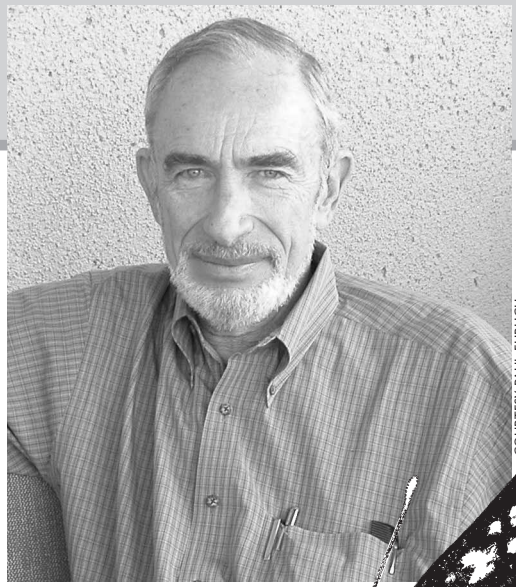
PAUL EHRLICH

phainopepla, pen-and-ink by Narca Moore-Craig



COURTESY PAUL EHRLICH

©Diana Dee Tyler

At age 70, **Paul R. Ehrlich**—*Bing Professor of Population Studies and Professor of Biological Sciences at Stanford University—almost ran across the stage to start his lecture at Middlebury College, Vermont. The Iraq war had opened hours earlier. He smiled, leaned forward until his head was just over the lectern, looked out at the hundreds of assembled undergraduates and academics, and asked, "How do you like being a citizen of a rogue nation?"*

Since the publication of The Population Bomb *in 1968, Ehrlich has combined a staggering erudition in the biological sciences with an unflinching willingness to ask uncomfortable questions about public policy and the social order.*

*As a teenager, Ehrlich spent his days collecting thousands of butterflies, which he later donated to the American Museum of Natural History, where he worked with the Curator of Entomology, Dr. Charles Michener, mounting insect specimens. He followed Michener to the University of Kansas where he explored the evolutionary processes that led to DDT-resistance in insects and completed his Ph.D. on the higher taxonomy of butterflies. In 1959, he joined the faculty at Stanford and began a study of checkerspot butterflies (*Euphydryas*) in central California that continues to this day. A distillation of this work,* On the Wings of Checkerspots: A Model System for Population Biology, *edited by Ehrlich and Ilkka Hanski, will be published next February—another addition to his list of 38 books and more than 800 papers.*

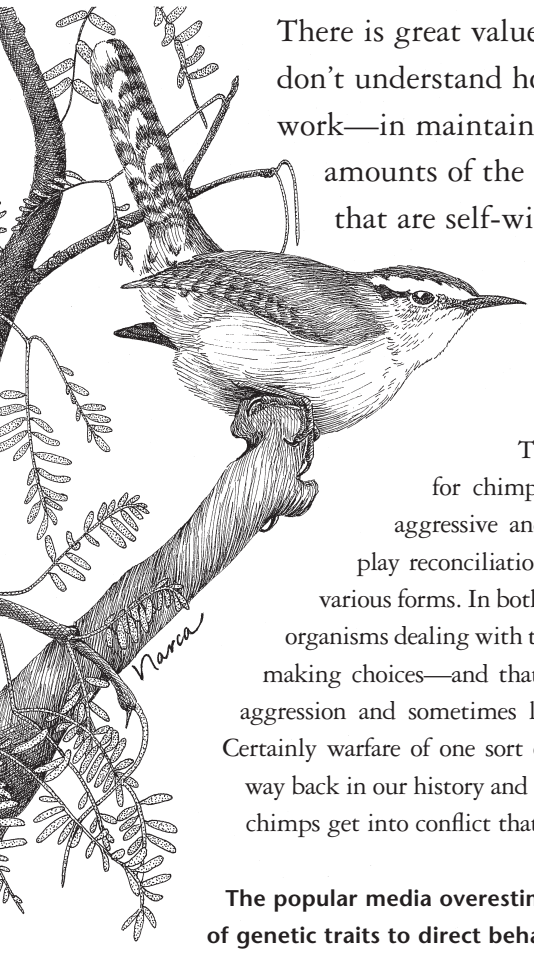
Ehrlich's studies of insect genetics, plant/herbivore interactions, and numerous other facets of ecology have taken him into the field on every continent. But he has always returned to his efforts (often in collaboration with his wife, Anne) to focus public attention on the connections between human population growth, consumption, extinction, and the fraying of the planet's ecosystems. "The population explosion is going to come to an end; will it be by humanely limiting births or will we stand around as the planet cooks and the death rate goes way up?"

