

Are We Collapsing? A Review of Jared Diamond's *Collapse: How Societies Choose to Fail or Succeed*

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Jared Diamond's Collapse: How Societies Choose to Fail or Succeed (Viking Penguin, 2005), tells the dramatic decline of past civilizations—the Easter Islanders, the Anasazi in the Southwestern United States, the Mayans in Central America, the Norse Vinland settlement in Greenland. These civilizations did not slowly fall apart; they suffered drastic reductions in population and productivity. In Diamond's account, their collapses result from mismanaged resources, lost friends, gained enemies, climate changes, and most tellingly, their cultures and beliefs. Diamond provides captivating histories and an engaging explanation of the sciences required to piece those histories together, but his logic and his prescriptions would benefit from greater familiarity with some basic principles of economics and a richer understanding of human nature.

Charlie Plott: Musical Director

In his basement Caltech experimental economics laboratory, Charlie Plott once ran a double auction experiment, in which participants buy and sell a stock that has a probabilistic payoff in each period. With probability one half the stock paid \$2.00, and with probability one half, it paid nothing. These experiments generated price bubbles: the stock would often sell for \$32.00 with only ten periods left, far more than the stock could have possibly paid in dividends. The creation of bubbles in an experimental setting was no great feat per

se; what distinguishes these experiments is that Plott assigned musical notes to each bid. The higher the bid, the higher the associated note. A bubble sounded like a child plinking at the upper end of a xylophone. Amid this plinking, bidders became edgy and placed extremely low bids. These first few low bids produced deep, primitive drumbeats that appeared to come from a distant source. They portended the bubble's inevitable collapse.

Easter Island

Modern Easter Island is mostly desolate. Most of its topsoil has blown out to sea. All but a handful of bird species have departed. Its original forests and ecosystems no longer exist. From the air, a patch of new

* Page: University of Michigan. I would like to thank Eric Ball, Jenna Bednar, Aaron Bramson, Anna Grzymala-Busse, Michael Mauboussin, John Miller, and Ted Parson for their comments on earlier drafts and thoughts.

experimental forest rises like a growth of moss on an otherwise barren rock. This obscure island tucked away in the Pacific would seem to be of little interest to anyone other than geologists, who would all too eagerly explain how the island formed from three volcanoes that rose up as plates shifted over a stationary magma source in the asthenosphere. Yet Easter Island beckons us. Not the island itself, as much as the 887 maoi that sit upon it. Maoi are large carved stone heads ranging in size from four to seventy two feet. Some of these maoi sport bright red granite headpieces called pukao. Some rest atop ahu, giant stone platforms that represent great feats of construction.

Not only do the maoi, pukao, and ahu intrigue us, so does their placement. The maoi are not aligned neatly in rows, nor are they arranged in a pattern that suggests an alien created crop circles. Instead, their placement suggests interruption. Two hundred and eighty stand upright on ahu that would seem to be their final destinations, another hundred or so lay strewn along the primitive roads, and the remainder, nearly half of the maoi, reside in the Rano Raraku quarry, still waiting for delivery.

What caused this interruption of civilization on Easter Island? An enemy attack? A fatal disease? A technological advancement that led them to abandon rock carving? None of the above. Neither guns, nor germs, nor steel. The answer is collapse. In Diamond's account, the thickest dullest heads on Easter Island belonged not to the maoi but to the chiefs who destroyed every last tree while building them. If the civilization on Easter Island ever spawned a Lorax, the character from Dr. Seuss who "speaks for the trees," that Lorax either arrived too late or lacked the charisma to derail a society bent on making ahu and maoi despite shrinking forests and thinning topsoil. The same can be shown of the Norse settlement in Greenland. No one shouted "Stop!" as the cattle herds grew larger and larger and the topsoil became thinner and thinner.

Diamond presents these histories of collapse as allegories, as rich descriptive parables that we can help our modern civilization avoid a similar fate. He claims that unchecked, we too will collapse, that we will run out of fossil fuels, topsoil, and even sunlight. To save us from this fate, Diamond has written this book. Like the low bids in Plott's experiments, it is a low drumbeat that resounds amid the more optimistic sounds that fill our days: the high pitched eight passenger SUVs, the McMansions with two and a half story foyers, and the fresh gray sole flown in each morning from the coast of Dover. It is a welcome and needed sound. For even if it turns out to be a bit too low, the reflection it provides comes at little cost. If it does ring true, and it may, collapsing our optimism could prevent the collapse of our way of life.

The natural question to ask then is whether allegory is accurate or, less demandingly, whether Diamond convinces? The evidence is mixed. As history and science, *Collapse* succeeds marvelously. Buy it. Read it. Anyone with an interest in how culture and institutions influence societies' abilities to manage resources and solve common pool resource problems will be spellbound. As predictive modern social science, the effort is less successful. It does not miss the mark, it is not wide left as some claim, so much as its main argument oversimplifies and overgeneralizes. The book's historical richness is not balanced by an equally sophisticated connection to the modern world and its capabilities.

