Harry Kreisler: Welcome to a "Conversation With History." I'm Harry Kreisler of the Institute of International Studies. Our guest today is John Harte who holds a joint professorship in the Energy Resources Group and the Echo System Sciences Division of the Colleges of Natural Resources at UC Berkeley. He is author of over 150 scientific publications, including six books. In 2001 he won the Leo Szilard Award of the American Physical Society and he was cited for his diverse and incisive efforts using physical reasoning and analytic tools for understanding environmental processes and for his teaching and writing to encourage this approach among students and colleagues. John, welcome to our program.

John Harte: Thank you very much

HK: Where were you born and raised?

JH: I was born in New York City, raised in New York City and the Bronx. I lived on one of the last dirt roads of the Bronx in a little house that's now sandwiched between tall apartment buildings.

HK: Oh, my goodness. And – go ahead, please.

JH: The house still stands and I went back to visit it a few years ago.

HK: I see. And I'm sure there was a garden in the back?

JH: We had a victory garden during World War II, and it's still there.

HK: And looking back, how do you think your parents shaped your thinking about the world?

JH: Well, my parents were both humanities teachers. My mother taught English, my father history, in the public high schools in New York City, and they certainly imbued me with a strong love of literature, art and history. I've tried to retain as much of that as I could, and I think my mother forced on me good writing habits. I think they gave me a very strong sense of justice. They were

both active in teachers' unions' movements in New York City and I think some my more radical ideas probably stemmed from them.

HK: They sent you to summer camp from the time you were ten until about sixteen. Tell us about that because that seems to have been a formative experience.

JH: It was very formative. It was a place called Sage Hill Camp that was in the green mountains of southern Vermont and it was a camp with a bunch of kids from the city and an old man named Mr. Smith, who was at the time in his seventies. There were no formal counselors, there was no regimented structure for the day, we built our own lean-tos that we slept in, we did a lot of the maintenance, and we kind of self-governed with Mr. Smith looking out at us and reigning us in when we got too ornery and mischievous. But it was a camp that really taught habits of independence and I think that was indeed very formative.

HK: And you write that you learned from him not just the names of animals and plants but how the pieces fit together.

JH: Yeah, back in the 1950s we didn't talk about systems ecologists but if ever there was one it was Mr. Smith. He actually had been in his middle years a forest ranger in California and he came back to the east coast from California just before World War II and wanted to do something to help kids have better youths, help them grow up, get out of the city, experience nature, and so he bought this chunk of land up in Vermont. It may be from his forest ranger experiences in the west, he understood intuitively the principles of ecology, and I learned a lot from him.

HK: You write you were impressed and one of the things that stayed with you was his acceptance of the chaos within us, and then you go on to speak of learning the value of chaos and continuity under his tutelage. Explain that.

JH: Well, I think what you're reading from was a little essay I wrote, which was kind of an homage to Mr. Smith and to the camp. I wrote about the phenomenon of ecological succession and it's in that context that that quote appeared. When I was about 16, the camp folded. The new generation of kids weren't interested in a camp where you had to house yourself and figure out how to spend your day. They wanted a more structured life, they wanted to sit home in the summer and watch television, or whatever, and the camp folded, and what had been a meadow in a clearing in the forest, and had originally, before he bought it as a camp, had been a farm, was now reverting back to the wilderness that used to be Vermont. I went back and visited – oh, it was probably about 25 years ago – and I noticed how succession was restoring some of the wild old growth forest in Vermont, that the original seeds had been left there and despite the manicured nature of the farms when they're deserted and abandoned the real wilderness returns, and with it the chaos of the wilderness. And so, we had the return of the chaos of old growth forest, the wildness and the jungle-like atmosphere in it, but it's a continuity because it's a recovery of what used to be. What I like to think Mr. Smith understood is that within each of us, each of these kids that were under his tutelage,

there was sort of a yearning to be wild and free and he let that come back, and a lot of that had been lost in some of these kids but he helped it recover.

HK: Tell us a little about your formal education, where you did your undergraduate work, what your major was, and then what you did on your dissertation.

