic resources; such contractions, even if permanent, will not be sufficient to cause the collapse of either an industrialized society or industrialized civilization.
(5-12) See Jared Diamond's "Collapse-How Societies Choose to Fail or Succeed", Penguin Books, 2005; and Joseph Tainter's "The Collapse of Complex Societies", Cambridge University Press, 1988.
(5-13) Because a single critical nonrenewable natural resource, such as oil, impacts an almost inconceivable number of industrial mosaic outputs, a permanent supply shortage or disruption associated with such a resource is sufficient to cause societal collapse. In the same way that the successful completion of a project is contingent upon accomplishing all tasks comprising the project's "critical path", the continuous and efficient operation of a society's industrial mosaic is contingent upon sufficient supplies of all critical natural resources, each of which enables thousands of critical paths through the mosaic.

Eliminating one task from the project's critical path will cause the project to fail; permanently reducing or eliminating the supply of one critical nonrenewable natural resource will cause the industrial mosaic to fail—and the society to collapse.
(5-14) 2007 US primary energy consumption totaled 101.9 quadrillion BTUs (Quads), of which 8.6 Quads was produced from renewable energy sources (hydro, geothermal, solar, wind, biomass, and ethanol). The EIA's 2030 forecast for US primary energy production from renewable sources, which can be considered the "most optimistic" case, is 14.5 Quads—which still amounts to only 14.2% of our 2007 (current) total primary energy consumption level - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_1.xls.
(5-15) While energy generated by the sun, wind, tides, waves, earth (geothermal), and falling water can be considered "renewable", the energy conversion, generation, and provisioning systems through which this energy is made available for human utilization are not currently enabled by renewable energy sources. As is the case with all other goods and services currently produced in our economy, the design, development, production, provisioning, operation, maintenance, and replacement of all existing renewable energy infrastructure is almost entirely enabled by nonrenewable natural resources. As critical nonrenewable natural resources become increasingly scarce, renewable energy conversion, generation, and provisioning must be accomplished to an ever-increasing degree by renewable natural resources. Renewable energy infrastructure enabled exclusively by renewable natural resources (think wood) will be incapable of providing energy at levels even close to today's levels, much less at the ever-increasing levels required in the future.

Chapter 6

(6-1) Societal Cognitive Dissonance (SCD) is the avoidance—through denial, rationalization, or faith-based justification—on a societal scale, of an unpleasant reality that runs counter to the society's prevailing worldview. SCD is our "societal defense mechanism" that enables us to maintain our distorted worldview despite irrefutable evidence that it is physically inconsistent with reality.
(6-2) Mainstream America still believes that America is the land of opportunity—every American generation must and will have it better than the last. Our American way of life is the model for the rest of the world; it will last for hundreds or even thousands of years, perhaps forever. "The American Way" will prevail—because we want it to…
(6-3) Our political and economic "leaders" are doing precisely what we have elected them to do; they are attempting to perpetuate our American way of life at any cost. They will do whatever they can on our behalf, as we do individually, to achieve that objective. The unspoken social contract between the American public and our political and economic leaders: "We won't ask questions about how you do it—any type of duplicity, hypocrisy, hidden agenda, manipulation, or international aggression is acceptable—just don't jeopardize our 'right' to our American way of life. If you can't, won't, or claim to be unable to 'guarantee' this 'right', you are out…"
(6-4) Attempts to forestall economic collapse through fiscal imprudence—economic asset liquidation, incremental debt, underfunded critical investments—will merely cause us to reach more quickly one or more pseudo purchasing power limits, thereby expediting our Last Depression.
(6-5) Pseudo purchasing power accounted for a very low percentage of our total purchasing power level at the time of our Great Depression. We were therefore essentially able to "buy our way out" of our Great Depression and all subsequent periodic economic contractions with pseudo purchasing power. We will be unable to buy our way out of our Last Depression.

(6-6) GFN Ecological Footprint Analysis data indicate that we are living within our means with respect to our utilization of renewable natural resources.

