

Hawken, P. (1997, March / April). Natural capitalism. *Mother Jones*.

Somewhere along the way to free-market capitalism, the United States became the most wasteful society on the planet. Most of us know it. There is the waste we can see: traffic jams, irreparable VCRs, Styrofoam coffee cups, landfills; the waste we can't see: Superfund sites, greenhouse gases, radioactive waste, vagrant chemicals; and the social waste we don't want to think about: homelessness, crime, drug addiction, our forgotten infirm and elderly.

Nationally and globally, we perceive social and environmental decay as distinct and unconnected. In fact, a humbling design flaw deeply embedded in industrial logic links the two problems. Toto, pull back the curtain: The efficient dynamo of industrialism isn't there. Even by its own standards, industrialism is extraordinarily inefficient.

Modern industrialism came into being in a world very different from the one we live in today: fewer people, less material well-being, plentiful natural resources. As a result of the successes of industry and capitalism, these conditions have now reversed. Today, more people are chasing fewer natural resources.

But industry still operates by the same rules, using more resources to make fewer people more productive. The consequence: massive waste -- of both resources and people.

Decades from now, we may look back at the end of the 20th century and ponder why business and society ignored these trends for so long -- how one species thought it could flourish while nature ebbed. Historians will show, perhaps, how politics, the media, economics, and commerce created an industrial regime that wasted our social and natural environment and called it growth. As author Bill McKibben put it, "The laws of Congress and the laws of physics have grown increasingly divergent, and the laws of physics are not likely to yield."

The laws we're ignoring determine how life sustains itself. Commerce requires living systems for its welfare -- it is emblematic of the times that this even needs to be said. Because of our industrial prowess, we emphasize what people can do but tend to ignore what nature does. Commercial institutions, proud of their achievements, do not see that healthy living systems -- clean air and water, healthy soil, stable climates -- are integral to a functioning economy. As our living systems deteriorate, traditional forecasting and business economics become the equivalent of house rules on a sinking cruise ship.

One is tempted to say that there is nothing wrong with capitalism except that it has never been tried. Our current industrial system is based on accounting principles that would bankrupt any company.

Conventional economic theories will not guide our future for a simple reason: They have never placed "natural capital" on the balance sheet. When it is included, not as a free amenity or as a putative infinite supply, but as an integral and valuable part of the production process, everything changes. Prices, costs, and what is and isn't economically sound change dramatically.

Industries destroy natural capital because they have historically benefited from doing so. As businesses successfully created more goods and jobs, consumer demand soared, compounding the destruction of natural capital. All that is about to change.

Natural Capital

Natural systems provide trillions of dollars in services that have no man-made substitutes, as Biosphere II's failure shows.

Everyone is familiar with the traditional definition of capital as accumulated wealth in the form of investments, factories, and equipment. "Natural capital," on the other hand, comprises the resources we use, both nonrenewable (oil, coal, metal ore) and renewable (forests, fisheries, grasslands). Although we usually think of renewable resources in terms of desired materials, such as wood, their most important value lies in the services they provide. These services are related to, but distinct from, the resources themselves. They are not pulpwood but forest cover, not food but topsoil. Living systems feed us, protect us, heal us, clean the nest, let us breathe. They are the

"income" derived from a healthy environment: clean air and water, climate stabilization, rainfall, ocean productivity, fertile soil, watersheds, and the less-appreciated functions of the environment, such as processing waste -- both natural and industrial. *Nature's Services*, a book due out this spring edited by Stanford University biologist Gretchen C. Daily, identifies trillions of dollars of critical ecosystem services received annually by commerce.

For anyone who doubts the innate value of ecosystem services, the \$200 million Biosphere II experiment stands as a reality check. In 1991, eight people entered a sealed, glass-enclosed, 3-acre living system, where they expected to remain alive and healthy for two years. Instead, air quality plummeted, carbon dioxide levels rose, and oxygen had to be pumped in from the outside to keep the inhabitants healthy. Nitrous oxide levels inhibited brain function. Cockroaches flourished while insect pollinators died, vines choked out crops and trees, and nutrients polluted the water so much that the residents had to filter it by hand before they could drink it. Of the original 25 small animal species in Biosphere II, 19 became extinct.

