



Environmental Incentives vs. Environmental Mandates

Lessons for Educational Policy

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Arguments favoring government provision and regulation of education mirror those applied to the environment. Proponents in both cases argue that government involvement is necessary for achieving quality, whether defined as a proficient cohort of young people or a clean and sustainable environment. The argument is that, left to their own devices, private schools would underinvest in some of our nation's brightest and most deserving children, and private organizations would underinvest in safeguards to maintain environmental goods such as biodiversity, clean air and water, and ocean ecosystems.

Calls for regulation, therefore, often have initial appeal because everyone wants better educational opportunities and a cleaner environment. But caution is merited before diving into the regulatory pool because bad regulations can do more harm than good, and good regulations have proven difficult to enact and administer. In economist Thomas Sowell's words, we need to evaluate policy "in terms of the incentives they create, rather than the hopes that inspired them" (Sowell 2010). We hope for good environmental health and good education for our children, but regulations offering these promises do not always deliver what we want.

Mark Twain is said to have quipped, "People who love sausage and respect the law should never watch either one being made." In the case of sausage making, it is not appetizing to see the process, but the outcome is most often a delicious dish at the dinner table. Law and public policy—often regulatory mandates—on the other hand, are generally not appetizing to watch but also often result in a less-than-desirable outcome. They are not appetizing because politics, with its special interest groups and shortsightedness, is focused on partisan interests rather than outcomes. This can leave us with environmental policy crafted to serve industrial interests, and educational policy crafted to serve teachers' unions. The political process brings these cooks together into the kitchen and often lets them choose the recipe they prefer rather than the meal that the customers prefer.

Moreover, because law- and policymakers have a difficult time dictating and measuring outcomes, they often regulate inputs. In the case of sausage, we can measure the ingredients that go into it and can evaluate the outcome by tasting it. In the case of law and public policy, it is possible to measure inputs, such as seasons for harvesting fish or hours of classroom time devoted to teaching math, but much harder to measure whether the health of the fishery has improved or whether students better understand the subject.

In what follows, we analyze why making good law and public policy is so difficult by evaluating failures and successes of environmental regulations in the United States and abroad. We find that regulatory failures almost always commit “the folly of incentivizing A and hoping for B” (Kerr 1975). This parallels the pitfalls of education policy, which too often commits the same folly by rewarding the wrong behavior. For example, if teachers are paid when student standardized test scores are improved, they are rewarded for higher scores (A) and we hope this means better overall educational training (B).

By regulating only what they can easily measure, policy mandates create incentives to comply, but not necessarily incentives to work toward the broader goal of environmental and educational health. Fisheries management offers an easily understood example. When fish in the open ocean are available for the taking, fishers invest time and resources to capture their value, leading to overfishing, or what economists call “the tragedy of the commons” (Gordon 1954). Because it is difficult to measure the health of an ocean fishery, lawmakers around the world regulated activity that is easily monitored and fishers responded by complying with the regulations but altering their behavior in other dimensions (Grainger and Parker 2013). When seasons were limited, fishers fished longer days and risked lives and gear when the seas were dangerous; when boats were licensed to limit the number entering, fishers got bigger boats; and when boat sizes were limited, fishers got better gear. These rational responses to regulatory mandates tended to increase bycatch (e.g., more turtles caught in fishing nets) and impair ocean habitat (e.g., damage to ocean seafloors scraped by big trawlers) because the fishers were narrowly incentivized to comply with mandated rules rather than contribute to the broader goal of improving ocean health. This provides lessons for a variety of public policies, including those used in education.

The remainder of this paper focuses on the potential for law and policy to get the incentives right for the environment. This typically means allowing private contracts and market exchanges between individuals with property rights, rather than mandates through government regulations, to provide environmental goods and services. As with so many public goods, be they education, roads, parks, or national defense, defining the final products and optimizing how to produce them is difficult because they are often bundled together and consumed or enjoyed by a collective of individuals, each of whom has a different idea of how the sausage should taste.

