

system is wet and it becomes anaerobic and does one type of purification process. The side over here, which is dry, becomes aerobic and is prepared to do another kind. And as you can see, this is an eclectic marsh, if there ever was one. We have the umbrella plant, which I think originated in North Africa, we have the eucalyptus, which are from Australia, and we have the scirpus, the bulrushes, from North America, three or four species, and these are all intertwined in this system to produce a polyculture, with each plant having different depths and different functions. Some remove organic carcinogens, actually physically break them up. Some of these other plants entrap heavy metals and lock them up rather than allow them into the environment, and get them out of the water so that they're not re-released into the bay. Now what we do with these heavy metals varies, depending on the plants that they get in. If it's a tree, a long-lived tree, then we like to find trees that concentrate metals in the stems and roots, and we can lock up these metals then for centuries or many, many years because they're planted out after they start life in this building to become landscape trees afterwards, and so that's kind of an important side of the story. Other plants take up heavy metals, like the tiny floating plants, and those are composted before they reach hazardous levels in the plant, so that they can be re-used on the landscape, but the metals levels are low enough that it doesn't cause long range degradation of the external environment. The third strategy that we use here is unique, and that is because this is an industrial city and the backbone of this city is in fact the jewelry industry. What we're attempting to do here is try and find plants which are called hyperaccumulators, and these are plants that actually try and mire specific species of metals out of the water and concentrate them so that they could be re-used as ore grade. And we have a long term project to try and study just this phenomenon and see if we can find metal mining plants that are happy to live in water or in wet marsh-like environments.

David Cayley

Because the sewage you're getting has significant amounts of precious metals in it?

John Todd

Yes, all of the precious metals are here. I don't think we measure for gold, but we measure for silver, of course, and then there's cadmium and mercury and lead and things like that. It's all in the sewers of the city and it's very erratic. Sometimes there's very little and then all of a sudden there'll be a big spike, and that tells us that one of the factories has done a discharge into the sewers of the town. Then as we go down here, as we walk toward the final treatment process, the actual diversity of plants and animals increases. So now we start coming into an area where we have crayfish and clams and more and more different species of plants. It's a tiny aquatic fern floating here that produces that carpet-lie mat and then, of course, there's the ubiquitous watercress in this system, which are the work horses in here. The final stage, which you see right here, is basically again an engineered marsh, but it's really a polishing marsh. The idea

is to remove the last of the fine particles, and the other thing that's very important in this phase of the process is to have plants in the polishing marshes which are powerfully antibiotic. And most bulbs are antibiotics, and that's one of the reasons why they store so well and don't rot so easily if they're kept relatively dry, and so you'll see a fair number of bulb plants in the system. Things like irises and others tend to be very good this way, and a lot of plants that we use in that way. And then it passes down through the fine crushed gravel filter and then leaves the building as clean water, roughly four days after it entered here.

David Cayley

After our tour, John Todd and I continued our conversation in the quietest place we could find, the cab of his pick-up truck, rolling down the windows after each exchange to prevent heat prostration and then rolling them up again to keep out the noise of the passing trucks. As we sat, facing the greenhouse, Todd told me what they had learned from the place so far.

John Todd

The facility we're looking at here can treat the needs of about 150 households. It's roughly 11 metres by 40 metres in length, and if we were to do all of the city of Providence, we're looking at an area of roughly 120 acres, something like that. That's comparable to the acreage that is currently used by the city to treat their waste to secondary standards, and this facility is treating to advanced wastewater standards, so when it comes to space, these new, light-driven, ecologically based processes are space competitive. So that the opportunity to treat the whole city in one place is there. But the other side of the coin, which I think is very important, is that because it's beautiful, because it doesn't stink, we now have the opportunity for the first time to disaggregate the problem of waste. So that each neighbourhood or each community could have its own facility, each neighbourhood or community could use its own by-products, the trees, the various flowers and things like that, to enhance the environment, so that these facilities could become epicentres for the whole landscaping of areas, including cities. So the state of Rhode Island, which is our host for this particular facility, is very definitely interested in the whole idea of disaggregating their problem, and the reason is, if anything goes wrong here at this plant, we have somewhere between 60 and 100 million gallons a day going into the Narragansett Bay, one of the great bodies of water in this part of the world, whereas if each of these were serving a community there would never be that kind of disaster. So that's the value of this type of ecological engineering, that it can help disaggregate the problem because it's no longer a foul process that nobody likes to think about and nobody can afford.

David Cayley

How about the cost of doing it?

John Todd

We've addressed the issue of cost in two ways. The first is

if we're dealing with a very concentrated waste, like septage, which is 30 to 100 times more concentrated than sewage and hard to treat conventionally, then we are far more cost effective than any other technology. We're way out front there. When it comes to sewage, we don't yet know our costs in relation to other facilities. It looks to us as though, for the price of an ordinary secondary treatment plant, we can build an advanced wastewater treatment facility. It looks to us as though we are modestly more cost effective in the dilute waste or sewage waste area.