Of course, there are parallels between past and present common pool resource problems. But there are also differences. The Norse built their roofs from irreplaceable sod, and we fuel our cars with irreplaceable oil. The Easter Islanders and the Mayans were bound in their thinking by their culture as are we. We cut down more trees, use more oil, and pollute more rivers than we should. And, like past cultures, ours cannot be altered quickly. We cannot read a

few books, hear a few cogent arguments, or learn of a gaping hole in the ozone layer and suddenly become a collectivist, pro-environmental people. That said, our self-interested culture differs in one important respect from those of the past; its effects can be manipulated in ways the others could not. Our sophisticated political, economic, legal, and social institutions allow us to channel and harness our self interest. These institutions provide levers upon which we may stand, and they (and not anthropologists and television as Diamond claims) may be our last best hope.

Four Books in One

Collapse is really four books in one. The first book describes the collapse and survival of past civilizations. In it, Diamond constructs a multicausal theory of collapse that explains why societies on Easter Island and Greenland collapsed and why the 1,153 residents of Tikopia continue a three thousand year experiment in sustainable civilization. This first book, like most ambitious projects, mixes brilliant insights with logical gaps. The second book, interwoven with the first, describes how scientists reconstruct the particulars of past civilizations and climates using bones, houseflies, and core samples drawn deep from bogs. Some of these techniques will be familiar: isotope analysis of bones reveals clues of diets and overlapping dendrochronology—comparing tree rings of trees with overlapping time spans—allows scientists to reconstruct centuries of rainfall data. But other techniques are more novel. Scientists can now uncover details about past civilizations' diets by sifting through the crystallized trash heaps of long dead pack rats. And, some techniques are so amazing that they seem to have been developed by an adult version of Encyclopedia Brown. Who else would have combined the knowledge that during droughts the heavy form of oxygen (isotope oxygen-18) becomes more prevalent with the realization that mollusks

take up oxygen forming their shells to piece together data about the duration and severity of droughts?

Book three is a thick, blunt allegory. The earth is an island and we are Easter Islanders cutting down old growth forests. They built stone heads and beautiful churches, we build super highways, giant stadiums, and big box department stores. This is not a mere “as-if” connecting, but an integrated linkage between past and present. The Easter Islanders, the Norse, the Mayans, and the Anasazi did not anticipate their collapses, and neither do we. Book four outlines how we might save ourselves from a similar fate, a guide for how to alter our behavior. Books three and four should delight environmentalists, as Diamond makes their case eloquently and forcefully. But these same two books will infuriate many readers, particularly economists. Of all the technological advancements that have been made over the past two hundred years, Diamond chooses to highlight DDT and chlorofluorocarbons (both of which were abandoned when found to be harmful), and leaves out computers, medicine, planes, trains, and automobiles. Those may not be entirely good, but they're not all bad either.

The Telling of the Collapses

Diamond's stated goal was to understand why societies collapse. By collapses, he means unsustainable trajectories that precipitously fall. He means civilizations within which everything seems to be humming along fine until one day the bottom falls out. Think James Dean's fiery death on the Pasadena freeway and not Ronald Reagan's slow agonizing decline.

Taking a scholarly approach that one hopes many emulate, Diamond describes the foot and a half high stacks of paper he gathered on each civilization, immersing himself in evidence before coming to any conclusions. (Paperlessness being next to godliness within the environmental community, one hopes

that this is metaphor and that he downloaded the material rather than printing out a stack of paper ten feet high.)

Most of us (economic historians notwithstanding) would not have bothered with such a fact filled undertaking. The reason being that economics can provide an austere mathematical explanation for collapses. This comes as no surprise; economists have an austere mathematical explanation for just about anything. In this instance though, the economic model proves relevant. It goes as follows: a society's output consists of labor and capital applied to some natural resources. In its starkest form, the model assumes a single natural resource, with an initial quantity denoted by Q . We can either assume that Q is renewable, in which case Q both decreases from extraction, X , and increases from regeneration, R , or that it is not, in which case Q inexorably decreases. If the natural resource is not renewable, collapse is unavoidable. As every child knows, eventually the Halloween candy, like our oil, will be gone. But as long as the Peanut M&Ms last, we might as well enjoy them.

If, instead, the natural resource is renewable, and if its level and regeneration rate are known, then choosing a rate of extraction that is balanced by the rate of regeneration, i.e., setting X equal to R , results in sustainability. Of course, a higher rate of extraction leads to collapse. In the civilizations Diamond studies that did collapse, the resources were renewable but X exceeded R . In Iceland, Tikopia, and Japan, X did not exceed R , at least not for long, and the societies succeeded.

At first, then, it appears that Diamond is promoting a single factor explanation. Civilizations that wisely manage their resources survive. Those that do not collapse. But Diamond argues that this explanation is incomplete. First, why did those past civilizations choose X larger than R ? Second, if these mistakes were made in the past, could not the same mistakes be made today? Why would not X have been chosen

optimally? The most compelling explanation is that Q and R were imperfectly known. Consider two extremes, one in which Q and R are known, as we might think would be true of forests (I'll challenge that claim in a second) and another in which Q and R are unknown, as might be true of topsoil. Failure in the former case is, for lack of a better word, dumb. (The term bounded rationality just doesn't quite have the necessary force here.) And Diamond had better have a compelling explanation for how a society could watch Q fall year after year and do nothing about it.

