

The Vanishing Book of Life on Earth — Eric R. Pianka

The great North American tall grass prairie — we just took it and turned it all into agricultural lands. We exterminated the bison, wiped out the Indians, destroyed the prairie dogs and those black-faced ferrets. We just erased an entire ecosystem. Now this was very nice for Americans because that rich topsoil has allowed us to grow food and we can feed ourselves and the rest of the world and we've grown fat and apathetic and miserable as a result of it. We've lost the bison — we've lost an awful lot that we'll never be able to recover.

Today I want to talk about an impending doomsday. I'm going to go down, down, down and then I'm going to try to come up just a little bit at the end.

The great early American naturalist Henry David Thoreau embraced wilderness and used a book as a metaphor for life on Earth. Philosopher of science Holmes Rolston III extended Thoreau's metaphor as the "vanishing book of life." Rolston remarks "destroying species is like tearing pages out of an unread book, written in a language humans hardly know how to read." This book of life is disappearing before our eyes. Each page corresponds to one of the many species of life forms that lived or still lives on Earth, and describes everything one could possibly want to know about its natural history and ecology, its parasites, prey, and predators, how it is related to its closest ancestors, as well as much more. Each chapter, in turn, describes how every member of this myriad of millions of different microbes, fungi, plants, and animals interact within a particular natural ecosystem. All of Earth's once pristine ecosystems, past and present, are thus described, metaphorically, in many volumes.

The massive amount of information contained in all life on Earth could never be recorded in a single book, or even in an encyclopedia, but would require something more akin to many libraries of Congress. This "Book of Life" is indeed the most valuable of all of our many books, as it contains the entire history of all life on Earth from its very beginnings 3,500,000,000 years ago. Unfortunately, this greatest book of all time is tattered and torn, pages are missing, and entire chapters have been ripped out. Humans are heedlessly destroying habitats, effectively ripping out pages of the "Book of Life" even before biologists have had a chance to read them. We are burning the greatest book for nothing more than to expand the human population, which is already precariously high.

Most people consider biology, particularly ecology, to be a luxury that they can do without. Even many medical schools in the USA no longer require that pre-medical students obtain a biological major. Basic biology is not a luxury at all, but rather an absolute necessity. Despite our human oriented attitudes, other life forms are not irrelevant to our own existence. We need them to continue to exist ourselves. As proven products of natural selection that have adapted to natural environments over millennia, they have a right to exist, too. With human populations burgeoning and pressures on space and other limited resources intensifying, we need all the biological knowledge that we can possibly get.

Ecological understanding is particularly vital. Without understanding natural ecosystems, how can we hope to manage man-made ones wisely? Basic ecological research is extremely urgent simply because the worldwide press of humanity is rapidly driving other species extinct and destroying the very systems that ecologists seek to understand. No natural community remains pristine. Pathetically, many will disappear without even being adequately described, let alone remotely understood. As existing species go extinct and even entire ecosystems disappear, we lose forever the very opportunity to study them. Knowledge of their evolutionary history and adaptations vanishes with them: we are thus losing access to valuable biological information itself. Just as ecologists in many parts of the world are finally beginning to learn to read the “unread” (and rapidly disappearing) “book”, they are encountering governmental and public hostility and having a difficult time finding support.

Let us consider the book of life: Several questions come to mind — Can we read it? Will we be allowed to try to read it? Do we have time enough left to read it? I have been very fortunate to have spent most of my life studying the ecology of desert lizards. I’m finding that I am no longer allowed to do things that I used to be able to do because as we have taken over habitats and imperiled other species, they have become so scarce that they must be protected. I worry that before too long ecologists won’t be allowed to touch a wild vertebrate. When this happens, time will have run out for us.

The biggest enemy we face is anthropocentrism. This is that common human attitude that everything on this earth was put here for our use — to be used any way we want. An example of an anthropocentric human is

a man with a chain saw cutting down a redwood tree that's a thousand years old. That is audacity and that is anthropocentrism and that is wrong.

I live in the hills about 35 miles west of Austin. It's turned into a bedroom community for the city. All kinds of people move out into the hills to avoid high taxes in Austin and they bring their mobile homes, their security lights and their cats and dogs so now there's a horrible, horrendous commute with new stoplights going in everywhere.

The city of Dripping Springs has had to build three new schools because of this and it's turned into a little suburb of Austin. And everything has gone downhill. When you meet your new neighbors — usually over a fence — they come up and say “Hi, who are you — what are you doing out here?” I introduce myself, and they want to know what I do — how do I make my living? I tell them I'm a university professor and a lizard ecologist and then I start to plead with them.

I point out that there used to be a lot of lizards and snakes living in these hills and that they're all disappearing because of this encroaching urbanization. I plead with them not to let their cats and dogs run loose — cats are born killers. They let dogs run loose so they can “play” with the deer. Well you can't do that — dogs are wolves — they pack up and they kill things. They don't belong out there. Another thing people do is put out feeders for birds — that brings in urban birds — so blue jays and things that shouldn't be out there replace the scrub jays that should be there. I've seen rattlesnakes disappear completely.