At the end of 17 months, the humans showed signs of oxygen starvation from living at the equivalent of an altitude of 17,500 feet. Of course, design flaws are inherent in any prototype, but the fact remains that \$200 million could not maintain a functioning ecosystem for eight people for 17 months. We add eight people to the planet every three seconds.

The lesson of Biosphere II is that there are no man-made substitutes for essential natural services. We have not come up with an economical way to manufacture watersheds, gene pools, topsoil, wetlands, river systems, pollinators, or fisheries. Technological fixes can't solve problems with soil fertility or guarantee clean air, biological diversity, pure water, and climatic stability; nor can they increase the capacity of the environment to absorb 25 billion tons of waste created annually in America alone.

Natural Capital as a Limiting Factor

The new limits to prosperity are natural systems -- not boats, but fisheries; not sawmills, but forests.

Until the 1970s, the concept of natural capital was largely irrelevant to business planning, and it still is in most companies. Throughout the industrial era, economists considered manufactured capital -- money, factories, etc. -- the principal factor in industrial production, and perceived natural capital as a marginal contributor. The exclusion of natural capital from balance sheets was an understandable omission. There was so much of it, it didn't seem worth counting. Not any longer.

Historically, economic development has faced a number of limiting factors, including the availability of labor, energy resources, machinery, and financial capital. The absence or depletion of a limiting factor can prevent a system from growing. If marooned in a snowstorm, you need water, food, and warmth to survive. Having more of one factor cannot compensate for the absence of the other. Drinking more water will not make up for lack of clothing if you are freezing.

In the past, by increasing the limiting factor, industrial societies continued to develop economically. It wasn't always pretty: Slavery "satisfied" labor shortages, as did immigration and high birthrates. Mining companies exploited coal, oil, and gas to meet increased energy demands. The need for labor-saving devices provoked the invention of steam engines, spinning jennies, cotton gins, and telegraphs. Financial capital became universally accessible through central banks, credit, stock exchanges, and currency exchange mechanisms.

Because economies grow and change, new limiting factors occasionally emerge. When they do, massive restructuring occurs. Nothing works as before. Behavior that used to be economically sound becomes unsound, even destructive.

Economist Herman E. Daly cautions that we are facing a historic juncture in which, for the first time, the limits to increased prosperity are not the lack of man-made capital but the lack of natural capital. The limits to increased fish harvests are not boats, but productive fisheries; the limits to irrigation are not pumps or electricity, but viable aquifers; the limits to pulp and lumber production are not sawmills, but plentiful forests.

Like all previous limiting factors, the emergence of natural capital as an economic force will pose a problem for reactionary institutions. For those willing to embrace the challenges of a new era, however, it presents an enormous opportunity.

The High Price of Bad Information

Economists make no distinctions when reporting growth -- whether we've invested in new schools or paid to clean up a toxic waste spill.

The value of natural capital is masked by a financial system that gives us improper information -- a classic case of "garbage in, garbage out." Money and prices and markets don't give us exact information about how much our suburbs, freeways, and spandex cost. Instead, *everything else* is giving us accurate information: our beleaguered air and watersheds, our overworked soils, our decimated inner cities. All of these provide information our prices should be giving us but do not.

Let's begin with a startling possibility: The U.S. economy may not be growing at all, and may have ceased growing nearly 25 years ago. Obviously, we are not talking about the gross domestic product (GDP), measured in dollars, which has grown at 2.5 percent per year since 1973. Despite this growth, there is little evidence of improved lives, better infrastructure, higher real wages, more leisure and family time, and greater economic security.