The comparison of regulatory incentives versus mandates for the environment focuses our attention on (1) the critical importance of getting incentives right, and (2) the ways in which policies supporting competition, property rights, and market trading can get those

incentives right. Many of the same lessons apply to other public policies. Requiring that students pass tests demonstrating their proficiency incentivizes teachers to teach to the test rather than to proficiency, but allowing market competition from charter and private schools gives schools an ownership interest and hence provides them with incentives to improve overall educational health that attracts families and students. Requiring coal-fired generating plants to install scrubbers on their smokestacks to reduce SO₂ emissions gives producers no incentive to find cleaner production techniques, but allowing them to sell pollution credits for developing cleaner production does the opposite. These ideas apply to the provision of both environmental goods and services.

ENVIRONMENTAL MANDATES HAVE BEEN THE NORM

It is hard to date the beginning of environmentalism, but it might be dated back to the Reverend Thomas Malthus in 1798 when he penned *An Essay on the Principle of Population* (Malthus 1798). Therein he postulated that humans would continue to reproduce until the population demands exceed their ability to produce food, after which famine, disease, and pestilence would check population growth in a “Malthusian trap.” Instead, with the right institutions, human ingenuity has allowed us humans to avoid the “trap.” Nonetheless, Malthus’s postulate continues to permeate environmental thinking, but now it is not just about food production; it is about the Earth’s ability to sustain humans given our effect on global ecosystems.

Malthus’s ghost continues to haunt the globe and revealed itself on April 22, 1970, when approximately twenty million people nationwide observed the first Earth Day. The gatherings were inspired in part by the energy captured in student protests opposing the Vietnam War, by books such as *Silent Spring* (Carson 1962) and *The Population Bomb* (Ehrlich and Ehrlich 1968), and by obvious environmental problems that people could taste and smell in their water and air. Other social cues for environmental despair included a picture on the cover of *National Geographic* showing the Cuyahoga River fire in 1969, allegedly caused by chemicals in the water. (Never mind the fact that the fire was caused by a railroad spark that ignited logs and other debris that had accumulated at a trestle [Boissoneault 2019].) Another concern was the precipitous decline in bald eagle populations attributed to the pesticide DDT.

The result was a regulatory alphabet soup—the WA (Wilderness Act, 1964), the CAA (Clean Air Act, 1970), the CWA (Clean Water Act, 1972), and the ESA (Endangered Species Act, 1973), to mention a few. These mandates were based on the premise that private individuals and companies will not be good environmental stewards, and thus federal regulations are required to protect the land, air, water, oceans, and wildlife. The support for these mandates ignored the fact that the environment was already improving in cases such as water quality, which was improving due to a mix of state and local regulation and technological change, and the fact that remote areas identified for wilderness designation were rarely under true threat of logging or mining.

Since the first Earth Day, concerns have become more global, focusing on population growth, resource depletion, climate change, plastics in the oceans, species extinctions, and, more generally, sustainability. Because these problems stem from individual actions, especially dependence on carbon fuels, the proposed solutions call for governmental mandates, some as extreme as China's one-child policy.

In some cases, environmental regulations have had a positive effect on the environment. Throughout the developed world, air and water are cleaner, and many formerly rare wildlife species, such as bald eagles and gray wolves, are now common. At the same time, some open-ocean fisheries continue to decline and the climate continues to change due to greenhouse gas emissions, suggesting that mandates are not enough and that environmental policies based on positive incentives and markets might work better.

Successful regulations must not be too costly in terms of reducing economic growth, because a driving force in the environmental improvements is rising global incomes. Consider results from a major study that develops an environmental sustainability index (ESI) for 145 nations.¹ Comparing a nation's ESI score with its gross domestic product (GDP) per capita reveals a strong positive correlation between wealth and environmental quality. For example, air quality in the United States was poor in many American cities in the 1950s and 1960s but improved dramatically as incomes grew. Similarly, reforestation has occurred in developed countries, and endangered or locally extinct species such as cheetahs in Malawi, wolves in France, and butterflies in the United Kingdom have been reintroduced as incomes have risen. In the United States, CO₂ emissions peaked in 2007 at 6,016 metric tons and decreased to 4,970 in 2022 while the US population increased 10 percent and real per capita income increased 28 percent.² In contrast, air quality remains poor in China, India, Bangladesh, and Pakistan, where incomes remain low.³

In other words, as incomes rise, people shift their focus from obtaining the necessities of life to other goods and services, especially what they deem to be a cleaner and healthier environment. That conclusion runs counter to the environmental mantra that follows from Malthus, namely that sustainability is not possible without reducing population and economic growth. This conclusion raises the question of how to balance the role of mandates and incentives for environmental improvement. The lens of economic thinking focused on trade-offs and incentives helps provide an answer.