Some new neighbors came up to me and when I pleaded with them about not letting their cats kill lizards — one of them made a huge mistake — she looked at me and said “what good are lizards?” She shouldn't have said that to me . . .

I looked her in the eye and said “what good are you?”

Ecologists want and need access to wild organisms in semi-pristine natural environments because these are the places in which they've evolved and to which they have become adapted. Organisms don't make any sense if they're not in their natural habitat.

Rattlesnakes...

People often call me to ask where can they see a rattlesnake. They don't want to see a wild rattlesnake; they want to see one behind glass. A rattlesnake in cage might as well be dead as far as I'm concerned. It doesn't have a natural habitat. It doesn't make any sense. I don't know where it evolved or what it's adapted to; I don't know anything about it. It's as if you took a pair of scissors to a collection of the world's greatest love stories and started cutting out the word "love" every time you saw it and putting the little "loves" into glass vials. You don't even know which book they came from, let alone whether they are verbs or nouns, you don't know who loves whom; love has been taken completely out of context. That's what's wrong with animals in zoos. They don't have any ecologies anymore. They might as well be dead.

We have to save the vanishing book of life, but we must also read it. And my point as a biologist is that anyone can help save it. There are tree-huggers galore out there and plenty of people who just want to save the planet. Anyone can do that. But it takes somebody who's dedicated and earnest and a little bit crazy to try to go out and read it and try to make sense of it. That's what we should do if we have the skills to do it. We should try to read it before it's gone. I don't see any point in trying to save anything unless biologists are allowed access to it. I think that is a critical point here.

Today we have many powerful tools to help us decipher the vanishing book, most of which were unavailable a few decades ago. These include air travel, email, fax machines, the global positioning system (GPS), satellite imagery, geographic information systems (GIS), the polymerase chain reaction (PCR) which allows amplification of DNA, DNA sequencing, powerful desktop computers and imaginative powerful software. Unfortunately, just as ecologists have gained access to this vast array of new technological tools, the very stuff we need to study is disappearing.

Now for some of you some of these things won't seem like they're new, but I'm pretty old and I remember when faxes first came out — I was working in Australia and I wanted to send something to Texas to Austin and I had access a new fax machine. As I was feeding it in down under, I could see it in now-time coming out in Austin — to me that was mind-boggling technology. I'm still hoping they'll figure out how to fax me back and forth so that I can avoid the plane trip and all the rest.

We've got technology now that is just out of this world. I started using the Net before it was Internet, before we had email, it was called the Arpanet back then and what I'm finding now with email is that I can have colleagues anywhere in the world and we can work really fast because if they're in Australia, when I'm asleep they're working, when I'm working they're asleep, so we're working 24 hours around the clock and we can fax stuff back and forth and email things back and forth, so our papers just come rolling out.

I wish GPS had been around earlier because when I was out collecting before lizards were gone from large parts of their geographic ranges I had to record localities as "15 miles north-northwest of Mojave, California," and I had to go to a map to try to estimate Latitude and Longitude. It would have been so much nicer to have a little GPS unit and been able to record these things accurately; but it's too late now because we've erased big chunks of information.

I've gone back to a couple of my North American study sites — they were just crawling, just teaming with lizards only 40 or 45 years ago, and now they are parts of little cities, trailer parks, and there's not a lizard to be found. So, the collections I made back then that are in storage in museums are really fossils. They represent what was there before humans took the habitat. To me that is shocking. It makes those collections pretty valuable, too.

I'm not saying I don't approve of conservation biology — Of course, we need it — but I'm saying if you consider yourself a rabid conservation biologist, please, please allow biologists access to the book of life. That's one of the main reasons for saving it.

Conservation biology is a crisis discipline. It's an emergency and it's a man-made emergency. We wouldn't need it if we hadn't ravaged this Earth and taken over so much of its surface. Right now, we are using half of Earth's land surface. Currently, we are using more than half of the available fresh water. And, we are now using half of the solar energy that impinges on the land surface of the Earth. That is shocking. One species has taken half of everything for its greedy little self.

In physiological emergencies, we must intervene so we resort to surgery

when somebody's dying. War is the equivalent in political science. When you have an international political emergency, you go to war. That's what conservation biology is — it's a crisis discipline — it's man-made, just like war.

Conservation biology is actually more than just biology because it bridges the gap to the social sciences — we have to start thinking in terms of the ethics of what we do with this Earth. We should have started thinking about it a long time ago.