Failure in the latter case is no embarrassment. If Q and R are not known, then the only certain sustainable path is to set X equal to zero. A more reasonable strategy might be to choose an X that worked in another, similar location. And, in fact, the Norse followed this approach in Vinland. Sadly, this strategy only succeeds if the regeneration rate, R , in the new location is equal to or smaller than R in the old location. As it turned out, R in Scandinavia was larger, and their Vinland civilization collapsed. Oops! By way of comparison, those who settled the United States found a relatively large R , and they prospered.

However, in Diamond's theory, mismanagement of renewable natural resources is only part of why societies collapse. The full explanation, which is his thesis, rests on four additional causes: *institutional and cultural failures, environmental change, a loss of allies, and a gain in enemies*. His most detailed case study demonstrating this thesis is the Norse Vinland settlement on modern day Greenland. The Norse settled Greenland in 980. By 1450 they had run out of fuel and were eating their baby calves to survive the harsh winter. Without question, the Norse overextracted. They overharvested their forests to such an extent that they had no wood to build boats. They depleted the precious, slowly regenerating topsoil by grazing cattle and sheep and even cut the valuable turf to make the walls and roofs of

their houses. But Diamond's other causes come into play as well.

Institutional and Cultural Failure: By institutional and cultural failure, Diamond means two separate effects that merit distinct treatments. Institutional failures refer to poor institutional choices that result in the failure to solve a collective action problem. Cultural failures refer to ways of organizing social and economic life, ways of seeing the world that create blind spots and limit opportunities. For example, culture and tradition encourage people to live and to see their relationship to the earth in particular ways. The Norse, though surrounded by whales, seals, and fish, continued to farm on marginal soil. The decision not to fish demonstrates the grip of culture.

The Norse, then, chose a way of life in Vinland similar to that of their ancestors in Scandinavia. They did not adapt to their new environment. They endowed them with the wrong cognitive map for their ecosystem. This observation is not unique to Diamond. Scott Atran and Doug Medin (2004) have found that culturally distinct groups, Ladinos, Itza', and Q'eqchi, each see their common Guatemalan ecosystem differently and the sustainability of their agricultural practices varies in ways that can be predicted by these cognitive maps.

The fishing puzzle remains. Could the cultural blinders have been that thick? Diamond hypothesizes that the Norse may have had a taboo against eating fish. He does not substantiate this conjecture other than to suggest that perhaps Eric the Red once ate a bad fish. This is pure speculation that does not square with the larger theme of the Norse keeping their old way of life, which included eating fish. The Norse were Catholics. Diamond makes a big point of this. In the Catholic tradition, fish ranks third behind bread and wine as a symbolic source of nourishment. One little stomach virus would hardly seem sufficient to abandon a way of life.

Diamond is on firmer ground when he ascribes the Norse failure to learn whale

hunting from the Inuit as exemplifying cultural blinders. Yet his own description of an Inuit whale hunt—attaching bladders to the harpoon ropes to increase the strain on the fleeing whales—reveals that the skills and techniques may not have been translatable; they may have been tacit knowledge. One can only imagine the reaction of the other Norse to some long forgotten Sven who advocated manning primitive boats and hunting whales in the frigid sea using only small harpoons.

Diamond's point that cultures change slowly is a good one. The people in a society cannot one day wake up and change their way of life. People stubbornly hold onto their beliefs and traditions, as well as to their ways of making a living. In the case of Easter Island, this inability of the society to change their culture contributed to its collapse. A once forested island was cleared of all its trees in eight hundred years. As Diamond's students at UCLA protested, why wasn't this foreseen? In fairness to the Easter Islanders, eight hundred years is a pretty long time. The change was gradual and might well have gone unnoticed. Every day in cities and towns around the world, men wake up surprised to find themselves old and overweight. In light of this, the fact that an Easter Islander ignored his grandfather's ramblings that his grandfather's grandfather remembered when there were 5 percent more old growth forests hardly seems dimwitted. Furthermore, clearing forests creates open space that can be converted to new forests. So the attitude that a few decades of planting could reverse the trend may have held sway. (Just as might claims by those modern men that they'll start doing sit ups and eating a little less fat.) Unfortunately, replanting does not succeed if the topsoil has blown out to sea.

Climate Change: There is weather, and there is climate. Weather refers to the month to month, year to year variations in temperature and precipitation. Weather is wet Aprils and warm Augusts. Climate

change refers to large scale fluctuations: decades of no rain, a century of wet weather, or a mini ice age. Civilizations, advanced or primitive, have little trouble adapting to weather. Harvests and plantings are pushed back or moved up a week. We pull out the winter coats a week early. Climate changes, though, create more tragic narratives. We can see this by returning to the toy model of resource extraction, a change in climate can reduce the rate of regeneration R . If so, the rate of extraction, X , must be reduced to maintain sustainability. Making this change would not be difficult were it not for changes in the weather. Separating seasonal fluctuations from global trends is tricky business, as evidenced by the Lomborg (2001) controversy about global warming. Add to this the fact that these earlier societies probably lacked centuries of accurate temperature data, and discerning climate change becomes almost impossible.

