The Next Big Thing in Environmental Protection

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Prepared by:
Dr. Bruce E. Tonn
Dept. of Political Science
The University of Tennessee
1018 McClung Tower
Knoxville, Tennessee 37996
Voice: 865.974.7041
Email: btonn@utk.edu

and

UT Graduate Students:
Lindsay Dawson
Dillon Gray
Christina Haddad
Jennifer Joice
Chris Oelgoetz

Institute for a Secure and
Sustainable Environment
311 Conference Center Bldg.
Knoxville, TN 37996-4134
Phone: (865) 974-4251
Fax: (865) 974-1838
E-mail: isse@utk.edu
URL: isse.utk.edu

THE UNIVERSITY of
TENNESSEE **UT**

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ABSTRACT

This report addresses this question: what is the Next Big Thing (NBT) in environmental protection? This question is probed in several manners. First, environmental implications of U.S. population growth to 420 million citizens by the year 2050 are considered. Next, numerous candidates for the NBT generated through various brainstorming exercises are presented. The set of ideas not only includes potential new types of threats but also encompasses emerging opportunities to improve environmental protection (e.g., through the development of nano-sensors) and future regulatory issues. Five of the candidate ideas are explored in some depth in the report: massive internal migration; toxic suburbs; construction and demolition waste; alternatives to conventional burials and cremation; and regulatory barriers to sustainability. The fourth section explores possible changes in environmental values that could impact expectations for environmental policy. This is accomplished through a scenario approach. The appendix contains an additional five scenarios depicting the U.S. in the year 2050. The report does not reach any firm conclusions about what the NBT might be, but does highlight a range of new threats, increasing pressures from existing threats, and emerging opportunities.

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1. INTRODUCTION

The list of environmental problems that the United States is actively confronting is long. Heading the list, at least since the 1960s, is water and air pollution. Since that time, numerous other environmental problems have joined this list, including municipal solid waste disposal, hazardous waste disposal, nuclear waste disposal, indoor air pollution, species extinction, soil erosion, and climate change. Both as a result of advances in science and changes in the environment-society-economic system, many familiar environmental problems have become more complex during the past fifty years. Air pollution was seen primarily as smog, but now the air pollution "problem" includes ultra-fine particulate matter and a plethora of air toxics. Water policy that once largely focused on point-source pollution (e.g., industrial discharges and ballast water) now also includes non-point-source pollution (e.g., agricultural run-off, combined sewer overflows, and soil erosion), wetlands, and safe drinking water. Additionally, concerns are increasing about the cumulative effects of multi-media cross contamination and potential exposure from multiple sources.

Most environmental policy has been reactive in nature. Burning rivers, dying birds, and suffocating smog prompted actions to reduce water pollution, ban DDT and other chemicals, and restrict emissions from vehicles and fossil-fuel power plants. It can be argued, in retrospect, that in most cases significant harm to humans and ecosystems and substantial remediation expenses could have been avoided had policy makers acted proactively rather than reactively. However, the Resource Conservation and Recovery Act can be viewed as, in part, a proactive measure to prevent the creation of future Superfund sites. Foresight might have spared the country the enormous expense of cleaning up the nation's nuclear weapons and research facilities. Foresight is needed to deal with environmental issues arising from new revolutions in information technology, bio-technology, nanotechnology, and beyond.

The past is past. Important lessons have been learned especially with respect to the potential benefits of foresight. So, this report addresses this question: What is the Next Big Thing (NBT) in environmental protection? If the NBT can be identified sooner rather than later, the expectation is that the problem will be dealt with before much harm has been done and in a more cost- and time-efficient manner. The purpose of this report is to generate a comprehensive list of candidates for the title "The Next Big Thing." Thus, this report does not claim to have found *THE* needle in the proverbial haystack. Rather, numerous possibilities are identified to facilitate further discussions in the environmental community.

Addressing the NBT issue is a challenging task. A review of past issues so anointed could help to guide the search for this new issue. One could put on this list issues like nanotechnology, endocrine disrupters, and biofuels. Of course, these issues are not "past-tense" in the sense that they have been solved. Indeed, they are now the subjects of new and active research and policy programs. However, some could argue that foresight processes brought them to our attention sooner rather than later.

This research employed three methodologies to generate candidates for the NBT. Simple analytic techniques were used to explore threats from a really big thing, the forecasted growth of the U.S. population to about 420 million persons by 2050 from just over 300 million persons currently

(Section 2). Brainstorming sessions were held to generate a wide-ranging list of NBT candidates that not only includes new threats but also numerous opportunities and regulatory issues that could be tackled (Section 3). Five of the issues identified through these exercises are explored in more depth in Section 4. Finally, scenarios were used to probe possible changes in "environmental values" that could alter, revise, and/or re-focus environmental policy in the future (Section 5) and to describe potential U.S. futures in the year 2050 (included in the Appendix). Thus, this report applies both linear (e.g., trend analysis) and non-linear (e.g., scenarios) methodologies to explore the NBT.

2.   POTENTIAL ENVIRONMENTAL IMPLICATIONS OF ANOTHER 100+ MILLION AMERICANS

2.1   Demographic Forecasts

Table 1 contains key demographic forecasts published by the U.S. Census Bureau. The U.S. population is forecast to increase from 282 million persons in the year 2000 to 420 million persons by the year 2050, an almost 50% increase. For comparison purposes, the U.S. population was approximately 150 million in the year 1950. The growth in U.S. population of over 100 million persons by 2050 can be expected to compound most, if not all, of the environmental issues already facing this country. Many of these issues are explored in more depth in this section.

In addition to the magnitude of population change, there are two other aspects of the population forecasts that need to be highlighted. First, the U.S. population is aging. The number of persons 65 years or older is forecast to more than double by the year 2050, with the percentage of individuals in this age group growing from 12% to 21% in this time period. An aging U.S. population has a differential impact on the environment, from possible substantial increase in the use of pharmaceuticals per capita to increasing demand by active retirees for access to natural amenities.[1] Also, the environmental impacts of more burials and cremations are discussed in Section 4.

Table 1—U.S. Demographic Forecasts[2] (millions: % of population)			
	2000	**2030**	**2050**
Total population	282	364	420
Persons 65 years or older	35 (12%)	71 (20%)	86 (21%)
White	229 (81%)	276 (76%)	303 (72%)
Black	30 (13%)	50 (14%)	62 (15%)
Hispanic	36 (13%)	73 (20%)	103 (25%)

Second, the U.S. population is forecast to be a one-quarter Hispanic by 2050. This change in the ethnic character of society may or may not have implications for environmental protection. This change may or may not influence the values brought into public discourse about the environment. However, this change does raise the prospect for changes in environmental values,

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[1] B. Tonn, C. Petrich, and G. Waidley. 2001. "The Aging U.S. Population and Environmental Policy." Journal of Environmental Planning and Management 44(6): 851-876.
[2] See: http://www.census.gov/

maybe due to changes in the ethnicity of society or due to the prospects of expanded life spans or due to other factors, such as not growing up with the threat of nuclear war but with the threat of catastrophic climate change. Changes in environmental values are explored in a set of scenarios presented in Section 5.

2.2   Built-Environment and Land-Use Impacts

Another 100+ million persons living in the U.S. could have significant impacts upon the built environment. In 2006, there were 114 million households in the U.S. The average number of persons in a household was about 2.6. Historically, this number has been decreasing. Around the year 1900, the average household size was approximately 4.8, and in 1950 the number was about 3.4. Smaller families and an increasing number of single-person households explain the decrease in household size over time.

The decrease in household size has an impact upon the built environment because, for a given population, more housing units are needed. Each new unit requires land and infrastructure (e.g., municipal waste-water systems or, in rural areas, septic tanks). Let's assume that the average household size remains at 2.6 persons in the year 2050. Then, in that year, one could estimate that there will be 161 million households, an increase of about 40% from the year 2006. If trends continue, however, household size could drop further, maybe as low as 2.3 persons. In this case, there would be 182 million households, an increase of 60%.

In 2001, 106 million of acres of land were classified as developed in the U.S.[3] This works out to about .36 acres of developed land per capita. Because of sprawl, this statistic has been increasing over the years (e.g., it was about .32 acres per capita in 1980). Using .36 acres per capita, by 2050 another 45-million acres of land will need to be developed to serve the forecasted U.S. population increase, a 40% increase in developed land. If sprawl continues to bloat our developed areas, say to .45 acres per capita, then another 83-million acres of land will need to be developed, a 78% increase from 2001. At the very least, one could expect a large increase in urban run-off from this new development.

In 2003, 367 million acres in the continental U.S. were devoted to cropland.[4] This amounts to about 1.26 acres of cropland per capita, a number that has actually been decreasing over time as these prime farmlands have been developed. Let's assume, though, that the per capita statistic is the same in the year 2050. Then, the U.S. would need 529-million acres of cropland to feed its population, an increase of 109-million acres. Given that population is forecast to increase worldwide by 2050 and that the emergence of biofuels may be increasing the demand for cropland, one can argue that this estimate of future cropland needs is not likely to be much lower and could even be significantly underestimated. Increases in erosion and agricultural run-off can be expected from this increase in cropland if current practices do not change.

The previous two analyses suggest that a total of almost 200-million acres of land could need to be converted to developed land and cropland by the year 2050. In 2003, pasture land totaled 117-

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[3] See: http://www.nrcs.usda.gov/technical/land/nri01/urban.pdf

[4] We apologize for the constant change in reference years. Data collection exercises are done at different times by different organizations.

million acres, rangeland 405-million acres, and forests 405-million acres. Given that one could expect demands for pasture and range land to increase because of increased demand for meat products (although their total acreage has not decreased much since 1980),[5] land for new developments and cropland may come at the expense of forestland. Reductions in forestland could impact important ecosystems, fracture even more areas around our national natural amenities, increase the number of endangered and threatened species, and reduce carbon sequestered in the environment in the U.S., among other negative consequences. Reductions in forestland could also make it difficult to expand our existing system of national parks and national forests to serve a growing population that might actually have more time to enjoy the outdoors.

2.3   Energy and Transportation Impacts

In 2006, the U.S. consumed about 100-quadrillion British thermal units (Btu) of energy.[6] To provide some sense of scale, it takes one Btu of energy to raise one pound of water one degree Fahrenheit. Figure 1 is an illustration developed by the U.S. Energy Information Administration (EIA) that shows U.S. energy sources and end uses. The most energy is consumed in the industrial sector, followed by the transportation, residential, and commercial sectors. Electricity and liquids (e.g., gasoline) are often distinguished in energy assessments.

The EIA is forecasting growth in electricity demand of at least 20% by the year 2030. In 2006, the U.S. had an installed capacity to provide just over 1 million megawatts (MW) of electric power. Natural gas units provided 442 thousand MW of this capacity, followed by coal plants (336 thousand MW), nuclear plants (106 thousand MW), conventional hydro (77 thousand MW), petroleum (64 thousand MW), and other renewables (26 thousand MW). If electricity use simply increases at the same rate as the general population, then another 430 thousand or so MW of capacity would need to be added to the electricity infrastructure by the year 2050. Given that natural gas supplies are already tight, petroleum production may have peaked worldwide within this time period, and most conventional hydro sites have already been developed, the increase in electricity demand would need to be met by coal, nuclear and/or renewables. To meet this increase in demand only by coal would result in the doubling of the number of coal plants in the U.S. (from about 1500 to 3000) or the quadrupling of the number of nuclear plants (from about 100 to 400) in this time frame. Wind and centralized solar would need to make astounding in-roads (sixteen times current installed capacity) in the marketplace for electricity to reduce the need for more coal and/or nuclear plants, which pose well known environmental problems (e.g., air quality, GHG emissions for coal, and safety, security, and waste issues for nuclear). Debates and controversies over the siting of new transmission lines can also be expected to increase for any new electricity sources.

In the year 2000, there were 133 million cars and 79 million light duty trucks on the roads in the United States. In 2001, this fleet logged 2.3 trillion miles (vehicle miles traveled). In 2006, 17 million new vehicles were sold in the U.S. The vast majority of fuels consumed in the

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[5] Americans consumed 59-billion pounds of meat in 2005 (at 200 pounds per capita per year), an amount that could be expected to increase to 84-billion pounds in 2050. In 2007, there were 97-million head of cattle and 62-million hogs and pigs being raised in the U.S.
[6] See: http://www.eia.doe.gov/

transportation sector are used by these two types of personal vehicles. The price of gasoline used in these vehicles has recently skyrocketed to over $4 a gallon. The world price for a barrel of oil has also increased to over $140 as of this writing, from as little as $20 a barrel in 1999.

Figure 1—Energy Profile United States: 2006 (Quadrillion Btus)
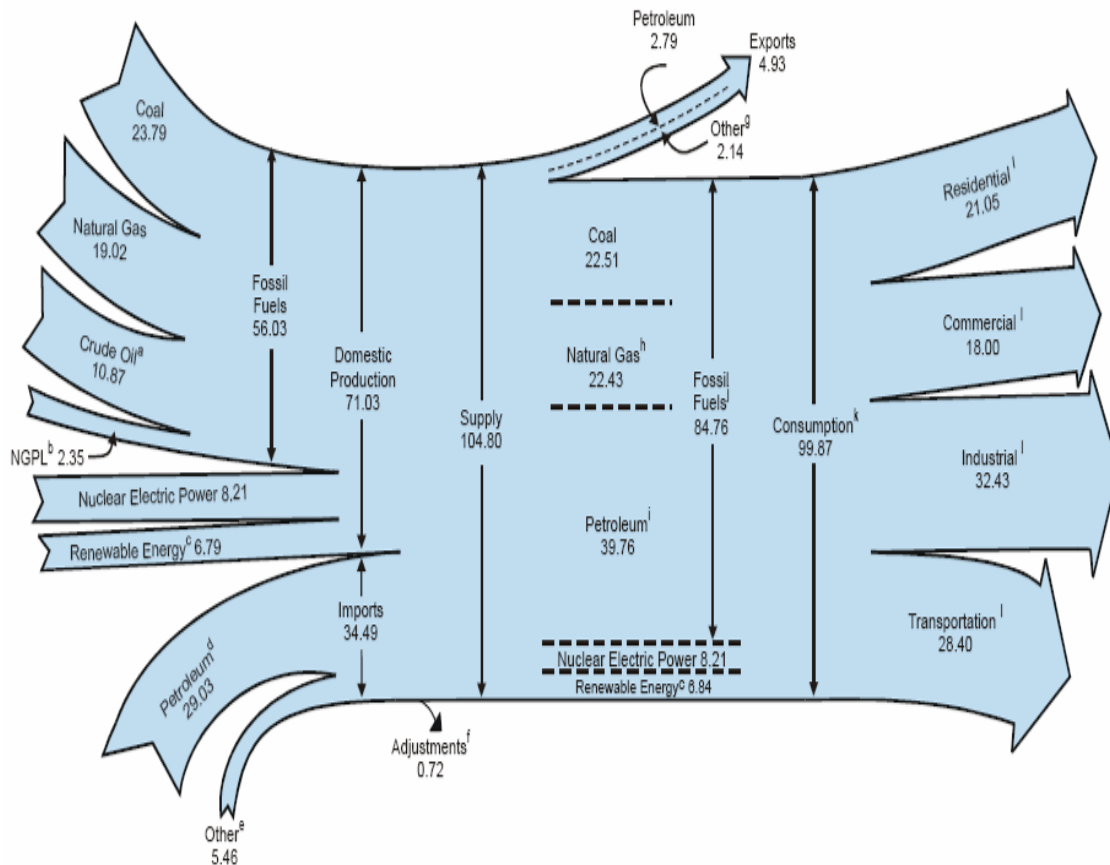
A market for bio-fuels has arisen in response. In the short term, the focus has been on corn ethanol. This substitute for traditional gasoline has been severely criticized because it takes almost as much energy to produce a gallon of ethanol as there is energy derived from it, competition for corn crops has raised world food prices, and growing corn has major environmental drawbacks (e.g., agricultural run-off, draw down of aquifers). Hopes are high for cellulosic ethanol (e.g., made from switch grass or poplar trees) but the technology for cellulosic ethanol has yet to be cost efficiently commercialized. Neither crop necessarily increases our energy security, it should be added, because variations in weather (e.g., droughts, floods, freezes) could substantially reduce supplies in any given time period. As mentioned above, growth in these crops could have major land use implications.

On the horizon, many people hope that electric cars will replace internal combustion cars. The latest new technology to attract attention is plug-in hybrids. All electric vehicles, such as a high performance one being developed and sold by a company named Tesla, await better battery

technology, which is predicted to emerge by 2050. Many people still support moving the transportation sector to hydrogen fuel-cell powered vehicles, where hydrogen would be produced by electrolysis powered by our electric utility sector (as opposed to reforming natural gas on-board, which has environmental drawbacks). The important point here is that it is plausible that by 2050 the transportation sector could mostly consist of electric powered vehicles. With respect to the environment, emissions from internal combustion engines would be eliminated, as would be the negative environmental consequences associated with growing biofuels. On the other hand, the electric power sector would need to increase by over 50% from today's level, or about double in size by 2050 if one includes increasing demands for electricity for other uses. The implications for coal, nuclear, and/or renewables and the larger environment appear historic in this scenario.