Problems in Conservation Biology

- Recognition and management of endangered species
- Restoration ecology
- Ecosystem conservation
- Ecological economics
- Environmental ethics
- Value of Biodiversity
- Design of Nature Reserves
- Minimum viable population size
- Genetic bottlenecks
- Population viability analysis
- Sensitivity analyses of Leslie matrices

Here is a short list of some things conservation biologists are concerned with — they design nature reserves, identify endangered species, help to prevent creatures that are teetering on the edge of extinction from going extinct, and all sorts of other things. And this is well funded in large parts of the world — but I don't consider this to be ecology — it is applied ecology. It's not reading the vanishing book, it's aimed at trying to save what little is left. Money has to be spent on that.

When I was a little boy I spent hours and hours looking through "Audubon's Birds of the World." I remember looking at the photograph of the last passenger pigeon — she died in a Cincinnati zoo in 1914. And as a little boy I couldn't believe it, because I read the text — it said the sky was blackened with billions of these birds flying over. And then I read further and found out that humans and their greed went up to their nests and clubbed the babies and pickled them and shipped them off to Europe to be eaten as squabs. They did this for a few seasons and managed to stop

reproduction of this species and effectively drive it extinct in just a very short time — a few years. Extinction is forever.

We did the same thing with the Carolina parakeet. Of course, until recently, we thought we had exterminated the ivory-billed woodpecker, but we were really lucky that a few managed to hang on. And you can bet right now avid bird watchers are out there trying to add the ivory-billed to their life's list.

When I first went to Africa to study lizards in 1970, rhinos were still fairly abundant and they hadn't been savaged by humans. There are several species of rhinos and now they are all endangered, and this is because of a myth that came out of Asia that rhinoceros horns are an aphrodisiac — rhinoceros horn can be worth twenty thousand dollars a pound. Look at these maps, original ranges are shown in gray, the little black spots are the only places you can find rhinos now. They're virtually gone from most of their former geographic ranges. Rhinos in some areas are under 24-hour armed guard, would be poachers are shot on sight. The scales have tipped on the relative value of a human life versus that of a wild animal.

Powerful people convince poor people who could never make any money in their whole life because they are poor blacks that live in Africa in third world countries that if they could get them a rhino horn they'll pay a thousand dollars, which is more than the potential killer could make in his whole life. Then the rich guy gives him a gun and if the poacher succeeds, he buys it for a thousand dollars, takes it to Europe or Asia, grinds it up and markets it for tens or hundreds of thousands of dollars. Clearly, it's high time we switched to Viagra.

This is the way we treat everything. Consider the history of the geographic range of the American bison — a very beautiful animal originally found from Buffalo, New York, all the way to Sierra-Nevada before the 1800s. Huge herds of millions were quickly culled. People back then told about bison thundering all through the day and all through the night. They called it prairie thunder. But that's gone and that's gone for good, and you're not going to see or hear it in your lifetime, and that's a loss. When they built the Trans-continental Railroad, people would buy a ticket and get a gun and load it with big slugs and shoot bison as they rode across the continent, leaving their carcasses to rot on the prairie. As you can see, they split the bison herd into northern herd and southern

herd.

Generals Sheridan said that bison hunters had done more to control the American Indian than all the cavalry put together. We basically starved out a lot of American Indians — those that we didn't kill instantly with smallpox and measles. We stole this continent from other people. We just took it because we could.

I have a herd of bison. They are absolutely magnificent animals. My herd bull, Lucifer stands six feet tall and weighs about twenty-six hundred pounds — when Lucifer wants to, he goes over the fence — and when he does (I've never actually seen it), the earth must shudder at this spot for a little while. His habit of jumping is how Lucifer got his name.

We have to get off our anthropocentric high horse. Biodiversity has a value beyond how it can be used by humans. Other things on this earth have been here longer than us — much, much longer — and they have a right to this planet too — that includes wasps that sting you, ants that bite you, scorpions and rattlesnakes — it includes wolves and wolverines and all kinds of things that we have pushed to very brink of extinction.

I'm not going to have time to talk about all the things that concern conservation biologists but I just wanted to point out one that it is kind of pathetic: we settled on the minimum viable population size — how low can you go and still have something — to me, this is tragic.

One conservation biologist coined the term “extinction vortex” — as we drive populations down, so that they get precariously low, all kinds of factors come together to sweep them down to extinction — and all are man-made. We stole their habitat. We fragmented their habitat. We've knocked their population sizes down to the point where genetic variability disappears — and, don't forget, of course, climate change and toxic pollution.

We're more concerned now about toxic pollution as it affects humans. It's causing cancers and feminization and all sorts of other maladies. But we ought to be worried about it as it applies to everything on this earth. And now, of course, people are finally, finally just now beginning to be aware, that we have savaged the atmosphere to the point that the entire planet is changing.

It's just a matter of time until the climate changes really drastically. Some meteorologists have models that show thresholds where it shifts almost instantly overnight. When people go to the supermarket and there are no more Triscuits on the shelves they will say "Hey, where did Triscuits come from, anyway?"