THE ECONOMICS OF ENVIRONMENTAL MANDATES

Mandates have contributed to environmental improvement in cases where market solutions have proven difficult to implement. Stricter air and water emissions standards have made the air breathable and the water drinkable and swimmable; regulations on the taking of wildlife have saved species such as the bald eagle; and strict limits on harvesting some whale species have helped their numbers recover. These successes, however, have come with decreasing returns, that is, higher costs with lower benefits, and could have been achieved with more incentive-based, market-like approaches. Moreover, mandates such as governmental bans

on plastic bags have generally not decreased plastic in landfills (e.g., Taylor 2019; Muposhi et al. 2022) and bans on hydraulic fracking for natural gas have worsened local air quality by encouraging the burning of coal as a substitute for gas (Johnsen et al. 2019).

Mandates can fail for three reasons: (1) by not taking into account all of the trade-offs; (2) by generating unintended consequences; and (3) by creating perverse incentives.

TRADE-OFFS

Mandates aimed at curing specific environmental problems have trade-offs, an unavoidable result of resource scarcity. Policies to counteract climate change offer many examples. Damming rivers for carbon-free hydroelectric power disrupts fish and wildlife habitat, and relying on electric vehicles means more mining for battery minerals and hence more deforestation and potential water and soil contamination from tailings (Zhang et al. 2023).⁴ Wind turbines with propellers 350 feet long are unsightly to some and can be dangerous for birds of prey flying in their path.⁵

UNINTENDED CONSEQUENCES

Mandates can lead to unintended consequences. Lighter, more fuel-efficient vehicles are less safe for passengers; short fishing seasons to reduce fishing pressure induce fishers to fish twenty-four/seven even when dangerous weather is on the horizon (as in the TV series *Deadliest Catch*); banning legal trade in elephant ivory drives up the black market price and incentivizes more poaching where enforcement is weak and elephant populations are most at risk; and economic reasoning implies that banning fossil fuels in some countries lowers supply, raises the price, and incentivizes production in countries with fewer regulations through a process economists call carbon leakage. And, as noted above, mandates banning plastic carryout bags at grocery stores can lead to more plastics in landfills because people substitute by buying heavier, reusable plastic trash bags (Taylor 2019).

PERVERSE INCENTIVES

Mandates focus on rules that are enforceable with the intent that obeying the rules will result in the desired outcomes, but the response is not always what is hoped. Consider preemptive habitat destruction under the Endangered Species Act. The Act, passed in 1973, mandates that taking a species (animal or plant) means to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct,” and harming means “significant habitat modification or degradation.” Obviously, killing a bald eagle would be a violation of the “take” provision of the law, and destroying its nest with eggs in it would be destroying its habitat. But what about cutting pine trees that could grow old and create nesting cavities for the red-cockaded woodpecker (RCW), a species originally listed under the ESA? A famous North Carolina case shows how this applied to landowner Ben Cone, who harvested trees on fifteen hundred acres of his seventy-two-hundred-acre property. Because the area was home to RCWs, he started cutting his trees before they became old enough to provide nesting cavities. As a result, he was fined for violating the “take” and “harm” clauses of the ESA.

Economists Dean Lueck and Jeffrey Michael predicted that this mandate and penalty for violating it could result in a disincentive for forest landowners to manage trees for critical habitat. Their study confirmed their prediction (Lueck and Michael 2003). Examining hundreds of logging operations in North Carolina, they found that the average age of harvested trees falls from nearly seventy years if there are no RCW colonies nearby to almost half that if there are twenty-five colonies within twenty-five miles of the logging site. They conclude that their finding “validates the concerns of some environmentalists who have noted that RCW populations have been declining on private land during the 28 years the red-cockaded woodpecker has been regulated by the ESA.” In short, the ESA can make endangered species the enemy of landowners if perverse incentives are ignored. This is an example of an unintended consequence that is contrary to the goal of the mandate. Moreover, the fine paid by Ben Cone provides a disincentive for landowners to provide habitat for endangered species.

