Dr. Donella Meadows, “Nature in Balance, a Vision”

Nobel Conference 1993

GACAC Collection 92, Box 13, Tape 33

Thanks very much. Wow, it looks really great from up here. I am supposed to summarize or in some way cap the wisdom of this conference. And I’m in deep trouble. I have been, I have sat through the six presentations with, scribbling notes furiously as the people around me know, knowing that I was to summarize.

And also trying to capture for my own records and my own memory, six wonderful presentations, truly wonderful, and six presentations that came at the subject of ecology and ecological knowledge and what it means for us as human beings, from so many different angles that I’m, I could, of course, not prepare for this speech because I had to summarize six speeches I hadn’t heard before I came here. And there were so many ways one could pick up the themes.

And so trying to figure out what to say, I’ve asked several people at the conference what remains to be talked about or what would you like to have picked up or what did you think was the most important thing here?

And really the most compelling answer to that question came from Unity High School in Wisconsin, sitting over at that table, who said, ‘We, let’s, let’s talk about what to do. And what we really can do and how we can do it. And I think underneath, of course, that’s what we are all, including the ecologists, are searching for is wisdom about that subject.

And as I tried to think what, the conference, of course, at many levels, talked about what to do. All the way from policy from political action to more knowledge, more science, more better, and more and better ways of communicating the science. There, there’s a lot of doingness to do in order to work out a balance between the human race and nature on this planet. And I use that word balance with much more circumspection than I did before this conference started.

But as I thought through the presentations, I thought that the most interesting take on what to do came from an area that isn’t usually considered doing. But I

think probably, and this also goes along with my experience in systems analysis, I think really is at the heart of doing and figuring out what to do and make, and doing it effectively. And that is seeing first.

I don't know if you were struck, throughout the conferences, I was, by how much talk there was about myths and models and mindsets and world views and different ways of seeing the same phenomenon. Whether that was the way of Papua New Guinean sees a bird versus the way we see a bird or the way economists see the problems we were talking about versus the way ecologists see them.

That struck me as a theme that every one of our speakers had something to do, something to say, something profound to say about, and, of course, it started with not only the title of this conference but the challenge of this conference, Nature Out Of Balance. And the first thing that happened, and this was the intention, I know, of the organizers of this conference, is to ask the question, is there balance?

And there already, we have a world view problem. Are we to see the world as a neat, static machine? Or as some kind of a dynamic mess? Some kind of a chaotic, emerging, self-organizing, evolving, fractal system? And then there's the question of suppose that we see it as a system and as a dynamic system. Suppose we see ecosystems, but what, are those ecosystems assemblies of species? Or are they assemblies of functions and purposes and processes? And that's a, that keys right into systems analysis where there's always an argument about whether the system is made of its elements, its countable, seeable, measurable pieces, or of its relationships, how those pieces interconnect.

By the way, systems analysis has a real clear answer to that question. The connections are much more important than the elements. What should we look at to see how we're doing? This is another subject that came up. What are our indices? What about, should we, should we be looking at economic indicators? Should we be looking at ecological indicators?

And if so, which ones? What should we see in order to guide our policy? What should we call natural? What should we call unnatural? What should be the public purposes of our society and what the private purposes and what happens when

we can't quite either figure out which should be which or what to do when they're in conflict.

These are some of the questions of seeing, of really how to we come at this problem, that I thi-, I think were raised. I think some of them were resolved in this conference and some were not. And an interesting moment came for me when a geologist in attendance, whose name I shall not mention, came to me in one of the breaks and said, 'Why is this so hard for the ecologists to figure out? We geologists went through this decades ago and we realized that the, that the physical earth is by no means a static, balanced, constant thing. It's constantly in turmoil and we had to, you know, we, we're working on time dimensions of millions of years of turmoil. It should be obvious that biological systems are that way. Why is that so hard?'

And I thought of pointing out that the economists haven't actually got there yet, even to raise the question. [laughter] That's going to be the last economist joke I tell, I promise. [laughter] And I think that, it's, I think that's a profound question, actually? Why is it so hard for us to see turbulence, variation, emergence, evolution, and so easy for us to see machine-like, harmonic, orderly ways. Orderly things in front of our eyes, whether that's a plate tectonic shift or a species or a stock market change.