JH: I went from public high school to Harvard College and at Harvard I went through a very strange set of transitions. I went thinking I might major in English literature, very interested in creative writing, and I discovered – I think I took my freshman year a course with Archibald MacLeish who was on the faculty, and in my class were juniors and seniors who were published poets and writers, and I just felt so outclassed by them, I thought, gee, maybe I'm not as good at this as I think. So, I ventured off into history. My mother's field didn't work, I thought I'd try my father's, and I realized that I had some great history teachers. I took a course from Schlesinger – it was a terrific course, but again, I had this feeling that maybe that's not where my real talent is. And when I took math and physics courses I did well and I realized, okay, I really do like physics, relativity and quantum mechanics are really exciting, just as exciting as Shakespeare, and I ended up majoring finally in math and physics.

HK: And then on to Wisconsin where you did theoretical physics?

JH: Wisconsin for graduate work in – I got my Ph.D., in theoretical elementary particle physics, studying the nature of subatomic particles and working with various techniques from theoretical physics to understand that better. I went from there on a post-doctoral fellowship to **Serrin [?]** in Geneva where there's a huge atom smasher, cyclotron, and studied there for a year, wrote several papers, was able to get a post-doctoral position at Berkeley. And I spent two years at Berkeley. I worked under the advisorship of Geoffrey Chew who was on the physics faculty, he's now retired but a wonderful man, and worked with him for two years, then took a faculty position at Yale and was an assistant professor of physics at Yale in the physics department. I started in 1968 and my second year there I began to get very, very upset about the Vietnam War, like a lot of my colleagues. And so, a colleague and I, Rob Soccalo [sp?] – the two of us organized a day of teach-in about the War, not a radical protest but a day where we would get as many students as we could, and as many faculty to cancel their classes and we would spend the whole day hearing seminars on the Vietnam War and discussing it. It worked well. We had a huge turnout, almost all the science classes were canceled, and one of the people we invited to that event was Murray Gell-Mann, the Nobel laureate in physics who was also a Yale undergraduate, so he was very happy to come back to Yale and do this. Murray **[Marvin?]** Goldberger, the President of the Institute for Advanced Study, was there, and the two of them had been hatching a plan to do a summer study on some environmental problem. The idea was to show that physicists were good for more than nuclear physics, that maybe they could so something, contribute to this growing thing, whatever it was, this – we didn't call it an environmental movement then. This was before the first Earth Day. The planning for this was in the fall of '68 and the event occurred on March 4th of 1969. At the dinner that night they asked me if I'd be interested in joining a few physicists and actually work on an environmental problem, and

the problem we chose was the Everglades. There were various threats to the Everglades, not the least of which was a huge jetport being planned to allow the supersonics that the U.S. was going to build then to land and take off. Florida would be the southern terminus in the U.S. for all the supersonic flights to the southern hemisphere, and this would be a huge runway. You need six-mile-long runways to land the supersonics, so the idea would be Miami International was not big enough and so they would build a new airstrip right in the middle of the Everglades. And our task was – our self-appointed task was to figure out what it would do, how much harm, and I said, sure, I'll do it. I've always been an avid birder and…

HK: And so, then you were in environmental sciences and you came here then to be a part of Energy and Resources.

JH: That's right. I got totally hooked by the work in the Everglades, told my chair of the physics department at Yale that I wanted to start an environmental studies program at Yale. He said, "Not in the physics department, you're not." So, I went to Kingman Brewster, who was President of Yale, said I'd like to start an interdisciplinary environmental studies program and actually designed something that looked a lot like ERG. And he said, "Well, I'll look at it, come back and see you in a week and I'll tell you what I think." So, I come back and Brewster said, "You know, at Yale we solve puzzles, not problems. This isn't the right place, the right university to do that."

HK: So, you came here.

JH: So, I came to Berkeley.

HK: Now this sets us up to actually talk a little about what are the skills involved in being an environmental scientist, and also, what do you see as the characteristics of the man or woman who does that kind of research.

JH: Well, I'm a pluralist about questions like that. I don't think there's any one best set of character traits or intellectual traits. There are a few generalities. You clearly have to love learning because whatever you are trained in, no matter how interdisciplinary your education was, you're going to discover very quickly when you confront a new problem that you need new areas of scholarship to understand it. And so, one of the things that appealed to when I decided not to stay in physics was now I had an excuse to learn about things like economics, which I had never studied, to learn about a whole variety of – and I had actually never studied much chemistry, even though I was a physics major, didn't have to take chemistry, I didn't like it, but I discovered when I was looking at environmental issues that you've got to understand chemistry. I had to learn some engineering, had to learn a lot more biology than I had already learned. And so, from anthropology, sociology, economics, you have to keep delving into those fields.