The logic here is simple, although unorthodox. We don't know if our economy is growing because the indices we rely upon, such as the GDP, don't measure growth. The GDP measures money transactions on the assumption that when a dollar changes hands, economic growth occurs. But there is a world of difference between financial exchanges and growth. Compare an addition to your home to a two-month stay in the hospital for injuries you suffered during a mugging. Say both cost the same. Which is growth? The GDP makes no distinction. Or suppose the president announces he will authorize \$10 billion for new prisons to help combat crime. Is the \$10 billion growth? Or what if a train overturns next to the Sacramento River and spills 10,000 gallons of atrazine, poisoning all the fish for 30 miles downstream? Money pours into cleanups, hatchery releases, announcements warning people about tainted fish, and lawsuits against the railroad and the chemical company. Growth? Or loss?

Currently, economists count most industrial, environmental, and social waste as GDP, right along with bananas, cars, and Barbie dolls. Growth includes *all* expenditures, regardless of whether society benefits or loses. This includes the cost of emergency room services, prisons, toxic cleanups, homeless shelters, lawsuits, cancer treatments, divorces, and every piece of litter along the side of every highway.

Instead of counting decay as economic growth, we need to subtract decline from revenue to see if we are getting ahead or falling behind. Unfortunately, where economic growth is concerned, the government uses a calculator with no minus sign.

Wasting Resources Means Wasting People

Reducing resource waste creates jobs.

Industry has always sought to increase the productivity of workers, not resources. And for good reason. Most resource prices have fallen for 200 years -- due in no small part to the extraordinary increases in our ability to extract, harvest, ship, mine, and exploit resources. If the competitive advantage goes to the low-cost provider, and resources are cheap, then business will naturally use more and more resources in order to maximize worker productivity.

Such a strategy was eminently sensible when the population was smaller and resources were plentiful. But with respect to meeting the needs of the future, contemporary business economics is pre-Copernican. We cannot heal the country's social wounds or "save" the environment as long as we cling to the outdated industrial assumptions that the summum bonum of commercial enterprise is to use more stuff and fewer people. Our thinking is backward: We shouldn't use more of what we

have less of (natural capital) to use less of what we have more of (people). While the need to maintain high labor productivity is critical to income and economic well-being, labor productivity that corrodes society is like burning the furniture to heat the house.

Our pursuit of increased labor productivity at all costs not only depletes the environment, it also depletes labor. Just as overproduction can exhaust topsoil, overproductivity can exhaust a workforce. The underlying assumption that greater productivity would lead to greater leisure and well-being, while true for many decades, has become a bad joke. In the United States, those who are employed, and presumably becoming more productive, find they are working 100 to 200 hours more per year than 20 years ago. Yet real wages haven't increased for more than 20 years.

In 1994, I asked a roomful of senior executives from Fortune 500 companies the following questions: Do you want to work harder in five years than you do today? Do you know anyone in your office who is a slacker? Do you know any parents in your company who are spending too much time with their kids? The only response was a few embarrassed laughs. Then it was quiet -- perhaps numb is a better word.

Meanwhile, people whose jobs have been downsized, re-engineered, or restructured out of existence are being told -- as are millions of youths around the world -- that we have created an economic system so ingenious that it doesn't need them, except perhaps to do menial service jobs.

In parts of the industrialized world, unemployment and underemployment have risen faster than employment for more than 25 years. Nearly one-third of the world's workers sense that they have no value in the present economic scheme.

Clearly, when 1 billion willing workers can't find a decent job or any employment at all, we need to make fundamental changes. We can't -- whether through monetary means, government programs, or charity -- create a sense of value and dignity in people's lives when we're simultaneously developing a society that doesn't need them. If people don't feel valued, they will act out society's verdict in sometimes shocking ways. William Strickland, a pioneer in working with inner-city children, once said that "you can't teach algebra to someone who doesn't want to be here." He meant that urban kids don't want to be here at all, alive, anywhere on earth. They try to tell us, but we don't listen. So they engage in increasingly risky behavior -- unprotected sex, drugs, violence -- until we notice. By that time, their conduct has usually reached criminal proportions -- and then we blame the victims, build more jails, and lump the costs into the GDP.