US GFN EFA Data (Global Hectares per Capita)

Metric	Footprint	Biocapacity	Ecological Surplus/Deficit
Cropland	1.38	2.30	.92
Grazing Land	.30	.29	0*
Forest	1.02	1.78	.76
Fishing	.10	.55	.45
Carbon FP	6.51	0	6.51
Built Up Land	.10	.10	0
Totals	9.4	5.0	4.4

*Close enough…

Our domestic US biocapacity equals or exceeds our current ecological footprint with respect to all renewable natural resource types: cropland, grazing land, forest land, fishing areas, and built up land. (2008 GFN data table - http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/). It is highly improbable, therefore, that our Societal Collapse will result from a shortfall in the supply of one or more renewable natural resources.
(6-7) Lifestyle disruptions associated with our Last Depression will be less severe than those associated with our Societal Collapse because the purchasing power reduction associated with our Last Depression will permit discretionary reductions in our total consumption level. We will be able to prioritize goods and services according to their relative importance, and eliminate initially those that are least essential. Life sustaining necessities will be eliminated only as a last resort, and even then their consumption levels can be reduced gradually.

Lifestyle disruptions associated with our Societal Collapse will be catastrophic because our associated consumption level reduction will be nondiscretionary. The specific goods and services that experience supply shortages or disruptions will be beyond our control—and they will be life sustaining necessities, by definition.
(6-8) Economic contractions—recessions and depressions—could delay the onset of our Societal Collapse by reducing our demand for and utilization of natural resources, thereby enabling us to stretch remaining supplies over a longer time period. On the other hand, economic contractions could actually expedite the onset of our Societal Collapse by reducing our capacity to secure sufficient supplies of critical natural resources, given ever-increasing competition from other nations.

Chapter 7

(7-1) From Richard Duncan, "The Olduvai Theory", 2006 - http://www.thesocialcontract.com/pdf/sixteen-two/xvi-2-93.pdf.
(7-2) Federal Reserve Bank of Boston's 2004 Annual Report: "Living Beyond Our Means", pg. 8 - http://www.bos.frb.org/about/ar/ar2004/living.pdf.
(7-3) From testimony before the House Ways and Means Committee, 2005 - http://waysandmeans.house.gov/hearings.asp?formmode=printfriendly&id=2519.
(7-4) "Flow of Funds Accounts of the United States" (Table L.1); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-5) "Flow of Funds Accounts of the United States" (Table F.6); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-6) "Gold: Back to the Future?", Downs and Matlack, 2004 - http://www.gold-eagle.com/editorials_04/matlack072304.html.
(7-7) "Flow of Funds Accounts of the United States" (Table F.1); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-8) "Flow of Funds Accounts of the United States" (Table F.7); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.