HK: So, it's really interdisciplinary work. You wrote a lovely book, which I'm going to show, and we're going to talk about The Green Fuse, which is published by UC Press but which is out of print

and which should be reissued. But you really – in talking about a number of your experiments, and all over the world things you've worked at as an environmental scientist, what's very clear is the work is really interdisciplinary. As soon as you find a problem and begin working on it, whether it's salmon or salamanders and what's happening to them, and what their nitrogen addition or subtraction to their local environment, basically you're moving from field to field.

JH: Yeah. In the Everglades work I had to learn hydrology, which I had never studied – meteorology – I mean, I'm now pretty well versed in the science of climate because I do a lot of work on how climate change affects ecosystems but you've got to understand climate. And it's even more than just within the sciences. As soon as I get out into the world of policy, which I like to do, I've had to learn a lot about law and economics. So, being a perpetual student is probably the most important thing.

HK: And patience is another thing that I think of. Your salamander experiments went on for ten years. Right?

JH: Yeah, that's right. Things don't happen fast, and if you look at only over a year or two you can often see what you think is a trend or a pattern and it turns out to be a little blip in an otherwise very different long-term trend, pattern.

HK: Now there's a very interesting interaction, which is in your discussion of how an environmental scientist works. It's often in very local areas, in defined spaces, but as you unravel whatever mystery it is that you're looking at you have to stretch the horizon. So, in looking at your career, as conveyed in this journal of your odyssey, The Green Fuse, you really are moving all over the globe. You're starting in a locale but you're always coming up against the extent to which the problems, that is the damage being done, are really kind of global or at least regional issues.

JH: The thing I most emphasize with my graduate students when they start thinking about a researchable topic is, what's the boundary. And very often the instinct is to draw boundaries too tightly. One has to draw them broadly enough to encompass everything that's important but not too broadly so that you get mired down in extraneous detail. The art of drawing boundaries around research problems is something that very few people just are born understanding. You have to develop better and better instincts for doing that through practice, and I spend a lot of time with my students on exactly that issue.

HK: Now when you won the Szilard Award you gave a talk comparing the differences between being a physical scientist and being an environmental scientist, and we've already just learned that you've seen life from both sides now. So, let's talk about that comparison a little. What's kind of the difference, what's the nature of the work, and what do you conclude about the differences?

JH: Well, there're two broad traditions in science: I call them the Newtonian and the Darwinian and they are very different. Let's start with the Newtonian. The goal of physics is to simplify,

simplify, simplify, to find the simple general law that describes everything in the universe, from atoms to galactic clusters. Physics has had a remarkable success record in doing that, and when you start looking at very fine details they get in the way of the physicist's goal. For example, Galileo who went up – at least the story goes, climbed the Leaning Tower and dropped a heavy object and a light object down, noted they fell at the same speed, and discovered the law of inertia that way and set the stage for all of Newtonian and modern physics. Now actually, if that were an ecologist doing that experiment he would've noted that the heavy thing and the light thing fell at slightly different speeds because air resistance will be different, and the ecological world view is to be fascinated by the differences between things. If I'm studying this type of frog for thirty years and that's my life's work, it's what's different about that frog that's important, not what it has in common with everything else in the living universe. Because if all of it's properties were in common with everything else, why bother studying it? So, uniqueness and particularity characterize ecology or Darwinian science, and generality, universality describe Newtonian science. And what I argued in that essay is that environmental issues require a synthesis of those two world views, that they're not incompatible, they're not dichotomous, but they reflect different historical patterns in the history of science, and that most every really interesting and important environmental problem, at least that I've ever encountered, can't be understood just from the Newtonian or just from the Darwinian perspective, we have to put them together. And I gave some examples in that article of how to do it.

HK: And so, when you have a student who has a particular problem and you're working with them – you use, in this book, examples of the salmon which requires you to go to Alaska and the salamander, I believe, in the Rockies. So, you have to be ready to pack up with your backpack in your field, but that aside, that you really – the problem requires you to unravel a story which sort of broadens the horizons and there's an awful lot of ambiguity about what is causing the particular problem. And I think at one point you say, in science you ask a question and then the second question is automatically, why are you asking that.