Many have lost touch with the reality of where food comes from. We're completely misled. Food is just a commodity that's bought and sold and people make money on it. You've got to think, you've got to think — remember, humans were hunter/gatherers not that long ago and will be again pretty soon.

One of the things we do is deforest everything — we cut down trees to burn to keep ourselves warm, build boats or houses. And deforestation has been pretty thorough in many places on the planet. The U.S. is fortunate — we still have the luxury of trees because we got into coal and fossil fuels early and managed to keep ourselves warm and/or in this case air-conditioned without cutting down too many trees.

There's an oasis in the Sahara desert out in the middle of nowhere in Northern Africa that had three trees. It was called tres arboles in Arabic, and I say tres arboles because I know you some of you speak Spanish. But some sucker cut those trees down, so although it is still on the map and it's still an oasis, there aren't any trees there anymore. One cold night, one selfish human cut them down.

Madagascar is one of the places that I really want to go before I die because it has many endemic species — it split off from mainland Africa a hundred million years ago and it's got all kinds of creatures that are found nowhere else on the earth. Yet, the people of Madagascar are third-world, starving, over-populated, eating everything. An endangered land tortoise in Madagascar is highly protected on the world's list of "don't do anything to this turtle" but they are commonly used for turtle soup by poor people in Madagascar.

Once, we were surrounded by wilderness and wild animals, now we surround them.

When humans first arrived in Wisconsin, a square mile was forested with

a little piece of prairie in the southwestern corner. The prairie burned every year (prairie fires) and over the centuries the prairie built up deep black top soils, which are nourishing our nation today. Now the first thing settlers did was cut the trees down as you can see. In a little over a century, this was turned into tiny wood lots. Imagine the effects this must have had on whatever used to live in that forest.

Here's an example from Borneo. This is what we are doing to this planet. Wood has become very valuable and we're clear-cutting anything that's left.

One of the problems with habitat fragmentation is that you lose core habitat. In that scene that I showed you from Wisconsin back in the 1830s before humans got there, there was only a little tiny bit of edge between the prairie and the forest. And cowbirds lived on the edge. Cowbirds are brood parasites. They lay their eggs in the nests of other birds. Cowbirds used to be very scarce in North America — with habitat fragmentation, their populations have boomed and the only place that small songbirds like warblers can lay their eggs to get away from these parasitic cowbirds is deep in the forest. If you only have tiny little patches, a small songbird can not escape from cowbirds. So now cowbirds are very abundant, small songbirds are heavily parasitized and their populations are on the brink of going extinct because of our clearing and habitat destruction and fragmentation.

Here is more testimony to our anthropocentrism and human greed. This is the work of a Texas company you might have heard of: Freeport-McMoRan. They have formed an alliance with Indonesian officials, and they're taking gold and copper off the top of this mountain in Papua, New Guinea (now part of Indonesia). They've stripped off most of the top of that mountain and shipped it down the side in great big slurry tubes that are ten feet in diameter to be sent back to smelters where they extract the gold and copper. The ore goes down to the sea where it is hauled away in ships.

You can see the damage this mining has done and is doing. It is causing huge mudslides on the sides of the mountain and these are polluting all the streams down below. Native tribes in the lowlands of New Guinea lived off these beautiful, clear streams with fish and crustaceans and food of all sorts — now they can't get anything because the streams are clogged with

mud from dirt from Freeport McMoRan's mining operation on top of the mountain.

A bunch of these people that are being dispossessed by this big, fat American company on top of the mountain broke into one of their shacks and got some dynamite and some primers and they blew up the slurry tube. One of Freeport McMoRan's CEO's complained that it was costing his company a million dollars a day not to have that slurry tube open.

They've been doing it for ten years. They've been taking a million dollars a day out of there for ten years. And, when they get done with this mountain, they'll no doubt move operations to the next one behind it.

This is the scariest graph that you're ever going to see in your whole life — take a good look at it. We hit six billion not very long ago and now we are at six and a half and we're still going, roaring. This kind of exponential population growth is unsustainable and has to stop. People sometimes ask "what is the carrying capacity for humans?" We humans occupy roughly half of Earth's land surface, consuming over half the freshwater and using about half Earth's primary productivity, but lots of those people are living in poverty and not even getting adequate nutrition. Many are just little babies, still living under their parent's roof, who in a couple of decades, will need their own houses and cars. A tidal wave of humanity is coming. No politician will even recognize, let alone address, this problem.

Now I'm going to try to prove to you that human populations must be reduced. Paul Ehrlich, in the 1960s, wrote a nice little book, "The Population Bomb," calling attention to this. Nobody paid any attention to Ehrlich. Even today, I hear people saying, "Oh, I've heard you doomsday ecologists before. We've still got water, there's no problem." They're so short-sighted.

Consider China. How would you like to live there? Look at all those little window A/Cs. They've got power, at least for now. Humans can be packed in. Do you want to live like a termite? Are we termites? Come on, I want to be up on top of the hill where that chair is and I want to have some space around me — don't you?