(7-9) “Flow of Funds Accounts of the United States” (Tables F.1 and F.7); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-10) From “Is America Bankrupt?” Lawrence Kotlikoff, Federal Reserve Bank of St. Louis *Review*, July/August 2006, page 235; “This partial-equilibrium analysis strongly suggests that the U.S. government is, indeed, bankrupt, insofar as it will be unable to pay its creditors, who, in this context, are current and future generations to whom it has explicitly or implicitly promised future net payments of various kinds.” - http://www.minyanville.com/assets/File/Kotlikoff_USBankruptcy_paper[1].pdf.
(7-11) “Overview of The President’s 2007 Budget”, pg. 5, George W. Bush, 2006 - http://www.whitehouse.gov/omb/pdf/overview-07.pdf.
(7-12) “Fiscal and Generational Imbalances: An Update”; Gokhale and Smetters; pg. 26; 2005 - http://www.philadelphiafed.org/research-and-data/events/2005/fed-policy-forum/papers/Smetters-Assessing_the_Federal_Government.pdf.
(7-13) “Flow of Funds Accounts of the United States” (Tables B.100, B.102, B.103, and B.106c); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-14) “Fiscal and Generational Imbalances: An Update”; Gokhale and Smetters; pg. 10; 2005 - http://www.philadelphiafed.org/research-and-data/events/2005/fed-policy-forum/papers/Smetters-Assessing_the_Federal_Government.pdf.
(7-15) “Fiscal and Generational Imbalances: An Update”; Gokhale and Smetters; pg. 1; 2005 - http://www.philadelphiafed.org/research-and-data/events/2005/fed-policy-forum/papers/Smetters-Assessing_the_Federal_Government.pdf.
(7-16) See the examples in “The Looming National Benefit Crisis”, USA Today, October 3, 2004. For a husband and wife who retired at 65 in 2005 and made the median national income at retirement, the difference between their total contribution to Medicare ($43,300) and the present value of their projected Medicare benefit ($283,500) was $240,200; the present value of their Social Security benefit is projected to exceed their contribution by $128,000 - http://www.usatoday.com/news/nation/2004-10-03-debt-cover_x.htm.
(7-17) “Status of Social Security and Medicare Programs (Summary) - http://www.socialsecurity.gov/OACT/TRSUM/trsummary.html.
(7-18) From “America at a Crossroads”, pg. 5, US Government Accountability Office, 2006 - http://www.gao.gov/cghome/d07171cg.pdf.
(7-19) “Table 2: International Investment Position of the United States at Yearend 1976-2007”; BEA - http://www.bea.gov/international/xls/intinv07_t2.xls; and
“Flow of Funds Accounts of the United States” (Tables B.100, B.102, B.103, and B.106c); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-20) “The Gathering Pensions Storm”, Business Week - http://www.businessweek.com/investor/content/jun2006/pi20060605_907646.htm.
(7-21) “Report Card for America’s Infrastructure”, American Society of Civil Engineers - http://www.asce.org/reportcard/2009/.
(7-22) “Six Ways to Compute the Relative Value of a US Dollar Amount, 1774 to Present”, Measuring Worth, 2008 - http://www.measuringworth.com/uscompare/.
(7-23) “Flow of Funds Accounts of the United States” (Table B.100); US Federal Reserve - http://www.federalreserve.gov/releases/z1/Current/data.htm.
(7-24) “Presentation at the Technical University of Clausthal”, Dr. Colin. J. Campbell, 2000 - http://www.hubbertpeak.com/de/lecture.html.
(7-25) Colin Campbell explains the depletion function associated with nonrenewable resources and provides examples pertaining to oil depletion in “The Coming Oil Crisis”, Colin J. Campbell, Multi-Science Publishing Company & Petroconsultants S.A., 1988, pgs. 95-97.
(7-26) “Peak Oil Overview—June 2008”, Gail Tverberg (The Oil Drum), slide 4 - http://www.theoildrum.com/node/4172.
(7-27) “Shell Chief Fears Oil Shortage in Seven Years”, The Times, 2008 - http://business.timesonline.co.uk/tol/business/economics/wef/article3248484.ece.
(7-28) “Oil” in this analysis includes crude oil, lease condensates, natural gas plant liquids, and processing gains (commonly referred to as “all liquids”).
(7-29) “2009 Annual Energy Outlook (Early Release)”, EIA, 2008 - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_11.xls.
(7-30) “International Energy Outlook”, EIA, 2008 - http://www.eia.doe.gov/oiaf/ieo/excel/ieoreftab_5.xls.

(7-31) "Annual Energy Review 2007", EIA, 2008 - http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_9.pdf.
(7-32) "Annual Energy Outlook", EIA, 2008 - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_2.xls.
(7-33) Estimated global peak oil production timing and levels, US peak oil supply availability timing and levels, and post-peak decline rates in both cases are summarized in the following Oil Supply Forecast.

Oil Supply Forecast

Oil (All Liquids)	Optimistic Case	Conservative Case
Global Peak Production Year	2020	2013
Global Peak Production Level	35 bb/y	32 bb/y
US Peak Supply Year	2020	2011
US Peak Supply Level	7.7 bb/y	7.5 bb/y
US Post-Peak Decline Rate	2%	3%
US Available Supply in 2020	7.7 bb/y	5.7 bb/y
US Available Supply in 2030	6.3 bb/y	4.2 bb/y
US Available Supply in 2040	5.1 bb/y	3.1 bb/y
US Available Supply in 2050	4.2 bb/y	2.3 bb/y

bb/y: billion barrels per year

The Oil Supply Forecast is a synthesis of the data and forecasts contained in the following studies and analyses.