JH: Yeah, often – because if you happen to like salamanders, like I do, it's very natural to ask, why is the population declining, but the real question has to do with the broader forces at work. For example, we were documenting how acid rain was beginning to eradicate a very unusual population of salamanders, a population that was unusual and whose habitat had been protected by the Nature Conservancy because of this unique feature of this population…

HK: Which is that they didn't go…

JH: They didn't metamorphose. Yeah. And so, they're stuck in these lakes and if the lakes get acidic, they're in trouble. And the interesting thing is that around that time – this was in the – we started around 1981, and it was around the time that I became convinced that global warming was a real problem, but I put that worry aside and I focused on acid deposition. But then I realized that there's an even bigger issue here, which is that under global warming those ponds won't even exist. Even if we reduced acid rain, as we did to a huge extent with the 1990 Clean Air Act amendments that apply to western coal fire power plants – we cleaned up the rain to a major extent in that part of

the United States, but the threat now is an even bigger one, which is that their entire habitat is going to disappear because these ponds will evaporate to dryness before the summer ends, and so creatures like these salamanders that can't metamorphose because they're perpetually in the larval stage, even when they reproduce, that they're not going to have any habitat left. And so, the questions keep, like Chinese boxes, getting bigger and sort of going into the box, you're going up to bigger and bigger boxes.

HK: And these creatures – is that the appropriate word here?

JH: Sure.

HK: Salamanders in this case, they're very delicate, and so therefore they are what you call a green fuse, a fuse in nature that sounds an alert that – what's happening in the world. And that is very important. So, it's local complexity leading to a wider and wider circle which then moves you into big issues.

JH: Some people like – they prefer the image of the canary in the mine, but my problem with the canary image is when the canary keeled over, the miners would run out of the mine, but we have no place to run. We don't have a place to run to, to escape the problem, and we have to change the system so if the fuse blows you know that there's a systematic problem that has to be confronted. That's why I use that image. The other thing is that there're three meanings of the word "fuse" and the book uses all three of them.

HK: And those three meanings are…?

JH: Well, there's the fuse as in something that leads to a bomb, you light the fuse that ticks away and this is the situation with climate. We're in for an explosively catastrophic climate if we don't do anything. The climate bomb is ticking. "Fuse" as in to cohere, to unite, to put together, and that's where these connections I show between what's going on in the arctic lakes, and what's going on in the Rockies, and what's going on in the Everglades, that their commonalities, the threads that tie these places together, and interactions between them. "Teleconnections" is a word that – I don't like the word but that's a word that climatologists use to describe this. If you look at a traditional nature show on television, this week it's on the Brazilian Amazon, next week it might be on the Canadian Rockies, the week after it might be on the Mediterranean, and each week it's a different place and you don't learn from those shows the connections between them. What I tried to do in that book was show the interconnectedness, and so "fuse" in that sense. And then finally, "fuse" in the sense that something that blows when you've overloaded the system, and we have overloaded the earth and the fuses are starting to pop.

HK: I think it's interesting at this point to raise the question, where does creativity come from. Is it in the midst of this complexity and the realization, hey, this answer isn't adequate because there's a

larger picture, or is it imagining something that isn't there, you say at one point, and wondering why it isn't there. I think it was cypress trees and the ocean, or something.

JH: Well, there were a couple of examples. One was – now I'm trying to think of the cypress – I don't remember the cypress tree example. But the creativity comes from sort of the bottom up and the top down. From the top down it comes from trying to understand how to develop ecological theory that can have the generality of physics and the specificity of biology. There's a tension between those. That's the issue of unifying two very different strands of science history and putting together new approaches that – this calls for a lot of very creative work and with my students I think we've made at least some progress in that. Then the other source is the bottom up source where you're seeing puzzles in the world, you're seeing things that should've been there and weren't. You're seeing the nitrogen levels behaving in a certain way in arctic lakes, and then you start to wonder, are the salmon returning from the sea, maintaining these nitrogen supplies, or if it's coming from the alder trees and the nitrogen-fixing lichen on the slopes above these arctic lakes, will that be impacted by air pollution. And so, you're asking the technical detailed questions and then trying to come up with answers to these puzzles. It's like detective work.