U.S. population will impact other aspects of the transportation sector as well. Vehicle miles traveled, if land use patterns stay the same, could climb to over 3 trillion per year. The highway and road systems would need to be expanded accordingly. Emissions from these vehicles could increase NAAQS non-attainment rates, especially for tropospheric ozone and even more especially in light of atmospheric warming resulting from climate change. Increases in air travel, commercial vehicle traffic (91 billion miles in 2006), and freight hauled by planes, barges, and trains can also be expected. In addition to the emissions from these transportation modes, there are enormous infrastructure costs. Currently, the U.S. is not keeping up with these costs. A recent report by the American Society of Civil Engineers says that the U.S. must invest $1.6 trillion over the next five years simply to maintain the existing infrastructure at an acceptable level of quality (e.g., bridges, highways, airports, locks and dams, drinking water systems, waste water systems).[7] Failure of infrastructure, especially if failures cascade through various infrastructure systems, also carries threats to the environment.[8]

2.4   Water

In the year 2000, 85% of the U.S. population was served by public drinking water systems.[9] These systems drew 43-billion gallons per day from our surface and underground water resources. This works out to about 180 gallons per day per person for all uses. With a population of 420 million and the same percentage of the population tied to public drinking water systems, the total would rise to 64-billion gallons per day.

Irrigation systems used 137-billion of gallons of water per day in 2000. This amount served a cropland base of around 370-million acres. We would need almost 200-billion gallons of water

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[7] See: http://www.stateline.org/live/details/story?contentId=270952

[8] Here is an example from Baltimore, MD as reported in *Electric Perspectives* (see: http://www.eei.org/magazine/editorial_content/nonav_stories/2002-01-01-chain.htm, accessed Oct. 7, 2008): " In July 2001, a train carrying chemicals and paper products derailed in a downtown Baltimore tunnel, caught fire and, in the ensuing five days, caused a series of infrastructure failures and public safety problems. The train leaked several thousand gallons of hydrochloric acid into the tunnel, and the fire caused a water main to burst. More than 70 million gallons of water spread over the downtown area, flooding buildings and streets and leaving downtown businesses without water. The fire also burned through fiber-optic cables, causing widespread telecommunication problems, while the fire and burst water main damaged power cables and left 1,200 Baltimore buildings without electricity."

[9] See: http://pubs.usgs.gov/circ/2004/circ1268/htdocs/table05.html

per day to serve a projected cropland base of 520-million acres in the year 2050. The combined increase in water demand only for public drinking-water systems and irrigation could increase by as much as 80 billion gallons per day by 2050.

It is unlikely that underground sources could meet much of this increasing demand because they are already being drained faster than they are replenishing. Thus, most of this new demand would need to be met by surface-water resources. This could be a problem for several reasons. One reason is that many of the fastest growing population centers do not have ready access to more surface water (e.g., Las Vegas, Phoenix). Another is that climate-change-induced periods of drought can severely reduce available water supplies (e.g., as in the Southeastern U.S., especially Atlanta, in 2007). Increasing droughts and draw down of surface-water sources could result in more surface-water bodies becoming listed under provisions of the Clean Water Act. Increasing levels of conventional and exotic pollutants in the water supply (see Section 3) could also make providing this scarce resource more expensive.

2.5   Goods, Services, and Wastes

Another implication of population growth is increasing levels of consumption. Here are some statistics of recent consumption in the United States:
- Microwave ovens – 730,000 (2007);
- Refrigerators – 12,000,000 (2007);
- Washing machines – 12,000,000 (2007);
- Cellphones/PDAs – 127,000,000 (2006);
- Personal computers – 24,000,000 (2006); and
- Personal vehicles – 17,000,000 (2006).

Although not every product bought in the U.S. is manufactured in the U.S., a substantial number of products and materials in those products are produced in the U.S. In 2006, according to the Toxic Release Inventory, 4.2 billion pounds of toxic materials were released into the environment (on-site or off-site) by organizations required by law to report their toxic releases. In 2003, 30-million tons of hazardous wastes were produced in the U.S. At 4.6 pounds per household per day in 2006, 251-million tons of municipal solid wastes were disposed of in our nation's landfills, and this is with a 32.5% recycling rate. Automobile shredder waste amounts to about 4.5- to 5.0-million tons of waste per year. These trends collide with the fact that many existing landfills have closed because of environmental concerns and many cities are running out of landfill space.[10] There are growing concerns about the disposal of medical wastes and consumer electronics.

Even with advances in recycling, product packaging, and manufacturing processes, population increases alone could increase emissions of toxic materials and hazardous wastes and disposal of wastes of all types. With respect to toxic releases, the question is: what would be the accumulated impacts of these releases, which could top 160-billion pounds, upon human and ecosystem health by 2050? Does the country have the capacity to handle the disposal of 1.2-billion tons of hazardous wastes and 12-billion tons of municipal solid waste by the year 2050?

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[10] See: http://www.biosolids.state.va.us/benefits.htm#saves

2.6   Climate Change and Financial Wild Cards

There is evidence that climate change is already impacting the earth. Biological systems are changing. Glaciers are melting. Weather patterns seem to be changing and storms seem to be gaining in strength and frequency. Even more substantial and possibly catastrophic changes loom in the future.

It can be argued that in many instances, climate change could exacerbate already existing problems. For example, atmospheric warming can result in increases in tropospheric ozone given no changes in emissions of nitrogen oxides and volatile organic compounds. Warming can also result in increasing demands for electricity for cooling in the summer, which if met by burning fossil fuels, could increase emissions of the pollutants that form tropospheric ozone. Forecasted population increases and global warming combined could greatly impact this type of air pollution, everything else being equal.

It was noted above that climate change could result in extended droughts in areas not previously plagued by this problem. It was also noted that increasing population and demand for biofuels may also increase demands for water. Added to this mix again should be the production of electricity. About 50% of the water taken from surface water sources is used for cooling electric power plants. Although most of this water is returned to the surface water source, it is returned at a higher temperature. Regulations limit how hot water bodies can get in order to protect aquatic ecosystems. If it is determined that power plant discharges will increase water temperature too much, the power plant may have to shut down. One can argue that power plant shut downs may become a significant problem in the future given a situation of decreasing volumes of surface water (due to increasing demand and evaporation from atmospheric warming), increasing ambient water temperatures (due to atmospheric warming and decreasing volumes), and more power plants.

These are just two examples of how climate change could exacerbate already existing air and water quality problems. Climate change could also threaten more species with extinction, improve conditions for invasive species, and result in even more devastating extreme weather events. All these problems could threaten both in-land and coastal communities. Of course, climate change creates a huge new problem for coastal communities, sea level rise. All these problems could result with gradual changes in the climate. Rapid climate change could overwhelm our already suspect ability to adapt.

Most of the problems mentioned above are tractable, given enough time and money. One purpose of this report is to help ensure there is enough time to deal with the problems. But, is there enough money?

The trends captured in Table 2 suggest one cannot assume that the U.S. will have the economic resources to deal with the environmental impacts of another 100-plus million citizens, even or especially by the year 2050. There are two trends that are going in opposite directions that support this bleak assessment. First, debt throughout society is increasing. It is well known that the U.S. government frequently runs a deficit. Recent years have witnessed record deficits and

the cumulative federal deficit is now approaching $ 9 trillion. It is also well known that the average household is in debt, in the case of credit cards as shown below, and also with respect to home mortgages. It is not as well known that states and local governments also carry a significant amount of debt (typically in the form of bonds) and that this debt is also trillions of dollars. Unfunded mandates given to states and local governments by the federal government cannot be expected to substitute for federal funding shortfalls. Raising taxes is difficult when the population has no extra cash. In the near-term and perhaps into the mid-term, new money to support environmental initiatives will probably be scarce.

As our ability to finance new initiatives is strained, the drain on existing resources is increasing. One key demographic trend mentioned above is an aging population. This population is entitled to social security and Medicare. As shown in the last row of Table 2, this population has ballooned in recent decades and will continue to increase, straining already limited funds. Costs for health care in general are still increasing rapidly. Individuals without health care are, unfortunately, increasing too, as shown below. Also, as mentioned above, the United States has fallen behind in its investments in crucial infrastructure. The financial demands for Social Security, health care, and infrastructure, which are high right now and should be expected to increase in the mid- and long-term, further constrain funds that could be available for environmental initiatives.

Table 2—Some Economic Trends			
Gross federal deficit is increasing	$290B (1960)	$5.6T (2000)	$8.6T (2006)
State and local govt. debt is increasing	$800B (1990)	$1.4T (2000)	$1.7T (2002)
Household debt is increasing–credit cards	$31B (1952)	$2,189B (2005)	$2.46T (2007)
Individuals without health insurance is increasing	13.9M (1990)	14.2M (2000)	15.7M (2004)
U.S. foreign trade imbalance is increasing	$3.4B (1970)	-$101.7B (1990)	-$650B (2005)
Foreign ownership of U.S. assets is increasing	$395B (1990)	$536B (1995)	$1,521B (2004)
Cost of oil is increasing	$10 (1970)	$20 (1999)	$140+ (2008)
Number of people receiving old age and survivor insurance is increasing	2.3M (1970)	33.6M (1990)	37M (2005)

2.7   Conclusions and Observations

A population increase of over 100 million persons by the year 2050 will pose substantial changes to those charged with protecting the environment above and beyond the emergence of any new problems identified in the next section of this report. Are we ready to deal with this big change in demographics?

Of course, much can change in forty or so years. There are numerous countervailing trends that could ameliorate many of the problems mentioned above. We will certainly see advances in the energy efficiency of our vehicles and electric devices. Green buildings are becoming common and "smart homes" should become common in this time frame. Advances in green chemistry promise to reduce the emissions of hazardous and toxic chemicals into the environment. Behavior change is also a possibility; people may turn away from a consumer-oriented lifestyle to one that is less materialistic and more community-oriented and spiritual.

Technologies exist to conserve water. However, closed-loop and grey-water systems are expensive. Desalination plants can provide communities fresh water from the oceans, but they are also expensive and demand energy. We know how to build renewable energy systems, but can we afford them even if we cannot afford not to invest in them? We know that higher population densities have less impact on the environment, but will people flock to cities that have crumbing infrastructures, suspect schools, and unsafe streets?

In conclusion, it is unlikely that environmental problems attributable to a substantial population increase will solve themselves. It is an open question whether existing laws, regulations, and programs are adequate to deal with increases in conventional threats to the environment. It is also questionable whether the environment can provide the same level of services as in the past. It is possible that carrying capacities, especially with respect to water resources, may be finally exceeded in some areas, possibly leading to population declines and new patterns of internal migration. Finally, it is an open question whether this country will be able to afford the initiatives needed to deal with our increasing population.

3.   BRAINSTORM IDEAS

This section presents lists of candidates for the NBT. There are three lists: threats, opportunities, and regulatory issues. The list was generated through individual brainstorming exercises by the authors and group brainstorming exercises conducted at the Institute for a Secure and Sustainable Environment at the University of Tennessee and with the Science and Technology Research Group in the Environmental Sciences Division of Oak Ridge National Laboratory. People involved in the brainstorming exercises have wide range of backgrounds. There was good coverage in these areas: environmental science, climate change, planning, social sciences, economics, general technology, life cycle analysis, and futures analysis. The brainstorming teams lacked experience in epidemiology and chemistry, which resulted in fewer NBT candidates in the areas of human health and the emissions of new, risky chemicals into the environment.

Almost all of the ideas generated during the brainstorming exercise were included in the three lists below. Some may seem new and fresh. Some are familiar but might be worth a second look. Some may seem blue sky or from the realm of science fiction. Discussion of any idea, however outlandish, could lead to new ideas that could result in the identification of the NBT. This is why few if any ideas were left out of the lists below. Given the large number of ideas generated, each is only briefly discussed, although five are discussed in more detail in Section 4.0. Of course, it is the intention that any idea or its variants can be explored in more depth if it seems to be a likely candidate for the NBT.

3.1 Threats

The candidate NBT threats are grouped into five categories: mainly water related; mainly air related; mainly solid-waste and built-environment related; mainly energy related; and mainly population related.

Mainly water related:

➢ Exotics in water supply – Prospects for exotic materials entering water systems and leading to human exposure through drinking water or through aquatic-based foods are increasing. Examples of exotic materials include: non-addictive recreational drugs, nano-engineered drugs that can breach blood brain barriers, and nano-particles in sun block that are washed off during showers and while swimming in the ocean (which is reportedly negatively impacting coral reefs). Reports of pharmaceuticals in the water supply are increasing (e.g., cough medicines, antibiotics, anti-depressants) as they are discharged from the body and from improper disposal.

➢ Additives to ethanol in water supply – A denaturant is added to ethanol to prevent people from drinking it. Typically, the denaturant is unleaded gasoline. The question to consider is whether this denaturant poses any new risks to the nation's water supplies.

➢ Cemeteries – The increasing population of the United States is leading to increasing demand for burials and increasing risks to water supplies due to leaching from cemeteries and massive flooding that washes out cemeteries. Alternatives to burial are discussed in Section 4.4.

➢ Aquaculture – Due to increasing decimation of ocean-fisheries, the aquaculture industry is increasing tremendously. Land-based facilities could pose threats to the environment from improper drainage and release of nutrients and drugs (e.g., antibiotics). Ocean-based facilities pose similar threats and there are also risks associated with escaping fish, especially if they are diseased.

➢ Nitrogen – The use of nitrogen fertilizers is still increasing. Releases of substantial amounts of nitrogen into the environment can cause eutrophication of lakes (e.g., through massive algae blooms). An extremely large area of the Gulf of Mexico, known as the Dead Zone, has no or depleted oxygen levels from nitrogen run-off accumulated down the Mississippi River. The question is whether regional or global nitrogen imbalances could have even more harmful consequences.

➢ Plastic particles – Plastics are ubiquitous in our society. Unfortunately, many plastic articles are disposed of into the environment. When the plastic items, such as plastic bags, break down and disintegrate, ever smaller plastic particles are produced and can find their way into drinking water and be accumulated through the food chain. There

could be serious human and ecological health impacts associated with exposures to small plastic particles.

➢ Active nano-particles – Nano-technology researchers envision the development of active nano-particles that can, for instance, attack and destroy viruses in the human blood stream (called microbivores).[11] Release of active nano-particles into the water supply could have unforeseen and very harmful consequences.

➢ Artificially intelligent micro-electronic mechanical devices (MEMS) – Slightly larger than nano-technologies, MEMS are being contemplated that can repair arteries and nerves without invasive surgery. Release of MEMS into the water supply could have unforeseen and very harmful consequences.

➢ Stream heating – Climate change promises to increase stream water temperatures around the United States. Discharges from power plants are already significantly increasing the temperatures of many streams. The question to be addressed is whether this problem could escalate to threaten both aquatic ecosystems and the electric power industry.

➢ Water scarcity – Climate change, through increased periods of drought, continued population increases, and increasing demands for irrigation (e.g., for corn for ethanol), promises to increase water scarcity throughout many new areas of the United States (e.g., in the Southeastern United States). What are the implications of a truly national shortage of fresh water?

➢ Synthetic life – Researchers are creating new life forms in laboratories. Release of these new life forms could have harmful impacts upon the environment.

➢ Desalination plants – To deal with increasing levels of water scarcity, many communities are contemplating the construction of desalination plants. These plants may not be a problem, but one could inquire about the energy requirements and any emissions and wastes from these plants (e.g., would the salt extracted from the water be sold commercially or dumped back into the ocean?).

➢ Ocean Acidification – Increases in the amount of carbon dioxide in the atmosphere are also leading to increasing levels of carbon dioxide in the oceans. Among other problems, this threatens calcifying organisms such as coral reefs.

Mainly air related:

➢ Cremation – An increasing number of people are being cremated upon their deaths and are also having their deceased pets and other domesticated animals cremated. Cremation can release unhealthy emissions into the air. (See Section 4.4 below for a more detailed discussion of the environmental impacts of cremation and alternatives to cremation.).

➢ Forest fires – Climate change, through increased droughts and the prospect of more storms with lightening, has the potential to increase the already high risks of forest fires throughout the United States. Increasing population by 2050 could result in more people living in already fire prone areas. In addition to destroying property and environmental amenities, forest fires could add to already high levels of particulate-matter pollution. This has been seen as an issue restricted to the Western United States, but fires have been increasing in the Southeastern United States and concerns could be extended to New England and some areas in the Mid-West and Southwest.

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[11] See R. Kurzweil. 2005. The Singularity is Near: When Humans Transcend Biology. New York: Viking Press.

➢ Accumulated depositions – Much attention is paid to annual, daily, and even hourly concentrations of pollutants in the air. A glance at the annual releases reported through the Toxic Releases Inventory suggests that very large amounts of toxic materials are emitted into the air and water every year. Studies have already been done with respect to accumulations of harmful materials in the food chain and in humans. Another question that could be considered is what would be the implications of several more decades, or even centuries, of accumulated depositions of toxics and other harmful materials in the environment on human and eco-system health. Are there total-loading thresholds to be identified?

➢ Internationally-sourced air pollution – As developed countries ramp up their economies, they are also burning more fossil fuel in power plants, manufacturing plants, and vehicles. Associated pollutants can be transported across the globe. Mercury pollution from China is currently being found in lakes in the United States. While this problem has already been identified, potential increases in its magnitude and the future characteristics of pollutants may require further attention.

➢ Space debris – There is an increasing number of man-made artifacts orbiting the earth. While much attention is typically paid to how safely artifacts leave the earth, much less attention is paid to their inevitable return to earth. Does space debris warrant the attention of the environmental community?