David Cayley

A final question about this place. It strikes me that knowledge you've spent half a lifetime acquiring must be at play here. In terms of the number of different things and number of different jobs they do, is this a kind of coming to fruition of the knowledge that goes right back to the beginning of New Alchemy?

John Todd

There is no question that this is a fruition, a coming of age. I have enough experience with different kinds of organisms and different plants and different animals and the way they work together in concert, and now I've actually reached the point in my life where I can start talking about something quite revolutionary and quite new, and that is the concept of a living machine. And a living machine is in fact an ecologically engineered technology that uses wide varieties of organisms to carry out the work of society. I can see the same kind of knowledge being used to produce foods without any environmental degradation, perhaps let's say environmental enhancement. I can see the same kind of living machines to produce fuels for our automobiles. I can see these same types of living machines to regulate our climates, both heating and cooling and air purification. So in areas of waste, food, fuel and even architecture, one can begin to see the concept of living machines which are contained in these gossamer-like environments, with light penetrating everywhere, to function as the work horses. In a sense, for the first time in the history of technology we're able to actually miniaturize the process of production and recycling. My dream is, if this is true--and some of these can be made to last for centuries, unlike mechanical or chemical engines. Some of the simple parts might wear out, but the overall systems can go on forever. They're self-replicating, self-repairing. They have all of the capabilities of machines, except they have attributes that machines don't have, hence the name "living machines." And so I think we're on the threshold of something really fundamental, and carried one step further, in fact, we are even beginning to talk major projects, beginning to talk about the idea, both in eastern Europe and in New York City, of actually designing intelligent buildings that carry out all of the support attributes using living machines. So that we're stepping into a new dimension, which is interesting, because it's fourteen years ago that the Ark on Prince Edward Island was finished, and that was the first complete statement of an integrated system. And it was interesting that what we were doing was

really totally misunderstood for about fourteen years, and now all of sudden the pieces have come together.

David Cayley

Ten years ago, in a book called *Tomorrow Is Our Permanent Address*, John and Nancy Todd drew a distinction between the structure of a system and its coefficients. An automobile is a structure, the fuel efficiency of its engine a coefficient. Tinkering with coefficients is the easiest and least threatening way to approach environmental problems. Improving the fuel efficiency of cars without challenging the structure of transportation is a good example. Using energy to recycle something that needn't have been produced in the first place would be another. John Todd's eye has always been for structure. He wants to redesign society so its structure resembles the structure of the living world. In living systems, each part is linked to the whole but retains a certain independence. This is what gives the system its resilience and adaptability. Our bodies are a co-ordinated play of such relatively independent parts. In contemporary social structures, that element of autonomy is missing. Analyze even your household economy and you'll probably find yourself linked into scores of unstable, ecologically destructive, politically questionable supply lines extending right round the world. Living machines are John Todd's answer, a way of making civilization continuous with nature by designing as nature designs. One of John Todd's inspirations in this work has been the Gaia hypothesis, the idea that the earth, as a whole, is self-regulating. Gaia, he thinks, is the framework in which ecological engineering finally makes sense.

John Todd

The whole notion of the earth as alive is ancient, but the idea of the earth being alive, when it becomes part of the consciousness of people, then their place on it changes dramatically. And my sense is that economies built on ecology will allow people to live and believe in one system, whereas now you can believe in Gaia and a single, wonderful manifest ecology, but how do you act on that belief, how do you live on that belief? And I think sometime in the future, the living and believing can come into harmony, and if I didn't think that, then I would probably have very little hope because I'm completely aware of the damaged ecological fabric of the planet. I guess the Gaian thing is coming around at the right time to provide a broad mantle under which people change the values and the way they work and their relationship with other living things, not just with each other. So that's my source of optimism.

David Cayley

John, thank you.

John Todd

Thank you.

Lister Sinclair

On IDEAS tonight, you've been listening to part five of *The Age of Ecology*, a profile of ecologist John Todd.

Lister Sinclair

Good evening. I'm Lister Sinclair and this is The Age of Ecology on IDEAS. Tonight we'll explore the implications of a theory which could revolutionize the science of ecology: Lynn Margulis and James Lovelock's Gaia hypothesis. You'll hear from cultural historian William Irwin Thompson.

William Irwin Thompson

One person called me Lovelock and Margulis's Thomas Huxley, that I was their bulldog, because I went around compiling these conferences and doing conferences and things with them in Italy and New York and in San Francisco. And there may be some truth in that.

Lister Sinclair

And from the originator of the Gaia hypothesis, scientist James Lovelock.

James Lovelock

Most scientists, for some peculiar reason, are quite naive about cybernetics. They don't seem to understand that a thermostat operates by an entirely circular logic and it's pointless to try and enter it in a cause and effect manner. The same is true of the automatic pilot that operates an aeroplane. The same is true of you or I, and the same is true of Gaia. We are cybernetic systems.

Lister Sinclair

"The Gaia Hypothesis," part six of The Age of Ecology, written and presented by David Cayley.