HK: You focus in your work on three things, climate change, diversity, and then sustainable ecology. How have those interests emerged on your part? Is it a result of where the whole field was moving, or do you bump up against those problems in the different local environments that you've worked in?

JH: Well, let me say that it would not surprise me or my colleagues if ten years from now I'm doing something different, because if I look back at how I spent the 1970s and the '80s, and the 1990s, and the last nine years, I've been doing different things. In the '70s, when I first came to Berkeley, I was working on what's called eco-toxicology, which is how do toxic substances affect aquatic life and ultimately how would it affect human life. I had grants from the Environmental Protection Agency to develop better methods for testing how aquatic ecosystems would be responding to acid rain – I'm sorry, to pollution, and one of the pollutants I looked at was acidity. That got me interested in acid rain and I realized I couldn't keep studying that in the lab, I had to get out and look at real lakes and streams, and real ecosystems. And so, I began ten years of field work on acid deposition and how it affects life, and I was working up in the Rockies. That was a very good place to do this work. But then I realized toward the end of the '80s, as I mentioned earlier, that gee, you could solve the acid rain problem and climate change would still wipe these creatures out. That got me interested in climate and I ended up doing a lot of work on how it affects plant communities, terrestrial ecosystems, forests and meadows, and spent a lot of time on that. That got me interested in how ecosystems influence climate. It's a two-way street. Climate influences ecosystems but as you change ecosystems, it can alter climate – that's called feedback – and I began studying the feedback effects by which ecological changes, whether or not they're brought about by climate change, will affect climate. And so, lately I've been doing a lot of work in that area, and then also in the biodiversity area I've been interested in trying to develop fundamental ecological theory that will help us better understand patterns, and the abundance and distribution, of species.

HK: Now as saw in the early parts of your career, science was bumping up against public policy in the sense that scientists were concerned about the Vietnam War, and then later the nuclear buildup and the nuclear arms race, and then when you start your work you're in the Everglades, and then you're bumping up against the building of a new airport, and this leads you to an analysis of what makes the Everglades tick. And one has to then come to the realization that the Everglades are very dependent on swamps, and on this phenomena of **maurel** [?], which you can explain. So, how do you get into the policy debate? What is the responsibility of the scientist?

JH: We went to Florida and began the study thinking we can show that this huge planned development in the Everglades was going to harm the alligators, and the wood storks, and all of the wonderful creatures in the Everglades. That would be reason enough to convince the public to stop it. Well, halfway through that study I realized, uh-uh, that's not going to do the trick, that there is such huge economic forces behind this push to build the supersonics airport there that we had to come up with something more. And I didn't know if we could but I began thinking about the hydrology of south Florida, and alligators and wood storks aside, draining the swamps, even if it didn't harm creatures – which of course, it would – but even it didn't it was going to destroy the water supply of half a million people in south Florida, not because they're drinking swamp water, they're drinking well water, but what's keeping that well water fresh and not saline. It's the swamp water that sits above it. You drain the swamps and the sea water comes into the wells. We showed that, we demonstrated it with physical principles, we put together maps of the aquifer system and were able to show that there was a threat looming here to about a half a million people living along the Gulf coast of southern Florida. And that was the argument that caused them to cancel the plan to put the airport there. Now later it turned out that we never built the supersonics and the need for that airport dissolved, and instead, when they had to build more runways and expand airports, they just expanded Miami International. But at the time, it was that argument about water supply to people that ultimately did the trick. And so, one of the things I've learned over the years is that I love nature, plants, birds, everything, but to really make an argument that will persuade policy makers you often have to extend the analysis and show how real, immediate, material human needs won't be met when you go ahead and destroy something as beautiful as the Everglades.

HK: And you have a very strong sense that the scientist has a responsibility not to abuse his own evidence because he's compelled by making the political point which is the right thing he thinks to do.

JH: That's right.

HK: And how do you do that? Where does that scrupulousness come from, and what have you learned from employing it?

JH: I think it comes from – and maybe this is where the sense of history that I got from my father comes from – that important as the thing you're currently working on may seem, it's not the most

important thing, that the problems we're going to face twenty, thirty, forty years from now could be much more important than they are today, and that if I go all out and twist and distort the science in order to get the public to do something about a current problem, I may sufficiently destroy the reputation of science, or at least my reputation. But it actually undermines all of science when people do this and makes it more difficult for my young students coming out now, in twenty years, to attack the problems they're going to confront. So, it's this feeling that we're always going to have problems and we can't pull the rug out from under the future by distorting the present. We have to be as honest and careful as we can today in order to protect the institution of science because we're going to need that institution in the future.