Mainly solid-waste and built-environment related:

➢ Landfill mining – It is conceivable that entrepreneurs will soon turn their attention to developing technologies to mine the nation's landfills, which could be a source of rare metals and other valuable recyclable materials. The issue is what environmental risks are posed by landfill mining. For example, worker exposure to toxic chemicals (e.g., mercury) could be one issue. Mining operations that breach leaching barriers or otherwise spread pollutants out from landfills could be another.

➢ Crumbling urban infrastructure – The United States' urban infrastructure is not being maintained at required levels. We are under-investing in our highways and roads, bridges, drinking water systems, waste water systems, storm water systems, electric power transmission and distribution systems, natural gas pipelines, locks and in-land waterways, and many other components of our essential urban infrastructure. This situation promises an increasing number of system failures and possibly catastrophic events due to failures of cascading systems. The most serious threats to the environment from infrastructure failures need to be identified and addressed.

➢ Construction waste – Construction waste is already a significant component of our solid waste streams. Massive amounts of new construction wastes will be created as infrastructures are replaced. Also, climate change can be expected to lead to more destruction of property. (For example, Hurricane Katrina resulted in million of tons of construction waste.) The issue is what to do with increasing amounts of construction wastes (see Section 4.3 below for a more detailed discussion).

➢ Land subsidence – Drawing water from aquifers, pumping crude from oil fields, and removing coal from underground seams are examples of how we extract resources from the ground. Unfortunately, oftentimes after these resources are removed, land subsides, essentially collapsing empty spaces underground. Communities could be at risk, especially those located over heavily tapped aquifers, as the land they sit on drops.

➢ Toxic suburbs – Many long-settled urban areas and inner suburbs are being abandoned. Historically, this has happened in places like Harlem and the South Side of Chicago. Now, migrations from places like Detroit are taking place. Massive home foreclosures may devastate many more urban areas. The problem identified here is that toxic substances could left behind in abandoned homes and could enter into the environment (see Section 4.2 below for a more detailed discussion).

➢ Embedded computers – Much attention is being paid to electronic wastes. The scope of such wastes could expand greatly as electronics (and associated nano-particles) become embedded into clothes, glasses, and other items. Consumers may not identify these new items as potentially being electronic waste and, therefore, may improperly dispose of them.

➢ Microbial endangered species – Through accumulation of pollutants in the environment, modern agricultural practices, climate change and other factors microbes important to human and ecosystem health could be threatened with extinction. Science is only beginning to understand the extent of the microbiological world and may find many such species to be endangered.

➢ Space elevators – Someday, a new feature of our built environment could be a set of space elevators. These elevators would be built out of a cable of carbon nano-fibers anchored to the earth at one end and ending into geo-synchronous orbit at the other. Instead of launching rocket ships into space, platforms could slowly make their way up the cables and into space. Environmental issues associated with space elevators include their construction, operation, safety while in operation, and end-of-life.

Mainly energy related:
➢ Carbon sequestration – There are increasing calls to sequester carbon produced during the combustion of fossil fuels. Some of the plans call for carbon to be sequestered in exhausted oil fields or abandoned mines. The environmental impacts of such sequestration plans are uncertain.

➢ Geo-engineering – Larger scale efforts to sequester carbon, such as by seeding the Antarctic Ocean with iron to spur the growth of carbon consuming organisms, or otherwise manipulating the earth's climate fall under the general rubric of geo-engineering. Efforts to manage earth systems require extensive study and testing.

➢ Ocean energy – Dwindling supplies of some fossil fuels and the environmental drawbacks of others are leading many to search for new sources of energy. Ocean energy uses waves or tides to turn turbines to produce electricity. Questions exist about the potential environmental impacts of ocean energy facilities, both upon the areas where they are placed and with respect to any emissions or degradation of the facilities once they are in the water.

➢ Deep geothermal energy – In an effort to find environmentally friendly sources of energy, many people advocate drilling deep into the earth to tap the inexhaustible supply of heat energy. However, many current geothermal plants emit large amounts of sulfur. The potential range of environmental impacts of deep geothermal operations is uncertain.

➢ Concentrated solar-energy systems – Another widely touted alternative energy supply is concentrated solar. In one approach, a large area of land is covered with reflecting surfaces, which focus sunlight to heat water to produce steam. The potential range of environmental impacts of concentrated solar systems is uncertain.

➢ Server farms – Companies like Google and Microsoft are building facilities that hold thousands if not tens of thousands of computer servers to power their Internet services. These server farms are among the most intense energy consumers (by square foot) on earth. It is an open question whether massive server farms pose any threats to the environment.

➢ High-energy-physics facilities – To further probe the nature of matter, reality, and the beginnings of the universe, physicists are building ever more powerful high energy physics devices. These devices are capable of accelerating particles such as protons and electrons to sub-liminal speeds. The faster the particles are traveling before they smash into each other, the more can be learned about the building blocks of nature. Some people have speculated that these devices could at some point create enough energy and violent collisions to tear the fabric of space time, with the possibility of destroying the earth in the process. This would be the ultimate environmental disaster!

Mainly population related:

➢ Environmentally related mental illness – As discussed in depth in Section 2.0 above, the population of the United States is likely to increase to about 420 million by the year 2050. This population increase could put additional pressures on our national forests and parks. Also, it is likely that, due to increasing prices for land and energy, if not scarcity, population densities could increase dramatically. Americans need access to the "environment" for good mental health and the American psyche is not particularly suited to crowding. A rash of environmentally related mental illness may result.

➢ Environmental terrorism – Homeland security analysts are already worried about attacks upon water supplies. Environmental terrorists could also purposefully introduce even more harmful invasive species or engineered viruses into our ecosystems. Strategies to prevent environmental terrorism may warrant consideration.

➢ Environmental migration – A combination of climate change induced storms, heat index increases and sea-level rise, and increasing levels of water scarcity may lead tens of millions of Americans to migrate from coasts, deserts, tropical areas in Florida, and other water-scarce areas. What might be the environmental impacts on both the receiving communities and those losing population through massive environmental migration? These questions are addressed in more depth in Section 4.0.

➢ In vivo assays and computational modeling for toxicity assessments – Technologies that enable rapid testing of the toxicity of materials on cells are advancing quickly. The results may completely change our understanding of the toxic risks faced by humans in everyday life. It could be argued that the ethical, legal, and social issues surrounding the information that this technology could generate deserve in-depth consideration.

➢ Personal privacy – As mentioned below, there will be dramatic increases in our ability to monitor the environment. Such data collection exercises could put additional pressures on our ability to protect personal privacy. In addition to the ethical, legal, and social issues of better information from ubiquitous sensors, political, environmental decision-making, and economic issues could also be explored.

➢ Environmental elitism – Demands for organic food products and other green products are growing in the United States. Many of these products, such as organically grown fruits and vegetables, are touted as being healthy substitutes for other foods. Unfortunately, many of these products are substantially more expensive and have limited distribution,

making them unavailable to low income households and communities. Is there a need to help ensure that these households and communities also have access to more environmentally friendly and healthy products?

➢ Ubiquitous wireless communication – Devices that communicate through wireless technologies are increasing every day. Dangers from electromagnetic forces from transmission lines and cell phones have already been researched. Human and ecosystem health impacts of ubiquitous wireless communication (e.g., radio-frequency identification RFID tags) should also receive scientific attention.

➢ Virtual gaming – The computer gaming industry has grown tremendously in recent years. The advent of powerful portable devices is beginning to take virtual gaming into the real world. The question here is whether virtual gaming gone real, which could involve thousands if not tens of thousands of players, poses any threat to the environment.

3.2   Opportunities

➢ Sensor technology –Sensor technology is improving rapidly. Emissions of many more materials measured in many more places will soon be possible. Real-time monitoring of air and water quality could also become cheap and ubiquitous. One challenging project would be to design a national system of ubiquitous sensors to comprehensively monitor the environment.

➢ National environmental digital library – The above-mentioned server farms are capable of holding massive amounts of data and information. One opportunity would be to use image services like Flickr and video services like YouTube to host a user-generated national library of environmental images and videos. The images could capture neighborhoods, farms, and scenes from vacations. Historical images could be compared to current images to track changes to the environment in ways more personal than aerial and satellite imagery.

➢ Personal risk assistants – One can imagine that advances in sensor technology, coupled with sophisticated software, could lead to the development of personal risk assistants.[12] Worn on one's person or embedded within a handheld device, the personal risks assessors would be able to detect pollutants in the air and even handle samples of food and liquids for testing. Could such devices actually be built and what might be their social implications?

➢ Sustainable zoning and residential work regulations – There are opportunities to change local zoning, building code, and residential work regulations to allow people to better integrate work and manufacturing where they live (see Section 4.5 below for a more detailed discussion). Changes in these regulations could contribute to larger efforts that generally fall under the rubric of smart growth.

➢ Re-environmentalisim – As human settlements increase their footprints, ecosystems continue to shrink and fragment. By extending improvements such as urban forests and green roofs, one can easily imagine more comprehensive efforts to truly blur the boundaries between human settlements and ecosystems. Much work is needed in the areas of urban design, species management, and human psychology to capitalize on this opportunity.

➢ Carbon sequestration in the built environment – A recent Brookings Institution report states that fully one-half of the built environment needed by the year 2030 does not now

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[12] A. Bostrom. 2003. "Future Risk Communication." *Futures* 35(6): 553-573.

exist.[13] Advances in carbon-based nano-materials and technologies could be used to create a new built environment out of carbon (e.g., roads, bridges, buildings, sidewalks). A built environment composed of carbon could both effectively sequester carbon and could substantially reduce emissions of greenhouse gases from the production of cement, aluminum, and steel.

➢ Dark factories and other advances in manufacturing – Automation of U.S. factories continues apace, if only to allow U.S. plants to better compete with low-cost manufacturing plants overseas. Opportunities to build environmentally friendly "dark" factories (i.e., those with few or no humans, thereby reducing the need for light in the factories) should be researched extensively.

➢ Advanced recycling systems – New technologies, such as automated disassemblers, hold much promise for improving recycling rates. On the other hand, new materials, technologies, and products may be harder to recycle (e.g., because of exotic coatings, composite materials, or nano-particles). Research and development needs to keep the cutting edge of recycling moving forward and in step with new material and product challenges.

➢ Holistic environmental education – Environmental education has made great strides. A next step could be to include community-scale systems education and insights into the political, economic, and social aspects of sustainable behavior.

➢ Second Life – EPA, NOAA, and other federal agencies are already experimenting with sophisticated multi-user platforms to provide educational services. One popular platform for experimentation is Second Life, which is a virtual socio-economic environment. Extensive use of these platforms could facilitate the progress of holistic environmental education.

➢ Public participation – Great strides have also been made in the area of public participation. An opportunity in this area would be to develop methods, systems, software, and websites to facilitate continuous public participation in environmental decision-making forums to build upon "as-needed" public participation processes typically implemented by federal agencies.[14]

➢ Interagency collaboration – The opportunities for interagency collaboration have been numerous and can be expected to increase in the future. Especially in the international arena, collaborations between agencies involved in environmental protection will probably need to increase. These agencies include EPA, NOAA, U.S. Forest Service, Department of the Interior, Department of Energy, Department of State, Department of Defense, Department of Transportation, and even the Departments of Commerce and Treasury.

➢ Environmental decision-making facilitation and mediation service – A fractured American political landscape acts as a nearly insurmountable barrier to rational environmental decision making. An opportunity exists to establish a special federal service to facilitate coordinated environmental decision making across jurisdictions (federal, state, and local), help involve other stakeholders, and mediate disputes among jurisdictions and stakeholders.

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[13] See: http://www.architectmagazine.com/industry-news.asp?sectionID=1006&articleID=385542

[14] B. Tonn. 2004. "MyEmpowerNet.gov: A Proposal to Enhance Policy E-Participation." *Social Science Computing Review* 22(3): 335-356.

- ➢ Climate-change-adaptation planning regions – Climate change has the potential to impact almost all aspects of the nation's regions, including water supplies and quality, air quality, electricity demand, human health, and ecosystem health. To help facilitate adaptation to climate change, climate-change-adaptation planning regions could be designated.
- ➢ International collaboration – Emissions of greenhouse gases and stratospheric ozone destroying chemicals have shown that environmental problems are global in scope. It is now known that emissions of air pollutants such as mercury around the earth can impact air and water quality in the United States. In response, environmental protection must incorporate effective international collaboration.

3.3   Regulatory Issues

- ➢ Regulation of nano-particles – Under which law(s) might emissions of nano-particles and nano-technologies be regulated, if indeed they need to be? The Toxic Substances Control Act? The Resource Conservation and Recovery Act? Maybe both the Clean Water and Clean Air Act? The regulatory responsibilities for nano-pollutants need to be determined.
- ➢ Frequent change in environmental regulations – The political landscape in the United States is fractured with respect to environmental regulation. This situation could become worse as social and demographic trends that suggest desires for even more stringent environmental regulation (see Section 5.0) collide with severe economic constraints related to high federal deficits, high U.S. foreign debt, high household debt, and expanding financial liabilities associated with entitlement programs and infrastructure investments (see Section 2.0). The challenge is to design regulations that can interact rationally with both trends.
- ➢ Expansion of the Toxic Release Inventory – Dramatic improvements in toxicity assessments and in sensor technology may result in proposals to increase the number of chemicals included in the TRI and to increase the scope of the firms covered by the reporting requirements.
- ➢ State Implementation Plans (SIPs) and climate change – It is predicted that higher summer temperatures, especially in the late afternoon and early evening, will result in increases in tropospheric ozone pollution. Currently, it does not seem that these predictions are required to be incorporated into SIPs or into plans produced by counties in non-attainment for ozone to move into attainment in the future.
- ➢ Total Maximum Daily Loads and climate change – Similarly, climate change has the potential to radically change water flows in listed streams and other water bodies. Incorporating climate change predictions into water quality assessments and TMDL analyses should be considered.
- ➢ National Environmental Policy Act and climate change – Consideration should be given to explicitly incorporating climate change into federal environmental impact assessments.
- ➢ Stream heating, energy production, and climate change – Increasing temperatures, especially when combined with lower water levels due to droughts, has the potential to negatively impact energy production. This is because power plants need water for cooling and regulations prevent power-plant operators from dumping water that is too hot for local aquatic systems to handle. These regulations are sure to be more closely scrutinized as threats of widespread power-plant shutdowns become more prevalent as the climate warms.

- ➤ Organic regulations – Are there unintended environmental consequences of organic farming? If so, should there be a regulatory response?
- ➤ Agent-based environmental regulation – The concept is to regulate "agents" in the environment in a holistic fashion rather than have a series of unconnected laws and regulations. An agent could be a building, plot of land, or even a vehicle.
- ➤ Flexible and adjustable environmental regulations – Advances in sensor technology and overall computing could allow environmental regulations to be quite flexible in real-time, especially if the regulations were agent-based. Permissible levels of emissions could change in real-time as conditions change. The model here could be real-time pricing of electricity and transportation congestion pricing.
- ➤ Uncertainty representation and acceptable risk – One can argue that risks that can be expressed in probabilities of harm are more amenable for discussion and potential regulation than risks that are more vaguely characterized. Much work has been done to estimate individual risks of death due to a wide range of threats. Much less work has been done to quantify risks at larger scales, such as regional economic and health risks due to climate change. Consideration could be given to developing methods for representing the uncertainty surrounding large socio-economic risks stemming from environmental problems.

4.   FIVE BRAINSTORM IDEAS EXPLORED IN-DEPTH

This section explores in more depth five of the ideas mentioned in the previous section: massive internal migration, toxic suburbs, construction and demolition waste, alternatives to conventional burials and cremation, and regulatory barriers to sustainability. These ideas were chosen based on the interests of the five student authors. We think they are viable candidates for the title the NBT, but we do not argue that these are the five top candidates.

4.1   Massive Internal Environmental Migration

This subsection addresses several potential issues associated with a massive migration of the human population out of environmentally disturbed areas. For example, a rapid and substantial rise in sea level or a dramatic increase in storm activity (i.e. hurricanes) along coastal areas have the potential to displace millions of individuals, as approximately fifty percent of the population of the United States lives in coastal counties. Other climate-change-related problems could impact migration from in-land areas as well, such as a lack of water, unbearable temperatures, and threats of tropical diseases.

Water and Other Resources in Areas of In-migration

The most pressing issue associated with a massive internal migration could be the strain on local and regional water resources, mainly due to waste water and outright shortages. The addition of thousands to perhaps millions of evacuees could overwhelm the waste water infrastructure in many areas, which is already aging and in need of repair. Internally displaced persons (IDPs) in evacuee camps or who live with family could generate massive volumes of waste water, which could overload the capacity of already overloaded water treatment plants, resulting in spillage into creeks, streams, lakes, and rivers. This

contamination could lead to a cascade of public health problems, including the spread of disease and contamination of drinking water supplies. Water may need to be supplied by external sources, placing undue demand on those supply sources. Areas where water supply is already tenuous (some western states, the desert southwest) could be hardest hit, and areas with "adequate" water resources (in close proximity to large lakes or rivers, or in the south and northeastern US) could see the heaviest migration. Water sources previously regarded as plentiful could be drawn down to unprecedented lows, affecting all water usage "downstream." Aquifers could be pumped dry, and populations that depend on aquifers (i.e., Memphis and surrounding cities) could be forced to relocate. Entire watersheds could face exhaustion, altering local and regional hydrology, which could lead to extensive drought and ecosystem destruction. Water used to irrigate crops could be diverted for human use, resulting in wide spread crop failures and food shortages.