- Wikipedia provides a overview of peak oil, which includes a general explanation, actual regional peak production and post-peak decline rate data, and several global peak production and post-peak decline rate forecasts: ASPO-71 (CO+NGL) 90 mbd in 2011, 75 mbd by 2020; Koppelaar (all liquids) 89 mbd in 2012, 73 mbd by 2025; EIA actual US peak of 3.5 bby in 1970, 1.55 bby by 2007 (2.2% annual decline rate); actual Mexico peak of 3.85 mbd in 2004, 3.5 mbd by 2007 (3% annual decline rate) - http://en.wikipedia.org/wiki/Peak_oil.
- Aage Figenschou and Matt Simmons provide a summary of the IEA's "World Energy Outlook 2008", which includes the IEA's latest projections regarding global oil field decline rates—observed rates for oil fields actually in decline: 5.1% per year on average; the IEA expects global oil production to peak at less than 90 mbd - http://www.aspousa.org/index.php/2008/11/a-peak-oiler-but-still-in-the-closet-iea/.
- Khebab (The Oil Drum) provides an overview of actual global oil production through August 2008, and various forecasts regarding global oil peak production timing and post-peak decline rates: May 2008 @ 86.05 mbd is the highest "all liquids" production level to date (also the highest for crude oil plus condensates @ 74.48 mbd) - http://www.theoildrum.com/node/3720#more.
- Gail Tverberg (The Oil Drum) offers a "Peak Oil Overview" consisting of a general explanation, historic data, and global peak forecasts and decline rates: US peaked in 1970 at 9.9 mbd, going to 4.4 mbd by 2007 (slide 4) [2.2% annual decline rate]; North Sea peaked in 1999 at 6 mbd, going to 4.1 mbd by 2007 (slide 7) [4.5% annual decline rate] - http://www.theoildrum.com/node/4172.
- Colin Campbell in "The Coming Oil Crisis", pgs. 101-105, projects three global oil "peak/decline" scenarios (he projects a 7-15 year plateau as well); post peak annual decline rates range from 2.2% to 3.5%.
- The "UK Industry Task Force on Peak Oil and Energy Security" predicts the global peak in oil production to occur between 2011 and 2013 (review of their report) - http://smarteconomy.typepad.com/smart_economy/2008/10/global-peak-oil-in-5-years-by-2013.html.

(7-34) "Exxon: Natural Gas has Peaked in North America" Past Peak, 2005 - http://www.pastpeak.com/archives/2005/06/exxon_natural_g.htm.
(7-35) "2009 Annual Energy Outlook (Early Release)", EIA, 2008 - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_13.xls.
(7-36) "International Energy Outlook", EIA, 2008 - http://www.eia.doe.gov/oiaf/ieo/excel/ieoreftab_6.xls.
(7-37) "Annual Energy Review 2007", EIA, 2008 - http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_9.pdf.
(7-38) NaturalGas.org - http://www.naturalgas.org/overview/uses_residential.asp.
http://www.eia.doe.gov/emeu/aer/txt/stb0601.xls.
(7-39) "Annual Energy Outlook (Early Release)", EIA, 2008 - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_2.xls.

(7-40) Estimated global peak natural gas production timing and levels, US peak natural gas supply availability timing and levels, and post-peak decline rates in both cases are summarized in the following Natural Gas Supply Forecast.

Natural Gas Supply Forecast

Natural Gas (Dry Gas)	Optimistic Case	Conservative Case
Global Peak Production Year	2025	2015
Global Peak Production Level	140 tcf/y	125 tcf/y
US Peak Supply Year	2020	2013
US Peak Supply Level	24.2 tcf/y	23.5 tcf/y
US Post-Peak Decline Rate	3%	4.5%
US Available Supply in 2020	24.2 tcf/y	18.3 tcf/y
US Available Supply in 2030	17.8 tcf/y	12.8 tcf/y
US Available Supply in 2040	13.2 tcf/y	9.0 tcf/y
US Available Supply in 2050	9.7 tcf/y	6.3 tcf/y

tcf/y: trillion cubic feet per year

The Natural Gas Supply Forecast is a synthesis of the data and forecasts contained in the following studies and analyses.