HK: Now this raises an interesting point, which is what exactly are your philosophical assumptions, beyond just your assumptions as a scientist, about how you work. And one thing that's very important is factoring in the consequences for future generations. Talk about that because that's really central to what you just said, which is not undermining the reputation of science in the future.

JH: Well, maybe coming from mathematics and physics I have this appreciation for the logic of something like the categorical imperative. The Kantian ethical principle is based on a kind of irrefutable logic but it's missing something. And what it's missing is something I realized and probably stems from some philosophical belief system I have, although I'm not sure I could characterize it real well. But it's two things, that the future is just as important as the present – there's a wonderful statement that summarizes this. I didn't think of this but it's a lovely phrase. I quote it in the book. Herman Daly, the economist who has fought this notion that if an economy doesn't grow, it dies – he's really the parent of the concept of a steady state economy. He once had to write a review of just an awful book by Julian Simon that was another economist who believed that there were no limits to growth, and Simon wrote, we should try to have as many people on this planet as we can, people are good so let's have more of them. And Daly, writing a review of the book, said – he began the review in a way that startled many of us when we read it. He began by saying, yes, I agree with Simon, we should have as many people on this planet as possible…but not all at the same time. And it's a beautiful statement. Let's keep the enterprise going for as long as possible rather than try to puff it up as much as we can today, and that, I think, is – or lard it up as much as we can today. That reflects a philosophical view that I share. And so, in extending the Kantian imperative to future generations, which is what I talk about in the epilogue in the book, I'm reflecting, I think, something that I feel very deeply. I have no idea why I think it or where it came from but – the other thing I feel very strongly – and again, this in a way started coming into consciousness with the Everglades study – is that there's been a progression. Long ago, people used to say man is the steward of nature, and that idea is considered an advance over the notion that man is the ruler of nature, that we should be more like a shepherd with his flock than like a vindictive ruler. But I don't think that goes far enough, the idea of man as the steward of nature. I really believe nature is the steward of us and that the human economy is a wholly owned subsidiary of natural ecosystems. Without the ecosystem services they provide, the whole human enterprise is over. And so, I feel very strongly that we should view our relationship to nature that way, rather than as we are somehow governing and stewarding nature.

HK: And one of the mistakes we make, you write, is not recognizing that nature requires restraint from us. [beginning of quote?] "If the human impulse is to dam the rivers, hack the forests, blast out the mountains and scour the rivers for metal ores, drain the wetlands and pollute the rain and snow, is given free reign in the western mountains, then our children and all future generations will not be blessed with these gifts of nature." That's a real re-definition, isn't it, that we're going to have to adjust to?

JH: Yeah. I think when we talk about conservation, I think what we really have to pull back on is our urge to do everything we know how to do. There're many things we could do if we wanted, and we have to restrain those urges.

HK: Now what is the implication of this for our commitment to capitalism? Recently Gus Speth was on our program from Yale, and he was arguing in that book, after a whole career in the environmental movement, he had come to realize both in government and outside of government that capitalism was part of the problem.

JH: Well, fortunately we've never really tried capitalism. We have some modified, sort of mongrel system, with some elements of capitalism and fortunately, many elements of regulation and control. We've seen in the current economic crisis that our controls and regulations aren't always adequate, strong enough. Pure, unadulterated capitalism would be an absolute disaster. Fortunately, I don't know of any modern society that's ever tried it but it would be an utter disaster, and the people who would hate it the most would be the CEOs of major companies. Think where the oil industry would be without the subsidies, and the regulations, and the military apparatus that makes possible what they do overseas. So, no, we don't have capitalism, thank goodness. What I believe is that we need a more well regulated economy with more government regulation, particularly to protect us from things like inefficient and excess use of fossil fuels when we could be at actually an economic advantage to ourselves be replacing fossil fuels with renewables and particularly with more energy efficiency.

HK: It would seem that one of the things obviously – and strangely and ironically – in the economic collapse becomes an opportunity to reconsider the way we do things and our relation to capitalism, our relationship to nature. But I'm curious, with your long experience – you've contributed to law journals, you've worked on issues of land use and where it's obviously very complicated how you resolve some of the dilemmas – I'm curious, what – it would seem that there's an important role for political education, for educating people about the science as a path to educating them about the social choices we have to make.