The theologian Matthew Fox has pointed out that we are the only species without full employment. Yet we doggedly pursue technologies that will make that ever more so. Today we fire people, perfectly capable people, to wring out one more wave of profits. Some of the restructuring is necessary and overdue. But, as physicists Amory Lovins and Ernst von Weizsacker have repeatedly advised, what we *should* do is fire the unproductive kilowatts, barrels of oil, tons of material, and pulp from old-growth forests -- and hire more people to do so.

In fact, reducing resource use creates jobs and lessens the impact we have on the environment. We can grow, use fewer resources, lower taxes, increase per capita spending on the needy, end federal deficits, reduce the size of government, and begin to restore damaged environments, both natural and social.

At this point, you may well be skeptical. The last summary is too hopeful and promises too much. If economic alternatives are this attractive, why aren't we doing them now? A good question. I will try to answer it. But, lest you think these proposals are Pollyannaish, know that my optimism arises from the magnitude of the problem, not from the ease of the solutions. Waste is too expensive; it's cheaper to do the right thing.

Resource Productivity

Innovations -- from ultrasound washing machines to virtual malls -- will radically reduce resource inefficiency.

Economists argue that rational markets make this the most efficient of all possible economies. But that theory works only as long as you use financial efficiency as the sole metric and ignore

physics, biology, and common sense. The physics of energy and mass conservation, along with the laws of entropy, are the arbiters of efficiency, not *Forbes* or the Dow Jones or the Federal Reserve. The economic issue is: How much work (value) does society get from its materials and energy? This is a very different question than asking how much return it can get out of its money.

If we already deployed materials or energy efficiently, it would support the contention that a radical increase in resource productivity is unrealistic. But the molecular trail leads to the opposite conclusion. For example, cars are barely 1 percent efficient in the sense that, for every 100 gallons of gasoline, only one gallon actually moves the passengers. Likewise, only 8 to 10 percent of the energy used in heating the filament of an incandescent lightbulb actually becomes visible light. (Some describe it as a space heater disguised as a lightbulb.) Modern carpeting remains on the floor for up to 12 years, after which it remains in landfills for as long as 20,000 years or more -- less than .06 percent efficiency.

According to Robert Ayres, a leader in studying industrial metabolism, about 94 percent of the materials extracted for use in manufacturing durable products become waste before the product is even manufactured. More waste is generated in production, and most of that is lost unless the product is reused or recycled. Overall, America's material and energy efficiency is no more than 1 or 2 percent. In other words, American industry uses as much as 100 times more material and energy than theoretically required to deliver consumer services.

A watershed moment in the study of resource productivity occurred in 1976, when Amory Lovins published his now-famous essay "Energy Strategy: The Road Not Taken?" Lovins' argument was simple: Instead of pursuing a "hard path" demanding a constantly increasing energy supply, he proposed that the real issue was how best to provide the energy's "end use" at the least cost. In other words, consumers are not interested in gigajoules, watts, or Btu, he argued. They want well-illuminated workspaces, hot showers, comfortable homes, effective transport. People want the *service* that energy provides. Lovins pointed out that an intelligent energy system would furnish the service at the lowest cost. As an example, he compared the cost of insulation with that of nuclear power. The policy of building nuclear power plants represented the "supply at any cost" doctrine that still lingers today. He said it made no sense to use expensive power plants to heat homes, and then let that heat escape because the homes lack insulation. Lovins contended that we could make more money by saving energy than by wasting it, and that we'd find more energy in the attics of American homes than in all the oil buried in Alaska. His predictions proved correct, although his proposals remained largely unheeded by the government. Today, the nuclear power industry has become moribund, not because of anti-nuclear protests but because it is uncompetitive.