It is possible that many communities that receive new residents could develop boomtown atmospheres. Many boomtowns suffer from growing pains and often lack infrastructure, water, schools, and basic police and fire protection. Land may be developed hastily and with little regard to environmental concerns. Consideration should be given to providing these communities with extra assistance to manage the influx of new residents in manners that best protect the environment.

Solid and Hazardous Waste and Evacuee Camps

As seen in the aftermath of Hurricane Katrina, many areas were hastily constructed or adapted to accommodate a large number of disaster evacuees. These areas were prone to food and water shortages, and lack of medical care led to casualties. A large-scale environmental catastrophe could create similar situations across the United States, equivalent to several, if not dozens, of Katrina-type evacuee events, with potential evacuees numbering in the millions.

Large evacuee camps and local areas swollen with IDPs who have found homes could generate prodigious amounts of municipal solid waste (MSW) in areas unprepared and unequipped to handle that waste. MSW that doesn't find its way into local and regional landfills, which in many cases are already overtaxed or nearing capacity, could need to be disposed of using alternate methods. In an emergency situation, incineration could be the quickest method of waste disposal, but is also the dirtiest, and could lead to deterioration of local and regional air quality. Airborne particulate matter could increase exponentially, and could cause a significant increase in human health problems and ecosystem damage. Toxic substances could inevitably find their way into the air, which could directly affect the human population (inhalation), contaminate food and water supplies, and lead to weather-related deposition events (heavy metal/acid precipitation). Formal incineration facilities could handle the bulk of the waste, but individuals could take matters into their own hands, so to speak, when waste accumulates too fast in a local area, and could burn waste in open fires without regard to hazardous materials, noxious clouds, or particulate matter.

As mentioned earlier, disease and contamination could be a major concern, and could be the most serious in evacuee camps, as overwhelmed infrastructures and lack of medical care

could lead to poor sanitary conditions. Untreated sewage, water- and insect-borne pathogens, decaying organic matter, air pollution, and hazardous waste in open areas could be the culprits in the alarming increase of medical problems.

In addition, environmentally overwhelmed areas that contain nuclear and chemical plants, refineries, and other industrial structures could suffer at least partial destruction, releasing deadly chemicals and radioactive elements into the environment, many of which are recalcitrant. Some of these chemicals and isotopes have the potential to contaminate thousands of square miles, leading to irrevocable environmental destruction.

Quick Fixes

Emergency situations call for emergency measures. There are immediate problems that *must* be dealt with. In the event of massive environmental migration, policies and laws concerning air and water quality and waste disposal could be suspended, or perhaps more accurately, ignored, in the interest of *saving lives*. Marginal lands, classified as such due not only to lower fertility, but because the soil is prone to disturbance (erosion, leaching of nutrients, mass wasting), could be brought into production to compensate for the loss (due to chemical contamination, salinization, etc.) of coastal agricultural lands, and could be annexed for new construction. The result, naturally, is increased soil erosion, which cascades into sedimentation of water resources, and permanently reduced soil fertility.

Disregard for policies and laws, which were hard won, could have both short- and long-term deleterious effects. While quick fixes may save lives, they ultimately could lead to a diminished capacity to provide for the welfare of the population, and could lead inexorably to permanent degradation of natural resources.

Conclusion

There is a common saying among many environmentalists: "It's not an *if*; it's a *when*." This means that society must act now to prepare for an event of the magnitude described in this paper. Essential to this preparation is an *integrated* approach, a view that incorporates air, water, land, and humans, as a functioning, interrelated system. Approaching a problem from one point of view may exacerbate problems in a different, but related, area, ultimately leading back to problems with the original solution. Future legislation and policy frameworks, institutional structures, budget requests, and delegation of human capital must be structured around this integrated framework. Bridges must be built among governmental agencies and non-governmental organizations to facilitate broad and simultaneous solutions.

4.2   Toxic Suburbs

The United States is faced with yet another problem, abandonment of large numbers of homes and other structures in the suburbs. The current foreclosure crisis has already left thousands of homes vacant and heading toward disrepair. Higher fuel prices and changes in lifestyle may also hasten the movement of people from the suburbs to denser urban cores and New Urbanism developments. Abandoned homes could pose significant threats to the environment and human

health because left behind in these homes could be such noxious substances as lead, asbestos, radon, formaldehyde, and mold. Vermin can also be expected to flourish in abandoned homes. Those exposed to these threats could be new occupants, squatters, kids playing in the abandoned homes, workers and neighbors. Many of these substances could find their way into waste streams.

Lead is primarily associated with older homes. Many of these homes, maybe as many as 35 million, have or used to have lead-based paint. Lead can also be found old homes located near roads and highways, where lead emissions from vehicles could have blown into various nooks and crannies. Rapid abandonment of homes could result in disturbance and disbursal of the lead that has settled in these homes. New occupants, squatters, and workers could be exposed to lead dust. Children playing in these abandoned homes could be exposed to lead dust and lead-laden paint chips. Abandoned homes torn down in haste could result in substantial amounts of lead being disposed of in municipal landfills. Health impacts due to exposure to lead include: hyperactivity, vomiting, anemia, kidney problems, reproductive problems and, in children, reduced cognitive abilities.

Asbestos is a similar problem. Exposure to asbestos-laden dust causes thousands of new cases of lung cancer in the United States each year. Certainly, people working to repair and rehabilitate abandoned homes can take precautions to limit their exposure to asbestos. Unwary occupants and uninvited visitors are at more risk. Again, hasty demolition of abandoned homes could result in significant amounts of asbestos entering the waste stream.

A toxin-based health problem in old and newer homes alike is formaldehyde. Many homes have elevated levels of formaldehyde because of the large amount of high-emitting pressed wood products used in their construction and because of their relatively small interior space.[15] Exposure to formaldehyde can cause irritation of skin, eyes, and upper respiratory systems. Formaldehyde can cause asthma attacks and can also weaken immune systems, making people more susceptible to health problems caused by other toxins. One can imagine many surfaces becoming unsealed in abandoned homes, allowing formaldehyde-laden vapors to escape. Again, unwary occupants, visitors, and workers could be at most risk.

Radon is now the second leading cause of lung cancer in the United States.[16] Most people that live and work in and around the suburbs often don't even know when radon is present. It is tasteless and odorless. It can enter homes and buildings through cracks in floors, walls, or foundations. Testing is the only way to know if your home has elevated radon levels. Nearly one out of every five homes have radon levels that exceed the EPA's "action" limit, making them unsafe for humans to live in.[17] Seals in crawlspaces and basements can prevent radon from seeping into homes. In abandoned homes, these seals may fall into disrepair, thereby allowing dangerous levels of radon to build up.

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[15] Since 1985, the Department of Housing and Urban Development has permitted only the use of plywood and particleboard that conform to specified formaldehyde emission limits in the construction of homes.
[16] See: http://www.cancer.gov/cancerTopics/factsheet/Risk/radon/
[17] See: http://www.epa.gov/radon/pubs/citguide.html

Toxic mold is a problem that could especially plague abandoned homes. This is because roof leaks and other problems could lead to substantial amounts of standing water, water logged walls, and other water and humidity build-ups. One example of toxic mold that could plague abandoned homes is stachybotrys atra. It can cause eyes to water, skin to become itchy, constant coughing, and physical exhaustion. This black mold can also cause sinus infections, and in more serious cases, brain damage.

As above, toxic mold can impact the health of unsuspecting occupants. However, unlike the risks mentioned above, once established, toxic mold can prove impossible to deal with. One method of dealing with stachybotrys atra that is growing in popularity is simply to burn the infected homes. To date, most of the homes that are burned are located in rural areas, which minimizes the threat of anything else in the area catching on fire. This solution may not be as viable in more densely settled areas. Disposing of toxic-mold-laden demolition wastes in municipal landfills poses risks as well.

Lastly, abandoned homes could be a boon to vermin and mosquitoes nesting in abandoned pools, fountains, and planters. Food waste and other garbage left behind is sure to attract rats and mice. Abandoned homes are ideal habitats for these types of creatures, too. Increasing numbers of vermin could increase health risks throughout communities with large numbers of abandoned homes.

The big question is: what should we do with our abandoned and decaying suburbs?

4.3   Construction Waste and Demolition Waste

By the year 2050 our built environment will probably have undergone incredible changes. More than half of the structures now standing will be gone. Because of expected increases in population, even more new buildings will take their place. It can be expected that this transition will lead to a massive increase in construction and demolition waste.

There are three other reasons to expect substantial increases in construction and demolition waste. First, the number and severity of storms is expected to increase because of climate change and it also expected that these storms will create large quantities of debris. A second factor that will result in a large increase in construction and demolition waste is the growing trend of urban abandonment. The final factor to take into account is radically different lifestyles that may require a different built environment. These three factors plus the general turnover in the built environment have the potential to create an unprecedented amount of construction and demolition waste. Waste from demolition on such a large scale can create significant environmental, economic, and public health concerns. By utilizing technology, implementing mandatory recycling regulations, and building environmentally friendly, sustainable buildings, many of these negative consequences can be avoided.

Construction and demolition waste constitutes a large amount of the material found in landfills. Approximately 136-million tons of construction and demolition waste are dumped into landfills

each year.[18] Typically, construction and demolition waste include concrete, wood, drywall, asphalt, shingles, metals, carpet, furniture, plumbing, and other structural materials. Climate change could result in more devastation with the increased number and severity of storms, such as hurricane Katrina that made landfall in 2005. Hurricanes Katrina and Rita combined produced approximately 46-million cubic yards (22-million tons) of storm debris, much of which still awaits disposal.[19] It should be noted that these two storms alone increased the amount of construction and demolition waste in the U.S. by at least 15%.

The growing trend of urban abandonment (and more recently home foreclosures) as we have seen in cities such as Detroit, Michigan is also producing substantial amounts of construction and demolition waste as well. Many homes and even office buildings and old factory sites have been neglected and left vacant for several months or years. These structures are being demolished due to their dilapidated state. Many of these homes and businesses were built before the 1970's when asbestos was banned in most construction material. Air quality could be extremely impacted when these structures begin to be torn down at a rapid pace in unsafe manners. Asbestos, PCBs, lead, and other harmful substances pose very serious public health threats. Many of these materials have the potential to cause cancer, birth defects, and genetic mutation, among other devastating diseases. Research into the disposal of mass amounts of these materials in an environmentally safe way is extremely important for public safety.

In the year 2050, different lifestyles may require radically different built environments and therefore add to the amount of construction and demolition waste. For example, people may shift their preferences from living in "pastoral" suburbs to living in more densely populated and accessible urban cores or New Urbanism developments. Housing units themselves may have different designs to accommodate increases in telecommuting and novel household arrangements. Many houses may even be designed to be energy and water self-sufficient, recycling friendly, and facilitate intensive permaculture. Old, obsolete structures will need to make way for new more attractive and functional designs, with one consequence being more construction and demolition waste.

Unfortunately, many landfills are already over capacity. Theoretically, there is plenty of land in the United States for new landfills. However, practically, the number of conveniently located sites is probably much smaller because many communities object to having new landfills sited near-by. Impacts on water and air quality are concerns. Aesthetics, noise, and smell are also important issues. Some communities are willing to deal with their own waste but object when waste is trucked in from other communities, especially from out-of-state. Huge increases in construction and demolition wastes would exacerbate and increase the number of contentious conflicts over landfills across the country.

There are several ways to combat the enormous potential increase in construction and demolition debris. These include employing new technological advances in waste elimination, utilizing recycling capabilities, and creating structures from non-hazardous, sustainable materials.

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[18] Tabitha Alterman. 2005. "Reduce your Building Waste. " Available online at: http://www.motherearthnews.com/Green-Homes/2005-07-01/Reduce-Your-Building-Waste.aspx
[19] Linda Luther. 2006. "Disaster Debris Removal after Hurricane Katrina: Status and Associated Issues." CRS Report for Congress, available online at: http://assets.opencrs.com/rpts/RL33477_20060616.pdf

Estimates suggest that nearly half of the built environment that will be needed for the population in 2030 has yet to be built. We have an opportunity to decrease the hazardous effects of building waste by creating environmentally friendly and efficient structures.

Many of these problems can be addressed through technological advancements. One such innovation is the conversion of construction and demolition waste into energy. Converting these materials into electricity will eliminate the amount of debris that is transported to landfills each year. Several facilities will need to be created in each state to allow the waste to be managed and processed closer to where it is produced. The process is the ultimate manifestation of recycling materials as the electricity produced will then go to power the community from which it came. The process will minimize environmental damage and preserve the aesthetic topography of the area.

A large portion of construction and demolition waste is not recycled due to convenience, market drivers, and simply the mindset of many in the business. A solution to a potential massive increase in construction waste is implementing stricter recycling regulations during demolition.[20] Demolition could occur in such a way that materials can be sorted and sent to recycling facilities in order to divert trash from being incinerated or sent to landfills. Mining operations for precious metals and other materials could be undertaken for those landfills that do still exist in order to recover and recycle even more material. Educational opportunities and market incentives can be created to stimulate these recycling initiatives.

The use of sustainable building materials should be part of this transition. Many structures can be deconstructed and allow various materials to be reused, or transformed into other products. Timber from structural framing can be salvaged along with sheet rock. These materials can be ground up and used as mulch or compost. Flooring can be made from organic materials to create plant-based linoleum and cork flooring. Cabinets and other interior structures can be made from wheat board. Recycled glass can be used for various components such as tiles. Soy-based paints and finishes can be used to limit hazardous emissions. Creating sustainable structures today will decrease the environmental and public health threats posed by a massive increase in construction and demolition waste.

An increase in severe weather, urban abandonment, and a radical change in lifestyles have the potential to create a large amount of building waste in North America. The increase in construction and demolition waste could pose negative environmental and public health consequences. Several solutions can be implemented in order to combat these problems. Increased technology can be utilized in order to convert waste into energy. Recycling could be mandated and landfills used as mining operations for usable materials. Finally, by constructing buildings today with sustainable materials, we can decrease the negative impacts of demolition in the future.

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[20] University of Florida, Gainesville, Department of Environmental Engineering Sciences. 2007. "Government Policies for Increasing the Recycling of Construction and Demolition Debris." Available online at: http://www.dep.state.fl.us/waste/quick_topics/publications/shw/recycling/InnovativeGrants/IGYear7/finalreports/ClayIRGRecyclingFinalDeliverable_10_23_2007.pdf

4.4 Alternatives to Conventional Burials and Cremation

By the year 2025, the U.S. Consensus Bureau projects that the death rate will climb to nine percent of the population.[21] That percentage is expected to increase even more as the demographics continue to change by the year 2050; this influx of bodies to dispose of will be quite problematic due to the lack of land space. Therefore, early research on alternative forms of burial may prevent a future disaster of mass bodies and help to foster a path of sustainability.

Alternative forms of burial are necessary because of the environmental hazards imposed by the conventional method of burial. Environmental issues include the use of caskets and vaults in which 30 million board feet of hardwoods, 90,272 tons of steel, 2,700 tons of copper and bronze, and 1,636,000 tons of reinforced concrete are buried in the ground annually. Not to mention the dangerous fact that there are 827,060 gallons of embalming fluid per year within bodies that are laid to rest. Embalming fluids, containing contaminants such as mercury, arsenic, and formaldehyde, are a source of soil and groundwater pollution. Studies have shown that embalmers and funeral directors have a higher incidence of leukemia and cancers of the brain and colon.[22]

However, 27% percent of Americans are choosing cremation as a more ecological alternative to conventional burial. It is projected that by the year 2010 there will be nearly one million cremations in the United States, nearly half of the population.[23] Although some Americans are choosing this option because it is more environmentally friendly, its true environmental consequences are being neglected. Even though the 1990 Environmental Protection Act placed certain responsibilities on crematoria to ensure that the process is carefully controlled to minimize the impact on the environment, crematories continue to emit nitrogen oxides, carbon monoxide, sulfur dioxide, particulate matter, mercury, hydrogen fluoride, hydrogen chloride, NMVOCs, and other heavy metals, in addition to persistent organic pollutants.[24] Therefore, it is imperative to find a proper ecological form of burial that is environmentally sustainable. Forms of popular alternatives that need further research as possibilities within the United States include resomation, promession, and natural burials.