- ASPO presentation "The Case for Peak Oil" (Bentley), Slide 6 provides a summary of expected global peak timing for oil and natural gas; forecasts global natural gas peak between 2020 and 2025 - http://cta.ornl.gov/oiltransitions/RoundTable/BentleySHORT.ppt#546,6,Slide.
- The EIA forecasts an undulating plateau for domestic US gas production over the next several decades, ostensibly enabled by increasing (questionable) supplies of nonconventional natural gas—coal bed methane, tight sands, and gas shales; note that liquefied natural gas is projected to contribute little to US supply in the coming decades - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_13.xls.
- "Fact Sheet: Liquefied Natural Gas (LNG)" cites a 2004 "Oil and Gas Journal" study forecasting the global peak in natural gas production in 2019; the article also makes the "case against" liquefied natural gas as a viable supply source - http://www.energyjustice.net/naturalgas/lngfactsheet.pdf.
- "Oil and Natural Gas Depletion and Our Future", Seppo Korpeta (The Energy Bulletin), 2007, shows a US natural gas production peak in 1973 followed by a "secondary peak" in 2001—states that the US is currently "in decline", especially regarding conventional natural gas production. Regarding decline rates: "The depletion rates for natural gas in the U.S. are larger than for oil. Fields put into production in 1990 were down 17% after the first year, those put into production today deplete more than 30% during their first year of operation." - http://www.energybulletin.net/node/32146.
- "Balancing Natural Gas Policy – Fueling the Demands of a Growing Economy", National Petroleum Council, 2003; page 11 shows current and projected (per the NPC) sources of US natural gas—notice the tremendous (unrealistic?) expectations regarding contributions from nonconventional sources. Such sources are "necessary", however, because, "Traditional North American producing areas will provide 75% of long-term U.S. gas needs, but will be unable to meet projected demand." - http://www.fossil.energy.gov/programs/oilgas/publications/npc/03gasstudy/NG_Vol1_9-25.pdf 2003
- "Future of Natural Gas Supply", Jean Laherrere, 2004; projects world natural gas peak production in 2030 at approximately 140 trillion cubic feet (tcf). Actual and projected decline rates associated with regions already in decline: Europe peaked in 2006 at 11.5 tcf, going to 2.5 tcf by 2040 (4.25% annual decline rate); France peaked at .4 tcf in 1978, went to .1 tcf by 2001 (6% annual decline rate); UK peaked in 2000 at 3.8 tcf, going to .3 tcf by 2020 (12% annual decline rate) - http://www.peakoil.net/JL/BerlinMay20.pdf.
- "China and India's Ravenous Appetite for Natural Resources", slide 50, by Vince Matthews, Director of Colorado Geological Survey, 2008; Shows US natural gas peak in 1973, followed by an undulating, but declining plateau and a secondary but lower peak in 2001 - http://www.cowatercongress.org/images/vince%20matthews%20-%20china%20india%208v1.6.pdf.

- Wikipedia overview of peak natural gas, "Peak Gas", shows post-peak decline rates for countries and regions already in decline, and cites several forecasts regarding US and global peak production timing—synopsis is that the North American natural gas production has plateaued, with terminal decline likely to occur between now and 2022. The most optimistic, those who believe the US can remain on a "supply plateau" until 2022 are counting heavily upon rapidly increasing contributions from nonconventional (smaller, lower quality, more expensive, harder to access) natural gas sources—coal methane, tight sands, and gas shales—and LNG. - http://en.wikipedia.org/wiki/Peak_gas.

(41) "Coal: Resources and Future Production", page 39, The Energy Watch Group, 2007 - http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Report_Coal_10-07-2007ms.pdf.
(7-42) "2009 Annual Energy Outlook (Early Release)", EIA, 2008 - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_15.xls.
(7-43) "International Energy Outlook", EIA, 2008 - http://www.eia.doe.gov/oiaf/ieo/excel/tableA7_mst.xls.
(7-44) "Annual Energy Review 2007", EIA, 2008 - http://www.eia.doe.gov/emeu/aer/pdf/pages/sec1_9.pdf.
(7-45) "Annual Energy Outlook", EIA, 2008 - http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_2.xls.
(7-46) Estimated global peak coal production timing and levels, US peak coal supply availability timing and levels, and post-peak decline rates in both cases are summarized in the following Coal Supply Forecast.