People don't seem to want to think. We still allow people to have more

than two kids. We encourage reproduction. We actually give you a discount for having kids. You should have to pay more when you have your first kid — you pay more taxes. When you have your second kid you pay a lot more taxes, and when you have your third kid you don't get anything back, they take it all. Our tax system is completely backwards. But, then, so is our whole economic system.

The U.S. Fish and Wildlife released caribou on the islands off of Alaska to help the Eskimos, the Aleuts, get protein. Herds from these islands grew exponentially just like the human population's been growing for quite a few years until they ate everything they could eat and then the deer populations crashed.

This is what's going to happen to us. This is going to happen in your lifetime. Does that look like fun? Do you want to go there? You've gone there. We waited too long.

Cartoonists have had a lot of fun with this.

Consider Genesis. We've checked all the boxes, except one. We have dominion over the fish and the fowl and everything that moves on this earth but we forgot, forgot to replenish it. We just shriveled it up like that little dried up raisin at the bottom — we're sucking everything we can out of mother Earth and turning it into fat human biomass.

Then, there's this Doomsday cartoon:

"I can't believe myself . . . I pass up salads, only to buy a hotdog! The looks I'm getting — everyone knows what's in one of these! I can feel their hot disapproval.

Hope you enjoy your meat. There goes another rainforest. Look, he's wearing leather shoes, too. Assassin. Polluter.

Maybe if I stand absolutely still. Look at him standing there spewing out CO₂."

Everyone of us is guilty — everything we do, every breath you take, every time you take a shower or flush the toilet, every time you drive your car, every time you buy anything we all contribute to the mess of pollution on this earth. In many cases you don't even know what you're doing.

And of course I want to single out CO₂ because this is turning out to be a big thing that could really spell out our demise sooner maybe than many people think or realize. The government doesn't want you to know about this. CO₂ has just risen steadily and it is way above normal levels, and it's manmade from our burning fossil fuels mostly, but also from cutting down forests and burning them up.

So this has caused global warming, and it's changing our climates and we don't know but some speculation says it might be affecting things like hurricanes and of course the more humans you pack in on the surface of the earth the more of these things are going to decimate the human population. I don't need to tell you about that.

But, I'm a little more concerned about things like polar bears. Polar bears are big, warm and fuzzy — the WWF cares about them, and everybody thinks polar bears are nice and it would be a shame to lose them. Polar bears require ice and ice floes. They're arctic adapted animals, and as the ice floes melt, some people are thinking that it might be the end of the polar bear.

And, of course, those of you that haven't thought an inkling about this will say, "Oh, we'll just keep them; we'll have them in zoos and have the air conditioning turned way down."

And, I remind you that they are not wild polar bears; they are like the words "love" in little vials.

So, the global climate is changing, and I come back now to Paul Ehrlich. I said this was going to go down, down, down and I meant it.

Ehrlich in the '60s said, if humans don't have the political will to control their own population, microbes will control our populations for us. Now I want to remind you of 1300 when the "black death" swept down from China and one-third of the world's population died.

We killed off an awful lot of indigenous new-world people with smallpox and measles. These were things that white humans in Europe were adapted to because we lived with them, but the people that made it across the Bering Strait could not cope and a lot of those nasty microbes because

of that. We're going to see this again, and on a big scale. Humans have been very lucky not to have experienced a worldwide plague for a long time, one is overdue.

Microbes are small, and they reproduce very rapidly — they have generation times measured in minutes or less. They also evolve really quickly, and we simply can't keep up with them. We are doomed. The microbes are going to get us. We are a great big emerging substrate just waiting for microbes to grow on us. And even though we are still *Homo sapiens* — you know what *sapiens* means, it means smart — I'd say we're not. I'd say we're dumb because we're letting our population grow just like bacteria grow on an agar plate until they've reached the limits; and that's dumb. Humans are no better than bacteria, in fact, just like them when it comes to using up resources. We need to **use** our brains, rather than merely breed our brains out.

So, to try to convince you that populations are regulated, I want to show you this plot — a plot of the percentage change in population size versus population density. When populations are large, they tend to decrease and when populations are small they tend to increase. If the slope of a regression line through those data points is negative, populations are controlled through population regulation.

Table. Frequencies of Positive and Negative Correlations Between Percentage Change in Density and Population Density for a Variety of Populations in Different Taxa

Taxon	Numbers of Populations in Various Categories					Total
	Positive (P<.05)	Positive (Not sig.)	Negative (Not sig.)	Negative (P<.10)	Negative (P < .05)	
Invertebrates	0	0	0	0	4	4
Insects	0	0	7	1	7	15
Fish	0	1	2	0	4	7
Birds	0	2	32	16	43	93
Mammals	1*	0	4	1	13	19
Totals	1*	3	45	18	71	138

* *Homo sapiens*. Source: from Pianka (2000)

Now, that plot was just one example. The table above summarizes a hundred-plus others. Most of these studies were done with birds. Birds have been well studied because humans like them, but a few invertebrates are included. To the right you see significantly negative regressions, like the one I just showed you; to the left are positive ones. The vast majority are negative, and half of them are significantly negative.