THE ECONOMICS OF ENVIRONMENTAL INCENTIVES

Laws and policies that encourage demanders and suppliers of environmental goods to balance benefits and costs result in gains from trade and stimulate entrepreneurship. This is why *The Economist* (2005) declared on Earth Day in 2005 that “market forces could prove to be the environment’s best friend” as opposed to approaches based on “mandate, regulate, litigate.” Gains from trade and entrepreneurship are the reasons that the Environmental Defense Fund claims to “examine every environmental problem through an economic lens,” and that the Nature Conservancy characterizes its approach as “practical, nonpartisan.”⁶

GAINS FROM TRADE

Trade not only encourages property rights owners to consider their own values in natural resource use decisions, but also the values of others who are willing to pay for the alternative uses of the resource. When rights are transferable in the marketplace, owners—be they individuals, corporations, nonprofit organizations, or communal groups—have an incentive to evaluate long-term trade-offs since their wealth is at stake. They also must consider any costs for which they are liable. In short, property rights align self-interest on both sides of the trade.

An example comes from the National Audubon Society’s ownership of the Paul J. Rainey Wildlife Sanctuary, a twenty-six-thousand-acre preserve in Louisiana.⁷ In addition to being a wildlife sanctuary, the preserve produces oil and gas. Because the Audubon Society owns the property, it captures profits from energy development, but also bears any cost of wildlife preservation. The sanctuary was created for bird habitat, so Audubon accepts fewer oil profits in exchange for strict requirements on extraction techniques, such as noise limits on engines and directional drilling so as not to harm sensitive habitat. And no drilling production is allowed during nesting seasons. The revenues from energy sales provide funding to expand conservation and restoration efforts.

Fishery policies that create individual transferable quotas (ITQs)—a cap-and-trade program—change the incentives for fishermen (Grainger and Parker 2013). Regulators set an overall

sustainable harvest quota, allocate shares of the harvest quota to individuals, and allow fishermen with quotas to trade their shares. ITQs fundamentally change the incentives for fishermen because catch is not based on the rule of capture. With secure allocations, fishermen have little to gain from racing, so there is little reason for them to invest time and capital into bigger, more powerful boats with no purpose other than to beat other fishers to fishing spots in the open ocean. Moreover, fishermen who can harvest additional fish more cost-effectively by specializing in their comparative advantage have an incentive to purchase additional rights from higher-cost individuals. These gains from trade reduce the overall costs of achieving a harvest goal. As a result, ITQ systems increase the net value of fisheries relative to season and gear mandates.

Empirical studies are delivering evidence that ITQs are improving the economic and ecological value of fisheries. Just one example is the British Columbia halibut fishery, where the implementation of ITQs delivered significant cost savings and improved product quality (because fish are less damaged if not caught during a hectic race to fish). And research using a global data set on fishery stocks finds that the implementation of ITQs in Canada, the United States, Australia, New Zealand, Iceland, and elsewhere has helped reverse fishery collapse common in other parts of the world. None of this is to suggest that ITQs solve all the problems that exist in marine fisheries. Incentives to capture gains from trade afforded by ITQ markets rather than mandates, however, are helping address one of the world's most pressing environmental challenges.

ENTREPRENEURSHIP

Market-based environmental policies create a decentralized system for enhancing the value of resources. They generate information, mostly in the form of prices, that give demanders and suppliers objective measures of subjective values. Resources will find their way to the highest-valued uses if private owners are rewarded for the benefits they generate while being held accountable for any costs they create.

To be sure, governments play a critical role in clearly specifying and recording ownership claims (such as ITQs), establishing liability rules, and adjudicating disputes over ownership. In that way, well-defined and enforced property rights impose discipline on resource owners by holding them accountable for the damage they do to others and rewarding them for improving the environment.