The Norse may well have suffered from having to endure a mini ice age. A rate of extraction that was already too high became increasingly so, and a people surrounded by fish nibbled on the remaining bits of flesh on their calves' hooves. The Norse were not alone in the concurrence of their collapse with a drought. The Anasazi also endured a drought near the end of their time in Chaco Canyon, as did the Mayans. The drought that affected the Mayans took place around 760AD. The Mayan civilization had survived over 3,500 years up to this point, and one might think that over that large span of time, this would have been just one more drought, but it combined with the other factors—in this case, over harvesting of trees and increased fighting—to precipitate (pun intended) the collapse.

Our simple model agrees with Diamond's theory: climate change may cause collapse. But his approach is fact laden and taxonomic, not process driven and model based. As a result, his checklists create false puzzles. For example, Diamond finds the survival of the Tikopians remarkable in light of their

volatile weather patterns. Their survival is to be expected when examined through the lens of our model. Frequent cyclones create an incentive to reduce extraction below the maximal sustainable level. These reductions in X made to survive variations in weather enable the society to withstand changes in climate as well. The practice of storing fermented bread fruit in pits that helped them survive cyclones proved prescient during droughts. The Tikopians also gave up raising pigs and capped their total population by literally voting people off the island. Without the ever present cyclones, the institutions and culture that supports them would not have emerged.

Friends and Enemies: Diamond's final two factors are a decrease in friendly relations with outsiders, i.e., trade, and an increase in hostilities with enemies. The inclusion of these external factors creates a potential problem. If these external factors are too important, they render the primary point that Diamond wants to make about environmental stewardship irrelevant. Youngstown, Ohio, a marginal producer of steel, collapsed when trade with friendly neighbors ceased. Poland collapsed when relations with Germany turned sour and Germany attacked. Environmental policies played no role in those cases. At the same time, Diamond cannot ignore the fact that just as no man is an island, no island is an island either, so he must include friends and foes in his analysis.

In telling of these collapses, ideally, Diamond would craft a version of the "for want of a nail" parable, in which lack of a small trading partner has cascading effects. Perhaps, a shipment of steel plows would fail to arrive and the Norse would have to fashion ineffective plows from church collection plates, but no such story appears to exist. If it did, we can count on Diamond to have found it. Evidence does suggest that Scandinavian ships visited less frequently near the end. And with this, Diamond makes the case for external causes. He adds to this

<i>Collapsed Civilization</i>	<i>Over Harvesting Renewable Resources</i>	<i>Climate Change</i>	<i>Fewer Friends</i>	<i>Greater Enemies</i>	<i>Institutional Cultural Failure</i>
<i>Easter Island</i>	Yes	No info	No	No	Yes
<i>Anasazi</i>	Yes	Yes	Maybe	No	Maybe
<i>Maya</i>	Yes	Yes	No	No	Yes
<i>Greenland</i>	Yes	Yes	Mild	Mild	Yes

the uniting of Norway, Sweden, and Denmark and the drying up of demand for the ivory that the Vinlanders were supplying. But why is this reduction not endogenous? Why undertake an expensive voyage to trade with people who have little to trade? Why is this not just the natural course of events in a collapse?

I think Diamond may have it backward. It is not that a reduction in trade causes the collapse but that the collapse causes the reduction in trade. As a society begins its collapse, it has less to trade and therefore trade falls. This also seems to have been the case with the Anasazi. When their economy in Chaco Canyon was robust, they had trees delivered from far away. As the economy faltered, trade decreased. Inferring the direction of causality is never easy. Sometimes it is hard to determine which came first, but often we can say with some confidence that the chicken came out of an egg.

The logic that increased hostilities causes collapse suffers from the same problem. Enemy attacks are not independent of a civilization's strength. The fact that the Inuit attack that killed eighteen Norsemen occurred when the Vinland civilization was declining was probably not coincidental. Similarly, as the Mayan civilization began to falter, attacks between cities increased. Here as well, the logic that a city's failure makes it more susceptible to attack seems at least as strong as the logic that points in the other direction.

Overall, despite the fact filled, thickly descriptive approach of Diamond, the evidence swings more toward the simple, stark model that economists use, with Diamond's addendum that fluctuations and shifts in R contribute to the collapses. One comes to

this conclusion by categorizing his evidence. The entries in bold are those for which his evidence is indisputable.

Were the table also to include those civilizations that did not collapse, it would show that they did not overharvest. Thus, the facts, as detailed as they are, support the simpler theory, that climactic variations spell trouble. The ecosystems that he studies were marginal places to live. Few would describe Greenland, Chaco Canyon, or Easter Island as fertile. We can thus infer that a civilization existing on marginal land, isolated from others, that does not strictly control population and suffers climate change will probably collapse. Where modern collapses have occurred, those conditions have also existed, as Diamond's analysis of Rwanda makes plain. Too many young men with no land, no jobs, and no prospects contributed to the Hutu killings of Tutsi and Hutu. But should the fact that civilizations on marginal land collapsed be seen as a warning that our modern, technologically sophisticated, and integrated economies are bound to collapse? That is not an easy connection to draw, and it is the task Diamond sets before himself.