There is one conspicuous exception — far, far off to the left — one species out of these one hundred and thirty-eight thinks it can violate the rules of the natural world and that it can grow indefinitely — humans think they can defy the rules. We are *Homo* the *sap*, not *sapiens* (stupid, not smart).

The Web is such a wonderful place. I thought, what would really jostle the audience? And I thought of the Four Horsemen of the Apocalypse, and so I typed that in — somebody spent days painting this for us.

That's Conquest in front, then War, Famine, with Death bringing up the rear. If humans don't go out in a blaze of nuclear holocaust, or starve in a massive famine, death by a lethal pandemic seems a likely prospect.

Then I typed in "skull" and got these, complete with flashing red eyes. Great, eh? Death awaits us all.

Think about everything I've said and more.

This is an AIDS-infected T-cell of a human. Each of those little round things is an HIV virion that can infect a new human. Basically, this virus uses our T-cells as factories to make copies of itself. HIV is a pandemic spread worldwide. It's increasing in frequency in a lot of places and it's a big concern to everybody. But, it's not going to be the one that gets us because HIV acts too slowly, it lets us live several years while it passes itself on to new hosts. HIV is no good, it is too slow to control human populations.

Now let's consider some other viruses — *Ebola zaire* has potential. It kills nine out of ten humans. It's never gotten out of Africa because it is so virulent it kills everybody before they can move. I mean it kills you within a day or two.

You can only catch *Ebola zaire* by direct contact with a human who's

infected. It causes you to bleed. It breaks capillaries and you bleed out your orifices and if you touch somebody who's sick with it you get it and you die, too — nine times out of ten.

Another variety of *Ebola*, *Ebola reston* did get out of Africa and into the U.S. in the form of green monkeys that were imported for medical research — it's named after Reston, West Virginia where they have a quarantine facility for these monkeys. They had an epidemic and all the monkeys died, without any contact with each other. The monkeys were sharing a common ventilation system in a room, with re-circulating air. All the monkeys in that room that breathed the same air caught the virus and died. Luckily for us, *Ebola reston* doesn't infect humans.

Now it is only a matter of time until *Ebola zaire* evolves and mutates a little, it will eventually become airborne, and then we might finally see it spread. And if it does, when it does finally sweep across the world — we're going to have a lot of dead people. Every one of you that is lucky enough to survive gets to bury nine. Think about that. However, I doubt *Ebola* is going to be the one that gets us, I think it will be something else.

Did you ever wonder why things like SARS and now the Avian Flu are continually cropping up? They're arising because we were dumb enough to make a perfect epidemiological substrate for an epidemic. We bred our brains out, and now we're going to pay for it. The microbes are going to take over. They're going to control us again as they have in the past. Think about that.

Humans could have been stewards of Earth and all its many denizens, microbes, plants, fungi, and animals. We have the ability to have been God-like. Instead, for a short-sighted and selfish transient population boom, we became the Scourge of the planet. We wiped out and usurped vast tracts of natural habitat. We ate any other species that was edible and depleted all Earth's multitude of natural resources. In a single century, humans burned fossil fuels that took millions of years to form. We fouled the atmosphere, despoiled the land, and poisoned the waters, making the planet uninhabitable even to ourselves. In fact, the disparity between what humans could have been versus the pitiful creatures we actually managed to become is tragic and unforgivable. If only more people would live up to their full potential!

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Now, here's a breath of fresh air: Aldo Leopold. This is the start of the tiny little up. We've been to the lowest of the low where the microbes are going to get us. Now, were going to try to come up a little bit. Aldo Leopold was a conservation biologist before anybody else was. He was in wildlife management at the University of Wisconsin back in the '50s. Leopold died young, but his children have put together a collection of his essays into a small book, "A Sand County Almanac." I encourage all of you to read it. Some of the things in it bring tears to my eyes. I mean I literally break down and weep.

One of the profound things Aldo Leopold said was each generation doesn't know what it has lost — only previous generations remember.

Like I remember when I could walk out my back door to a semi-pristine creek and catch snakes and lizards, and kids these days don't have that opportunity. There aren't any pristine creeks and they're living in cities, and that's unfortunate. I became a biologist largely because of that — you really can't help but be a biologist if you're exposed to it when you are young.

Now one of Leopold's statements was that we cannot continue to act as conquerors, that we weren't given some God-given right to do anything we want like chop down redwood trees and we must have respect for fellow inhabitants of this earth. We need to transcend anthropocentrism. Other creatures have a right to this planet, too.

