

Earth Resources and Society

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Introduction

Over the last 25 years the United States, and later, much of the rest of the world, has made attainment of near-pristine physical environments a major priority, has identified theoretical environmental issues as being of crucial importance to the well-being of society with consequent new regulations, and has opted for preservation of visually and biologically undeveloped lands, central to public policy regarding natural resources.

In taking these actions, the nation has decreased access to its natural resources, increased costs of doing business in and with the United States, restrained its economy, and begun to transfer wealth from the United States to other, mostly third world, countries.

Increasing global population, uneven distribution of wealth, unequal distribution of earth resources, and poor knowledge of dependence of

civilization upon earth resources have created a setting in the United States where esthetic, biological, and social resources are given priority over earth resources, to the detriment of society. Much of the strife between economic expansionists and contractionists is rooted in lack of knowledge and understanding of the earth resource base upon which society is constructed and civilization is maintained. Lack of this understanding has led to world war in the past and to limited wars and reactionary isolationism in the present.

We should not forget that the Second World War was fought over natural resources, the Saar for Germany in Europe and Asian mines and petroleum needed by Japan.

Today the United States faces a huge balance of payments deficit, global indebtedness, lack of competitiveness, and societal decay. Some of these problems lie in uneducated promulgation of laws

and regulations, litigation affecting development of earth resources, and strengthening of anti-resource production attitudes. Global population continues to grow geometrically, while national access to resources declines.

It is not our purpose to argue that these actions or attitudes are correct or incorrect. It is our position that, as these actions are proposed, theories argued, and public policy decisions promulgated, American people must understand the effects of each upon a holistic world. We need an environment where cause and effect are openly debated, where theory is identified, and where educated citizens critically read and view media for truth. Lack of clarity in vision flaws the process by which public policy decisions are made.

We have chosen to address earth resources (minerals, energy, water, and soils) as our base, because a logical connection between the well-being of our social fabric and the use of earth resources can be easily constructed, because our area of expertise is primarily geology.

We believe the issues addressed are fundamental to maintaining the fabric of society that is fast

unraveling. One hypothesis is simply that in our haste to preserve the biological world we have ignored the more pressing issues of preserving society. If we have, then all environmental efforts are ultimately in vain. And we do not wish that.

Earth resources are the basis of human civilization. An educational malaise engendered by increasing urbanization and unfocused teaching has created a generation of citizens who lack understanding of their society and its dependence upon earth resources. Soil, timber, water, minerals and energy are precious resources upon which the societal fabric of America depends. Their accessibility is being diminished amid political arguments that use of earth resources is damaging to the human environment and destructive of the biologic environment. Missing from most arguments is an understanding of the dominance of earth resources over the national economy; real perception of actual societal needs for resources; knowledge of the technology and interactions of exploration, development, extraction, and reclamation of natural resources; and the origin of earth resources.

For instance, in a world where the United States faces increasing economic competition, few citizens realize that our earth resource policies help determine our national economic health. For instance, transfer of wealth from the United States to other countries through purchase of basic earth resources, such as oil, in support of developing a service industry, causes a net loss of wealth to the United States, thus weakening the economy and increasing dependence upon goodwill of third-world and oriental countries for our basic commodities and credit.

Earth resource policies of the United States are composites of local, state, federal, and international regulations and perceptions, promulgated for purposes as diverse as environmental preservation, public health, and social engineering. National health and security requires that a strong earth-resource base be present under the United States flag, but it is not clear that public policies serve that purpose.

Clear diversity of opinion about resources policy has evolved from the three major groups who

determine policy: the industries involved, the government, and various non-development groups. In consequence, policy, particularly federal policy, has lacked consistency and become litigious. For example, Environmental Protection Agency standards for water quality may conflict with ambient natural pollutants, water quantity cannot be assured at sufficient quality because of new measurement technology to parts per trillion, and public health concerns over degradation of water quality conflict with industrial, residential, and other resource development.

How has this misunderstanding of the role of earth resources in maintaining society occurred?

To start with, increasing urbanization has created a divorcement between resource use and understanding of resource origins. Little connection is made by most citizens between turning on a television set and mining coal, dressing in new man-made fiber clothing and drilling oil wells, or eating a bounteous meal and making fertilizers, products of those same oil wells. Many years ago we farm kids laughed at city kids who

thought milk came from bottles in grocery stores. We did not correct then the problem of source and product divorcement, so now we reap conflict over resource access.