The ambitious connection between the telling of the collapses and the modern situation in all its complexity is the most problematic part of the book. If we take seriously Diamond's claim that the world is one big Easter Island, can we interpret the allegory as richly as Diamond wants? Probably not, but let's give him credit for a solid effort. Of the five parts of his theory, two do not apply. If we are one big island, short of an extraterrestrial encounter we cannot have fewer friends or more enemies. So, let's put those two aside. A third, the cultural/institutional failure argument points in the wrong direction. Unlike

the Norse, who were bound by a single culture, those of us living on the “big island” have diverse cultures and institutions. The Inuit live on that big island, as do the !Kung, as do the French. That diversity may be shrinking as market based economies and democratic forms of governments continue their spread, or it may be increasing as coalescing ethnic identities spur nationalist movements. Regardless, these diverse cultures often include attachments to geographic locations and generate natural resource stake holding. They can only help.

The big island’s cultural diversity also provides advantages that the Norse, the Mayans, the Anasazi, and the Easter Islanders lacked. Our diversity permits experimentation. Suppose that the European best current technology approach to environmental management proves more successful than the U.S. risk-based regulatory and market-based approaches (Morag-Levine 2003). Then perhaps the United States and other countries can imitate those policies. The same logic applies to developments in transportation systems, housing, and ecosystem management: we can imitate successful approaches. The catch here is that some of these policies and approaches may bump up against cultural barriers. Culture may not be a hard constraint, but it does make some changes harder than others. Cultural and institutional diversity also provides insurance against widespread collapse. Regardless of what the future holds, some culture is likely to have the required skills to thrive in it.

A fourth part of his theory, *climate change*, works differently in the modern context. Past societies failed because long scale droughts or mini ice ages meant that crops would not grow. But these droughts were local phenomena. Localized droughts have smaller effects on the big island. Hurricanes, tsunamis, earthquakes, and volcanic eruptions always have and always will wreak havoc, but our ability and growing willingness to respond globally to these local catastrophes mitigates their impact. They will not cause a collapse. A

second difference is that in the past, climate change was an exogenous force. Now, it is a confusing mixture of exogenous and endogenous forces. As for a mini ice age, a recent *Scientific American* asks whether the deforestation of the earth prevented one. Even if our turning up of the thermostat by messing with the carbon cycle was fortuitous, we have no known way of dialing back down. And, as a result, we may bake. (Or we may freeze—this global warming stuff is nothing if not complex.) Thus, it is fair to say that endogenous global warming could lead to the collapse of modern civilization for reasons that differ from the exogenous changes in temperature that exacerbated the decline of the Norse.

This leaves the *overharvesting of renewable resources*. The connection of the overharvesting on Easter Island and in Greenland to modern economies is problematic in at least four ways. First, the most pressing modern resource problems concern nonrenewable resources: oil, natural gas, and uranium. Second, the modern big island has sophisticated economic and political institutions that create well established property rights. The oil is owned by someone, and it is priced. A growing China cannot continue to do the modern day equivalent of cutting down trees by consuming more oil because China will have to pay for that oil. As they and others demand more oil, the price will rise. This is true whether we are at the peak of oil production or far past it. Diamond’s projections then that we will run out of oil in a “few decades” runs counter to basic economic logic. Oil’s price rise will reduce demand. No rational seller of oil would let it run out in a few decades. As shocking as this may sound, the market can play the role of the Lorax and simultaneously create incentives to search for alternatives, but it may not do so fast enough.

The third difficulty with the connection to modern problems is that deforestation matters less than the destruction of ecosystems. Diamond is quite clear on this point. Yes, Easter Islanders cut down trees, but

they also destroyed ecosystems. Replanting a forest is relatively easy when compared to re-creating an ecosystem.¹ It is the space between taking a shovel and digging a bear den in your yard and taking some DNA and creating a brown bear in your basement. Tree re-plantings occur on multiple scales: timber companies and energy companies plant whole forests to capture carbon, and sprawlers on our ex-urban fringe convert farm land to forests, albeit manicured ones with nonnative species. I do not mean to imply that the planet is becoming greener, only that we are far from headed toward brownout. The earth is not going to become a lifeless ball of mud any time soon.

Fourth, the complexity of our environmental interactions far exceeds those of previous societies. Diamond recognizes this. Cutting up turf, exhausting soil, and chopping down trees have (relatively) straightforward consequences. Our own dumping of chemicals, widespread use of fertilizers, and introductions of new species create complex, unpredictable effects. We're not messing with a single ecosystem in primitive ways. We are fundamentally altering multiple ecosystems in myriad ways. This does not mean that Diamond's theory is wrong. To the contrary, it makes his argument stronger. Problems that arise in complex systems are harder to anticipate and harder to solve.