This figure is from a conservation biology textbook, and I think it's very appropriate in these days. Remember, or probably you don't remember unless you've ever lived in a cave, but if you've ever thought about being a caveman, we had small little tribes, and if I was an old guy, you probably would have killed me because I can't see without glasses, so I probably wouldn't have made it. But cave men kept around a few elders for their wisdom — because they had been through droughts and solved other problems. For example, those guys might have known how to treat a broken leg or some illness. And, of course, you had the medicine men and women who specialized in such information.

We lived in little inbred groups and occasionally people would move

between caves but these family groups were little tribes that battled over resources. That's at the bottom of this figure. We're all familiar with selfish behavior in those small circles at the bottom. We're all selfish and natural selection favors selfish behavior. Now you can be a little bit altruistic towards your kin, as long as they share genes that are identical by descent.

Cavemen tribes worked, but now as we expand outwards to less closely related individuals and to larger social groups, finally to races or entire nations, altruistic behavior vanishes.

Look at the polarization in America today — 50 percent one way and 50 percent the other. We are not doing very well at cooperating as we go outside of that tiny circle to larger and larger domains such as dealing with people in other nations with different belief systems. We need to engage in dialogue and communicate and change each other's minds. All of us need to consider the health of the entire Earth.

Going still farther out, you get to individuals of other species. Here I'm thinking of chimpanzees, gorillas and orangutans. They're our closest relatives. They share our blood groups. They probably can think. I just wonder if one of those species had been the lucky one to inherit the earth and evolve the big brain and take control over everything else, how they would be treating us. We would be the chimps and the gorillas and they'd be using us for medical experiments and eating humans like we now eat gorilla "bush meat" in Africa. Think about that.

Actually this goes beyond gorillas and apes to the entire earth, and we really need to take control and be stewards of this planet rather than remain mere conquerors and rapists.

Here's one more little upbeat thing, but unfortunately this isn't very much of an up, Herman Daly has identified the big problem, which is our economy. It's basically completely flawed. You've heard politicians talk about "growing the economy." Our economy is based on the principle of a chain letter, a pyramid scheme. That simply cannot work. Upside down pyramids must fall over. Bubbles always burst. And this bubble is going to burst.

It's bursting right now in terms of fossil fuels. The price of gasoline isn't

going to go down again. Some oil men are getting very rich from this.

You need to hone your survival skills. The first thing you should do when you go home tonight is get a real tarp, one that's made out of canvas that's waterproof. Don't get one of those crummy plastic ones — They deteriorate too fast. Start packing it with the absolute necessities you must have to stay alive. These would include things like needles and thread, a blanket, some sharp knives, pliers and wire, water containers, some string, rope, and twine, among other things.

I'm not talking toothpaste. I'm not talking about a lot of things. Wrap them up and figure out how you can carry it on your own two shoulders because you are not going to be able to take public transport or drive your car when the time comes. And then you want to get as far away as you can from any other human beings because they will take your stuff away from you. Try to snare a rabbit, if there is still a rabbit out there to catch. And, when you get that rabbit, skin it and tan its hide (soon you'll be wearing it!)

I could give you some other tips on your survival kit, but I don't have time.

Now let's get back to Herman Daly. He wants the economy to be sustainable, and he has the idea of an equilibrium economy. Solzhenitsyn had the same idea. In an equilibrium economy, every one of us would leave this earth in exactly the same shape it was when we came into it. None of us are doing that. None of us.

Mainstream economists think Daly is a nut, he's a kook — they just ignore him. Mainstream economists, the economists that advise our political figures, have relied completely on grow, grow, growth-mania — impossible voodoo economics. They place no value on wilderness and actually assume that resources are infinite.

So, if you have a leaning towards economics, here's a challenge for you. Economics must be reinvented. Herman Daly published four books on it. He has to get some people on his side. People have to think. They can't just keep behaving like sheep thinking resources are ever expanding. They've got to realize that the resources are ever contracting, and we're running out of everything that matters. And I mean everything — oil,

food, clean air and water.

Meadows et al. wrote a book on some of this, actually, three versions. The first one was commissioned by some people concerned about the environment back in the '70s. Dennis Meadows was the first author and it was called "Limits to Growth" — he developed a systems model for the earth and its resources and how many people we could put on it. He worked through various scenarios including unlimited technology and a lot of other things.

Technology lures us out on to thin ice. I learned this years ago, when I got my first 4-wheel drive vehicle. Thinking that now I could go anywhere, I soon discovered that you get stuck using four wheels, too, but much worse than you can get stuck with two-wheel drive (a Land Rover stuck up to its axles in deep mud is sad to contemplate!).

Unlimited cheap clean energy, such as that so ardently hoped for in the concept of cold fusion, would actually be one of the worst things that could possibly befall humans. Such energy would enable well meaning but uninformed massive energy consumption and habitat destruction (i.e., mountains would be leveled, massive water canals would be dug, ocean water distilled, water would be pumped and deserts turned into green fields of crops). Heat dissipation would of course set limits, for when more heat is produced than can be dissipated, the resulting thermal pollution would quickly warm the atmosphere to the point that all life is threatened, perhaps the ultimate ecocatastrophe.