And I think part of the answer is because of the tools and I think that may also explain why this is coming to economics and ecology at a different moment. I personally happened to be handed in my education the tools of organ-, of analysis of complex systems before I studied ecology. And so for me, because I knew how to model non-linear dynamic oscillating evolving systems, it was no, this entire controversy is easy for me. But it's only because I've been given the intellectual tools to deal with it.

Most of economics evolved and was institutionalized as an academic science before there were even computers. When a lot of the economic calculations were done by hand, calculators are simply by hand. And the idea of an equilibrium is firmly engrained and not, and of linearity. It's firmly engrained in economics, I think simply because the economics came, much of the theory came before the tools came, which allowed you, it's like being a set of glasses that allows you to see things that you couldn't see before.

And the mathematics of dynamic systems and the later mathematics of chaotic systems and of emerging self-organizing systems, I think has allowed this whole discussion finally to move into econom-, into ecology and I'm sure it, is already moving into economics.

I think that's part of the answer about why it's hard to thrash, to thrash out this machine versus dynamic, organic system world view. World view difference. I think another answer is simply because of the culture of the industrial mindset, the Western culture, the culture that has gotten its wealth and progress and success literally through machines. And that has not organized particularly its industrial sector around expecting machines to behave like machines, people to behave like machines, and nature to behave like a machine.

I think it's extremely hard for people who have been raised in the industrial culture to deal with organic-ness and changeability and variability and bugs and birds that, and people who refuse to behave like machines, which of course they always do.

And I think there's even a maybe more profound reason than that why it's so hard to come to terms with a world that is slipping, sliding, varying, resisting, and doing all kinds of dynamic, dynamically disorderly things, I think it's because we like to think that we are constant. That when we wake up tomorrow morning, we're the same person we were when we went to bed tonight. I think there's a great investment in the human ego that we as human beings have a consistency, a non-variability that we are definable.

I think this is very deep in our sense of our identity of who we are, that the world may be a mess out there, but we're constant. We may be growing, we may be evolving, but there's, there's a constancy that we would like to think about ourselves. And if we are constant items in a shifting world, this is an extremely uncomfortable feeling.

And even more than us as individuals because of course we know that we are all born and grow and evolve and die. We like to think that our institutions have the ability to endure, to be dependable, to not be dynamically, non-linearly perverse.

And so that even though we may pass, we would want our beloved colleges to go on and not change too fast, as any president who's tried to change a college can

tell you, and certainly our governments shouldn't change too fast and our body of knowledge shouldn't change too fast.

And I think this is, the more we've come to see the world as a chaotic, self-organizing set of hierarchical nested and unpredictable systems, the more we have a kind of wheezy feeling about who we are ourselves. And of course, anybody who has gotten into a subject you've already had a Nobel Conference on, fractal geometry and chaos, knows that we are living examples of it, in our bodies, not to mention our minds.

So if we're going to come to terms with an ecology and an economy that are disorderly from the world view of people who like predictability and machines, then we have to raise very deep questions of who we are. And especially when we get into the question of the relationship of human beings and the human economy with nature.

This brings us back to first principles. And the Eastern religions have an easier time of this because I think they've never bought into the industrial mindset in the first place and their basic set of wisdom is you are not the same person today than you were yesterday. Let go of that image of constancy and play. Play with the beautiful, ever-changing, cycling and evolving human beings around you and nature around you.

But we still like to cling and when communism falls, apparently, almost overnight, when the stock market falls overnight, when our social systems, not to mention our environmental systems, show this non-constancy, this non-predictability, we get very upset.

Now I actually happen to think that this ferment in ecology and I hope soon in economics, and in many other, almost every other way of seeing that the idea of chaos and evolution and self-organization is beginning to hit, and it's beginning to hit most every science. I think this ferment is super. I think it's excellent. I think it's time that, that our tools evolve to the point where we can put on the glasses that allow us to see the world a little, I think, more completely as it is. Which includes we ourselves inside ourselves, the other human beings we interact with, the human institutions that we create, the economies that we create, and the environment, the planet and the ecosystems that support everything that we do.