Wild Earth*'s assistant editor* **Joshua Brown** *spoke with Paul Ehrlich after his lecture on March 20, 2003.*

WILD EARTH: At 5:30 this morning U.S. forces launched an attack against Iraq. In times like this an age-old debate about the nature of humankind surfaces: are we inherently aggressive? I know you have been skeptical of theories that suggest there is a "militaristic gene" or that there is a simple equation to explain the ongoing repetition of warfare across human history. So why do we fight?

PAUL EHRLICH: For as many reasons as there are stars! First of all, we do not understand cultural evolution anywhere near as well as we understand genetic evolution—and we still have a long way to go on genetic evolution. What we do understand about genetic evolution tells us that complex behaviors—like warfare and other aggression—cannot be fully coded into our genome. You could say we have a tendency to be aggressive about as easily as you could say we have a tendency to be cooperative. After all, human society is a form of cooperation; that's what makes the society work. We have many tendencies and few fixed behaviors.

Baltimore checkerspot (*Euphydryas phaeton*), pen-and-ink by D. D. Tyler



There is great value—since we don't understand how the systems work—in maintaining large amounts of the biosphere that are self-willed.

The same thing goes for chimps; they can be very aggressive and they can also display reconciliation and cooperation of various forms. In both cases we have smart organisms dealing with their environments—making choices—and that sometimes leads to aggression and sometimes leads to cooperation. Certainly warfare of one sort or another goes way, way back in our history and you can see that even chimps get into conflict that looks like warfare.

The popular media overestimate the capacity of genetic traits to direct behavior?

Vastly. It's not just the popular media, it's a whole discipline—or pseudo-discipline—called evolutionary psychology, which is made up mostly of psychologists who really don't understand evolution, and certainly don't understand genetics.

There aren't enough genes to do the job. There aren't enough genes to program our everyday behaviors, and even if there were, evolution wouldn't have worked it that way. We have large, conscious brains to act as a buffer against environmental variability, to allow us to respond adaptively in different situations.

The brain is the only organ in the body that requires gigantic amounts of environmental input before it will even function. If you blindfold a cat or human being at birth and take the blindfold off five years later, they can't see even though their eyes work. They get impressions but they can't tell a star from a square.

I breathe more easily not picturing my DNA as the "master puppeteer." But are we merely looking up the wrong set of strings—or is the entire enterprise of seeking a deterministic explanation for human behavior a false framework?

If it is genetic determinism, it is clearly a false framework. If it is an effort to understand how our genomes interact with our environments to produce behaviors, that is a valid enterprise.

Here is an example of where genes do affect our behavior: we are sight animals primarily because we used to live in trees and snatch bugs with our fingers—and the individuals that tried to smell where the next branch was before they jumped didn't reproduce as well as those that looked.

Think of our racial prejudices. They are based on a trivial characteristic that happens to be visual: skin color. Skin color has no connection to intelligence, no connection to behavior. It has to with the amount of solar energy our ancestors were exposed to, and yet it is a huge factor in our society partly because our genetic evolution made us extraordinarily sensitive to visual cues—to things that hit us in the face.

We may even see our biological biases in expressions like "in your face." It is much more dangerous to have a little bit of chlorinated hydrocarbon on your apple, but you are struck by the litter along the road because you see one and don't see the other. This bias influences our whole view of environmental problems: visible messes attract concern more than poisons you can't see.