To address these issues, we must separate the actual issues and decisions from the processes by which the decisions are made. We may never agree on a policy decision, but we can agree that a policy is developed from a rational consideration of causes and effects upon all of society and natural systems.

If one lives along a seashore, longshore currents drift past our homes. If one person decides to trap a little extra sand for her beach by constructing a jetty or groin, than the loss of sand from the currents made up by eroding sand from the downstream neighbor, who is then forced to build a groin to save his beach, and so on down the entire reach of coast. Any disturbance of equilibrium in a natural system brings downstream changes. So we must view the world of regulations, social policy, and environmental tinkering.

To avoid these pitfalls and to promote understanding of effects of

decisions over the long term, we developed two devices: a formula to relate population, wealth, and standard of living; and a method of scaling environmental issues to focus upon proper responses.

Our discussion centers on earth resources, specifically, energy and minerals, since we have a limited amount of time with which to work, and a fuller consideration of soils and water would simply take more time than available.

Wealth

Wealth is the value of materials and goods produced, as we define the term. All materials come from the earth. Period. Wealth can be increased by labor of processing, value-adding the original resource. Our country's rise in global importance has been the result of its early near self-sufficiency in earth resources, particularly in energy, food, and metals. Cheap food and cheap energy have always driven our economy, and has been a national policy for over a century. Our industry that has so well sustained the national economy and created jobs until recently is based upon the hydroelectric dams, coal mines, uranium mines, farms,

forests, fishing boats, and oil and gas wells that dot our country and its offshore waters.

Wealth describes how much money there is to support the national, local, or individual standard of living. More wealth usually translates into a higher standard of living. Nations with great wealth are usually endowed with natural resources that they efficiently exploit (Canada) or by very industrious people (Japan). Japan is an example of a resource-poor country sustained by value-adding imported resources. Japan exports the value-added goods, transferring wealth from the purchaser to add to its national wealth. One major purchaser is the United States.

Some nations have sufficient resources of critical minerals to permit them to operate despite an embargo by the rest of the world, as was the case of South Africa with its huge gold, uranium, metals, and diamond resources, required and purchased by the rest of the world, plus coal resources large enough to develop a synthetic oil supply.

It should be clear that natural resources are unevenly distributed across the earth. Geologic history

determines the presence or absence of potential ore or mineral or energy deposits; human ingenuity is required to locate economic deposits and technology is required to convert them into wealth. One cannot reasonably predict petroleum will occur in northeastern Minnesota. In contrast, granite, and perhaps copper ore, occur in Kansas, but are thousands of feet below the surface, where they have no present value.

How important are minerals and fuels to Americans? Recognizing that most people intellectually accept that their very existence is dependent upon mining, drilling, and smelting, few recognize the breadth of minerals influence on their daily lives. Evidence is all around.

Common rocks and minerals such as sand and gravel and limestone, used in cement, building construction, and roads, are abundant, but are heavy, bulky and expensive to transport. On the U.S. Virgin Islands there are no sources of high-quality concrete sand, so sand must be imported from Puerto Rico to build houses and other buildings (termites destroy wood houses, and there are few effective

pesticides legally remaining that will control tropical termites). Consequently, housing costs three times as much on St. Croix as on the mainland, even though neither cold weather or hot weather must be considered in construction. Closer to home, Johnson County, Kansas, is the location of some of the fastest population and economic growth in the central U.S. This suburb of Kansas City, Missouri, has a financially privileged population, complains loudly about increasing costs of public construction, but fights fiercely against having any limestone quarries operate near their back yards. Similarly, in Denver, Colorado, in the mid-1980's, local government voted to not expand existing sand and gravel operations in the South Platte River bottom, depriving the building boom of the time of its cheap concrete, with consequent increased costs of housing, public works, and lessened investment in commercial, high-tax-paying construction.