I celebrate that change. And I think the sooner it comes, the better. And now I'm getting to the what can we do? I think that of all the things that I've learned in my attempts to understand the various complex systems that I've just been talking about, complex, non-linear feedback, disorderly, evolutionary, always-changing systems, I think probably the most powerful lesson anybody ever taught me about how to deal in that world effectively was a lesson in how to see. And it came about shortly after I wrote a book called *The Limits to Growth* which was just held up before you, 20 years old now.

And it turned out, to my great surprise, the book basically said something that was, from my point of view as a scientist, so obvious it was hardly worth saying, which was that the physical, human population and economy cannot grow forever on a finite planet. Basically that's what the book said.

And I didn't think there would be much controversy about that. Turned out there was a controversy that I and my co-authors, as we watched it unroll around the world, could hardly believe. The reaction to that general idea was varied. It was quite diverse because there were about, it turned out, at least eight different major ways to attack that hypothesis, depending on whether you were a mainline economist, whether you were a rightist or a leftist, Russian or an Argentinian or whatever. There were lots of ways to say, well, no, we really can go growing.

I realized much later, as I watched these reactions, which, to me, were out of proportion to what we had said. There was an emotional edge to them. It was not a rational discussion. And I was a scientist. I kind of had been led to believe that discussions generally were rational in the world. It was a great learning experience. I realized that we could have, in fact, written a book called, *The Limits to Growth*, four words, and had blank inside and we would have been attacked.

Because the idea of questioning growth in 1972, and as it turns out, by experience, also in 1992, the questioning of growth was something that offended the very deep mindset, the very deep world view, the very, one of the basic hypotheses of the industrial revolution. Certainly offended almost all of economics. It certainly offended all political rhetoric about how we're going to solve every problem by growing out of it.

And I tried to answer these arguments and the four of us who wrote that book spent several years all around the world trying to argue back and not really quite

understanding why the arguments wouldn't meet, why they kept sailing past each other. And I remember saying to one of my co-authors once, how is it that we can be living in the same world and all see it so differently? And not even really quite be able to communicate about why we see it so differently.

And then somebody hearing me voice this question handed me a book that was one of the more important books I've ever read in my life, Thomas Kuhn's book, *The Structure of Scientific Resolutions*. And a lot of heads are nodding in the room and you've read it. And for the high school students and some of the others who haven't read it, it's a book about the history of science. A seminal book about the history of science. And the hypothesis, and I'm going to exaggerate a little bit what Kuhn said because he really was talking very strictly about science history. And I'm going to take his basic idea and enlarge it to talk about especially human history and social history and the history of world view conflict.

Basically he said, first of all, that we only, he said scientists, I'm going to say all people, they only see and know the world through models. And I was a modeler at the time and that was one of the first statements we were taught as modelers, so that one I had no trouble with.

We only see the world, we only know mindsets, world views, models, and assumptions. We don't know the world. In our heads is not the world. It's an abstraction of the world. It's a simplification of the world. It could be extremely sophisticated one based on a lot of experience of the world. But we don't know the world.

We have to have models for our own sanity. We have to have assumptions about, basic, deep assumptions about how the world is. You know, it's flat and every day a chariot raises the sun up from the east and carries it across the sky and set it in the west, right? Deep down model of, or it might be round but it's very definitely, the world, that is, in the center of the universe, and everything revolves around it. And the reason it's in the center of the universe is because God created it and us and we are the most important of God's creations so he put us in the middle.

And, of course, these are exaggerations of very deep world views that the, much of the world not only believed but killed each other over for centuries. Models. Models that we now don't believe in. Although, everything that we do believe in

is still a model. Nothing, nothing as complex as the amazing, rich complexity of the real world.

The second thing Kuhn said, and that's OK, I think most scientists would go that far, no problem. Second thing he said was that our world view, our mindset, our very deep assumptions about how the world is structured determined how we see the world. And this is one that was a shock to me, or would have been a shock to me until I got into an arguments about *Limits to Growth*.