Resomation is an environmentally responsible, water based, flameless "biocremation." [25] The individual corpse is placed inside a silk bag that is placed within a metal cage frame. Alkali and water are added and the mixture is heated to around 150-170 degrees Celsius; the procedure is complete in about 2 hours. This process speeds up the natural form of alkaline hydrolysis that occurs naturally in soil. Leaving only "bio-ash" and innocuous liquid, resomation is a safe and effective means of conscientious burial. The technology has been proven; it only lacks consumer attention.[26]

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[21] See: http://www.census.gov/ipc/www/idb/country/usportal.html
[22] See: http://www.naturalburial.coop/about-natural-burial/conventional-burial/
[23] See: http://www.mastertouchcremation.com/2/3.html
[24] See: http://www.environmentalcaskets.com/htmlpages/cremation.html
[25] See: http://www.resomation.com/
[26] Brochure available at: http://www.resomation.com/sitebuildercontent/sitebuilderfiles/brochurereso08.pdf

An even more ecologically friendly alternative to cremation is promession, invented by Susanne Wiigh-Mäsak, a Swedish biologist.[27] Already in the town of Jönköping, Sweden, trials have been successful and there are plans for a Promatorium to be erected. Promession is the process of freezing a corpse in a vat of liquid nitrogen; the very brittle remains are then carefully broken apart with ultrasonic vibration that results in a damp powder that is dried and then packaged in a small biodegradable coffin. These remains are even finer than "bio-ash" and can be returned to nature through burial or even through garden composting. Promains are very nourishing for plants but can also be kept by the relatives of the deceased or even buried naturally.[28]

Natural burial could be the most easily accepted form of burial for Americans because it is the least drastic.[29] Natural burial may not be the most effective means of disposing of bodies in an environmentally responsible manner, but it is a definite step in the right direction. Natural burials are also referred to as green burials or eco-cemeteries. This form of burial focuses on simplicity and naturalness. No embalming fluids or concrete vaults are used, and remains are placed in a biodegradable casket or shroud. Much pride is taken in these eco-cemeteries; families are encouraged to plant native trees and shrubs as memorial markers, or flat stone rocks are even used. The theme is protection and stewardship over the land to which your loved one has been returned.

As we approach the year 2050 and the baby boomer generation begins to die off, there is going to be a real and definite problem of what to do with all of the bodies. Land space is already an issue both within and outside of the realm of burials. Listed above are three legitimate alternatives to the polluting practices of traditional burials and cremation. Death provides the true means of recycling: "ashes to ashes, dust to dust." We are bound to return to the earth, and there must be other options that do not include toxins and pollutants. It is imperative for this issue to be addressed as it includes both aspects. Although this issue may seem humorous or benign, it is real and must be considered as a platform for further research on how to implement new practices and how to overcome social and/or religious moors that are integrated with the act of burial. It is proposed that consideration be given to the development and enforcement of environmentally responsible burial methods. More research on the actual effects of conventional burials and on ecological remedies is needed to the increase environmental awareness of alternative methods.

4.5   Regulatory Barriers to Sustainability

The famous American photographer Ansel Adams once said, "It is horrifying that we have to fight our own government to save the environment." Nowhere is this more evident than in local government directives that virtually dictate irresponsible growth and impede individual sustainability efforts. To be sure, laws are necessary and the ability of government to use them to promote health and safety is essential. This legislative power can and should serve as a tool to impress upon society the dire need to change our unsustainable path and heed the call of an ailing environment. Instead, many municipalities continue to impose regulatory barriers on green

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[27] See: http://www.wisegeek.com/what-is-promession.htm and http://www.promessa.se/nyhetsbrev5_en.asp
[28] Brochure available at: http://promessa.se/doc/Ekobegr_eng.pdf
[29] See: http://naturalburial.org/index.php?option=com_content&task=view&id=19&Itemid=41 and http://www.greenburials.org/.

and sustainable initiatives that ultimately discourage such activities. The following paragraphs discuss some of the barriers that could impede lifestyles that aim to revert to "back to the land" as portrayed in the *Needless Majority* and *Pangaea Panacea* sustainable community scenarios found in the Appendix.

There is no doubt that many things would have to happen for true sustainable communities to ever be realized, nonetheless it is useful to discuss legislated barriers that are in place today that obstruct the greening or "smart" lifestyle attempts of many citizens. For example, in Tennessee the City of Knoxville's ordinance 5-101(a) states, "It shall be unlawful for any person to keep or allow to be kept cattle, horses, sheep or goats of any kind in any residential section within the corporate limits of the city."[30] Since Knoxville's city limits are now fairly extensive and encompass rural areas, this ordinance serves to dampen many self-sustainable aspirations in terms of sustainable agriculture. For the brave souls on the outskirts of the city who are allowed to have livestock, the zoning code that prohibits "offensive odors" in residential areas makes sure these dwellings are on larger pieces of land in "agriculture" areas, which are shrinking rapidly according to the Knoxville Municipal Planning Commission.

As for solid waste disposal techniques of a sustainable community, wide acceptance is not readily forthcoming. Health authorities are unfamiliar with new technologies such as composting toilets, and building codes require standard disposal techniques. There are plumbing codes in many settlements that require "direct connection to local municipal sanitary sewer where one exists."[31] Cassandra Naylor, a Baltimore County, Maryland resident, installed a Clivus Multrum composting toilet as one of her attempts to live off-the-grid in the 100-year old barn on her family farm. The system "fascinated the county building inspectors" but they insisted she install a "superfluous septic field" anyway.[32] Given the added cost of conforming, these types of pioneering efforts face serious barriers.

Many plumbing codes also mandate that any water collected for any use be potable and come from the tap. This encumbers widespread use of rainwater collection and other grey water systems meant for purposes where non-potable water use is acceptable, such as for irrigation. Just as sewer connections must be made, so too must water connections to the main line of the jurisdiction. It is hard to believe that water-saving techniques are not always applauded and are normally obstructed. The plumbers union in Philadelphia is blocking the initiative to install water-conserving urinals in the Comcast Center men's rooms. The no-flush system would save 1.6 million gallons of water every year and no doubt lessen the need for plumbing services.[33] So, not only is sustainability up against codes constructed for health and safety, but also codes constructed to economically benefit certain groups.

The ability to generate one's own energy is possible these days and some states will even subsidize homeowners for the infrastructure. Utilities can buy the excess energy. This assistance, though, is not offered at a widespread level, nor is it accepted in many areas due to the

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[30] See: http://www.ci.knoxville.tn.us/services/codes/
[31] West Coast Environmental Law. "Cutting Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations." April, 2002. (Available online at: http://www.wcel.org/wcelpub/2002/13724.pdf.)
[32] "Responsible Renovation." 2008 (April). *Cottage Living Magazine* 5(3): 52
[33] See: http://www.philly.com/mld/philly/news/14131612.htm

appearance of roof-top systems. Many areas do not allow solar panels to be seen from the street; if the front of the house is the only side that gets sun, this self-sufficient energy acquisition is not possible for these unfortunate homeowners. In Knoxville, to build or remodel in a historic zone you must comply with the codes that aim to keep the area consistent with its original time period designs. Solar panels violate this requirement. At the very least, these homeowners should get tax breaks for producing clean energy and taking some pressure off local utilities. This is not always the case. In Trenton, NJ, a homeowner who bought solar panels was slapped "with a $12,000 increase on the value of their home, leading to a $400 increase in property taxes."[34]

The design of one's home and strategic placement of the building on the property according to natural characteristics can make a significant difference in terms of efficiency. The ideal design is one that takes advantage of old growth trees to shelter the house from excess direct sunlight to keep it cool while positioning the house to utilize natural sunlight for light at certain times of the day to minimize energy consumption.[35] This may take the shape of a long one-story house or a tall multistory house depending on the makeup of the property. Setback ordinances usually get in the way of thoughtful orientation of a building. Setbacks in Knoxville residential zones are 12 feet on the sides, 35 feet in the front and 25 feet in the back, unless your back also abuts a road, then its 35 feet there as well.[36] This leaves very little room to maneuver for many. Long houses are rare as the codes mandates that no building shall exceed 35% of the area of the property. The height of a house is not to exceed 36 feet, so if it takes 40 feet to get a house into optimal daylight exposure, too bad.

How a homeowner manages the vegetation on his or her property can be highly contested as well. According the Knoxville Metropolitan Commission Ordinance, landscaping and vegetation shall be maintained in a "satisfactory manner." This vague statement leads one to ask "satisfactory to whom." Well, the matter is spelled out more clearly in the Knoxville neighborhood codes, where it states that a lot is considered "dirty" and subject to fines if "vines, underbrush, or grass exceed 12 inches high."[37] Mark Campen, a Knoxville homeowner, has gone to great lengths to re-establish the natural wildlife corridor in his front yard. In the summer this area is packed with wild nature Tennessee species, some of which are considered weeds by the neighbors. Even though the National Wildlife Federation has declared the area a Wildlife Habitat, authorities continue to harass Mark with legal threats.[38]

Green roofs, also called vegetated roofs or living roofs, are "typically planted with native grasses, wildflowers or other climate-appropriate groundcovers, they slow the flow of stormwater off the roof, keep surrounding outside air temperatures cooler, insulate the home from noise, heat and cold, and may even extend the roof's life."[39] Unfortunately they are not widely accepted by neighboring homeowners or regulators due to the unusual look. Regulators who declare them a fire risk can prevent a green roof from being installed. Just as with many

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[34] See: http://nylawline.typepad.com/greencounsel/regulatory_barriers_to_sustainability/index.html
[35] See: http://www.ciwmb.ca.gov/GreenBuilding/Basics.htm
[36] See: http://archive.knoxmpc.org/zoning/Knoxville.pdf
[37] See: http://www.ci.knoxville.tn.us/services/codes/
[38] Mark Campen. Personal interview. 3 April 2008.
[39] See: http://www.greenhomeguide.org/

other innovative environmentally friendly techniques, the green roof is not understood very well and could be considered a liability to local authorities.

One of the most obvious and researched impediments to smart growth is local zoning regulations. There is widespread agreement that sustainable growth includes multi-use and high-density development. A variety of uses, residential, commercial, open-space, and institutional, in one place is crucial.[40] Therefore zoning that places strict restrictions against multi-use and high-density development, as in the residential zones of Knoxville, is considered irresponsible by "smart" standards. The pattern of residential development in places like Knoxville has created unsustainable auto-dependent societies. Delaying the inevitability of change are policies such as Tennessee's Public Chapter 1101, a growth boundary act to minimize sprawl, which gave the false impression of smart oversight management when in reality it only made things worse.[41]

Restrictions that prescribe the number of units per lot, setback standards, and site cover percentage can act as barriers to the infill development that is recommended by smart growth practices. What is not as widely known or discussed are the restrictions found in plans like Knoxville's MPC "Heart of Knoxville" infill guidelines that restrict "green" infill.[42] Under the "Design Guidelines," not only are setbacks to be consistent with original houses, but the front door and garage location, porch orientation, building scale proportions, foundation height, similar pitch, and complex roof forms as well. There are drawings of the "appropriate" window usage with a Craftsman; Craftsman's are naturally dark inside, which is not particularly efficient by today's standards. Pre-1940s infill must use "darker shades of shingle roofing" (pg. 18). This directive is clearly not in line with anything but aesthetics, given that it is widely known that a roof must be light colored to reduce heat absorption if one is interested in efficiency. In fact, a lighter shade roof can lower the temperature of the roof by up to 100 degrees F.[43]

Just as there is little incentive to take on an infill project, building revitalization is anything but rewarded. Although many states have addressed the code issues that successfully block responsible renovation, many continue to place a disproportionate burden on recovery to that of new construction. It is therefore not surprising that perimeter home building is the dominant form of construction. Code organizations, the International Code Council and the National Fire Protection Association, have oriented codes specifically for rehab undertakings like the 25-50% Rule and the Change of Occupancy Rule. The 25-50% Rule mandates if a proposed building rehab cost is to exceed 50% of the cost to replace the building then the project was to include bringing the entire building into modern code compliance. If the cost is more than 25% replacement cost, then the areas undergoing construction must meet modern code compliance. The Change of Occupancy Rule states that if the building changes its use, the construction requirements must meet the current standards for its new use. For example, if the use was

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[40] "Getting To Smart Growth II: 100 More Policies for Implementation." Available online at:
http://www.smartgrowth.org/search/default.asp#SGN%20Partner%20Publications
[41] Colin C. McCleod. 2003. "Tennessee Urban Growth Boundary Plans: An Analysis of Local Governments and Urban Sprawl under Public Chapter 1101." Masters Thesis, University of Tennessee, Knoxville.
[42] See: http://archive.knoxmpc.org/plans/dguides/infill_guide.pdf
[43] See: http://www.greenhomeguide.org/

industrial and is being changed to residential, it must meet current residential criteria.[44] Because sometimes it is cheaper to start anew than to retro-fit, these codes represent recovery deterrence.

Americans seem to have an affinity for roads. Paved surfaces for vehicles make up a huge portion of the American landscape. Our roadways get bigger and bigger, while communities lose trees, sidewalks, and greenways. Efforts to install greenways and sidewalks are often prevented due to the road regulations that deal with emergency access standards and development standards. Emergency access standards maintain road width for emergency vehicles and development standards orient roads "based on traffic studies, maintenance, and snow clearing assumptions."[45] Though these are important, alterations could be made, emergency vehicles could be smaller or grasspave techniques that allow only emergency vehicles on them could be installed if municipalities are interested in a healthy, sustainable community. Also, parking bylaws, laws insisting there be a certain amount of parking allotted for specific land uses, take up chunks of land unnecessarily to accommodate excessive parking requirements.

Municipalities can do many things to improve the sustainability and efficiency within their communities. There are even little things that would make a huge difference, like revamping recycling activities. In Knoxville, a county homeowner pays a flat fee for garbage pickup and a substantial fee for a small recycle bin. This discourages recycling by allowing an unlimited amount of garbage and only a limited amount of recycling to be discarded. In most cities, builders are charged if recycling bins are placed in the streets, so they are likely to forego this effort. These are small changes that could make a big difference and a great start to encouraging green thought that may influence other policies in the future. Awareness that the regulations created to save us from ourselves can cause more harm than good is the first step.

5.0   POTENTIAL CHANGES IN ENVIRONMENTAL VALUES

The issue addressed in this section is whether Americans' environmental values will change over the next several decades. This question is addressed with a series of vignettes that describe major demographic groups that could come to exist in the U.S. over the next several decades. The first three vignettes portray groups of people who are recognizable today but may not represent large fractions of the population. The fourth addresses how the dominant group in today's society may morph and struggle in the future. The last two vignettes portray the economically disadvantaged in urban and rural areas. Let's assume that these vignettes are set around the years 2030 to 2040.

5.1   Jetsons

The Jetsons are the new elite of American society. They are active and cosmopolitan. Much like the world of the cartoon character George Jetson, they are comfortable around and with technology, such as home robots, 150-story skyscrapers, or AI-controlled super-fast electric cars. As a group, they are rather status conscious.

The Jetsons comprise about twenty percent of the population. They live in up-scale, gentrified areas in and adjacent to vibrant urban cores or in gated, high-end suburbs near commuter trains

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[44] See: http://www.goodjobsfirst.org/pdf/breaking%20the%20codes.pdf
[45] West Coast Environmental Law. "Cutting Green Tape: An Action Plan for Removing Regulatory Barriers to Green Innovations." April, 2002. (Available online at: http://www.wcel.org/wcelpub/2002/13724.pdf.)

or automated highways. Most of the little Jetsons are programmed through the educational system and receive two or more college degrees. Jetsons just out of college almost all live in segregated enclaves in active urban areas. Nightlife is important to this crowd. When Jetsons eventually marry, a big decision is whether to raise their two children in the city or move to a gated community. Retired but still active Jetsons live two or three different places during the year (e.g., by the beach in the fall and winter, up north in the summer). The latter part of their lives is spent in up-scale, alma mater-run assisted living facilities.

The hitch in this story is that Jetsons do not want to get older, much less pass away into the night. Sometimes called Kurzweilians, Jetsons take advantage of the full arsenal of medical science and technology. They are often referred to as cyborgs; many have artificial eyes, hearts, hips, knees, whatever. Genetic therapies are also making in-roads, leading them to be called the first trans-humans, too. Some in government are wondering whether disposal of dead Jetsons needs to be regulated under RCRA or some other environmental laws.

Jetsons are a curious mix of outlandishness and energy and extreme risk aversion. Those who expect to live forever do not want to die from accidents or exposures to environmental pollutants. The Jetsons spearheaded the tightening of almost all environmental laws; thou shall not emit anything in the environment that may shorten the lives of the Jetsons. The Jetsons, being great travelers, also pushed through measures to protect their vacation spots, such as national parks and Atlantic and Pacific beaches, as well as attractive international destinations. Although the Jetsons generally own and manage large, transnational corporations, their desire for immortality has changed corporations from being opponents of environmental laws to being its staunchest supporters.

5.2   Home Dwellers

If the Jetsons are the extroverted, life of the party types, the Home Dwellers are their polar opposites. Have you ever seen a Home Dweller in real-life, in real-time? Probably not, unless you receive a rare invitation to visit their cyberspace cocoons in person. Home Dwellers are those neighbors you never see, the people who spend their lives on the Internet, the people who send you nasty notes and pictures, the people whose real names you never know.

As may have guessed, Home Dwellers do not get out much. They work at home. They home school their kids or enroll them in distance education programs. Their entertainment is provided through computer screens, virtual reality heads-up displays, and mash-ups of music, images, and video. They do get some exercise, running through virtual environments while in rotating spherical cages or carefully walking on treadmills as they navigate the Web. They live everywhere in the United States but mostly in the ex-urbs or other less populated areas. Their homes are bigger than average, to support their stay-at-home livestyles. Home Dwellers do go to college, and experience five to six years of wild behavior and embarrassing social situations before disappearing in their new cyber-enhanced digs. Jetsons wonder how Home Dwellers ever get married and have kids. It is important for social scientists to figure this out because Home Dwellers make up about one-fifth of the population.

The Jetsons and the Home Dwellers do not get along, but since they rarely cross paths, this is not a huge problem. Also, it helps that both groups are cyborgs at heart. Home Dwellers may

actually more resemble the Borg of Star Trek fame, plugged in and operating as a quasi-hive mind. In any case, they are finicky about their food (everything must be organic) and nutrients. Botox and cosmetic surgery is not for this group (attractive avatars are used to enhance their self-images), but all other medical advances are welcome. So, together with the Jetsons, the Home Dwellers pushed through legislation to tighten emissions standards of all sorts. On the other hand, since they do not get out much, Home Dwellers are not big environmentalists.