If people and chimps have, at least, a measure of choice, of will power, do you think this extends to larger systems in Nature? I find the term "self-willed ecosystems" to be poetic but useful. Is the aspiration for self-willed ecosystems—ecosystems that are largely left alone by people—an illusion?

I think it is a useful illusion. The entire planet has now been modified by *Homo sapiens.* If there is any place that hasn't felt human influence, it might be the very deepest ocean trenches—but if we went down to find out we would influence them! Every other cubic centimeter of the biosphere has been influenced by radionuclides that didn't exist before we exploded atom bombs, atmospheric pollutants, and so forth. On the other hand, there is great value—since we don't understand how the systems work—in maintaining large amounts of the biosphere that are, as you want to say, self-willed, or as close to self-willed as we can have it.

Of course we can't restore the Pleistocene megafauna in North America, and the world is changing all the time. But the idea that we know enough to control the evolution of ecosystems—upon which we are utterly dependent for our lives, for ecosystem services—is a level of chutzpah that takes the breath away.

One amusing proof in the pudding is that dome in

Bewick's wren, pen-and-ink by Narca Moore-Craig

Arizona, the Biosphere II. Here they tried to make an ecosystem of just a few hectares and it went promptly to hell. They didn't understand what they were doing; we do not know enough. We're crazy to destroy the functioning ecosystems that we have with the idea that we can easily replace them.

But that view is not going to take hold in Washington these days; I doubt George W. Bush could spell "ecosystem."

Your work as an entomologist is helping us to understand how some population systems, if not whole ecosystems, work. I understand you have been studying checkerspot butterflies for the last 42 years—and that this is perhaps the longest continuously studied species in science. What does this timespan tell us that other shorter studies would miss?

One of the reasons that the fields of ecology, evolution, and taxonomy are so far behind genetics is that geneticists have concentrated their efforts on a few systems for a long time. Intense study of four or five organisms has contributed 99% of our knowledge of how genetics works.

We owe a great debt to the fruit fly.

That's right. And to *Escherichia coli* and a few others. We haven't done the same sustained study of systems at the population biological level. I deliberately started the checkerspot work trying to establish the dynamics of one population system that can illuminate a wide variety of other systems. Ecologists, evolutionists, and taxonomists have scattered their efforts over a wide variety of systems and groups and get little bits of information from lots of short-term studies. We often don't know what all these little bits mean.

As an amateur birder, I have long loved *The Birder's Handbook,* with its friendly, intelligent essays on all manner of bird behavior and its hundreds of entries on avian natural history—but it was only yesterday that a friend pointed out to me you are one of the co-authors. When did you first take an interest in birds?

Most of my work has been with butterflies—I have worked on reef fishes and mites and a lot of other stuff—but my main research had been on butterflies until about 20 years ago when we started doing fieldwork in the Great Basin, comparing birds and butterflies.

I had casually birded when I was a kid, but only in the Arctic—I had Ross's gull on my list before I had the cardinal. I didn't bird when I was down here, because I am color-blind. I thought it would be too much of a handicap. But when I said that to Jared Diamond, around 1983 or 1984, he said, "Aw, it's not that big of a barrier, come on." He gave me a pair of binoculars, we went out in his backyard, and we saw a phainopepla and a Bewick's wren. I was hooked.

A year later, my department at Stanford got a lot of pressure because all of our courses were principle oriented, rather than organism oriented—and students wanted an organism-oriented course. I had followed the bird literature casually but not intensively. I thought, "One good way to really get on top of some material is to teach a course in it and try to stay ahead of a bunch of smart undergraduates." So I started offering a biology of birds course: all the principles of population biology and ecology and evolution—as illustrated by birds.