Coal Supply Forecast

Coal (All Types)	Optimistic Case	Conservative Case
Global Peak Production Year	2035	2025
Global Peak Production Level	11,000 mst/y	8,500 mst/y
US Peak Supply Year	2040	2030
US Peak Supply Level	1,450 mst/y	1,350 mst/y
US Post-Peak Decline Rate	1.5%	2.5%
US Available Supply in 2020	Sufficient	Sufficient
US Available Supply in 2030	Sufficient	1,350 mst/y
US Available Supply in 2040	1,450 mst/y	1,048 mst/y
US Available Supply in 2050	1,247 mst/y	814 mst/y

mst/y: million short tons/year

The Coal Supply Forecast is a synthesis of the data and forecasts contained in the following studies and analyses.

- "Coal: Resources and Future Production", The Energy Watch Group, 2007; projects US peak coal production in 2025 at approximately 20% above it current level, or approximately 1350 million short tons (pgs. 38 and 39); they project world peak coal production in 2025 as well, at approximately 30% above 2005 levels, or 8,500 million short tons (page 7). They further state that US coal peaked in terms of "heat content" in 1998 (pg. 15). Regarding post-peak decline rates, they project: world peak in 2025 at 3.6 million tons of oil equivalent (mtoe), going to 3.4 mtoe by 2050 (.5% annual decline rate); China will peak in 2015 at 2450 mtoe, going to 850 mtoe by 2050 (3% annual decline rate); and an optimistic US case of peak in 2030 at 1450 mst, going to 700 mst by 2070 (2% annual decline rate) - http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Report_Coal_10-07-2007ms.pdf.
- "The Peak in US Coal Production"; FTW Publications, Greg Vaux, 2004; projects US peak coal production (volume) in 2032 at over 3,000 mst (considerably higher than more recent EIA demand projections); also cites UK decline rate: UK coal production peaked in ~1915 at 250 mst, at 35 mst by 2000 (2.25% annual decline rate) - http://www.fromthewilderness.com/free/ww3/052504_coal_peak.html.
- Wikipedia offers a good overview of the peak coal concept and cites several peak coal projections; also mentions that US anthracite production peaked in 1914, US bituminous production peaked in 1990, and US coal production in terms of energy content peaked in 1998 - http://en.wikipedia.org/wiki/Peak_coal.
- "Hubbert's Peak, The Coal Question, and Climate Change", David Rutledge (Caltech), 2008, on "peak fossil fuels", "The projection is that we will have consumed half of the ultimate world oil, gas, and coal production by 2019." - http://www.its.caltech.edu/~rutledge/AGU%20abstract.pdf.