One of the examples that Kuhn gives in his book is actually a study that was done at Dartmouth College, where I teach. And it was in the early days where they, they were determining how fast human beings can react to a visual signal. How long you had to see something before you could recognize it. They had a machine that would put up an image for a fraction of a second, they could dial how long, and take it away, and you had to say what you saw. It was a measure of reaction time. And they used playing cards for this machine. And they'd figure out, they'd put a four of hearts and you'd say four of hearts and they, and so on, and they'd get it down to the edge of such a fleeting image, it was right at the edge of your ability to identify what the card was. But you could say get, the average person could get 80 or 90 percent right.

And then someone had the bright idea of throwing in anomalous cards, like say a red four of spades. Cheating, right? And they'd put those in the pack and go through the experiments and, as usual, people could identify the cards with a certain fraction of a second. And every time an anomalous card came up, without any hesitation, the red four of spades would be called a four of hearts or, yeah, four, or four of diamonds. Without the slightest hesitation. And they thought that was interesting so they started slowing the image down and letting you look at it longer and to see how long you would have to look at it before you'd find the mistake.

People didn't find the mistake, they just confidently called it a four of hearts. And finally they stopped it. They said, 'Look again. Look harder.' And at that point there was a breakdown in the observer. And the breakdowns took different forms depending on the observer, but some people would say, 'Oh, you cheaters,' you know, and get really angry that somebody had messed up that deck. And other people would get just so confused, they couldn't find their way out of the

confusion. They'd say, 'Well, that looks like a four of hearts, but there's something wrong with it. And maybe it's spades with red lines around it or, what, you know, what is that? What does a heart look like anyway? And what does a spade look like?' The point, Kuhn uses that example as a point, is that we have boxes in our minds. We have categories. We have expectations and we're eagerly fitting the world into the way we've already got the world set up. And there's very little chance that we will actually see something, or credit seeing something that hasn't already fit our expectations.

And this is one of the reasons why all of the discussion we've been having about whether we see nature as in balance or out of balance, or how we define a good balance versus a bad balance, or a good change versus a bad change. All of this is filtered through the way we see, the way our experience in the world, our upbringing, our formal education, our research, has conditioned us to see.

I'll just give one example of this because, by the way, Kuhn calls that critical moment when you suddenly see it a different way, like when the people finally figure out that the card was an anomalous card and that there could be such things, he calls that moment a paradigm shift, a revolution, like when the world slowly accepted and fought over the idea that the Earth is not in the center of the universe. Like the moment when the geologists that the folks who said that when you slide Africa into South America, they fit, so they must have been together once. When they finally agreed that that probably was right. And so on.

There have been many such paradigm shifts in science and never easy ones. And there have been many such paradigm shifts in society. And also probably less easy ones. Because we let in the information that already fits and because we are actually all of us exposed to completely different sets of information as we work through life, the basic message that I took from that is that we badly need each other. And we especially badly need the opposing world views or paradigms because they're letting in different information. And we can never get anything like a whole picture unless we can combine our information, which I can let in certain things and you can't.

But the next point that Kuhn made makes it very difficult for us, though we need each other, to get together. And that is, he said, especially with deep paradigms, paradigms, world views, mindsets that tell us who we are, we have an incredible

difficult time listening to each other. You know, I give you any conversation between an economist and ecologist or between a pro-life person a pro-choice person or between a conservative and a liberal, between Rush Limbaugh and Larry King, you name it, these conversations do not go well. [laughter]

And I'll just let you get in touch with a moment of the last one you had that rendered you trembling and wordless. Okay, whatever that one was, your paradigm, your world view, was being attacked by one that looked to you, and the other person probably, contradictory. The interesting question is why the emotion? It's always there. It's always there. Why the emotion? Why is that so hard? Why does that conversation devolve very quickly from the rational level to the emotional level? Why is it your first instinct when your world view is really deeply attacked to do something in your mind that's bad to that other person. [laughter]

Discount them, deride them, make up a caricature of them, deny them, walk away from them, punch them in the nose, whatever? Why can't you allow your belief system to be openly challenged without this emotion? And, you know, having experienced, of course, this, especially within the debate about 'Limits to Growth', having experienced this many times now, I think it's just because, very simply, our belief systems, are world views have become scrambled in our minds with who we are and who the other person is as a human being.