That went for a couple of years, and then it dawned on me that every question that the students asked about the birds—except, what does its song sound like, what does it look like, and where does it live geographically—were not answered in any of the standard bird guides. They wanted to know: where does it nest, what is its nest like, how many eggs does it lay, and that kind of thing. So we decided it would be fun to write a book that answered all those other questions. The result was *The Birder's Handbook.*

Let's jump into the metaphysical for a moment. You have written, "Science tells us we are creatures of accident clinging to a ball of mud hurtling aimlessly through space. This is not a notion to warm hearts or rouse multitudes." Do you think that this bleak conception of existence, at least in part, explains why conservation biology has largely failed to stop the destruction of Nature: people will not rally to a banner whose metaphysics are uninspiring at best and despairing at worst?

Yes. That's why I have said elsewhere—and been heavily criticized for it—that we need a quasi-religious transformation to get us to save Nature. What else do we have to love? We evolved in Nature and are in some sense fitted to it.

People don't rally to the idea that we are doomed; that we don't know where we came from and that we are doomed to go back to the same place; that thirteen billion years ago there was a great explosion and four and a half billion years from now the sun will have expanded and we will have fried. (Fortunately, it is billions of years; you know the old saw where someone says, "You mean we're all going to be destroyed in four million years?" "No, no, it's four *billion*." "Oh what a relief, I thought you said four million.")

Do you see yourself as a creature of accident hurtling aimlessly through space?

It depends on what you mean. Accident, yes. But a creature of accident can take on purpose. You can build purpose. I don't think human life has any intrinsic value. I am against the death penalty, but not because I don't believe there are people the world would be better off without. I think a human life acquires value based on behavior. On the other hand the attitude that the society ought to be able to easily, capriciously kill people hurts the society.

We could make an ethic for our society that would greatly increase the value of Nature—just like we made an ethic that overthrew slavery. Attitudes toward Nature have changed dramatically in the United States in the last 150 years.

Then this quasi-religious transformation you envision is primarily a personal ethical reformation?

Yes, our ethics evolve. You can see them evolving in our attitudes toward animals. One of the saddest things is that the animal rights movement puts so much emphasis on pets and deer—and it doesn't pay the slightest attention to the flora or the many kinds of not so charismatic animals that depend on the flora and so on—but we could evolve it further.

And learn to love the mosses and the spiders.

Right, we can learn to relate to the mosses and the spiders the way people now relate to their domestic animals. I think most of my ethics came from my mother, who used to discuss the value of life. I don't like killing butterflies. I do it. I like killing birds even less.

Less than butterflies?

The average lifespan of butterflies we work with—these are adults that have lived most of their lives when they become adults—is about ten days. Some birds can live for decades. Still we try to avoid killing butterflies. We get into battles with one guy who runs a field station who thinks you have to have a voucher specimen of everything even if we know perfectly well what it is. We say, "No, we're not going to kill one."

Isn't one of the best ways to protect butterflies and birds—and many other life forms—to protect large chunks of connected wilderness and let natural processes run their course?

Sure, people need to learn to love wilderness and we need more of it and the small pieces should be connected up.

But given that we are not going to convert half of the United States to wilderness in the next 10 years, or even 50 years, what can we do to make this landscape [indicates plowed farm fields out window] more hospitable to biodiversity without having to change other values to the point where you hit huge resistance?

Gretchen Daily [Ehrlich's colleague at Stanford] has been working on this in Costa Rica. The field of countryside biogeography which she invented—looking at how you can improve already highly transformed and degraded landscapes to make them more hospitable to biodiversity and the ecosystem services they provide—needs to be a top priority.

We get too focused on species diversity as being the ultimate value. This overvaluing of species certainly pollutes taxonomy and pollutes conservation biology to a degree as well. It is good we are starting to move away from this perspective and talking much more about whole landscapes and how they work. The wolf is not in danger of extinction at the moment, but we would like to have wolves over much more of the country. We'd love to have mountain lions to eat the deer and the joggers, both of whom are in surplus. (I'll probably get it for that comment on joggers; our enemies are not overwhelmed with senses of humor.)

Speaking of enemies, if restoration ecologists are being pitted against people trying to protect more intact ecosystems, then the forces of anti-conservation are winning. We need both.

Exactly. Some of the results from our work with checkerspots have been critical to intelligent reserve design—as well as restoration efforts.