At the heart of market transactions are the environmental entrepreneurs who see opportunities that others have not seen. Capitalizing on those opportunities requires contracting with owners of the inputs necessary for production of the new good or service. For example, suppose an environmental group would like a wheat farmer to manage her property differently to produce sage grouse habitat. The sage grouse proponents will have to know what is meant by "sage grouse habitat" and how to specify that in the contract. The wheat farmer will have to know what she is giving up in foregone wheat production. Having this knowledge, which would be quite local and specialized, and specifying it in an enforceable contract is what environmental entrepreneurs—"enviropreneurs"—do (see Anderson and Parker 2013).

Another example is contracting with farmers who have rights to divert water for irrigation to leave the water instream for spawning salmon.⁸ In Oregon, diversions for agricultural and urban uses have made it difficult or impossible for salmon to swim upstream to spawn. Enviropreneurs in Oregon pioneered stream restoration by paying farmers and cities to reduce their diversions, thus increasing instream flows. Their efforts have been copied in Montana, Washington, Idaho, and Colorado. One innovative contract in Oregon included an “option” clause that paid the ranchers for reducing diversions only when the stream was low and paid them market value of the crops foregone.

ACHIEVING BALANCE BETWEEN INCENTIVES AND MANDATES

There are two parts to balancing environmental policy between incentives and mandates. The first is to determine when mandates are necessary to correct market failures, and the second is to determine how markets can be blended with mandates.

Because markets are built on the foundation of property rights, we must first ask whether property rights are well defined and enforced, and if not, why they are not. Defining and enforcing property rights is not free. Doing so requires that effort and capital be put into the definition and enforcement process. Land must be surveyed, fences must be built, emissions into water supplies must be measured and monitored, trespassers must be caught, animals must be tagged, and harvested fish must be counted, to mention a few costs.

If the costs of defining and enforcing property rights exceed the benefits in the form of better stewardship and higher values, environmental markets are much more problematic. In that case, environmental resources may become subject to the “tragedy of the commons,” meaning the resources will be overused by people with unlimited access and the value of those resources will be diminished. In the context of any open-access fishery, there will be too many fishers chasing too few fish.

If property rights are lacking, mandates can be an effective way of restricting access to land, water, air, wildlife, or other resources so that they are not overused. Entry gates to national parks, for example, limit the number of people entering the parks, and restrictions on where people can go and what can be done in the parks limit the pressure on the resources. As noted above, mandates on wildlife harvest, taking of endangered species, and emissions into water and air are examples of mandates trumping markets.

Also as noted above, mandates may not always consider perverse incentives and the unintended consequences that can result. Destroying potential habitat that could become inhabited by endangered species was not the intention of the Endangered Species Act.

Melding incentives and mandates using cap-and-trade policies can create incentives for better stewardship. The cap is the mandate that creates a right for the holder of the cap, and the trade is the incentive to find better ways of using the cap. The cap set by a government agency specifies the amount of use that can be made of a resource. The government agency

distributes the cap to existing or potential users and enforces the cap, and holders of the use rights can trade them with others who make a greater use of the resource. This approach has been used successfully to limit overfishing and to encourage endangered species habitat conservation when other mandates have failed.

TRADABLE EMISSIONS CREDITS UNDER THE CLEAN AIR ACT

Due to lobbying pressure from industry, the Clean Air Act of 1970 initially forced new plants to adopt a particular abatement technology (smokestack scrubbers) even though alternatives to getting cleaner air existed, such as burning low-sulfur coal (Ackerman and Hassler 1981). The requirement caused existing plants to delay upgrading and to forgo cleaner coal, thereby decreasing air quality in some locales. The 1990 amendments improved incentives, however. They implemented emissions standards rather than specific technology requirements. Importantly, the amendments created a cap-and-trade emissions system (Stavins 2011). This gave regulated facilities (e.g., power plants) a stronger incentive to reduce emissions further than mandated by regulations because a facility that did so could sell emission-reduction credits to other businesses facing higher reduction costs. These potential gains from trade caused some facilities to adopt new, cheaper technologies for reducing emissions. According to one assessment, the amendments helped the CAA deliver benefits valued at ten times the regulatory cost between 1992 and 2017 (Keiser and Shapiro 2019, table 1).