5.3 Islandians

In 1942, Austin Tappen Wright's lengthy utopian novel entitled *Islandia* was published. Islandia is a fictional island nation in the Southern Hemisphere facing the Antarctic that combines the best features of an agricultural society with the best features of a society that is technologically advanced (at least at the turn of the 20th century). Wright's utopia of the past was characterized by strong and extended families, generations of ownership of agricultural lands, local sustainable communities, unquestioned generosity, and the allocation of "surplus labor" to organizations that conduct medical, agricultural, and other forms of research.

As the mid-point of the 21st century approaches, real-life Islandians have become a major social and political force in the United States. Islandians live in sustainable communities across the U.S., although most are in "fertile" areas in farming country or in suburbs that have been flattened, cleared of debris, and remediated for environmental problems. The communities have communal land-use designs. These designs allow the communities to be highly self-sufficient in energy, water, and food. New nano-technologies also allow a fair amount of other products to be produced in homes and within the communities.

Most Islandian "settlements" have around 200 people. Anthropologists call them clans and indeed many settlements have clan-type names (e.g., the Leopolds, Friends of Life). These "clans" serve to foster local sustainability efforts and to re-establish strong social bonds among people at the community level. Two hundred seems to be a magic number, which is reflected in the size of pre-historic clans and modern day military units and divisions within large bureaucracies.[46] The number is small enough for people to keep track of their obligations to others and yet large enough to encompass the needed diversity of skills and social roles to allow the group to survive.

Nearly all adults in the clan contribute about one-half time to self-sustaining activities and one-half time to regular jobs. Elders once again are revered for their knowledge and wisdom. Storytelling and other group activities dominate social life. Many Islandians live their entire lives in the clan of their birth. The clans have their own schools. Many children to go off to college but they often return with new skills needed by their clans. Sometimes Islandians will have disputes with each other, which will lead some to move to other clans. Also, like the Amish of old, some grow weary of the lifestyle and move to the cities, while some Jetsons who wish to step off the fast track try out Islandian settlements.

Contrary to wide-spread beliefs, Islandians are not anti-technology. They have preferences for advanced and small-scale organic agriculture, recycling, and decentralized, renewable energy

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[46] See: http://en.wikipedia.org/wiki/Dunbar's_number/

technologies. They deplore coal, nuclear power, and SUVs. Their politics focus on saving the earth. They share the Jetsons' concerns about parks and beaches but also want to preserve wilderness areas. Their doggedness about reducing greenhouse gas emissions finally wore down the rest of society, which agreed to a sweeping program of renewables, cap and trade measures, and, yes, in exchange, a modicum of new nuclear power. They also support the Jetsons' and Home Dwellers' concerns about reducing emissions.

Yet, they often clash with these two other groups. They find the big cities unhealthy and Home Dwellers sickly. They take pride in the fact that their homes and communities are integrated with the environment whereas Jetsons seek to manage the environment and Home Dwellers generally do not care. They rely much less on the market economy than these two groups and therefore often clash over economic policies (they abhor growth-first macroeconomics). However, because of their buying power, markets now sell more efficient vehicles and appliances, and new homes and apartment complexes routinely have photovoltaics, permable parking areas, and other sustainable characteristics.

5.4   American Gothics

Salt of the earth, hardworking, religious, these are some of the words used to describe American Gothics (Goths). These are the people who still attend Rotary group lunches, organize July 4th parades down Main Street, and volunteer for the military. Children born into Goth families find the lifestyle decidedly boring, at least compared to the Jetsons. Once the dominant demographic force in U.S. society, this "mainstream" group has declined to just about 25% of the population, as some Goth children rise into the Jetsons' realm, find more meaning living in Islandian clans, or become addicted to the cyberspace lives of the Home Dwellers.

Most Goths live in functional, middle-class suburbs, lower density rings within major cities (e.g., Chicago's Northwest area), or traditional rural towns that actually still have Main Streets. Families live in single family, detached homes. After leaving home, maybe after getting that first job right out of community college, Goths live in apartments but those who embrace this lifestyle soon buy homes of their own. Their communities have a functional level of social capital, due to the various social activities, and small town feel. Some may move after retirement but most remain in their communities their entire lives.

Technology vexes Goths. Religious sensibilities push back against technology. Obvious benefits of new technology are enticing. Religious Goths are not afraid of dying. They find the Jetsons' goal of immortality immoral. However, they want the best medical care for their children.

Most Goths are active environmentalists. Religion has embraced stewardship of the earth over man's domination of the earth. The almost messianic calls by Islandians to protect the earth were influential in this change. That, and the realization that climate change was real (more massive storms, sea level rise, devastating changes in the weather, especially in agricultural areas, etc.), finally became impossible to ignore. The Goths joined forces with the Islandians to support climate change legislation and with the Islandians and Jetsons to protect national parks and other popular domestic vacation destinations.

While the Goths support environmental initiatives, they do not find Islandian lifestyles attractive. Clans feel stifling, too close knit, not private enough. Therefore, Goths do what they can for the environment. They recycle, buy efficient lights and appliances, and drive electric cars or those powered by biofuels.

5.5 Urban Poor

The urban poor live in un-gentrified areas of urban cores (e.g., parts Chicago's Southside, various areas in Los Angeles, parts of Harlem and the South Bronx, etc.) and in the toxic, previously abandoned suburbs. The majority of the urban poor are minorities. Many move from home to home rather frequently, depending on their financial situation, but the moves are mostly confined to their communities. They aspire to become Jetsons, but will settle for a Goth lifestyle. For most urban poor, Home Dwellers are too anti-social and Islandians too social. It is very difficult for the urban poor, which comprise about 10% of society, to escape poverty because of a lack of educational opportunities and social networks beyond their impoverished communities.

The Islandians, the new missionaries in American society, have taken a keen interest in the urban poor. With some effort, the toxic suburbs could be converted into sustainable communities, just like many of the areas where Islandians now live. After all, the toxic suburbs have relatively low population densities, a surfeit of abandoned properties that could be cleared for intensive urban agricultural, and the inhabitants generally have nothing better to do. As it turns out, the urban poor resist the Islandians efforts. It is unclear whether the urban poor do not feel empowered or are repulsed by the Islandian lifestyle or simply consider the effort too much work.

The urban poor share a central set of environmental values with the rest of society. However, their focus is fairly narrow. They believe that they are victims of environmental injustice. They battle to get government to clean up the toxic suburbs. They fight not to have noxious facilities located in their communities – new landfills, medical waste incinerators, and urban wind turbines are frequent points of contention. They rail against environmental elitism: they would like to buy organic foods like the rest of society but cannot afford to do so. They also would like to buy energy-efficient products, but never seem to have enough money to do so.

5.6 Rural Migrants

Migrants work in the fields tending to and harvesting America's crops. Like many species of birds, they travel north for the summers and back south for the winters. Most migrants stay with their bands, working the same jobs at the same times, year after year. Although only a relatively small number of people are migrants, their lives, being so hard on the one hand and so seemingly free on the other, have been mythologized by the rest of American society. It is still unclear how many migrants are American citizens and how many are illegal immigrants.

It is clear, however, that most migrants are Hispanic. The Hispanic population of the U.S. is now over 20%, quickly working its way to 25%. Now, the migrant workers have a political base to look after them. The Hispanic population, scattered among migrants, urban poor, Goths, and Jetsons, coalesced around an organic fruits and vegetables agenda, in collaboration with the

Jetsons, Home Dwellers, and Islandians. Drastically reducing migrants' exposures to pesticides and herbicides has immeasurably improved their health.

This group has also supported efforts to mitigate and adapt to climate change. This is because climate change is already significantly impacting the agricultural sector. Now, migrant workers are finding work unpredictable. Will the crops come in this year? If so, will the timing be different? Will they need to alter their travel patterns? Will competition increase among traveling bands of migrant workers? Although most migrant workers would not choose this lifestyle for their children, they worry that their unique lifestyle may be threatened due to climate change.

5.7   Summary

This set of vignettes portrays a U.S. society that supports stricter environmental regulations and more strident measures to protect the earth. While the six demographic groups described above can be considered caricatures to a large extent and cannot be said to capture all possible groups within society, it can be argued that they do represent signs for social evolution that is occurring today. The Jetsons are a most interesting case. Life expectancy rose from about 47 years in 1900 to almost 77 years in the year 2000. Given exponential change in knowledge and technology, one could argue that life expectancy will shortly exceed 100 years, may be on its way to 150 by the end of the 21st century. It seems reasonable that people best able to take advantage of life extension technologies and who believe it is ethical to do so will be much more risk averse to environmental risk than previous demographic groups. Whether increased risk aversion will result in increased burdens on the economy is an open question because the promise of new technologies could virtually eliminate emissions of pollutants into the environment, at least in developed countries. In any case, the Jetsons will lead a sea change in the corporate world with respect to the environment.

The rise of the Islandians can be seen in today's society as well. Campuses across the country are leading society's efforts to become green. It can be argued that most young people take climate change seriously. People of all ages are becoming much more sensitive to where their food comes from, opting to buy local products if at all possible. A tangible back-to-the-land movement has not yet been realized but talk is on-going and more farmers are growing organic products. New technologies can allow a fairly substantial number of people to actually live the Islandian lifestyle. Environmental values are being infused into corporate boardrooms and adopted by religious congregations of all types. These trends promise to overwhelm current corporate resistance to environmental initiatives.

Of course, many people will only support environmental values as they relate to their lifestyles and self-interest. However, even the most focused group, the Home Dwellers, have some stake in environmental policies. Urban poor and migrants also support environmental policies that affect their communities and working conditions, respectively.

6. SUMMARY AND OBSERVATIONS

The Next Big Thing in environmental protection could take many forms. Straightforward forecasted population increases will be a big thing, possibly worsening every single environmental problem that the country already faces. Are we up to the challenge? Changes in environmental values could be another candidate for the next big thing? If for any of a number of different reasons, society demands stricter environmental regulations, can these be implemented in cost efficient manners, given potential current and future economic constraints?

Will the Next Big Thing be a new threat, possibly linked to new technologies or pharmaceuticals? Or will the Next Big Thing be an opportunity to use a new technology to accomplish something wonderful? Or will the Next Big Thing be a tough to implement but valuable improvement in environmental regulation? Of course, it is possible that there is no Next Big Thing, but lots of important things that will need attention simultaneously and will need to be approached in an integrated manner. If this is the case, maybe the Next Big Thing is more transcendental in nature—the ability to sense the bigger, long-term picture and find innovative win-win solutions to environmental problems.

7. ACKNOWLEDGEMENTS

APPENDIX: FIVE SCENARIOS – UNITED STATES IN 2050

This appendix contains scenarios that describe the United States written by five graduate student authors from the University of Tennessee-Knoxville. Before writing these scenarios, the students completed several other assignments. They wrote memos on the potential impacts of another 100-plus million persons in the United States. They also studied trends and wrote memos in the following areas: information technology, climate change, biotechnology, nano-technology, economics, politics, culture and cults, families, work, and education.

In the end, each scenario was constructed around a central theme or driving force. Briefly, the five scenarios are:
  ➢ *Darkly Green* – This scenario plays off a growing gap between the rich and increasingly environmentalist elites and the rest of society;
  ➢ *The Needless Majority* – This scenario assumes that personal values change, resulting in drastically reduced consumption;
  ➢ *Water Rising* – This scenario explores a world pummeled by catastrophic climate change;
  ➢ *We Never Stopped* – In this world, sprawl continues to dominate the American landscape; and
  ➢ *Pangaea Panacea* – This scenario depicts an attractive, ecologically friendly world transformed by globalization.

A.1   *Darkly Green* by Dillon Gray

The credit debacle in the first decade of the new millennium ushered in a new age of privatization in the United States. New jobs at lower wages fueled immigration, and privatized social security to adequately met the needs of the high numbers of retirees. The corporations that provided services formerly provided by government agencies began to accumulate even larger amounts of capital, and wealth became more intensely concentrated among the power elite. The United States officially became the North American Union (NAU) in 2025. Socio-economic institutions were re-formed in the image of trans-national corporations, and large rural-urban fusion zones, called Green-Zones, emerged in key geo-political centers. The areas that exist outside the incorporated limits of the Green-Zones are called Sprawltowns, which grew to house the masses that support the Green Zones.

The population of the NAU in 2050 is approximately 430 million. Ten percent of the population lives in the Green Zones (43 million, colloq. Greens), while the rest live in Sprawltowns (387 million, colloq. Sprawlers).

Technology

Technological developments in 2050 have advanced far beyond those that existed in the early 21st century. Privatization on a national scale has allowed corporations to far exceed the capital accumulation of the previous decades, and this capital has been funneled into major technological innovations. Research, development, and deployment of these technologies lies strictly within the purview of the Green Zones, and infrastructure to support the Sprawltowns

radiates out from the Green Zones. Those who live within the boundaries of the Green Zones are the primary beneficiaries of advanced technology, as the Zones represent the physical embodiment of human achievement.

Fusion reactors provide the bulk of energy needs at extremely low cost, resulting in the near elimination of carbon emissions. Fossil fuels now serve primarily as base chemical components for advanced materials design and research, and biofuels are utilized to run the few remaining internal combustion engines. Medical advances, including advanced genetics, longevity treatments, and cellular manipulation, have defeated most chronic and debilitating physical diseases, and have increased life expectancy. Most vehicles utilize efficient solar batteries or magnetic levitation fields, and many citizens, especially those in the Sprawltowns, use mass transit systems. The built environment is constructed using strong, light-weight, non-hazardous materials that are well insulating, and architecture favors energy efficient designs. Alternative agriculture systems popular in the early 21st century, such as Organic Agriculture and Permaculture, are the standard today, and provide a dependable, nutritious, and sustainable food supply, while simultaneously enhancing soil resources for future generations. These agricultural systems no longer need external inputs, and utilize ecological factors to manage for pests. Advanced information technologies, such as powerful microcomputers and hyper-wireless technologies, provide the immense computing power needed for automation and allow for instantaneous, reliable, wireless transmission of massive amounts of data across the globe, which is received by personalized communication devices (PCDs). All interpersonal communication occurs via PCDs. Mass transit systems (including air vehicles) utilize automated GPS guidance, eliminating the need for a driver or pilot in many cases. Information technology is also used for security purposes. Cameras, lasers, voice and face recognition, and biometric scanners provide both physical and cyber security. One cannot enter a Green Zone without passing through these layers of security.

Technology found in the Sprawltowns is typically of the hand-me-down variety, or is a scaled-down version of what is available in the Zones. However, it remains functional. Sprawlers typically cannot afford many of the high-tech personal devices and services that Greens enjoy; in fact, they aren't available in Sprawltowns. Wireless computer-televisions are ubiquitous, and other home-use technology (cleaning, cooking, and repair systems, entertainment consoles, etc.) are equally common. The transition to mass transit has virtually eliminated private ownership of vehicles in the Sprawltowns, with the exception of a fair number of electric motorcycles. Vehicles that do exist are usually civil service vehicles, i.e. fire trucks, police cruisers, ambulances, and utility vehicles. There are local recycling centers where all waste is (supposed to be) shipped, and that which cannot be recycled locally is transported to more advanced facilities in the Zones. While fusion reactors located within the Zones distribute power to the Sprawltowns, there are some local wind farms and solar collection facilities for emergency use.

Environment

The overall state of the environment in 2050 is healthy, or becoming so. Natural resources (water, arable land, minerals, etc.) and areas with special ecological significance (wetlands, parks, and the like) lay within the boundaries of the Green Zones, and thus are well protected. Environmental factors are not limited by incorporated boundaries, so the Sprawltowns also enjoy

clean air and water, and have access to the natural spaces in the Zones. Recycling and composting technologies have been incorporated into all manufacturing and production processes, enabling almost complete recovery of waste materials. Extraction industries have since been cleaned up, the result of reduced demand (due to recycling) and molecular mining techniques.

The Sprawltowns are not as bright, shiny, and aesthetically pleasing as the Zones, but nevertheless are relatively clean. Land use in the Sprawltowns is confined to residential and commercial development, as the most productive and pristine areas are incorporated into Green Zones. Thus, when deterioration occurs, it is the result of non-use or neglect, rather than over-use or pollution. There exists a very gradual accumulation of waste, which increases the further away one travels from a Green Zone, and this waste is inert and non-hazardous and often bio-degradable (paper, plastic, etc.).

Society, Class, and Civic Unrest

On the surface, life seems pretty good. There is no shortage of food, energy problems have been largely solved, and citizens live in relative harmony with the environment. There is plenty of entertainment: television shows, movies, arena events, art exhibitions, all at varying levels of sophistication. Under the surface, however, the story is a little different.

The economic crunch of the early 21st century brought together the brightest minds of humanity. Race, gender, and ethnicity held little sway in the development of the new paradigm, and thus Green society is diverse and integrated. Enjoying everything life has to offer, Greens range in "occupation" from super-elite power brokers and independently wealthy socialites to talented researchers, scientists, engineers, and corporate strategists. Also generally included in this society are famous and gifted artists, actors, musicians, writers, and the like. All are wealthy (personal assets in the tens of millions, at a minimum), a necessary requirement to live as a part of this exclusive society. Greens enjoy more time off from work for travel, leisure, and personal enrichment, and are healthier than Sprawlers. Daily life for the Greens is generally fresh and easy, depending on the intensity of occupation. Simple tasks are largely automated, and many personal errands can be handled wirelessly.