One discovery, which doesn't seem like much now, but was 40 years ago, is that population extinctions are very common. There tends to be a metapopulation structure, so population units must be defined before we can conserve them. Otherwise your harvesting strategy or protection strategy is likely to be just wrong. Also, for some creatures, habitat area may be much less important than habitat quality. In particular, for a lot of insects and small mammals and some birds, topographic heterogeneity is critical.

In our checkerspot work at the Jasper Ridge reserve, the two study areas get basically the same macroclimate every year—but what matters to the butterflies is the *microclimate*. The timing of the butterflies and the plants they feed on can easily get screwed up in a spot with just one slope exposure—say a flat place. If there is a year in which the phenology is off,

We could make an ethic for our society that would greatly increase the value of Nature—just like we made an ethic that overthrew slavery.

the butterflies go extinct. But if you have a varied landscape then every year there is at least one area that has perfect phenology for the butterflies and plants. A few subpopulations of butterflies do very well and a few fail—and so the overall population doesn't go extinct. Topographic heterogeneity is an important consideration in trying to evaluate what places to protect for insect preservation.

How do we get biologists and the public more interested in population diversity?

Consider this: If you could take every plant and animal on the planet and reduce it to one minimum viable population—which could persist for 100 years—you'd have preserved species diversity. But we'd all soon be dead. You have one good minimum viable population of wheat, one minimum viable population of rice. One of each pollinator: one minimum viable population of honeybees and so on. All the ecosystem services would collapse. All life would soon be gone.

Or this: If you are living in a valley in Colorado and the population of blue spruce that's on the slope above you is cut down it does not mean blue spruce is in the slightest danger of extinction as a species. But when the avalanches come you'll be stone cold dead because that population was removed.

It's not just all politics that is local.

That's right. Gerardo Ceballos and I wrote a paper for *Science* [vol. 296: 904–907] a year ago on the massive loss of mammal populations, and one of the things we discussed is what we call political endemism. That is, if you have a fairly widespread species, but its range is restricted to Uganda and Idi Amin is in the saddle, it is in greater danger than if it gets restricted to Sweden or Switzerland. These are smaller countries, but with stable politics and an interest in conservation. You've got to think not just about the distribution and populations of a species—but how it relates to the local political situation.

The idea that we're doing alright if we turn the world into a zoo where each species persists is not going to work. I believe what Aldo Leopold said: the first rule of intelligent tinkering is to save all the parts. We should do everything we can to avoid massive species extinctions—because you can't tell what's needed. Even if one species today is not playing a critical role it may be the one that can take over that role when the main-role player is wiped out by climate change. I'm not saying for a minute that species diversity and hotspots are not important, but these should be one part of a bigger story that includes thinking about population diversity and maintaining ecosystem services over as much of the planet as we can.

When you let yourself imagine a best case scenario for North America in 100 years, what do you see in terms of human population and landscapes?

Best case? Oh, 80 to 100 million people, something like what we had around the turn of the nineteenth to twentieth century. A paper that Gretchen Daily and Anne [Ehrlich] and I wrote years ago figured an optimum population would mean a world with many opportunities: enough people to have vibrant cities, symphonies, great food and so on, but few enough people that you could have wilderness areas where people who wanted to live away from big cities could—without having airplanes overhead all the time and snowmobilers on every trail.

That would mean shrinking the U.S. population to something on the order of a third of its present size—and the same for the global population. When I was a kid nobody felt there was a shortage of people. The East Coast was heavily populated, and out West you could find some wilderness (more or less; even then there were many roads). I was first out West in 1947 and it was wilder then.

One hundred million people with more careful attention to what is left in wilderness so those areas aren't destroyed by overgrazing and overharvesting of timber. Imagine if we had a third of today's population with today's knowledge. We know that the West didn't look like a desert when the Spaniards arrived; there was grass over the horses' bellies. Have you ever been to the Audubon Ranch in Arizona where they have brought much of the grass back? The difference between that and the neighboring cow-turd vistas will make your eyes pop.