In 1976, energy experts used to argue about whether the United States could achieve energy savings of 30 percent. Twenty-one years later, having already obtained savings of more than 30 percent over 1976 levels -- savings worth \$180 billion a year -- experts now wonder whether we can achieve an additional 50 to 90 percent. Lovins thinks we might possibly save as much as 99 percent. That may sound ridiculous, but certainly no more so than the claim that textile workers could use gears and motors to increase their efficiency a hundredfold would have sounded at the beginning of the Industrial Revolution. The resource productivity revolution is at a similar threshold. State-of-the-shelf technologies -- fans, lights, pumps, superefficient windows, motors, and other products with proven track records -- combined with intelligent mechanical and building design, could reduce energy consumption in American buildings by 90 percent. State-of-the-art technologies that are just being introduced could reduce consumption still further. In some cases -- wind power, for example -- the technologies not only operate more efficiently and pollute less, they also are more labor-intensive. Wind energy requires more labor than coal-generated electricity, but has become competitive with it on a real-cost basis.

The resource revolution is starting to show up in all areas of business. In the forest products industry, clearinghouses now identify hundreds of techniques that can reduce the use of timber and pulpwood by nearly 75 percent without diminishing the quality of housing, the "services" provided by books and paper, or the convenience of a tissue. In the housing industry, builders can use dozens of local or composite materials, including those made from rice and wheat straw,

wastepaper, and earth, instead of studs, plywood, and concrete. The Herman Miller company currently designs furniture that can be reused and remanufactured a number of times; DesignTex, a subsidiary of Steelcase, a leading manufacturer of office furniture, sells fabrics that can be easily composted.

Although a new "[hypercar](#)" is now in development, "new urbanist" architects, such as Peter Calthorpe, Andres Duany, Elizabeth Plater-Zyberk, and others, are designing communities that could eliminate 40 to 60 percent of driving needs. (A recent San Francisco study showed that communities can decrease car use by 30 percent when they double population density.) Internet-based transactions may render many shopping malls obsolete. Down the road we'll have quantum semiconductors that store vast amounts of information on chips no bigger than a dot; diodes that emit light for 20 years without bulbs; ultrasound washing machines that use no water, heat, or soap; hyperlight materials stronger than steel; deprintable and reprintable paper; biological technologies that reduce or eliminate the need for insecticides and fertilizers; plastics that are both reusable and compostable; piezoelectric polymers that can generate electricity from the heel of your shoe or the force of a wave; and roofs and roads that do double duty as solar energy collectors. Some of these technologies, of course, may turn out to be impractical or have unwanted side effects. Nevertheless, these and thousands more are lining up like salmon to swim upstream toward greater resource productivity.

Resource Politics

Reducing income taxes while increasing resource prices will stimulate employment and environmental restoration.

How can government help speed these entrepreneurial "salmon" along? The most fundamental policy implication is simple to envision, but difficult to execute: We have to revise the tax system to stop subsidizing behaviors we don't want (resource depletion and pollution) and to stop taxing behaviors we do want (income and work). We need to transform, incrementally but firmly, the sticks and carrots that guide business.

Taxes and subsidies are information. Everybody, whether rich or poor, acts on that information every day. Taxes make something more expensive to buy; subsidies artificially lower prices. In the United States, we generally like to subsidize environmental exploitation, cars, big corporations, and technological boondoggles. (We don't like to subsidize clean technologies that will lead to more jobs and innovation because that is supposed to be left to the "market.") Specifically, we subsidize carbon-based energy production, particularly oil and coal; we massively subsidize a transportation system that has led to suburban sprawl and urban decay; we subsidize risky technologies like nuclear fission and pie-in-the-sky weapons systems like Star Wars. (Between 1946 and 1961 the Atomic Energy Commission spent \$1 billion to develop a nuclear-powered airplane. But it was such a lemon that the plane could not get off the ground. History's dustbin also includes a nuclear-powered ship, the Savannah, that was retired after the Maritime Administration found she cost \$2 million more per year than other ships.)

We subsidize the disposal of waste in all its myriad forms -- from landfills, to Superfund cleanups, to deep-well injection, to storage of nuclear waste. In the process, we encourage an economy where 80 percent of what we consume gets thrown away after one use.