The United States, with 6% of the earth's human population, uses about one third of the world's energy (Youngquist, 1990) and each year each citizen consumes nearly four times as much mineral as the average consumer in the rest of the

world (Skinner and Porter, 1989). We use about 17 million barrels of oil each day, while producing only about 7 million, a number that is dropping consistently and rapidly. We produce about \$30 billion of minerals in a year, of which we export about \$18.5 billion. But we import about \$35 billion (net imports 1989 are about \$12.5 billion [USBM]). About half of our oil is imported, costing us about \$140 million per day! (or \$51 billion per year).

The point we wish to make is simple: the wealth of society is directly proportional to the minerals, energy, and products extracted from the earth. Our lives are absolutely dependent upon minerals and energy, whether that dependency is for food, shelter, medicine, or trinkets. Our standard of living is based upon our wealth.

Wealth, population, and standard of living

With these statements in mind, consider the following equation:

$S_{ol} = W/P$, where S_{ol} is "standard of living", W = wealth, and P = population. This equation was derived recently while trying to

communicate the relationship of earth resources to societal behavior, and it seems to encapsulate our argument.

Population is the denominator. Results of the equation (S_{01}) change greatly with relatively small changes in the denominator. Since the beginning of the industrial age, global population has increased geometrically, although it had only a slow arithmetic rise until then (Stein, 1992; Gore, 1992). Despite the rise in global population and the strains upon countries with greatest populations, continuing rise is forecast. Population control is fought by various groups for economic, religious, and social reasons, but perhaps without sufficient thought of the future of humankind.

Without trying to quantify the term S_{01} (at this time), let's examine the relative values it may have in the United States in the future. The U.S. population has doubled in the last 50 years to about 238 million people, with U. S. Bureau of Census estimates of about 349 million by 2025. If these estimates are entered into the equation, and we assume that there will not be a consequent increase in the production of

minerals in the U.S., then the standard of living (S_{01}) falls considerably.

In that case population, the denominator, tripled, the numerator is unchanged, and $S_{01} = 0.33$ of its initial value. A more likely scenario is that we have produced more wealth since 1940, and we will import more and more (we must then subtract the value of the imported minerals or processed goods, such as automobiles from Japan, from our national wealth). Dollars that go outside the country must eventually find their way back, but commonly it is in foreign ownership of U. S. property and industry.

Resource abundance

Why would our natural resource production and processing fall, relative to our population? A few years ago Paul Ehrlich prophesied that the world would have huge starving populations by now because there would be more people than we have ability to feed. At the end of the Second World War, we were going to run out of iron ore,

coal, and other earth resources. There have been forecasts of petroleum shortages and other resource shortages ever since the beginning of time. No resource has become unavailable. Even in firewood-short Europe in the middle ages, wood was available to those who could afford it. Price determines abundance and availability of resources.

Long-term shortages do not occur because of the balance of supply and demand and the creativity of people. When resources are in short supply, prices rise, and substitutes are progressively invented or adopted. Alternatively, new supplies are brought into the market, or complete new technologies permanently supplant a scarce resource. As examples, when petroleum prices were pushed out of reason by OPEC in the 1970's, conservation of motor fuel took place, new drilling in the U. S. increased domestic supplies of oil, and coal was substituted for liquid petroleum in many applications. Prices came down, and remain down. When South Africa was denied access to imported petroleum because of its social policies, it built SASOL plants that produced liquid petroleum from

coal, which it has in abundance (although some shortages did occur). When copper became too expensive for home plumbing, plastics substituted. When beaver pelts were popular and expensive in the last century, silk came on the market and ran beaver trapping virtually completely out of business. In 1978, when Canada and Germany controlled the price of the mineral potash (an essential ingredient for agricultural fertilizers and other common chemical products) and raised prices disproportionately, other companies rushed to Montana and North Dakota to mine deeper and more expensive potash resources. The mere threat of these mines coming on line and then producing for fifty or more years was sufficient to drive down the price of potash. The new mines were never constructed, nor have potash prices ever returned to exorbitant levels.

Therefore, potential supplies of resources are not an issue. Access to them and costs of processing them are an issue. The United States has gradually decreased access to its natural resources through various deliberate and accidental stratagems.

Among those withdrawals are large tracts declared unsuitable for development of resources because of adverse impact on pristine air quality, proximity to other human developments, expanded wilderness areas, arguments about visual pollution, state regulations against extraction activities in general, congressional bans against development, and regulations designed to increase costs of operation sufficiently to preclude the operation from taking place. All these are standard practices in the political world of public policy development, whether environmental, tax, or social policies.