Sam Hurst of NBC News and I used to do a five-minute segment on environmental issues for the *Today Show*—until

they got fed up with us. We did one on the cattle industry and overgrazing. The waste of the West is unbelievable—just to subsidize about 30,000 ranchers. Most U.S. beef is produced in the East of course, but few people know that. The desertification of the West is what the cattle industry does best.

We were in this arroyo—Sam, and a cameraman, and I were filming because there was not a visible blade of green, the cattle had eaten everything and it was a carpet of cowshit. As we're filming, this cowboy comes out—we'd gone through a fence saying "no entrance"—six-shooter on each hip, two pit bulls following him on his horse, and I thought, "Oh no." The cowboy says, "What you fellas doing?" and Sam says, "We're photographing the wildflowers." This guy looks around and there is not a blade of grass anywhere; he says, "Really?" Sam says, "Yeah, we're making a TV film." (I am busily putting on my adidas. You know that one: I don't have to be faster than his horse, I just have to outrun Sam.) Sam says, "Would you like to be in the picture?" And the cowboy says "Yeah!" Sam says, "Why don't you ride off into the sunset?" So we filmed this guy proudly riding away through the "wildflowers." We got enormous flack from the cattlemen's association.

What role do you see for governments in working toward a lower human population?

I have very little faith in governments to effectively control population, probably less today than when I wrote *The Population Bomb.* I have argued long and hard that we ought to get onto this [population] problem before governments wake up because when governments wake up they tend to do things that are bad or silly.

I don't now believe everything I wrote in *The Population Bomb.* Any scientist who believes everything that he or she wrote 35 or 40 years before is in a very slow moving science! But I have never had enormous faith in governments and that lack of faith has been justified over the years. I think that's why more and more of us are looking toward market mechanisms to do a lot of the work—leaving government to the simpler problem of trying to level the playing field.

For example, we have been negligent in the development of better contraception, partly due to our very litigious society. The government has not stepped in to make the playing field work for pharmaceutical corporations, so the risks of developing more effective contraceptives are simply too high. That is a good place where market mechanisms should be modified to make it possible to develop much better contraception.

Some optimists suggest that the warnings about population growth are hysterical and wrongheaded. They argue that a growing population will only mean more economic growth and a happier populace. What do you say to this view?

It is self-evident to me that there is no sensible reason to expect the United States to be any better in 50 years—with 409 million people as projected—than it is today. In fact, if you take a standard measure of utility, that is, an index of people's perceived satisfaction—while we have expanded our population and our GDP for the last 50 years—satisfaction has declined. Measures of happiness have certainly not increased. There is a long series of social and economic studies that bear this out. So I see no reason to believe expanding to 409 million people is likely to increase our well-being—quite the opposite.

If you're going to have everybody else in the world go into deeper and deeper poverty, then you might make 409 million future Americans better off than today's 293 million Americans, but the costs will be huge: use of the atmosphere as a sink for carbon dioxide and methane, destruction of our soils, the pressure we put on the rest of the world so we can import food from absolutely anywhere we want at any time of the year. Americans, per capita, put by far the heaviest stress on the non-sustainable systems of the planet.

If you think we can continue to shift more and more of the world's resources to the United States, then it might be possible to support 409 million people, assuming you think the rest of the world will sit still for it. But I don't imagine they will sit still. Many nations, and soon many sub-national groups, are going to have nuclear and biological and chemical weapons. I think our chances of success at that game are very small.

But there is no way you can prove this; we could have some sort of miraculous breakthrough—be able to make wine out of water. Make it Chateau Mouton '45 and I'm really in favor of just waiting around for that miracle.

I imagine you are not persuaded by the claims that Americans have a right to their way of life.

Arguing about basic rights is not an argument; it's a discussion. What are the rights that everybody ought to have? If we agreed, for instance, with the rights for life, liberty, and the pursuit of happiness, does that mean for only our nation? All people? All life forms? The heart of the matter is what your *behavior* is going to be in response to these rights. What are your obligations to a starving child in Africa? To the vanishing forests? How will we choose to live? ☾