From an early age, Greens are encouraged to develop and express their individuality, educate themselves, explore the world and nurture their bodies, thus creating the Green ideal: worldly, educated, independent, hale. They learn the ropes of corporate society from the standpoint of creation and leadership; in short, they are bred to lead, and have a natural sense of superiority to the Sprawlers.

Sprawler society developed out of the essential need for labor to construct the new paradigm. The influx of immigrants combined with eager and willing middle class Americans provided the huge labor force needed for construction of the new paradigm. The name "Sprawltown" is a carryover from the days when residential and commercial structures were hastily constructed, using cheap materials and quick construction techniques reminiscent of the late 20th and early 21st centuries. As the new socio-economic order took hold, Sprawltowns were gradually

upgraded with newer technologies that enhanced the efficiency of the exploding bureaucratic networks and increased the quality of life among residents.

Sprawler culture was shaped significantly by immigration, resulting in a fusion of the strong work ethic of Latinos and the shaky identity of the American middle class. Latinos also brought a set of family values that spread across cultural boundaries, and solid extended families and communities came forth to replace the vagaries of the former middle class social structure.

The daily life of Sprawlers is dominated by service to corporations. Some travel to the Zones to complete a day's work. They keep the machines running, troubleshoot networks, and perform other tasks of skilled and unskilled labor that keep the bureaucracy on an even keel. Those that do not travel to the Zones work remotely from their homes or operate local facilities, such as food distribution hubs, local recycling centers, or the various restaurants, bars, entertainment complexes, and other service industries in the Sprawltowns. Sprawlers have the opportunity to travel if they are frugal, and can enjoy some of the natural beauty of the Zones. Very few Sprawlers live in the Zones; those that do are private employees of individuals or have special skills that make them valuable.

There is significant friction between Greens and Sprawlers; the two classes do not intermingle in any way save through the bureaucracy. The socio-economic order has stabilized, and the Sprawlers have found that their salaries cannot buy them the lifestyle that the Greens enjoy, no matter how hard they work, or how much they save, or how long they serve. The economic disparity between Greens and Sprawlers is extremely wide, and the Sprawlers have become discontented with this arrangement. In the unlikely event that a Sprawler could find the money to live in the Zones for any length of time, they would never be a part of the Green culture. The Greens are subconsciously aware of the injustice of the system, and employ mass media and glitzy techno-fixes to sate the masses into apparent submission, all in the name of maintaining a system that provides for everyone. The Sprawlers harbor a deepening resentment towards the "right of heritage" the Greens claim as their own. This situation comes to a head more frequently with each passing season, and the main acts of defiance are walk-outs and refusals to work. These acts of civil disobedience are scorned by Green society as selfish and lacking appreciation, and economic incentives to maintain the status quo are given at times to quell the restless masses. The most extreme acts of outright rebellion are infrequent, but are violent in nature, typically sabotage of local production centers or transport conduits heading into the Zones. These violent acts are on the rise.

This scenario represents a state of transition for human society as a whole. The methods that were used to avert catastrophe worked for quite some time, and resulted in major leaps forward for humanity. But evolution never stops, seeking change at every turn. Those who benefit from the status quo seek to preserve what they would call the Golden Age, and those that suffer want to see the old guard burn and crumble, to make way for a newer and brighter future. It is this tension that drives humanity forward.

A. 2 *The Needless Majority* by Jennifer Joice

It is 2050 and the face on the American majority is one of skepticism and distrust of traditional authority and mass organization. The long-established governance as we knew it in 2008 has crumbled due to its stagnation, lack of accountability, and ineffectiveness. Two-thirds of the United States populace have rejected conventional values and social norms and taken domestic matters into their own hands. We have entered into a post-materialist society as a result of widespread awakening to the cancerous effect of the consumer culture, which has changed the American landscape dramatically.

The continued reliance on crop production for ethanol to feed energy needs has resulted in massive ecosystem degradation due to the exorbitant use of pesticides. Manipulation of crops via genetic modification for maximum yield has come close to wiping out species variety and the end product was eventually proven to be unfit for human consumption. The outbreak of drug-resistant infections in 2011 added to corporate and government distrust among the people. A continued trend of inactive behavior towards climate change and dispassion for its effects has added to overall discontentment for conventional management. The K-12 educational system has collapsed due to funding mismanagement, crumbling infrastructure, and violence. This lack of general oversight was the driver for the rise of the "Needless Majority."

Political boundaries have been altered to reflect ecosystem concerns such as major watersheds (i.e., Upper Tennessee River zone or Watts Bar Lake). Regions speak continuously with other regions since a form of adaptive governance fostering holism as its core has risen out of prevalent anxiety for natural systems. Addressing these matters is the dominant function of regional leaders, unless their region is one of the "cities," because the Needless Majority have structured their societies to no longer need other services. The Needy, super rich who prefer comfortable city life, only a portion of the super rich choose this lifestyle, and super poor who could not secure a farm or manufacturing job for various reasons, remain in the "cities" where they are able to utilize provisional amenities as they remain dependent on these services. These super-rich, now called "junkies," must stay close to the tiny market that still exists for them in the city. They live in highly secured high rises.

The Needless Majority have arranged themselves into "communities" based on previous neighborhood lines and name themselves according to pre-existing themes or dominant landmarks. These "communities," by way of emergent leaders, have formed agrarian districts where food is grown organically to meet the needs of the group. The new communities pride themselves on being self-sustainable so they also create their own energy via solar panels and wind turbines. The only service utilized is that of water acquisition as the ground and surface water has been deemed hazardous to human health. This support, though, is provided by small private utilities who service a hand full of communities, called their utility "network", and is operated by members of those communities. They made a conscience decision to create small "grids" for these networks so to capture excess energy and sell it to the closest cities. This is the only way cities get energy as dirty means have been outlawed and it is more efficient to buy from community utility networks than to build the necessary infrastructure.

The needless majority communities educate their own children mostly within their group proper, but some combine their "network" teaching abilities and most at least make field trips for combined "field days" or on their once a week day in the woods for social variety. The "founders," 60-90 year olds within the community who are the heart and soul of these groups, are plentiful and well seasoned so they take on the responsibility of educating the youth. Once a child demonstrates aptitude for a particular discipline, a founder will take them on as a sort of apprentice and if there is no founder with this background, the child will commute to another community where they can obtain this specialized study. This happens less frequently as individuals will typically fall into either disciplines that involve community needs, which are obviously mastered within the group, or into specialties of founders within the group. Youth that desire a specialty beyond domestics eventually attend one of the remaining university's.

Needless majority communities are grounded in their cultures and place value on each other instead of materials. Emphasis is placed on relationships with one another and respect for nature. There is no crime as everyone has a sense of place and belonging and is connected to most of what they consume eliminating the previous feelings of isolationism. Everyone has a job in the community. One parent normally engages in a form of tele-work, biological repair activities, university component or any other traditional form of employment that still exists. The other parent is involved with food acquisition for the community and apprenticeship teaching. Children, typically 1 of 3 now, are involved in studies, and then help the founders. Founders that are not involved in early education are in charge of food preparation and also apprenticeship teaching. Elders, 90+ year olds, are the wise ones that sit on the porch or by the fire and tell stories or give advice. The elders are highly respected and are catered to as they are in the "down time" stage of their lives. They all come together for lively meals, fires and music at night.

Even though there is an occasional television to be found, for the most part they are gone. Professional sports and sitcoms/movies are forms of entertainment that no longer exist. Stories are told of the large human-like athletes that once dominated the television screen. These "beasts" are rare these days since most of them died prematurely due to the growth enhancement drugs that made them large and machinelike. Communities have large screens in a sort of gathering spot where they will convene to catch up on worldly events on the one public channel station. This is more for a visual picture of world happenings as the needless majority are very aware of what is going on through public radio. Entertainment is found either at night around the fire where there is music or in the form of outdoor recreation.

The needless majority are minimalists in this post-materialist society. They still spend money, though trade is more popular, to obtain vehicles, technology necessary for work, food acquisition, and energy (solar panels, wind turbines, incinerators). Demand for these items is high, but former strong holds within each industry have consolidated because people just want what is necessary and will only purchase or trade at a "fair" rate and refuse to do business with anyone who doesn't practice social responsibility. This social responsibility will typically involve these larger sellers who have provided manufacturing towns. Once previous companies consolidated, they purchased towns and turned them into sustainability communities. These communities function the same as the others, but the one parent works at the factory in the town.

The purchasing of towns from consolidated companies (CCs) proved to be the only way some families got any money for their homes. Most of the tract neighborhoods built at the end of the 20th and beginning of the 21st century were done so poorly. The sub-standard materials used to throw these houses up made for weak infrastructures that began to crumble and could not support the necessary technology that would make them sustainable. It was cheaper to tear these houses down and start over. Therefore, people hoped for buyers like the CCs or sustainable developers, though rare because there are only so many CCs and sustainable developers only did a development here and there because there was more demand for older high quality retrofitted houses among old growth within existing sustainable communities.

Several towns were salvaged by those who could afford to purchase hundreds of acres with those homes on them, which were extremely cheap, tear them down and create organic and socially responsible farms that provide food to hospitals, universities and the fancy markets in the cities. This was quality food, so it was too expensive for the government to provide to the super poor in the cities. That food is from somewhere else. These phenomena combined with the fact that there were no longer shopping areas and highways were disappearing meant that land was plentiful.

There is great emphasis on cultural and religious tolerance in the needless majority communities. This is necessary as the natural formation of these communities, especially in the South, resulted in groups that tend to be alike. Though, not always the case, this occurrence is certainly dominant among the communities. Those once known as the middle class are the ones more able to begin or sustain communities. The majority of lower income families became part of Consolidated Company towns or large organic farms. Awareness of this divide has prompted "exchange student" activity where communities take in students from other communities for a short while that have cultural differences.

Highways are disappearing because after the fall of the ethanol industry scientists united and formed the airmobile, which runs on food waste and is, hence the name, airborne. These vehicles are programmed to a specific location, so there is no more driving. All vehicles communicate with each other to avoid collision. The airmobile can be fuel from inside and needs very little food waste to go a very long way. This technology has made it possible to go overseas easily and for "exchange students" to visit distant cultures quite regularly where they stay with foreign communities.

The airmobile also made it possible to for certain communities to elude the fatal heat. These southern communities, from the coasts up to around what was formally known as middle Kentucky, migrate North for the summer months to escape the disease-carrying mosquitoes and miserable temperatures. These communities are called "gypsy" communities due to this living pattern. They prefer the migration arrangement, as they are best at growing food that is grown in warmer climates and are quite fond of their southern dwellings. In the summer they set up camp in the northern wilderness and with "packed in" supplies and hunting they subsist. Some even visit their sister Northern communities bringing with them "Southern delights" to share. The Northern communities have mastered their storage abilities to get through the winter.

Due to the harsh realities of climate change, it has become a major priority among the majority of American's to do what is possible to slow the warming of the planet. Major changes have

taken place including the abolishment of coal and fossil fuel use that have aided in this cause. One of the most significant policy additions in terms of ecological sustainability is the adoption of the precautionary-principle (if we don't know the environmental affect of an action we don't do it), which is applied to all decisions relating to the environment.

The only taxation is a sales tax. This tax funds the small amount of government assistance still left and ecosystem repair. Given government assistance has dropped dramatically, infrastructure is practically gone and we are no longer interested in war, tax acquired from the small amount of goods still purchased is enough. This was considered to fairest way to tax given the great distain for the super poor in the cities. So, instead of taxing any income from these communities, they are only taxed through what they purchase. This also encourages less purchasing.

Health care is no longer a problem. The majority are incredibly healthy as they eat pure food, are very active and many of the problems that contributed to illness 40 years before are no longer an issue, i.e. air pollution. There are no more car accidents and mental illness is a thing of the past within the majority. Any health issues that cannot be solved within the community (they have become very good at healing) are just paid for by the community. This does not happen often nor do they let anyone's ailment drag on. The needless majority are very practical people who recognize when it is time to let a member go. The super poor in the cities utilize government health care, which is very bad, and the super rich have their own personal doctors.

The needless majority have utilized the old drinking water infrastructure, though refurbished, but have no need for the wastewater infrastructure. The sewer system of the past had become so inefficient and dilapidated that when the needless majority arose, they decided to set up a system that allowed for environmentally responsible waste recycling. Once treated in the household "pit", the waste can be used as fertilizer for the crops. There is no odor as waste is less redolent due to the diet and the treatment smells of vanilla (ingredients include toad spit) giving the waste the same fragrance. Not surprising, vanilla is no longer desired as a food flavor. There is no run-off of the waste fertilizer into water bodies due to the decay of most impervious surface.

These communities are extremely proud and protective of their way of life. The founders keep the communities in check as they remember the old life and never want to go back. Great thought is put into youth education to reflect these principles and ensure that they carry on through the years. They are creating new traditions that are grounded in many cultures, but particular fusions are specific to regional communities, so future generations can be tied to the sustainable principles by celebration. This also gives them identity, which is considered an important additive to this way of life as its roots are still shallow.

A.3   *Water Rising* by Christina Haddad

Today, nine billion human beings inhabit the planet. Fears once rumored fifty years ago concerning global warming have become an overwhelming reality as precipitation and river run off have increased, and the Greenland ice sheet has melted completely. All of these reactions to global warming have increased the amount of freshwater flowing into deep water formations. Within the past fifty years we have seen the ice caps in Greenland melt completely, impacting the entire globe by raising sea levels almost seven meters, or twenty-three feet. The melting of the Greenland ice sheets has had diverse repercussions. The consequences of global warming are affecting us environmentally, politically, economically, and socially.

As sea levels have risen due to the ice sheets melting, we have seen a dramatic change in ocean currents. These abrupt changes are the result of the sudden start up or shut down of density-driven ocean currents. The ocean currents have slowed down and undergone a rapid transition. We have seen rising ocean currents drown most coastal regions and coastal farmland. In 2008, there were more than three hundred million people that lived less than five meters above sea level. Today, that number has grown exponentially, with more than eighty percent of these people living in developing nations (Wheeler, 2007). The planet was trying to send us warning signs as long ago as thirty five years. In 2015, we saw an island in the South Pacific, known as the Carteret Islands completely disappear. (CNN-Planet in Peril, 2008).

As the sea levels rose in North America water covered areas such as Manhattan down the east coast to Florida. We are seeing an astounding increase in the number of refugees due to this coastal flooding. Historical predictions are ringing true, that a one meter increase in sea levels will contribute to the creation of more than sixty million refugees world wide (Wheeler, 2007). We are witnessing a displacement of people inland. Population density has increased dramatically and caused these inland areas to become almost uninhabitable. A densely populated North American continent has caused agricultural areas to expand vertically as well.

North America is suffering greatly. The majority of the west coast has become desert, and the east coast has been completely flooded. Infrastructure along these coasts has been lost. Utility infrastructure, housing, and other buildings have been destroyed by the rising waters. With populations concentrated in such small areas the major concern has become the increase in air pollution and the decrease in water quality. The melting of the ice sheets has caused annual rainfall to decrease 30% in the United States and Canadian west coast, causing a severe water crisis. The lack of rain in these regions has caused a drought in critical agricultural and water resource areas for major population centers in the Pacific regions of North America. "Animals are on the run. Plants are migrating too. The Earth's creatures, save for one species, do not have thermostats in their living rooms that they can adjust for an optimum environment. Animals and plants are adapted to specific climate zones, and they can survive only when they are in those zones." (Hansen, 2006, pp.2). Natural ecosystems are being forced to adapt to a drier climate. Many species are going extinct as they are unable to survive while others are migrating to areas they had never before been seen. The shift of ocean currents is also altering the habitats and seasonal patterns of marine and other aquatic life forms.

The planet is becoming colder and drier leading to more severe, frequent storms, floods and droughts. We are seeing a food shortage and decreased availability and quality of freshwater and energy in several regions due to the shift in precipitation patterns. Ninety seven percent of the world's water is saltwater, while only three percent can be considered freshwater. In turn the climate changes are affecting our national security leading to border supervision, global conflict, and economic malaise. Nations that are less fortunate are initiating conflict between their neighbors for access to food, clean water and energy.

As a result new alliances have been formed based on these resource scarcities. We are seeing a new global political scene based on resource scarcity and abundance, and the challenge is for nations to retrieve these goods for survival or protect their stocks. "As famine, disease, and weather-related disasters strike due to the abrupt climate change, many countries' needs [are exceeding] their carrying capacity" (Schwartz & Randall, 2003, pp.18). Nations have been put on the offensive or defensive depending on whether they hold resources or not. Through technological advances nations with resources have been able to build virtual walls to "preserve resources for themselves" (Schwartz & Randall, 2003, pp. 2). Technology is playing an ever increasing role in human adaptation to these climate changes. Not only through telecommunication, but also other technological innovation that is aiding in allowing people to produce food and access clean water and energy in conditions that were once inhospitable to such action.

The economic scene is ruled by each nation's need for survival, and the prevention of the complete breakdown of the economic structure. As sea levels rose we saw the complete disappearance of almost every trading seaport in the world. International trade has almost come to a complete stop. As a result, international employment and incomes have decreased dramatically. Water has covered a large majority of airports, as many are found near seaports. Transportation patterns in general have been altered due to the depletion of oil, and the inability to find an alternative source that can accommodate the needs of such a large human population.