As for farming, the U.S. government covers all the bases: We subsidize agricultural production, agricultural nonproduction, agricultural destruction, and agricultural restoration. We provide price supports to sugarcane growers, and we subsidize the restoration of the Everglades (which sugarcane growers are destroying). We subsidize cattle grazing on public lands, and we pay for soil conservation. We subsidize energy costs so that farmers can deplete aquifers to grow alfalfa to feed cows that make milk that we store in warehouses as surplus cheese that does not get to the hungry.

Then there is the money we donate to dying industries: federal insurance provided to floodplain developers, cheap land leases to ski resorts, deposit insurance given to people who looted U.S.

savings and loans, payments to build roads into wilderness areas so that privately held forest product companies can buy wood at a fraction of replacement cost, and monies to defense suppliers who have provided the Pentagon with billions of dollars in unnecessary inventory and parts.

Those are some of the activities we encourage. What we hinder, apparently, is work and social welfare, since we mainly tax labor and income, thereby discouraging both. In 1994, the federal government raised \$1.27 trillion in taxes. Seventy-one percent of that revenue came from taxes on labor -- income taxes and Social Security taxes. Another 10 percent came from corporate income tax. By taxing labor heavily, we encourage businesses not to employ people.

To create a policy that supports resource productivity will require a shift away from taxing the social "good" of labor, toward taxing the social "bads" of resource exploitation, pollution, fossil fuels, and waste. This tax shift should be "revenue neutral" -- meaning that for every dollar of taxation added to resources or waste, one dollar would be removed from labor taxes. As the cost of waste and resources increases, business would save money by hiring less-expensive labor to save more-expensive resources. The eventual goal would be to achieve zero taxation on labor and income.

The purpose of this tax shift would be to change *what* is taxed, not *who* is taxed. But no tax shift is uniform, and without adjustments for lower incomes, a shift toward taxing resources would likely be regressive. Therefore, efforts should be made to keep the tax burden on various income groups more or less where it is now. (There are numerous means to accomplish this.) The important element to change is the *purpose* of the tax system because, other than generating revenue, the current tax system has no clear goal. The only incentive provided by the Internal Revenue Code, with its 9,000 sections, is to cheat or to hire tax lawyers.

A shift toward taxing resources would require steady implementation, in order to give business a clear horizon in which to make strategic investments. A time span of 15 to 20 years, for example, should be long enough to permit businesses to continue depreciating current capital investments over their useful lives.

Of course, a tax shift alone will not change the way business operates; a broad array of policy changes on issues of global trade, education, economic development, econometrics (including measures of growth and well-being), and scientific research must accompany it. For the tax shift to succeed, we must also reverse the wrenching breakdown of our democracy, which means addressing campaign finance reform and media concentration.

It is easier, as the saying goes, to ride a horse in the direction it is going. Because the costs of natural capital will inevitably increase, we should start changing the tax system now and get ahead of the curve. Shifting taxes to resources won't -- as some in industry will doubtless claim -- mean diminishing standards of living. It will mean an explosion of innovation that will create products, techniques, and processes that are far more effective than what they replace.

Some economists will naturally counter that we should let the markets dictate costs and that using taxation to promote particular outcomes is interventionist. But *all* tax systems are interventionist; the question is not whether to intervene but *how* to intervene.

A tax system should integrate cost with price. Currently, we dissociate the two. We know the price of everything but the cost of nothing. Price is what the buyer pays. Cost is what society pays. For example, Americans pay about \$1.50 per gallon at the gas pump, but gasoline actually costs up to \$7 a gallon when you factor in all the costs. Middle Eastern oil, for instance, costs nearly \$100 a barrel: \$25 to buy and \$75 a barrel for the Pentagon to keep shipping lanes open to tanker traffic. Similarly, a pesticide may be priced at \$35 per gallon, but what does it cost society as the pesticide makes its way into wells, rivers, and bloodstreams?

The Future

Our living systems and social stability are at risk. But the solutions are profitable, creative, and eminently possible.