What costs does the nation pay from some of these practices? Brimelow and Spencer (1992) have cited EPA estimates that EPA's suppressant effect on the economy through pollution controls alone was about \$115 billion dollars in 1990, about 2.1% of the GNP! They estimate that in the 1990's we will pay about \$160 billion per year plus another \$30-40 billion for the new Clean Air Act implementation. The EPA has been accused frequently of underestimating its negative impacts and overestimating its positive impacts. Since the science of

politics suggests this could be true, the total effect of the EPA controls may be far larger.

How does it affect you? Each person in the U.S. pays about \$450 in additional taxes or higher prices for EPA regulation, or \$1800 per year for a typical family of 4.

So what? Who pays?

Who pays the costs of reduced wealth generation and transfer of wealth to third world countries? Many assume that companies pay increased costs, and some argue that the government pays the costs. Companies only stay in business if they are profitable. Investors who provide the capital to the companies must have a return on the capital they provide greater than that of a certificate of deposit. Increased cost means reduced return on investment. So, companies don't pay the costs. If costs are too great, companies either quit, such as the large oil companies that have moved overseas (with consequent loss of about 430,000 jobs), or they must pass on additional costs to the consumers. You.

This statement should not be construed to imply that companies

don't support increased environmental cognizance, because most do, and include them as costs of doing business. The costs are still passed on to consumers.

Government writes checks to pay bills, but it doesn't generate a penny of wealth. Government only spends. Taxpayers provide the money that fuels government. Who pays the taxes? Ultimately, only you. One way or another, every cost of regulation or policy is paid for by consumers. Companies are in business not to serve, but to earn income on invested capital. Workers work not for pleasure, but to earn an income for labor invested. Government exists to insure that the process works. Most corporations are owned by consumers, through stock ownership by pension plans and mutual funds.

It is crucial that people understand that there is a balance between what we wish to have, a pristine world, and the ability to sustain the society. One trade-off we have already made is a loss of jobs and economic growth in the United States, and that is reflected in our unbalanced budget and in part by the misery of minimum income jobs, welfare, unemployment,

dysfunctional families, and a burgeoning crime and drug subculture. It is no accident that increased hopelessness and increased crime seem to coincide.

The big issues and *Qui bono?*

What about the issues of environment that threaten the world, the earth itself, and the physical survival of humankind? Aren't they of such overriding importance as to negate any economic analysis of mitigation measures? Most people today would agree that global warming, ozone, and destruction of habitat are the major international environmental issues. We do not all agree about the validity of these issues nor their potential effects if the issues are real. Although much print and video time has been spent on these issues, careful analysis of each shows major deficiencies in the theories, rather than scientific consensus. Acid rain was the issue of the 1980's, but where is it now? If you could take the time to read the Draft NAPAP (National Acid Precipitation Assessment Project) report (which was never released to the general public) the answer is clear. Acid precipitation turned out to be a non-issue. Not that it is innocuous, but its long-term effects

were simply blown out of proportion. People got caught up in the fervor, and some very strong statements were made, including one by congressional staffers to the NACOA (National Advisory Committee on Oceans and Atmosphere) study panel on acid rain to the effect that "no reputable scientist would ever suggest natural causes nor question the validity of the phenomenon!"

Global warming is another issue that receives great attention, as does the ozone "hole." Dixie Lee Ray (1990) argues forcefully that they are not major issues, and no one has so far negated her position. Two points are important here, with regards to these and future issues. First, most natural phenomena are more controlled by natural processes than by human intervention; it is only our human egos that make us believe that we can affect the course of earth history. Mt. Pinatubo's eruption in 1991 may have affected the ozone layer more than the cumulative effects of all the chloroflorocarbons ever produced. Further examination of the earth's Cenozoic history shows that climate changes are cyclical and the earth has gradually dried and become warmer over 60 million years. Our interglacial climate is subject to many changes;

both warming and cooling will occur. The frigid winters of the middle ages testify to the potential for coldness, while the Viking settlements of Greenland and Canada testify to the earlier warm climates.