These features—difficulty of anticipation and problem complexity—are two of the four failures in group decision making that Diamond identifies as leading societies to fail to prevent collapse. The other two are a failure to recognize the problem and a failure to even try to respond. The first of these latter failures is both less and more of a problem now than it was in the past. True, we have an abundance of measures of our environmental impact, whereas the Norse

didn't even know what the carbon cycle was. But we have not reached a scientific understanding of our actions' implications. The second failure, that of not responding, may be more true now, not because we care less about dealing with problems but because we have too many problems to fix. Environmental devastation competes for our limited bandwidth with a host of other catastrophes: terrorism, asteroids, avian flu, nuclear weapons, and realignment of the magnetic field (see Rees 2004 and Posner 2004). Environmental collapse does differ from many of these potential catastrophes in that we have a degree of control. We can choose to reduce our odds of it happening. We cannot do much if a moon sized asteroid heads our way. And, the looming possibility of asteroids, flus, and war should not be an excuse for fiddling away while devastating our planet.

In this last part of the book, Diamond provides a list of modern activities that create environmental problems. If he meant to frighten, he succeeds marvelously. Here are Diamond's dirty dozen. Of the world's original forested areas, we've destroyed half.² We're reducing sources of wild foods. We're destroying habitats, making species extinct. Diamond uses Erlich's metaphor of these lousy little species being lousy little rivets in an airplane, (a strained metaphor as other species adapt within food webs, something that airplane rivets cannot yet do). We're eroding our soils. Iowa, for example, has lost half of its topsoil. We're depleting our freshwater. We're using up all available sunlight.³ We're introducing chemicals in the air and water, which may be lowering our sperm

² Diamond is assuredly not a creationist, and he does not tell us when the origin was, so this fact is on somewhat shaky ground.

³ As crazy as that may sound, he's right. The earth has a photosynthetic ceiling. Given temperature and rainfall there is a maximum amount of sunlight that can be absorbed per acre. Crops, tree planting, golf courses, roads, buildings, and parking lots absorb over half of this. We're not going to run out of sunlight; we're just not leaving any for natural ecosystems.

¹ Unfortunately, the logical chain connecting the potential collapse of modern civilization and the fate of spotted owls and lichens has ever too many links to result in significant public support for species preservation, apart from those species that are cute and furry or magnificent.

counts. We're inadvertently introducing alien species, such as emerald ash borers, that wipe out native plants. We're using up finite oil, natural gas, and coal reserves. We're producing greenhouse gases contributing to global warming. And finally, we're overpopulating the earth and demanding more of it: people in the developed world have ecological footprints nearly three dozen times as large as people living in more primitive societies. Only the most hopeful of readers can remain optimistic after trudging through this litany of existing and looming environmental problems which Diamond has nailed to our front door.

This doomsday list might lead some to classify this as yet another alarmist environmentalist tract that undermines the environmentalist movement (Shellenberger and Nordhaus 2004). It is not, though I wish Diamond had given more attention to the pragmatic realization that to make an omelet you have to break a few eggs, that if we want Ford Explorer Hybrids and iPod Nanos and Clinique Bonus Days (and hey, let's be honest here, who doesn't?), we need to generate a little pollution along the way. I also wish he had given technology some chance to save us. Diamond dismisses technological solutions out of hand. He claims that the history of technology demonstrates that it has created more environmental problems than it has solved. He believes that technological optimists like the late Julian Simon just have it wrong.⁴

As to the point that the modern world is so different from Easter Island, Diamond suggests that those places that are most politically unstable are also the most environmentally stressed that today as in the past, environmental problems induce political instability. Many will take exception to this last causal arrow, as well they should. Once again, Diamond needs to include arrow pointing in the other direction as well.

He is correct in stating that environmental problems can lead to political and economic instability by necessitating cultivation of new fields, which in turn strains property rights and adjudicating institutions. But, at the same time, political and economic instability allow for unchecked exploitation of resources and ecosystem mismanagement. Thus, political instability causes environmental degradation. These twin failings create a positive feedback loop with dire consequences.

Bottom Up and Top Down

Is then Diamond signaling the end? Is the party over? Hardly. Diamond sees himself as an optimist and an activist and this book as a political act, as an appeal for us to change our values and beliefs. I think the book will fail to achieve that ambitious goal. To explain why, I first offer up a modified version of Plott's experiment to highlight the various dimensions of behavior that Diamond hopes to change. In Plott's original experiment, the participants know the probability distribution over the dividends that are to be paid each period. The bubble emerged anyway. In my variation on the experiment, people may not know the value. Suppose, for example, that people bid for the rights to existing virgin forest. Each period, the owner of a unit of forest can cut down and sell the trees or allow them to grow. The value of a unit of virgin forest has three components: the value of the wood and pulp to be used in production, the value of the ecosystem, and the value of the carbon in the trees as a reducer of global warming. In this richer experiment, there are more ways for the market price to be inaccurate. As before, there can be standard price bubbles in which the price of the stock exceed the possible future value of the forested land. There can also be inverted bubbles in which the price of stocks are too low given future demand. Such mispricings are a cost of operating a market. Eventually, though, some beating of a bass drum or a few notes on a piccolo tends to correct them.