And it's, we ourselves, it's our whole world that's being shaken by a real cross paradigm conversation. And when you've got nothing, no gro-, when the very ground that you are used to standing on is being challenged, it's like being in an earthquake, there's nothing to hold onto. It's very scary. It's almost intolerable. And in most cases it is intolerable and you get out of the situation one way or the other.

There's nothing more difficult than a real good, deep, cross-paradigm conversation, keeping the other person human in your mind. And when I get to what we can do, that's number one. Mindsets, however, do, can and do change. You almost think from Kuhn first hypothesis, if you're only letting in the information that already agrees with what you already thought, how can you ever change your mind?

And the way you change your mind, the way science does, and I think the way human beings do is by finally enough exceptions, enough disproof, enough experience with something that doesn't fit your mindset piles up and one day it overwhelms you. And in my experiences, how it feels inside me, you just go click and you get it. You see it another way.

And Kuhn more or less describes it the same way, even in science. It's a you see it, now you see it, now you don't. It's like those optical illusions that, you know, look at it one way it's a rabbit and you look at it the other way, it's a duck. And you either see it as a rabbit or you see it as a duck. You can't see it as both as once and the switch back and forth, it's a little hard to describe what's really going on in your head.

OK. So that can happen and anomalies, falsifying information, which normally you sweep away and don't count, but when it piles up enough, one day you get it. I'll just give you one example from my own life. I'm getting to really enjoy paradigm shifts when they happen to me At first they're disconcerting but they can be really funny. For years, as I modeled on a computer dynamic, non-linear feedback systems, including ecological systems and economic systems, every now and then in one of my models, everything would go, I'd twist a little number, change a number somewhere, and the whole thing which was, say, oscillating very nicely or growing very nicely or whatever, would suddenly go into nutty behavior.

It wasn't repetitive, it wasn't a cycle. It was wildly up and down. And it looked random and I, and every time that happened, not only I, but the whole field of modeling that I learned from, said, 'Oh, that's a D.T. problem. It never happens in the real world. Change the number so that behavior will go away.' [laughter] And the people who are laughing understand chaos theory, that was chaos. We were looking at it for years and dismissing it. Because we didn't have a box in our mind to put that in. Nobody had ever told us that, and of course everybody who's gone through the chaos paradigm shift has experienced the same thing. Once you start seeing it, you see it everywhere. You see it all around. The world does it all the time.

But before you could see it, the world was still doing all that but as far as you were concerned, that was turbulence or that was, you know, unorderly behavior. That was stuff you really didn't want to think about too much until you had a tool,

a pair of glasses, a set of words, a language, an endorsement from the scientific community saying, yeah, create a box for that. It's important and it's really out there. Okay. So you can change your mind and usually you remember those moments. They're, they're places where it's like the wool falling from your eyes and you suddenly see things you couldn't see before from your old mindset.

I guess the last thing that I need to say before I go onto what does any of this have to do with the subject of this conference is, well, two last things. One is that everything I have just said is a mindset. It is itself a paradigm. It is itself a model. It is itself a way of looking at the world. It is probably falsifiable and you either get it or you don't. And if you get it, you'll see it everywhere, and if you don't, you won't see it at all. And that's okay. I'm not trying to convince you of anything. I just wanted to warn you that Kuhn and his way of seeing both science and the process of human learning has himself given us mindset. It's a mindset about mindsets. It's a meta mindset. And therefore I think it's powerful.

And, of course, the minute I read Kuhn, I got it, bang. It explained the problem that I had been dealing with as an anomaly. I thought people were rational. They were having all these irrational discussions. And since it explained a problem that I was really trying to deal with, I got it quickly. And then I started seeing mindsets everywhere.