Second, one must diagnose each issue and its mitigation by examination of who benefits. Qui bono? The global warming issue is pumping huge amounts of money into biological and chemical research, while for the most part ignoring the earth's own historical record. Species diversity and extinctions are subject of much study and funding, while little funding goes to study the effects of wealth deprivation upon the working poor, the homeless, and the welfare class. For each issue, some groups benefit greatly by popular interest, others lose.

Who benefits is a question that must always be asked when examining questions of policy - someone wins, someone loses with each policy change. That's politics, that's the world. Knowing who benefits can help determine whether an issue is real, significant, or simply the scare tactics of a benefiting group. Self-interest is no crime, but it must be

disclosed so that judgments may be made with balance.

Quo vadis?

We have tried to present one concept: Choices must be made by informed decision-makers. Increased costs of production, decreased national wealth, population growth and reduced access to new wealth are detrimental to the national welfare. There is no way of having increased wealth and population growth without paying an environmental cost. Society cannot exist without extensive quantities of natural resources, resources need to be extracted, and there is at least a visual environmental cost to extraction and a pollution cost to processing and value-adding resources. Decisions about these issues must encompass their complexities.

What is the balance? We don't know. We are not defining the balance in this paper. It is our intent that no decisions be made about that balance without properly considering the cause and effects of each action. There is no free lunch, someone said, and there is no free environmental or developmental

action. Our homeless, our working poor, and our crime and drug-ridden inner cities testify to the need to bring our entire population into consideration of environmental policies. Increasing cost of transportation to inner city poor in minimum wage jobs without providing adequate public transportation is long-term environmental folly. Burning cities pollute more than do automobiles. "Visual environmentalism" that denies jobs to needy people is elitist. No environmental policies will be ultimately successful without provision for the health and welfare of all of society.

The worst possible scenario is a negative societal reaction to environmental regulation that results in stripping of the best laws along with the worst. Our decisions must be informed, but today they are not.

Placing issues into perspective

We have shown how to relate population, wealth, and standard of living. One problem faced by society is the balance of standard of living and creation of wealth in a setting where creation of wealth offends some portion of the

environmentally concerned. One way to analyze this problem is to rank various issues and their potential solutions in terms of the issues impact on society.

We have chosen to scale issues as follows.

Micro environmental issues.

Those are issues that are short-term or in-home issues, such as disposal of household chemicals, lawn mulching, objections to sand and gravel extraction in the neighborhood, recycling of household wastes, and similar small-scale individual decisions. These are personal decisions, and although they impact the lives of others, their impact tends to be very local, and action agendas can be very personal.

Macro environmental issues.

These issues are of larger temporal scale and cut across geographic boundaries. They include air pollution in large cities, single major aquifer contamination or dewatering, factory smokestack output, or single tributary stream basin issues. Frequently, like the preceding class, these are issues of

NIMBY, not in my backyard, but actions of no one person can materially affect an issue.

Tackling these issues requires organizational action rather than personal action, but care must be exercised to not let parochial views override the negative effects of actions on the community.

Meso environmental issues.

These are regional in nature, and may have impact on very large numbers of people. The Mt. St. Helens volcanic eruption and the eruption of Mt. Pinatubo in the Philippines are examples of natural phenomenon that fall into this category. Acid rain, when perceived as an issue, would have fallen into this category. Automobile efficiency and offshore drilling prohibitions are of similar scale in their potential long-term effects on standard of living. Population growth is at least this important. Pesticide regulation, predator control, insect control, and crop fertilization are all issues of this magnitude and have great impact on nearly all of society.

Great care must be exercised in the application of governmental power to insure that the issues solved are

not symptoms, and that the solutions devised are real, necessary, and do not cause negative large scale-downstream effects. National government is responsible for exercising this concern and care, but must do so in an open and informed arena, and the examination and treatment must be holistic.

Mega environmental issues.

Global change, ozone concentrations, and biodiversity are the three most popular issues today in America, but overpopulation, mass famine, soil erosion, desertification, and massive plague are much more pressing to the majority of the world.