LANDOWNER COMPENSATION AND CONSERVATION CREDITS

As noted above, Endangered Species Act regulations can reduce private land values and hence create perverse incentives for landowners to preemptively destroy species habitat to avoid regulation, as in the case of early tree harvesting to avoid hosting red-cockaded woodpeckers (Lueck and Michael 2003). Market reforms to mitigate these effects, such as safe harbor agreements and habitat-conservation plans that promise to not punish landowners who provide habitat, lessen the perverse incentive to preemptively destroy habitat (see Langpap 2006; Langpap and Kerkvliet 2012). More recent amendments allow transferable habitat-conservation credits, to recognize that different tracts of land can provide suitable habitat for endangered species such as red-cockaded woodpeckers and allow a private landowner to develop one tract if she conserves another. Not only can this save costs of compliance by selecting tracts with lower-valued alternative land uses, but it also increases the incentives for private landowners to comply. For example, International Paper, in partnership with two government agencies and NGOs, has established a 2,146-hectare red-cockaded woodpecker mitigation bank in southwest Georgia.⁹ As a result of these incentive programs, the Environmental Defense Fund sees “a plume of hope for an endangered bird [the red-cockaded woodpecker] and its forest.” This allows the company to invest in habitat with a financial reward.¹⁰

CONCLUSION

The key insight from economics is that incentives matter and, when they are applied to the environment, this means that ownership matters. When individuals and businesses lack

ownership stakes in clean air and water and robust fish and wildlife populations, they have weak incentives to invest in their health. Without private investment a tragedy of the commons can occur, leading to declines in air and water quality and fish and wildlife numbers. Regulations can react to the decline—a symptom of incomplete ownership—with detailed command-and-control mandates on how to restrict emissions, where to prohibit habitat conversion, and when and where to allow fishing and with which gear. Or the regulations can address the root cause by acknowledging and creating property rights to certain aspects of resource use and then relying on the entrepreneurship of resource users to solve detailed management problems.

Herein lies the key lesson from comparing environmental policies based on mandates to those based on property rights and market competition. Whereas policies that mimic ownership and encourage markets generate incentives for entrepreneurs to find new ways to continually improve the environment, mandates simply create incentives for users to comply with rules. This means that politicians and bureaucracies responsible for mandates commit the folly of rewarding A (compliance) and hoping for B (improved environmental quality at acceptable costs with few unintended consequences).

As examples from the Clean Air Act, the Endangered Species Act, and ocean fisheries reveal, command-and-control mandates have often not delivered hoped-for results. CAA requirements that power plants adopt a specific technology (smokestack scrubbers) led to the burning of dirtier coal. ESA bans on habitat modifications for listed species led private owners to destroy habitat before it could be inhabited. And fishery regulations that limited catch and the number of boats led to dangerous fishing derbies that increased bycatch and damaged marine habitat.

The good news is that policies that get the incentives right help foster environmental improvements at a reasonable cost. Amendments to the CAA allowing power plants to achieve emission targets however they saw fit led to innovation, cost savings, and lower emissions relative to a command-and-control approach. Better yet, CAA amendments that created private emission rights and allowed plants to trade with one another created market competition that furthered entrepreneurship, emission reductions, and cost savings. Similarly, amendments to the ESA that compensated private landowners for providing habitat removed perverse incentives, and further amendments allowing trades of low- to high-valued habitat caused landowners to embrace rather than fear habitat conservation. And fishery regulations that introduced individual tradable quotas transformed incentives such that fishing industries are now making private investments in the health of marine ecosystems.

While we do not have a specific blueprint for applying these lessons to education policy, there are two general guidelines that can be followed. First, public schooling regulations that disallow market competition and simply apply command-and-control mandates are at risk of delivering modest successes at best, and perverse consequences at worst. For example, mandating that a school's student body achieve minimum average scores on standardized tests does not reward stellar achievement beyond the minimum. Moreover, such mandates

create perverse incentives for educators to push out low achievers to raise average scores (Gilligan et al. 2022; Ryan 2004). These mandates in education commit the folly of rewarding A (minimum test scores) and hoping for B (better educational quality).