It's been just one ch-, I see the world that way, except there's been one change since. And this is part also of, I think, what we can do. The enlargement, I guess, of that mindset, came when I started hanging out with people who, who are from an Eastern tradition. And they, they had a level of mastery primarily over themselves, over their own behavior, their own emotions, their own ability to be where they were at, that I admired, which is why I was hanging out with them. And one of the things that I learned from them is that the real mastery in the level of mindsets, in the theory of mindsets and in the practice of mindsets, is to be able, deliberately, to choose the mindset that produces in you the behavior you want to produce.

And this is something I don't think Kuhn even hints at, as I recall his book. And this is, by the way, exactly what Olympic coaches know, that if you, and any good athletic coach, knows that after a certain amount of practice, the remaining steps toward excellence in an athletic performance have to do with what you're

thinking in your head. And whether you're thinking you can do it or you can't. And how accurately you're thinking that you can do it or not.

A lot of the other kinds of real mastery in the world come from, for example, giving up an addiction. I think that's a real exercise in choosing a mindset that produces in you a behavior you want and squelches in you a behavior you don't want, as another example. There are lots of things, of course, you cannot do by just choosing a mindset about it. You can't break physical laws. YOu can't climb a tree, get a mindset that you can fly and fly away.

So the mastery of mindsets has more to do with human behavior, and particularly your own behavior, than it does with changing anything outside yourself.

OK. So I guess if I could make one change in the world on the way toward producing what I would call a sustainable world, a world where human beings and nature live in, I will no longer say balance, but I will say harmony and mutually fulfilling self-organization and evolution, that the one, a lot of changes. I would have a long list of changes I would like to make. I would like a carbon tax, I would, and so on.

But the first thing I would say is I wish we would be able to jointly, as communities, as political beings, as human beings interacting with each other at all levels, I would like to learn how to think about how we think so that we can deal with the question of our own mindsets and other people's conflicting mindsets, or world views. So that we could understand how much we need each other so that we could know when we were having an argument about an observable scientific difference that we could go out and settle by looking at something. And we could know when we were having an argument based on our mutual blindnesses. Mutual conflicting, inconsistent blindnesses. And at that point say, oh, this is a mindset discussion. Let's go up a level to the metal level and know how to have that discussion.

I think that that would, first of all, put an enormous humility into all of our political confrontations, and humility I think is the most important thing that ought to be there that isn't. It would allow us to admit that roughly 90 percent of the stuff that comes out of our mouths, we're not really sure of. And that would help. And furthermore, it would allow us, I think, to be a little more conscious, a little more aware of the way, whatever mindset we were walking around with is

not allowing us to see things that we need to see, that would, in fact, bring about, if we could just change, by our own personal mastery, that part of our mindset, it would bring about a different result in our own behavior.

And I'll give you, again, some personal examples from me. I once ran into some people who assured me with no doubt whatsoever that people were basically good. That people were not basically selfish, or corrupt, or willful, ignorant or violent, that, in fact, if they looked at their own personal experience as opposed to the nightly news, that about 99 percent of the people that they knew, most of the time were doing good things, were being constructive, were being harmonious and were not screwing up. And this, because I take the nightly news as my, sort of formed my model of human nature without my ever really examining it, this was a revelation to me. And as I looked around, that created a box in my head called, good human behavior, which hadn't been there before. And allowed me to take in all the information about that.

The same sort of people started telling me good news stories, in particular about the environment, about the interaction of human beings with environment. That created another box for me called, not, I had, by the way, as an environmentalist, typical environmentalist, I had a big box called, all the ways that human beings are abusing the environment. And I was storing all kinds of information in that box. I didn't have a box called, all the ways in which human beings are interacting with the environment in a positive way, restoring things, learning things, doing good things. And as soon as I created that box, guess what I saw? All kinds of such stories.