In 1750, few could imagine the outcome of industrialization. Today, the prospect of a resource productivity revolution in the next century is equally hard to fathom. But this is what it promises: an economy that uses progressively less material and energy each year and where the quality of consumer services continues to improve; an economy where environmental deterioration stops and gets reversed as we invest in increasing our natural capital; and, finally, a society where we have more useful and worthy work available than people to do it.

A utopian vision? No. The human condition will remain. We will still be improvident and wise, foolish and just. No economic system is a panacea, nor can any create a better person. But as the 20th century has painfully taught us, a bad system can certainly destroy good people.

Natural capitalism is not about making sudden changes, uprooting institutions, or fomenting upheaval for a new social order. (In fact, these consequences are more likely if we don't address fundamental problems.) Natural capitalism is about making small, critical choices that can tip economic and social factors in positive ways.

Natural capitalism may not guarantee particular outcomes, but it *will* ensure that economic systems more closely mimic biological systems, which have successfully adapted to dynamic changes over millennia. After all, this analogy is at the heart of capitalism, the idea that markets have a power that mimics life and evolution. We should expand this logic, not retract it.

For business, the opportunities are clear and enormous. With the population doubling sometime in the next century, and resource availability per capita dropping by one-half to three-fourths over that same period, which factor in production do you think will go up in value -- and which do you think will go down? This basic shift in capital availability is inexorable.

Ironically, organizations like Earth First!, Rainforest Action Network, and Greenpeace have now become the *real* capitalists. By addressing such issues as greenhouse gases, chemical contamination, and the loss of fisheries, wildlife corridors, and primary forests, they are doing more to preserve a viable business future than are all the chambers of commerce put together. While business leaders hotly contest the idea of resource shortages, there are few credible scientists or corporations who argue that we are not losing the living systems that provide us with trillions of dollars of natural capital: our soil, forest cover, aquifers, oceans, grasslands, and rivers. Moreover, these systems are diminishing at a time when the world's population and the demand for services are growing exponentially.

Looking ahead, if living standards and population double over the next 50 years as some predict, and if we assume the developing world shared the same living standard we do, we would have to increase our resource use (and attendant waste) by a factor of 16 in five decades. Publicly, governments, the United Nations, and industries all work toward this end. Privately, no one believes that we can increase industrial throughput by a factor anywhere near 16, considering the earth's limited and now fraying life-support systems.

It is difficult for economists, whose important theories originated during a time of resource abundance, to understand how the decline in ecosystem services is laying the groundwork for the next stage in economic evolution. This next stage, whatever it may be called, is being brought about by powerful and much-delayed feedback from living systems. As we surrender our living systems, social stability, fiscal soundness, and personal health to outmoded economic assumptions, we are hoping that conventional economic growth will save us. But if economic "growth" does save us, it will be anything but conventional.

So why be hopeful? Because the solution is profitable, creative, and eminently possible. Societies may act stupidly for a period of time, but eventually they move to the path of least economic resistance. The loss of natural capital services, lamentable as it is in environmental terms, also affects costs. So far, we have created convoluted economic theories and accounting systems to work around the problem.

You can win a Nobel Prize in economics and travel to the royal palace in Stockholm in a gilded, horse-drawn brougham believing that ancient forests are more valuable in liquidation -- as fruit crates and Yellow Pages -- than as a going and growing concern. But soon (I would estimate within a few decades), we will realize collectively what each of us already knows individually: It's cheaper to take care of something -- a roof, a car, a planet -- than to let it decay and try to fix it later.

While there may be no "right" way to value a forest or a river, there is a wrong way, which is to give it no value at all. How do we decide the value of a 700-year-old tree? We need only ask how much it would cost to make a new one. Or a new river, or even a new atmosphere.

Despite the shrill divisiveness of media and politics, Americans remain remarkably consistent in what kind of country they envision for their children and grandchildren. The benefits of resource productivity align almost perfectly with what American voters say they want: better schools, a better environment, safer communities, more economic security, stronger families and family support, freer markets, less regulation, fewer taxes, smaller government, and more local control.

The future belongs to those who understand that doing more with less is compassionate, prosperous, and enduring, and thus more intelligent, even competitive.