Societal factors have also been altered as people are being forced to change their behaviors and lifestyles to deal with the new reality of resource scarcity and decreases in water quality. The trend of over consumption has ended and led to the mentality of conservation and sustainable development among those who are most deprived. Disparities have grown wider than ever imagined. The people who were lucky enough to retain resources within each country are ruling the land, while the vast majority, (95-98%) worldwide are living in poverty with little ability to travel far distances. As population density increased, the ability for an area to deal with waste issues has decreased. The growing waste problem has created decreased health standards and increased disease.

The melting of the Greenland ice sheets has had vast consequences environmentally, politically, economically, and socially. The planet's precipitation patterns have shifted as the globe has warmed over the past forty to fifty years. Politically we are seeing international turbulence, as nations fight for resources. Economically, nations are suffering greatly and will continue to suffer until we are able to find efficient solutions to resource scarcity, and transportation problems. Society as a whole has undergone major shifts in lifestyle patterns, and faces large challenges to public health and safety. The human race is being forced to overcome resource

conflict and find ways to make globalization and technological advancement work in a positive and progressive way.

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A.4   *We Never Stopped* by Chris Oelgoetz

Almost every major problem this country suffers from can be linked back to sprawl. In addition to land and water scarcity, there are other more detrimental effects that can all be tied together. Sprawling America has depleted oil quicker, and not everyone can afford the new alternative and the automobile that supports it. These expensive prices have contributed to the shrinking middle class, which leads to more people having to work from home, receive online education, and have resulted in serious health risks for all Americans, especially children. The list is endless. In this paper I will discuss the major implications of sprawl that America is dealing with in the year 2050. I will also discuss the lifestyle that Americans have come adopt. It's a very different world now that is drastically different from the year 2000.

In any given day, oil will be completely consumed. With the innovation of newer cars in the 2030's that allow cars to get nearly 100 miles per gallon, oil was not depleted as quickly. However, it is still almost out and the vast majority of Americans have abandoned automobiles that run on oil. This is mostly because the automobiles that still run on oil are priced so high, and gasoline prices have skyrocketed since cars are getting better gas mileage. The alternative, which is named Alternative X, isn't much help to Americans either. It's a relatively new source that is still new and is extremely expensive for Americans. Only a small percentage of people are able to even afford the new automobile that supports this alternative. It has created a stressful time for everyone living in the United States and the implications of oil has changed the way everyone has lived their life. Everyone has suffered. The effects can be seen especially in the job market. High transportation costs have hit businesses hard. We now live in a time where only the strong survive, and there is in many cases a monopoly of businesses that control everything. Companies like Wal-Mart have put many of their competitors out of business. Local businesses and restaurants are starting to become non-existent. They cannot afford the transportation costs to keep their businesses up and running.

In addition to large corporations taking over, the daily tasks for the average individual have become more difficult as well. Everyday chores and obligations have changed the way Americans will live their lives forever. People are no longer moving out to the suburbs. In fact, people are taking a loss on their homes when they try to sell. Everyone is attempting to move closer and closer to the central business district. Since Alternative X is so expensive, everyone wants to live close to their place of employment and also places of necessity, such as food stores and locations along a public transportation route. Public transportation is being used now more than ever. The stigma that only the extreme poor ride public transportation no longer exists. Public transportation is expensive as well, but still considerably cheaper than owning an automobile. The roads are less busy at this point. Almost half of the vehicles traveling on the roads are city buses.

Another implication from high transportation costs is a mass exodus of people from the north and Midwest to the south and west. Cities are now being planned to cater to the pedestrian. Roads are less busy, and bike paths and sidewalks are being built since so many people no longer drive their own car to work. People are now riding electric scooters and small electric golf cart sized vehicles that they can electrically charge at home. The cities of the south and the west are seeing this trend the most. Since the cost of living along with transportation costs have

skyrocketed, people are packing up and moving to locations that are warmer. The emphasis of transportation will be walking and the use of small electric vehicles. These electric vehicles do not posses all the amenities and comforts of regular cars, so their use will be mainly restricted to driving to work and places closer to home. The cities that will see the highest use of these vehicles will be those that have a warmer climate.

The economy now is not in great shape. As I stated before, many business owners have to close up shop because they cannot compete with the Wal-Marts of America. High transportation costs forced local businesses to raise their prices on their goods. Their prices were so high that people took their business elsewhere. Those who strongly opposed big business are pretty much forced to give in to them because of skyrocketing prices. The lack of an adequate transportation system has almost eliminated the middle class. The majority of those who were in the middle class have become lower class. The shrinking middle class can be attributed to many factors, all of which can be connected to sprawl. The lack of an adequate transportation system has made America far less mobile than we once were. Job loss is at an all time high since so many businesses are folding. This has left a high percentage of Americans without jobs. Those without jobs are unable to invest in the economy. When money isn't being invested into the economy, even more businesses shut down. Increases in technology have also taken away many blue-collar jobs. Jobs that people were once able to hold can now be done by computer, machines, and so on. The United States is on the verge of a depression, and there are no long-term solutions at this point that will pull us out of it.

The farm industry has taken a huge hit. With transportation costs being so high, more food has been grown locally. Farms are unable to ship many of their products to other side of the country. As a result, specific type of foods will be localized to specific regions. Oranges sold in the state of Montana will cost considerably more than they would in Florida. Grapes sold in the State of Maine will cost considerably more than they would in California. The list is endless. Farmers are struggling. It also doesn't help that the country now has a program that allows illegal immigrants from other countries to work on the farms for a specific amount of time before they have to go back to their native country. The issue is a double-edged sword. Not only are these workers taking jobs away from the American people, but the farmers would not be able to survive without these workers from other countries. They are able to pay them far less for the same output. Americans need the farm jobs, but would not be able to survive on that pay. Farmers cannot afford to pay their workers anymore; otherwise they will go out of business. It's an endless cycle of problems for everyone.

The effects of the shrinking middle class are proving to be detrimental. Prices are so inflated that people can only afford to pay for needs, not wants. The effects are seen around the country. Vacation resorts are shutting down. Malls are left barren, and many of them have closed. Suburbs are being replaced by smaller communities that have needs all within a short distance. Neighborhoods not only consist of homes, but also schools, grocery stores, appliance stores, and other type of businesses that people often have to frequent. Necessities have to be close to where people live in order for many families to stay afloat. Family size has also dwindled. There is an emphasis on couples to have no more than two children because often the cost is too much to handle. More than half of mothers in the U.S. are having their tubes tied after giving birth to

either their first or second child. Schools that once taught strictly abstinence are now teaching about safe sex in order to prevent unwanted pregnancies.

While the unemployment rate is as high as it's ever been, many of Americans still hold stable jobs. However, with the combination of technology as high transportation costs, many are working from home. Since 1998, the percentage of Americans working from home has increased by 15% every year. There are many advantages working at home. First and foremost, Americans are able to pick their own schedule as far as daily activities as long as their work gets done. People are able to get more sleep, which is important to their health. No longer do people get up an hour and a half or two hours before work to get ready. Americans can make their own sleep schedule. Once they get up, there is no getting ready for work. We don't have to make sure our appearance is well, and we do not have to travel long distances to our place of employment. Parents also have the opportunity to take care of their children while they work, instead of having to pay a daycare or a babysitter. In today's world people only have to show up at the office maybe once a week. Companies meet with their partners and clients in business professional chat-rooms and teleconferences. In addition, employees are generally happier people which helps promote a friendly business. Studies have shown employers benefit from less sick and personal leave taken; lower turnover, which cuts hiring and training costs; reduced office and parking space needs; and increased employee productivity and morale.

The results of working from home show better output. People have fewer interruptions, and they may put in more work hours because their spouse isn't home yet, or they felt they gained time by not sitting in traffic. Just by getting out of the office people have reduced their stress level tremendously. One reason is that working from home has allowed people to allocate their time more effectively. Former commuting time can now be used for other things that need to be done at home. Americans can start earlier or work later in the day than if they were required to work a 9-5 job. People can take breaks when you need them, not when someone at the office says you can take one. Overall, the average worker saves money by working at home. It's a trend that has become extremely popular and is gaining ground. Perhaps this will be the solution to stimulating the economy. Americans can start investing money saved back into the economy.

One of the fastest growing trends that has hit this country is E-Learning. For the past 50 years, colleges and universities have offered online courses for students as an alternative to classroom study. Like working from home, taking online courses has allowed students to be more flexible with their time. They do not have to go to class at a specific time. If students are sick, they are not forced to miss class or get marked off on attendance. They are more able to go about their daily activities with ease. If life gets hectic they can focus on whatever is most important knowing they still have time to complete their schoolwork. Throughout the past few decades, online education began working from the top down. First it was universities, and then online high schools came into existence, and then middle schools. Now there are even elementary online schools. With assistance from parents, children are now able to receive their entire education online.

The trend began to take shape because of implications from sprawl. A struggling economy, lack of transportation, and a shrinking middle class made it difficult for parents to even transport their children to school. Schools began to charge fees once gas prices became too high in order to

operate their bus system. This coupled with the fact that so many parents work from home made it easier for parents to just enroll their children in online schools for a small price. Like college students, K-12 students can work at a time that is convenient for them. Most do not have to wake up at 6 am in order to catch the bus on time. They have all day and even night if they need it to get their schoolwork accomplished. Students are able to spend more quality time with their families as well.

The benefits from working at home and being enrolled in online schools appear to outweigh the benefits to the naked eye, but there are also serious health implications with this lifestyle. First and foremost, children who have been enrolled in online education their entire life has shown to have more problems in a social setting. Attending school not only allows students to receive an education, but also teaches them social skills that they will have for life. Studies have shown that students enrolled in online education growing up have had harder problems getting jobs, especially those that require specific social skills when dealing with clients and partners.

Obesity has reached new heights now. At one point Americans were motivated to exercise. Obesity rates declined. Everyone thought that since people were spending more time at home, they would have more time to exercise. The fad didn't last that long, and now we are back to where we once were, and even worse. The rates of obesity have increased steadily since the turn of the century and the health of the country is in question. Among the fastest growing group are the children. Since many are staying home to receive their education, they miss out on recess, P.E., and other physical activities that children who attend school participate in. Instead, children are planting themselves in front of the television, playing video games, and surfing the web. It's become a national epidemic and even Congress is thinking about stepping in. A law is about to be passed that will require all students who attend school at home to participate in some physical activity for at least half an hour a day. Online schools will offer exercise classes, much like instructional videos, every hour. Students must log in order to show that they are participating. It's also mandatory that students have a web-camera pointed on them while they perform the exercise so the instructor can see that they are attempting the exercises.

Rickets has also become a problem, although it's not nearly as serious as obesity. Since many families are spending the vast majority of their time at home, they are receiving a lack of Vitamin D. Other common problems resulting in Vitamin D deficiencies are hypocalcaemia, skeletal and dental deformities, and neuromuscular problems. In an effort to combat this problem, every new neighborhood being built is required to have one playground for every 30 houses. Cities are focusing their attention to community centers as well. An emphasis is being placed on building tennis courts and swimming pools since these are outdoor sports.

A.5   **Pangaea Panacea** by Lyndsay Dawson

It is the year 2050. Four decades have passed since the fall. The fate of economics has drastically changed Earth, as we once knew it. The structural adjustment measures, global, unregulated free market, lack of protection for emerging economies, and debt were all the events that contributed to the international economic and financial collapse that occurred in the year 2010. For five long years, each nation tried to survive independently of each other in order to stabilize their local sectors. Although drastic, the one hope that was shared by each nation was the positive attributes of the increased interconnectedness through globalization that had increased throughout the Information Age. When each nation's amount of resources and food productivity waned, the lack of supplies enticed each of the nation's political leaders to finally overcome the isolation period. Political agendas no longer were a priority; survival became the bigger issue. Thus, the basis of the meeting, "Darkness Succumbs," was one of answering the question of how to cooperate in order to survive and prosper. Prosperity was no longer about flourishing economically; the new meaning is one of cooperation and learning to trust in order to survive. The results of the meeting were to dissolve divisions that had previously disjointed the world. No longer would the world be run by economics under the capitalistic regime of profit maximization. The committee that met established the next five years for rebuilding a unified space, Pangaea Panacea, for all humans to flourish. As a result of "Darkness Succumbs," the leaders, calling themselves the Rejuvenators, became representatives in the new initiative of Pangaea Panacea. The factors of joining together created four positive aspects that has enabled the growth and stability that continues today in the year 2050. These elements include: cultural fusion, world consciousness, eco-technology, and non-spatial borders.

Pangaea Panacea operates under one world system that has constructed a fusion between the many differentiated cultures that once inhabited the earth. Without boundaries, a greater level of mixing between and amongst groups has led to an emerging "raceless" society. With the emergence of the one-world concept, the social construct of race has diluted into the homogeneity of the human race. Before the collapse, the mixing of cultures was becoming steadily popular and one was no longer bound to a specific ethnic type. In fact, in America, the kids on the streets were referring to themselves as "Blaxicans," "Chino-Latinos," and "Mexipinos, "to name a few of the terms socially accepted among the youth. Even then, forty years ago, the United States was a place of integration and ethnic groups were no longer feeling the need to become American by assimilating into the culture. Since the emergence of Pangaea Panacea, people are desensitized to cultural mixing. The youth who have been born into the new world do not understand the heavy distinction that was once in effect. Thus, it is common practice for youth to participate in transculturalism, which is the desirability to trade at whim any cultural trait as the fad permits. Unfortunately, there exists confusion within the thirty year olds whose parents have specific cultural backgrounds and they feel as if there is a hole within their identities. However, as time passes, each generation will progressively accept the new culture as truth and reality and the years before will seem like a tale from a storybook.

Between the years of 2015 and 2020, the Rejuvenators directly focused on how to integrate the world system into a world consciousness that did not operate under the basic premises of capitalism. The economic collapse liquidated the value of currency for all nations, so the Rejuvenators decided not to even assign value to any particular object and began to rely upon the

bartering system again. Eliminating the exploitative nature of capitalism was key into planning one economy that runs efficiently and cooperatively. Now, people trade under the principles of David Ricardo's comparative advantage in order to make the most of trade. In order to make the most of resources that are allocated in different regions of the world, there exists a system of importing and exporting that fairly distributes necessities across borders. Everyone operates under a system that is globally aware of environmental issues. Therefore, the trade routes are set up in order to ensure that each container leaves full and comes back full. The system has been reliable for the past thirty years and since there is a wider global scope and a confidence in fair-trading, the worldwide population has leveled in order to live in a more sustainable fashion.

The increased world consciousness of Pangaea Panacea has made a difference in the technology industry as well. Since there is no war and competition amongst the different nations within the technological industries, the scientists have formulated an eco-technology laboratory, "Pangaea Panacea Primo," in order to research the world's best interests. At this research facility, scientists are focusing on ways to treat climate change and preventative measures for the future. All of the creative energy is focused into designing products that are ecologically centered for problems such as resource scarcity, ecological footprint, and other sustainability issues. Thus far, an environmentally sound transportation industry has developed that is free from fossil fuels. Mainly the transportation is designed for trade routes in order to operate under the Ricardo system of comparative advantage. The development of the information technology is so advanced now that it seems as though travel is enabled through the use of the Panagaean network. Families and friends are able to chat through this system in a virtual reality. Scientists are currently working on a global mass transit system that is separate from the trade routes.

Pangaea Panacea is a one world integrative system that eliminates spatial borders. Since 2020 when the system began operating, not only has borders between nations dissolved, but also many states and provinces within nations as well. America has divided into regions that are based on agriculture. So in a sense, we are living in more of a pre-industrial agrarian society where focus is on crops. However, with much research dedicated to organic farming and machinery that makes this more efficient, the life of a farmer is much different than a century or two ago. Within each nation are eco-transportation sites where travel is facilitated. Passports are no longer needed and terms such as "Illegal Aliens" are passé. The world operates under a one-world system in which all inhabitants of the world share all bodies of water and all landmasses. Although work is still being done on eco-international transportation, people living in countries that border each other are free to interchange. Immigration is a problem of the past unless there are creatures from outside of the Earth that are trying to emigrate. However, that has not been a problem yet.

Pangaea Panacea is a cultural based utopian outcome of global problems that have been continuously neglected. The global debt and financial crises has been problematic since the early 90's, the carrying capacity of the Earth is being threatened, and climate change is beginning to have a perceptible toll on the environment. Pangaea Panacea gives us a glimpse of a possible new future reality. Already we are seeing signs of cultural fusion, especially within the United States. Not only are people mixing ethnicities but also religion as well. These cultural combinations will redefine social values and also effect traditions. Little by little, people are becoming more aware of environmental issues as they occur globally and realize that we need to have a global consciousness. Although technology is not the solution to environmental problems,

it does offer a way to enhance sustainability if people are willing to make the sacrifice and reduce impact in order to secure the environment for future generations. However, sacrifice is not easy for selfish desires. Currently we are farthest from the last possibility in the scenario, non-spatial borders. Illegal immigration continues to be a threat to many nations, especially the United States. Security measures are steep and the passing in and out of countries is becoming increasingly difficult. Although Pangaea Panacea is just a glimpse of what could be, I truly believe that the world is growing ever more connected and in order to solve the big problems, it requires cooperation and joining together.

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