Actually that, one of that, those confrontations in a debate about *Limits to Growth* which I having with Herman Kahn. And I don't know how many of you remember Herman Kahn. He's dead now but he, he was one of the people who basically was opposing us by saying, 'Everything is working out great. There's no collapse in our future. Our technology is going to solve all of our problems. We're going to make it. You know, theer's no need for any really big change in the world.' And we were having breakfast in a hotel at the place where we were going to debate, reading the New York Times at different tables. [laughter] And afterwards we got together as we were getting ready to go on stage. He said, 'Did,' and he pointed to the Times. He said, 'Did you see this article about this

huge new gas discovery, gas deposit that was discovered in Louisiana?' And I pointed to the paper and I said, 'Did you see this story about this big chemical spill in, in Italy that's causing all sorts of people to have to be evacuated and the soil to be scraped away. And then he said, 'Did you see about,' you know, I said this, he said, and so we had been reading, literally, two different papers, though they were the exact same morning edition of the New York Times. He was letting in the egood news, I was letting in the bad news. All that news was truly there.

That was one of the points that made me realize, and it's always your worst enemies that make you realize the new boxes that you need to open in your mind. So I would say that some of the things I've discovered I absorbed from my culture without question that I've had to challenge on the level of paradigm within my own self. And that have created out of that a whole different set of behaviors on my own part. One of them is that you can't do anything if it's not economic. Or that you must do something if it is economic. Or that if something is politically unfeasible at the moment, you might as well just stop talking about it. You know, if they won't do it in Washington, forget it.

Big one for me was that anybody who goes through that comes out different on the other side. And the way in which I came out different, among other things, was that I, I allowed, I, I guess I was so glad to come back to the world and to, away from the medical system. [laughs] And, and out into the, it was spring when I really was recovering again, out into a blooming nature again, I, I really allowed myself and ha-, this has been an irreversible change for me, to slow down and welcome the miracles that absolutely when you've been in a hospital for 6 months or dealing with, I wasn't in a hospital for 6 months, but dealing with the medical establishment in a New England winter for 6 months, and you come back out to nature.

Your first e-, you're really able to let it in and to say, what an incredible blessing. Every day. Every minute in the slightest detail and in the largest landscape. What on Earth have we done to inherit such miracles. And, believe me, that's a, that is a way of exper-, I know everybody's experienced that for a moment. But to have your whole life switched to experience that nearly all the time is to get a sense of stewardship and wonder, which every child has, but which, if everyone were open to that flip, I think, again, automatically would change our behavior.

And I guess, because I find it very hard to find the words to describe that experience of nature, a, a, just a blessing beyond any imagining and the more you learn about nature, the more it seems like a blessing.

I'm going to read some people who I think have said it better than I can. The first is Walt Wil-, Whitman. 'I believe a leaf of grass is no less than the journeywork of the stars. And the running blackberry would adjoin the parlors of heaven. And the cow crunching with depressed head surpasses any statue. And a mouse is miracle enough to stagger sextillions of infidels.' And on the mouse theme, from one of my favorite scientific poets, E.O. Wilson, Edward Wilson, 'In a purely technical sense, each species of higher organism is richer in information than a Caravaggio painting, a Bach fugue, or any other great work of art. Conider the house mouse. The full information contained in his genes have translated into ordinary sized printed letters, would just about fill all 15 editions of the Encyclopedia Britannica published in 1768. I suggest that as biological knowledge grows, the ethic will shift fundamentally so that everywhere the fauna and the flora of a country will be thought part of the national heritage, as important as its art, its language, and that astoninshing blend of achievement and farce that has always defined our species. '

And probably my favorite nature writer, Rachel Carlson, and notice that what she's saying in this quote, it's very similar to what we've been talking about at this meeting. She's looking for message and meaning in nature. And she comes out being tolerant of mystery and miracle. She says, 'What is the message signaled by the hordes of diatoms fleshing their microscopic lights in the night sea? What truth is expressed by the legions of barnacles, whitening the rocks with their habitations? And what is the meaning of the transparent wisp of protoplasm that is a sea lace, existing for some reason inscrutable to us. A reason that demands its presence by the trillions amid the rocks and weeks of the shore. The meaning haunts and ever eludes us. And in its very pursuit, we approach the ultimate my of life itself.' Thank you.