Addressing these issues first requires full assessment that the issues are real, anthropogenic, and their effects are negative to the long-term health of the human population. Until this is accomplished, actions should be minimal because any attempt to solve these perceived issues will have extremely large "downstream" effects. The global population is at risk, and most of these issues are long term. Humankind can take the time to be sure that both the issues

are real and the solutions viable. Holistic action is the hallmark of successful treatment. Human egos are caught up in a sense of omnipotence in assuming that mankind can actually cause harm to the earth. To destroy ourselves, yes. The earth, no.

We believe that excruciatingly careful research is needed, unbiased by desire for funding rather than desire for knowledge. Answers can not be dictated by the press, by zealots, by unknowing but anxiety-prone citizens. Cassandras, hidden agendas, and special interests abound in this highest stakes game. Read the newspapers.

Why aren't we better informed?

We think that there are several reasons why we aren't better informed: education, behavior, and ethics. First, education rarely extends to critically reading or viewing. Where in academia are students taught to question statements, to look at issues from varying perspectives, to critically analyze background information? Much criticism is given to the news media for biased and distorted

reporting of issues. This could not take place if most people actually critically read and viewed media products, challenging those that do meet objective criteria.

A necessary first step in critical analysis is to identify and examine all assumptions. Most false arguments fall when this occurs, for few false prophets take the time to carefully construct even spurious data backup. Further, just questioning assumptions frequently provides alternative analyses, simply because new assumptions appear more realistic. Skill in critical reading and viewing is very important, but teaching such skills is beyond the purpose of this paper. Do remember the old computer-age adage: "garbage in, garbage out."

Second, our human behavior seems to predilect us to worst possible scenarios; as someone said, we "love to be scared." We immediately believe those who bring us doom, and give short shrift to those who argue for rational examination. The earth is huge. Changes occur slowly, and most changes are not in control of human population. An earthquake, a tornado, or a volcanic eruption all have more energy release than any atomic explosion

devised by man. The natural world is powerful; humans are puny by comparison. But frightening scenarios of human impacts on the earth are popular, covered extensively by the press, and embraced by our friends. Some are real, but not all.

Another and crucial behavioral aspect is our tendency to focus upon single issues and view them simplistically. For instance, here is talk of addressing the global change issue by eliminating fossil fuels. A very simple solution to a complex issue, and one that ignores the gross distortion of society that that solution would impose. The earth is an extremely complex system. No major perceived environmental issue is simple, and all are inter-related. If we do not view the earth holistically, then we will continue to ripple chaos into our world.

Similarly, many of our investigating scientists are so discipline-oriented that much effort is wasted. Most environmental issues today are phrased in biological terms, yet nearly all are really chemically or geology-based. Some noted biologists are attempting to establish a National Institutes of the Environment, but without any earth

or physical sciences participation. Discussion and reading of their materials makes it apparent that this endeavor is to develop additional research funding for university biology programs. Qui bono? The university programs surely need funding, but is it ethical to couch the need for funding in public environmental issues solely in one's parochial discipline? Education has nurtured this problem by insisting upon more and more narrow studies in response to increasing technology and an exploding knowledge base. It is a challenge to higher education to cut this gordian knot, to develop a rationale for increased breadth of education and multi-disciplinary approaches to problem-solving.

Last, and with reluctance, I must report that our own house is not clean. Scientific and academic ethics for the dispassionate portrayal of truth have slipped in the battle for external funding and research recognition (Bennett and DiLorenzo, 1985, p. 144, 145). The previous question of "Qui bono?" is appropriately asked again. NBC's two recent ethically untenable doctoring of television "news" shows have placed the ethics issue squarely before the American

people. Should we wonder that misinformation, factoids, and anxiety-twining are rampant?

Summary

$S_{01} = W/P$. We can not change the equation. We must either increase wealth as population grows, slow population growth, or lose standard of living. Few people will willingly erode their standard of living. The prospects for population control are poor. Somehow we must find ways of increasing wealth at a rate sufficient to match population increases, without sacrificing more environmental quality than necessary. Pristine environments, if they ever existed, were lost when humans discovered fire and are just romantic figments of our past. We can obtain realism and action by understanding a holistic earth, and by careful analysis of issues. Answers are there, but the real questions must first be asked. We believe we are asking the wrong questions, poorly diagnosing ills, and just nibbling at the symptoms of a growing earth population.

People deserve better.

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