⁴ Even though Simon did win his famous bet with Paul Erlich on commodity prices.

Diamond clearly believes we are in an inverted bubble now, that current prices represent Tulipmania turned on its head. Part of Diamond's goal is to explode the bubble, to get us to recognize that we are caught up in dangerous group think. (Alas, those hoping for a reference to hyperbolic discounting by Diamond will be left wanting.) Diamond also believes that there are other causes for this pricing error: people are unaware of the second and third components of the forest's value. If so, this mispricing is not then an idiosyncratic bubble such as those found by Plott, but a systematic underpricing, and hence, the need to increase awareness. He wants us to care about the environment, knowing that if we do, we will change prices. And, as made clear by his references to his young sons, he wants us to care more about the future. In the cold calculating language of economics, this increased concern for the world that we leave our children can be captured by a lower discount rate (a higher δ) and higher prices in the modified Plott experiment.

Like Diamond, I too wish that people cared more about the environment. I too wish we would stop poisoning our atmosphere, that we would try to slow global warming, that we would make more meaningful efforts to preserve our prairies, lakes, streams, forest, bogs, and oceans for our children and our children's children, and that we would devote more resources to finding new sources of energy, but we do not. Our environmentalism is bumper sticker thick. As a parable for what he hopes to accomplish, Diamond refers to Aesop's fable of the wind proving unable to get someone to remove his coat but how the sun, by shining its light, accomplished the task. Fables aside, no single book is likely to transform us into a nation of people living in funnel topped yurts who sell energy back to the grid.

This begs the question of what is to be done. There are three alternatives: bottom up environmentalism, letting markets work, and government prodding. Diamond

believes the bottom up approach can succeed. He advocates turning out to vote, purchasing from environmentally friendly companies, sharing information about companies that are friendly or harmful to the environment, joining local organizations, and giving money to environmental groups. These activities are all well and good, but are far from the fundamental changes in behavior that are necessary. Modern day Americans may be no more likely to become environmentalists than the Norse were to become Inuits. Our tastes have cultural roots. The Norse wore inappropriate clothing and ate inappropriate foods given their climate because they were Norse. Americans like stuff because we are American (Whybrow 2005). Our more environmental European counterparts do as well, though to a lesser extent. Presentations of complicated data suggesting global warming interwoven with detailed case histories are not likely to convince people to change their way of life permanently. We are not likely to buy less stuff or live in smaller houses.

The bottom up approach fails because of scale issues. Some political scientists, most notably Elinor Ostrom (1999), have found evidence that small communities can find bottom up solutions to solve common pool resource problems. A small group of people in Montana can self-organize and save a stream or a forest. However, with large populations, and here we are talking about all six billion people on the modern Easter Island, the local bottom up approach is too optimistic. Here Diamond's advocacy runs counter to his own evidence and his theory: culture, though not immutable, is stubborn. Self-gratifying symbolic acts of environmentalism may well have a negative effect. Buying a Volvo wagon because the entire car can be recycled may be well and good, but the bulk of any vehicle's contribution to the carbon cycle is in the fossil fuels it burns. Production is only a small part. Better I buy a more fuel efficient Chevy and leave it by the side of the road when it breaks down.

Planting a tree and riding a bike are good ideas, but they are not sufficient (Maniates 2001). Appeals such as Diamond's that we live greener often have limited impact because many of the most vocal environmentalists are perceived to have the largest ecological footprints. Though they walk to work and eat less meat, they also love nature and frequently visit it in its many forms. Montana is a long way away, as are the Galapagos. Getting there takes gas and lots of it. Getting there is half the fun and ninety nine percent of the environmental damage. Thus, suggestions by globe trotting environmentalists and Hollywood actors that those of us who love water skiing should abandon it for bird watching and nature hikes ring hollow and lack sense. Visiting nature may be a more environmentally damaging activity than riding around in an SUV.

An economist is compelled to ask: won't the market work? Not necessarily. An unfettered market cannot solve a common pool resource problem, but the market can create incentives that lead to new technologies. The discovery of crude oil saved us from declining whale oil reserves, so the past gives us hope. But, we have no guarantee of future resources. A belief that market forces will sort this all out is naive. Would that we could just shift resources to existing technologies, but those technologies do not yet exist. They must be developed. Betting on innovation is risky. It's why we subsidize pharmaceutical and energy companies.

It is true that during the first half of this century we saw many technological advances in transportation, heating, cooling, and production processes, but we now have little room for improvement in those areas. Gas heaters are nearly 100 percent efficient. No one has ever so much as hinted at a Moore's law when it comes to energy production because there is not one. Our most recent technological advancements in computing power, informational systems, inventory systems, and medicine that have been driving growth may fuel optimism in technology, but

none produce fuel. You cannot drive your car with Viagra (though you can have some fun in the back seat).