JH: That's exactly right. One of the things I enjoyed teaching in a class I taught this fall during the worsening of the economic situation was how we can look at the human economy, the way an ecologist looks at the feedbacks in an ecosystem, and within our economic system we've rigged it so that there are these positive cascading feedbacks, not positive in that they're good for us, positive in

that they're amplifying. And so, something that starts to go wrong, that triggers a response, that triggers a counter-response, and then the end result is that you've exacerbated the original triggering causes and made the situation worse, so we spiral down into true recession, which is where I think we are now. I think political scientists need to hear how ecologists view these problems and understand this systemic – this systems approach to thinking about the economy in the broad sense of the term, not just the monetary economy but the whole structure of governance.

HK: Is this a generational thing? I mean, obviously you've just walked us through how you came to see the importance of ecology and environment, and the turns that you took, so the question is, is there a kind of environmental consciousness that you see among a broader sweep of students, growing and growing that actually at a certain point will have political impact?

JH: Yeah, and I think it's been documented not by me but by people who do opinion polling and sociologists who have conducted surveys, and the young kids coming out of grade school now know so much more about how the world really works. Back when I was a kid, nobody was taught where food comes from, or how climate influences our wellbeing, or any of this stuff. Partly we figured it out, partly we went back into history and read accounts of how – Jared Diamond's book, Collapse, and we learned about the connections between the natural world and the world of people and society. But today, I think students are learning much more about this as they come out of school, and so when students now come into our graduate program they often know in a factual sense, as much as I do, about the problems that the world faces. What they're lacking often are the analytical tools to go deeper and understand deeper causes and especially solutions. So, that's where we can provide good training, I think.

HK: One of the chapters in the Green Fuse book is a visit to China, and there you touch upon an issue that we have to put on the table, namely this whole question of these latecomers to development and the consequences of their following our erroneous paths for global development. Now you were involved in the anti-nuclear buildup movement, I know, so give us your insight into how this kind of international dynamic works, either between environmental scientists across the globe but beyond that to global governments.

JH: I think what a lot of – a number of us in the environmental movement are doing, whether we think about it consciously or not, is actually trying to save developing countries from a path that will prevent development, destroy their quality of life and wreck their economy, namely a path that looks just like the one we in the west took. There's a better way to do it. If they try to do what we did, they're not going to get to our standard of living. You just can't do that with the available resources and the high population densities that now afflict Africa, China, India. You have to do it better. And what we're trying to say is that what we should be doing in the west is also what they should be doing in the south and the east, namely developing sustainable, renewable resources, solar and wind, not oil and coal and natural gas. Those are vulnerable sources, they're going to get more and more expensive, they're going to foul the air and they're going to destroy the climate. What we need to do is develop ourselves better by replacing the dirty energy sources that led to our development with

cleaner ones and see the developing countries do the same. What I'd love to see, my dream is an economic arms race, if you like, between the solar developers and the wind turbine developers in China and India, and the south, and our own renewable energy developers. Who is going to be the John D. Rockefeller of the second half of this century? Who are going to be the corporate giants? It's not going to be the people pulling oil out of the ground. Rockefeller did what he did because it was a long time ago and you could do it then. Now it's going to be the people who come up with the most cost effective energy sources that are clean and voluminous enough to really make a difference. If you look actually, China is a world leader in solar panel development. China and Germany are the two leaders. We should be but we're not. I'm hoping with the transition in Washington that we will soon get back on that path and start competing with the rest of the world. If we don't, we're on the outside, we're going to lose, and the economic giants of the second half of this century will be the countries and the corporations that have the wisdom to invest in these kinds of developments.

HK: Let's talk briefly about global warming. It's an enormous topic but we've gone – here we have people like you warning us decades ago that this problem was emerging, we've had in the last eight years, I guess one could say, science locked up in Vice President Cheney's safe, in the…

JH: The famous lock box.

HK: That's right. [laughs] So, now we have an administration that's ready to move. What would you like to see happen? Obviously these are long-term problems. Today we're doing this interview in late January, a report is issued saying that it may be that carbon deposits may be irreversible and the damage that's being done, even if we reduce the carbon. What would you like to see the new administration do?