In 1972, Meadows basically said, we better do something fast. And, of course, like all of us who grew up in the '60s, nobody paid any attention. We just kept breeding our brains out and ignoring it. Then in 1992 they wrote a second book called "Beyond the Limits," in which they pointed out that we could never ease back into a sustainable society, that we had already gone too far in 1980.

Now it's 30 years later and, with his daughter, Donella, and Jorgen Randers, Meadows has put out "Limits to Growth — The 30 year Update." This is quite a depressing book because in every scenario they run, humans must experience a big collapse. Collapses are worse in some scenarios than in others, but all are in the immediate future.

You are going to see it in your lifetime and the important thing is this is just the beginning, this peak oil problem we are experiencing right now. We aren't ready for a what's coming. The future is coming up on you fast and you are going to become a hunter-gatherer. Think about that.

Here's one of their graphs where Earth's carrying capacity for humans is compared to the human footprint: that horizontal dashed line is the carrying capacity and the solid black one represents resources used by our actual population — you can see we crossed the maximum level about 1980, and in 1999 we were more than 20 percent above according to their estimate (it's probably at least 25% now).

This graph is overly optimistic because we could never have reached six-and-a-half billion without fossil fuels. Basically, we turned oil into food and food into humans, and we used the oil to build highways and cars and take over and make this mess — the CO₂ pollution and all the rest. But we're running out of fossil fuels and haven't invested enough in developing renewable resources, especially solar energy.

So this is really an exciting time in the history of mankind. Remember the ancient Chinese curse: "May you live in interesting times"? I think that right now has got to be just about the most interesting time ever and you get to see it, and, hopefully, a few of us will live through it.

Here's another graph from their book. The only one I could find on the Web was a little outdated, but they predicted the oil peak long ago. And, of course, there are still fools out there claiming that there's oil galore that we will keep finding it and keep on going, and I just cannot believe these people that don't understand or won't face a finite world.

But notice the estimated population curve with a collapse — things are going to get better after the collapse because humans won't be able to decimate the Earth so much. And, I actually think the world will be much better off when only 10 or 20 percent of us are left. It would give wildlife a chance to recover — we won't need conservation biologists anymore. Things are going to get better for the other denizens of Earth as they deteriorate for humans.

I recommend Heinberg's "The Party's Over. Oil, War and the Fate of Industrial Societies" — a chemist once told me, "it's like we were on

a luxury liner and we're on the upper floor of the ship and there's a hole in it and it's sinking, but everybody's having a big party up here, and it's just a matter of time until we are all underwater." This is Heinberg's message — he carefully researched all the facts. It's a doomsday book but he's an optimist so he has this optimistic end where he lays out what we can do, as individuals, if one is to live lightly on the land, you know, lessen your footprint — drive a Prius instead of an Excursion — it'll save you money — ride a bicycle — grow your own food. He has all kinds of good ideas. Unfortunately, even if you do all you can to minimize your own footprint on Earth, many others won't. Cleaning up the trash along highways merely makes things seem better and fosters litterbugs.

Educated people tend to have fewer children than uneducated people. Garret Hardin pointed this out, and said those who don't have any conscience about the Earth are going to inherit the planet, because those who don't care are leaving more progeny than those who do care and make fewer babies. And so human conscience is on its way out, if we persist on our present course, we're going to evolve into uncaring humanoids. That's probably already happening and IQs are falling for the same reasons, too (Herrnstein, 1989).

To conclude, I want to quote John Stuart Mill (1859) to point out that bright people have seen this coming for a long, long time:

"I cannot . . . regard the stationary state of capital and wealth with the unaffected aversion so generally manifested towards it by political economists of the old school. I am inclined to believe that it would be, on the whole, a very considerable improvement on our present condition. I confess I am not charmed with the ideal of life held out by those who think that the normal state of human beings is that of struggling to get on; that the trampling, crushing, elbowing, and treading on each other's heels . . . are the most desirable lot of humankind . . . It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture and moral and social progress; as much room for improving the *Art of Living*, and much more likelihood of its being improved" (my italics).

Mill wrote that almost 150 years ago, and it's basically a statement about

a stationary world and how a stationary world can be a good world. In a stationary world you don't have to worry about survival kits, bubbles bursting, losing your stock, or about running out of oil. A stationary world is sustainable and the world stays the same from day to day.

Let's have a stationary world as opposed to one that's based on growth-mania where everybody has to elbow the other guy and compete to get to the front and be concerned about who's going to win and who's going to lose every day in the stock market. In a stationary world, we can focus in on things that really matter — I love Mill's phrase "the art of living." Let's get to work on improving the art of living.

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