Diamond seems convinced that the market is responding too late. He may well be correct, but not because the market is irrational. The reason may have more to do with differences between how economists and environmentalists discount the future. To wit, I recently attended a function with a group of long-term value investors. Many of them smoked cigars and ate copious amounts of red meat. Only a handful, so far as I could tell, ate reduced calorie diets, practiced Pilates, and aspired to eternal youth. So-called "long term" investors work on mere ten, twenty, and thirty year time horizons, not on hundred year or thousand year time horizons. Our government only recently reissued thirty year bonds.⁵ Long term time horizons may be environmentally beneficial but they run counter to economic logic. Take out a calculator and raise \$0.95 to the hundredth power. You get less than six tenths of one percent. This means that if you discount the future by five percent per year, you really do not care much about what happens one hundred years from now. At most, you care about what happens in the next twenty years. This harsh economic logic explains how the end of known oil reserves can be well in sight yet have little influence on the profit motive and hence on incentives. Even if I had a cheap alternative to oil, I couldn't make much money on it for thirty years. Thus, if Diamond and I want our children's children to get an occasional peak at the Arcadian dream, we cannot rely on market logic alone.

To summarize, neither the change in values that Diamond advocates nor market forces are sufficient alone to right our path. And even though the two generate symbiotic effects—a greater concern for the

⁵The French government recently issued fifty year bonds whose sales surpassed expectations, and in the 1990s Disney issued one hundred year bonds.

environment increases the incentives for fixing it—some government intervention will be necessary. We cannot just have faith in markets to produce technology. We need some top down support for technology prior to the economic incentives taking hold. We also need the government to pass laws preventing us from destroying ecosystems. To wit, one of the most fascinating histories in *Collapse* concerns the Dominican Republic and Haiti, two countries that share a common island. From above, the boundary of the two countries is a visible scar. The land on the Dominican side is green. The land on the Haitian side is brown with less than 1 percent forest. On the Dominican side is 28 percent forest. Haiti has four parks. The Dominican Republic has seventy four. Per capita GDP in the Dominican Republic is five times that of Haiti, and its population density is much lower. These disparities partly can be explained by the richer soil and more plentiful rivers on the Dominican side and by the French exploitation of Haiti's resources. But Haiti's failure cannot explain the success of the Dominican Republic. That environmental success is largely due to two dictators: Trujillo and Balaguer. The latter even empowered the army to round up poor people squatting in the forests. Top down, government imposed environmentalism has a role.

In America, we live in a democracy. Our government, at least to some extent, does what we ask. And it appears we need to ask it to help us change who we are, to change our culture. This does not mean that we have to mandate environmentalism at the expense of growth. The evidence suggests that intelligent policies can change our behaviors and make economic sense. Taxes on cigarettes have reduced smoking as have restrictions on where people can smoke. But neither intervention stopped smoking entirely because smoking is addictive. Reckless consumption, accumulation, and travel are also addictive behaviors. Asking us

to stop consuming by telling us that we're contributing to the destruction of rain forests hasn't had much of an effect. Neither, I am sorry to say, will telling us stories about people living on marginal land whose civilizations collapsed. So, if Diamond and others are to have an effect beyond energizing environmentalists, they should push instead for government policies that encourage us to change our behaviors. These policies require an understanding of our culture as well as of economics. Raising the tax on gasoline may affect the behavior of most Americans and therefore change the broader culture. Maybe our children will play soccer in their backyards rather than riding ten miles in minivans to play with the kids next door. Outlawing the excessive packaging that I cannot avoid on the plastic toys that I buy my children may change how I think about waste. This could have cascading effects, as would legally preventing my community and my university from forcing me to flush my toilet with water pure enough to drink, as would removing the home mortgage deduction on any home with a wasteful two story foyer. Paying me to plant a lawn on my roof may get me to understand more about the carbon cycle. (Prior to reading this book, I, like many, had thought a carbon cycle was something that Lance Armstrong rode.) Neoclassical economics has taught us that incentives induce behavior, they induce beliefs, and they result in the creation of routines and artifacts. Together, these define our culture (Bednar and Page 2004). Many of us originally wore our seat belts because it was the law. We wear them now because it is part of our safety obsessed culture.

Common sense says that no treaty signed in Kyoto or anywhere else for that matter will save the planet if we all continue to drive huge SUVs, live in enormous houses that we refill with new furniture every five years, and take fabulous skiing vacations. The environment has long used double entry accounting. Examine its books.

Unbridled self interest and consumption will lead us to collapse. Diamond is correct. Someone will drive the last mile in a Ford GTO. Someone will eat the last jelly donut. Someone will groove to the last hip hop beat. To prevent this collapse, we cannot be expected to adopt an Inuit culture. (I, for example, look frumpy in seal skin and find harpooning dull.) We must recognize that our ability to alter modern culture is limited and, rather than try to change it wholesale, we should attempt to leverage it by pursuing policies based on the principles of jujitsu. We must turn the awesome forces of freedom, self interest, and ambition against their current wasteful incarnation. We can, and should, continue to aspire, to dream, to achieve, to engage in the pursuit of happiness, meaning, and knowledge, but we should be encouraged to do so without using so much stuff or by using stuff that is renewable and recyclable. This should be the low drumbeat we hear off in the horizon. It would be music to our ears.

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