JH: Okay, glad you asked. My wife and I have actually written a book and it's available free online – there's a website. There's going to be a big article about it in the Berkeleyan – is that the name of the…?

HK: Yeah, the campus paper.

JH: Yeah – coming out, I think, this week…

HK: When we put this interview up, we'll link to it.

JH: What we do is describe – the first two chapters present to the layperson a clear, simple explanation of global warming and why the science is utterly believable, and why we should be concerned, and why we need to take action. The next nine chapters talk about what to do, and we present a complete, coherent plan, the technology, the economics and the policy, for achieving a solution. And we do this, by the way, without any carbon sequestration because I'm not persuaded that it's plausible to sequester carbon, and we do it without a large commitment to biofuels because

I'm very concerned about the competition for land between food, which we're going to need more and more of in the future as population grows, and land for biofuels. So, no biofuels, no carbon sequestration. Nuclear – we don't require it. It's there but we're not asking for an extension on it. We rely on efficiency, wind, solar and some geothermal, a lot of efficiency. You had an interview with Amory Lovins, and so you probably got a good exposure…

HK: Sense of that – yeah, and the re-engineering required, yeah.

JH: That's right. A huge amount of fat in our system that could be cut out with efficiency gains. And the policy measures include regulations to impose higher and higher fuel efficiency standards on automobiles. We can easily get to 60- or 70-mile-per-gallon by the year 2025, if we tell the auto makers they have to do it. If we don't tell them to do it, they won't, but if we do, they must. So, fuel efficiency standards for automobiles and for homes, new homes, appliance standards for air conditioners, refrigerators and stoves, and so forth. Then I want to – this is one of the more radical pieces of the plan. One way to think about what we're asking for is that we treat solar and wind the way we now treat oil. We hugely subsidize oil. In fact, the Iraq war, which some people would argue is an oil subsidy because it was a major motivation for the war, is going to cost over a trillion dollars. Imagine what you could do with a trillion dollars spent on solar and wind turbines to produce electricity. We could wean ourselves off of all of our coal and about three-quarters of our oil. We still need some for liquid fuels for aircraft, and so on. But replacing current automobiles with rechargeable hybrids and getting the electricity to charge them from wind and sun – how do we get society to go there? Well, shifting subsidies, and then I want to take that foolish tax cut that Bush gave the wealthy and I want to keep it as a tax cut but not for the wealthy. I want to make it a tax cut, a tax break on the profits from the sale of clean energy. There's a motivation for people to invest in clean energy. It doesn't pick winners in events because if you're not selling clean energy because you didn't invent the right device, you don't get the tax cut. So, it's a tax cut that automatically targets the winners, and from what I can understand of investment, and technology, and economics, such a tax shift would cause a flood of investment money into the clean energy sector. And the combination of shifting subsidies, shifting that tax break, and regulations – we wouldn't even need a carbon tax, which I think politically is a very tall order. I don't think it's going to be easy to get a carbon tax in place. So, we don't need it, if we do all these things.

HK: What is the title of the book, so that people can Google it, if it's available online?

JH: The website where you can do a free download of the book is www.cooltheearth.us.

HK: And I think our audience will want to read that, and it can serve as a guide as they watch the new administration move forward, but then maybe backward as it feels political pressure.

JH: Yeah. And the title of the book is Cool the Earth, Save the Economy: Solving Global Warming is EASY. And the E is for efficiency, the A is for the automobile, the S is for solar, and the Y is for

you, and you, and you. It's for all the things we have to do as individual citizens to complete the four parts of the strategy.

HK: And you co-authored this with…?

JH: With my wife.

HK: And her name is…?

JH: Mary Ellen Harte.

HK: So, the Hartes are giving us something that we need to look at. So, John, before I thank you, I want to show this book, which I read for this interview. It's called The Green Fuse: An Ecological Odyssey, and our audience will discover that it's out of print but I'm sure they can write to UC Press and invite them to reissue it, or at least put it in digital format so others can get to it. So, on that note I want to thank you for taking us on this intellectual odyssey.

JH: It's been fun.

HK: Because it's really helped us to think about the opportunities that we're now presented with, with the new administration. Thank you very much.

JH: Thank you very much.

HK: And thank you very much for joining us for this "Conversation With History."

[End of Interview]