The second guideline is that educational reforms that incentivize administrators and teachers to act *as if* they are owners of the local schools hold the most promise. Such policies encourage educators to invest in the long-term success of a locale’s educational programs by flexibly applying their human ingenuity through what might be called “edupreneurship,” as in our tagline for “enviropreneurs.” Private schools create this basic incentive structure because teachers, curricula, and demands on students are mainly determined by market forces. Public school reforms that enable charter schools and school-of-choice programs that foster competition for students can also mimic this structure, however (Raymond et al. 2023). These reforms acknowledge that parents will scrutinize school performance in deeper ways when they have choices, and that such scrutiny will create better incentives for educators to provide educational quality. Returning to the wisdom of Thomas Sowell, arguments in favor of such reforms are based not on “the hopes that inspire them” but on “the incentives they create.”

NOTES

1. The analyses were conducted by the World Economic Forum, the Yale University Center for Environmental Law and Policy, and the Columbia University Center for International Earth Science Information Network at <https://sedac.ciesin.columbia.edu/data/collection/esi/>.
2. See “Carbon Dioxide Emissions from Energy Consumption in the United States from 1975 to 2023,” retrieved from Statista, October 8, 2024, <https://www.statista.com/statistics/183943/us-carbon-dioxide-emissions-from-1999/>; World Bank, “Population, Total for United States,” retrieved from FRED (Federal Reserve Bank of St. Louis), October 8, 2024, <https://fred.stlouisfed.org/series/POPTOTUSA647NWDB>; and US Bureau of Economic Analysis, “Real per Capita Personal Income for United States,” retrieved from FRED (Federal Reserve Bank of St. Louis), October 8, 2024, <https://fred.stlouisfed.org/series/RPIPCUS>.
3. “Potential Gain in Life Expectancy Compared to WHO Guideline,” Air Quality Life Index map created by the University of Chicago’s Energy Policy Institute, <https://aqli.epic.uchicago.edu/the-index/>.
4. For damming, see “Environmental Impacts of Hydroelectric Power,” Union of Concerned Scientists, March 5, 2013, <https://www.ucsusa.org/resources/environmental-impacts-hydroelectric-power>. Mining these metals has major environmental impacts, typically requiring deforestation and a lot of water. Tailings from mining can pollute waterways with toxic chemicals such as cyanide, mercury, and arsenic if not properly contained. See Liz Kimbrough, “Study: Tricky Balancing Act between EV Scale-Up and Mining Battery Metals,” Mongabay, September 8, 2023, <https://news.mongabay.com/2023/09/study-tricky-balancing-act-between-ev-scale-up-and-mining-battery-metals/>.
5. See “Conventional Wind Energy—A Design Deadly for Birds,” American Eagle Foundation, accessed August 31, 2024, <https://eagles.org/take-action/wind-turbine-fatalities/>.
6. See “Helping People and Nature Prosper Together,” Environmental Defense Fund, accessed August 29, 2024, <https://www.edf.org/economics>; and “How We Work,” The Nature Conservancy, accessed August 29, 2024, <https://www.nature.org/en-us/about-us/who-we-are/how-we-work/>.
7. See “Rainey History and Mangers [sic],” ArcGIS StoryMaps, accessed August 31, 2024, <https://storymaps.arcgis.com/stories/4acedd355efe47bba03e02d3477ea857>.
8. “Free Market Environmentalism with Terry Anderson: Perspectives on Policy,” YouTube, accessed August 31, 2024, <https://www.bing.com/videos/search?view=detail&q=Terry+L.+Anderson%2bHoover+Institution%2bwater+markets&mid=547E903980AA91B03618547E903980AA91B03618&FORM=VIRE>.

9. "International Paper's Habitat Conservation Plan for the Red-Cockaded Woodpecker: Implementation and Early Success," Fire Research and Management Exchange System (FRAMES), accessed August 31, 2024, <https://www.frames.gov/catalog/42869>.
10. Michael Bean, "A Plume of Hope for an Endangered Bird and Its Forest," Environmental Defense Fund, October 10, 2017, <https://blogs.edf.org/growingreturns/2017/10/10/a-plume-of-hope-for-an-endangered-bird-and-its-forest/>; and "Habitat Exchanges Transform Conservation," Environmental Defense Fund, accessed August 31, 2024, <https://www.edf.org/ecosystems/habitat-exchanges-transform-conservation>.

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