(7-47) “Where Have All the Metals Gone?” pg. 4, 1976 - http://www.roperld.com/minerals/metalgon.pdf.
(7-48) The US is far from self-sufficient regarding our supplies of critical non-energy minerals and metals; see “USGS Mineral Commodity Summaries” (2007 U.S. Net Import Reliance for Selected Nonfuel Minerals), USGS, pg. 6, 2008 - http://minerals.usgs.gov/minerals/pubs/mcs/2008/mcs2008.pdf.
(7-49) The information presented in the US Critical Minerals Profiles table was obtained from “USGS Mineral Commodity Summaries” (Mineral Commodities), USGS, pgs. 20-192, 2008 - http://minerals.usgs.gov/minerals/pubs/mcs/2008/mcs2008.pdf; The Universal Mining Machine”, Ugo Bardi, 2007 - http://www.theoildrum.com/node/3451; “Post Peak Minerals”, Ugo Bardi, 2007 - http://europe.theoildrum.com/node/3086; “Earth’s Natural Wealth: An Audit”, David Cohen, New Scientist, 2007 - http://www.newscientist.com/article/mg19426051.200-earths-natural-wealth-an-audit.html?full=true; “Where Have All the Metals Gone?”, David Roper, 1976 - http://www.roperld.com/minerals/metalgon.pdf; and “China and India’s Ravenous Appetite for Natural Resources”, slide 106, by Vince Matthews, 2008 - http://www.cowatercongress.org/images/vince%20matthews%20-%20china%20india%208v1.6.pdf.
(7-50) From Colorado Capitol Watch, 2008 - http://coloradocapitolwatch.com/blog/2008/04/16/potash-is-the-new-gold-as-competition-for-resources-swamps-the-globe/.
(7-51) Data regarding nitrogen, potassium (potash), and phosphorous (phosphate rock) obtained from note 7-48 and note 7-49 above.
(7-52) “Fertilizer Contributions to Crop Yields”, International Plant Nutrition Institute, 2008; their study concludes: “data and the results of the chemical use reduction investigation (Smith et al., 1990) tend to support the generalization that somewhere between 30 to 50 percent of crop yield in the U.S. is attributable to nutrient inputs.” - http://www.ipni.net/ppiweb/usagp.nsf/$webindex/485AF893EC22742A86256B80007B54DD.
(7-53) “Millennium Ecosystem Assessment”, Millennium Ecosystem Assessment Board, United Nations, 2005 - http://www.millenniumassessment.org/en/Products.BoardStatement.aspx.
(7-54) “Groundwater depletion: A global problem”, Konikow, L.F. and Kendy, E., Hydrogeology Journal, v. 13, 2005, p. 317-320 - http://water.usgs.gov/nrp/proj.bib/Publications/konikow.kendy.2005intro.html.
(7-55) “Natural Resource Inventory, 2003 Annual NRI” - http://www.nrcs.usda.gov/Technical/land/nri03/nri03eros-mrb.html.
(7-56) “The Causes and Effects of Overfishing”, from US Commission on Ocean Policy - http://www.grinningplanet.com/2005/06-07/overfishing-article.htm.
(7-57) “2005 Global Forrest Resource Assessment.” Table 9 Annex 3 - ftp://ftp.fao.org/docrep/fao/008/A0400E/A0400E14.pdf.
(7-58) “Water Quality Conditions in the United States”, pg. 1, EPA - http://www.epa.gov/305b/2000report/factsheet.pdf.
(7-59) “United Nations Environmental Programme, “Global Environmental Outlook-3; North America Fact Sheet”, page 3 - http://www.grid.unep.ch/geo/pdfs/GEO-3%20Fact%20sheet%20N%20America.pdf.
(7-60) “Soil Depletion”, T.J. Clark, 2006, from 1992 Earth Summit Statistics - http://www.tjclark.com.au/colloidal-minerals-library/soil-depletion.htm.
(7-61) “An Ocean Blueprint for the 21st Century”, page 3 - http://www.oceancommission.gov/documents/full_color_rpt/00b_executive_summary.pdf.

Chapter 8

(8-1) From “Thermo/Gene Collision - On Human Nature, Energy, and Collapse”, Jay Hanson, 2007 - http://www.thesocialcontract.com/artman2/publish/tsc1703/tsc_17_3_hanson.shtml.
(8-2) See David Stannard’s “American Holocaust – The Conquest of the New World”, pgs.261-268, and 339-341 for details regarding the original settlement of the US and for pre-Columbian population estimates.
(8-3) See David Stannard’s “American Holocaust – The Conquest of the New World”, pg. 268, and 339-341.
(8-4) Canada’s 2007 population was approximately 33 million, which was approximately 10% of the combined US and Canadian population of 335 million at the time - http://en.wikipedia.org/wiki/Canada.
(8-5) For an explanation regarding the unsustainable nature of the agrarian lifestyle paradigm, see “Agriculture: Unsustainable Resource Depletion Began 10,000 Years Ago”, Peter Salonius, 2008 - http://www.theoildrum.com/node/4628#more.
(8-6) President George H. W. Bush, at the 1992 Earth Summit in Rio de Janeiro.

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