David Cayley

The Gaia hypothesis takes its name from the ancient Greek goddess of the earth, Gaia, the mother of the gods. The name was suggested by the novelist William Golding. Golding and James Lovelock were neighbours at the time that Lovelock conceived the idea that planet Earth might constitute a single cybernetic system, and when Lovelock explained the theory to Golding during a walk round their rural English village, Golding proposed the name. It was a portentous choice. The evocation of Mother Earth and the ancient religion of the Goddess gave the theory a cultural resonance lacking in a bald scientific statement of the idea that the earth is self-regulating. The idea of Gaia dovetailed with feminism's recovery of the Goddess, inspired artists like musician Paul Winter to create his *Missa Gaia*, or *Earth Mass*, and helped focus the concern of environmental movements on the planet as a whole. The theory, in a sense, was overwhelmed by its own cultural implications, but Gaia remains primarily a scientific hypothesis which holds that life on Earth produces and regulates its own environment, or better, that life on Earth is its own environment. The origins of the Gaia hypothesis lie in some work Jim Lovelock did for the U.S. government's National Aeronautics and Space Administration in the '60s. It was during the planning phase of NASA's Viking mission to Mars, and Lovelock and his colleague Dian Hitchcock were asked to devise experiments that could detect the presence of life on Mars, should such exist. Lovelock, with the naivete of genius, decided to turn

the question round and perform a thought experiment designed to detect life on Earth.

James Lovelock

We thought, well we better check our theory by looking at a planet that does have life on it, and of course the only one we know about is the earth, and it's quite easy to do a gedanken experiment and set up an infrared telescope on Mount Olympus and look back at the earth. So we did this, and when we looked back, we found an atmosphere that was wildly anomalous, and a strange, wonderful and beautiful anomaly that sort of shouted a song of life, as I said, right across the solar system, right out into the galaxy. If somebody says, well what do you mean by this, what anomalies? I say, well just consider two of the gases, oxygen and methane. Oxygen's present at 21 per cent, methane's present at 1 1/2 parts per million, a mere trace you may think, but their coexistence at a steady state in an atmosphere represents an anomaly measured in hundreds of orders of magnitude, as far as its disequilibrium goes. You see, for methane and oxygen to coexist in an atmosphere on a planet, at that steady state, means that something must be making the methane and something must be making the oxygen, because they react together and they use each other up. And knowing the volume of the earth's atmosphere and the rate of reaction which you can calculate from the intensity of sunlight in the earth's atmosphere--of course it's that which causes them to react--you can calculate that the "something" must be introducing no less than a thousand million tons of methane every year into the atmosphere, and something must also be introducing something like 4,000 million tons of oxygen every year into the atmosphere to account for the losses from the reaction of these two substances. And there just aren't any non-living processes that can do that in an atmosphere such as the earth's, so the answer must be that there's life. So we reported this to our sponsors, NASA. They couldn't have been more disgusted. You see, not only had we proven that there wasn't any life on Mars, and they badly needed life on Mars to justify sending Viking there, but much worse than this, we'd used NASA funds to prove that there was life on Earth, and they were scared witless that the message would get back to Senator Proxmire, and you can just imagine the questions he would ask about this waste of NASA money. Of course, he would have been wrong, as he always is. It wasn't a waste of money because looking at the earth that way was as much a scientific revelation, I think, as the view that astronauts have. The astronauts, when they first saw the earth, many of them said, Rusty Schweickart was one, "My God, the thing must be alive, it's so beautiful, it's so much a whole." But what we were seeing was a hard science suggestion that there must be life. You see, to keep those unstable gases at a perfect steady state requires a lot of organization, but much more remarkable than this, how on earth could an atmosphere that was a bit like the gases that go into the intake manifold of an internal combustion engine be just right for life. This was even more extraordinary, and of course that's what made me think, well maybe we're looking at it the wrong way round. The atmosphere isn't an environment for life, it's something

that life has made as an environment for itself. It's something it has chosen and deliberately keeps going because it likes it that way. And that, of course, was the Gaia hypothesis and that's how it started.

David Cayley

At the time that you were having these thoughts, what was the mainstream scientific thinking about the origin of the atmosphere?

James Lovelock

Much as it is now, that it was pure geology, that the biota was just a passenger on the planet and had very little to do with it. It just used the oxygen, we used it, and we burn the carbonaceous matter and we return CO₂, and the plants take in the CO₂ and push back oxygen. It just goes round and round in a cycle and does nothing, said the geologists. Life has no effect on the geological evolution of the planet. They're so locked into their paradigm that they don't seem to be able to realize how inconsistent their position is. The question I always ask is, Well what would happen if all life suddenly ceased on earth? What do you suppose the atmosphere would be? And they rarely ever give a straightforward answer, but you can quite simply calculate it and model it, and you find that in the course of perhaps a million years--it takes a long time for geological process to go through--we would finish up with an atmosphere very like that of Mars or Venus. It would be dominated by CO₂, there would be very little oxygen at all, probably no nitrogen, certainly no methane, and the planet would probably be very hot indeed. Not as hot as Venus, but getting far too hot for life.

David Cayley

Can you explain some of the Gaian mechanisms, for example perhaps the oxygen-methane cycle?

James Lovelock

I could, but that's a more difficult one. Let me explain one of the ones that we know best about, and that's the CO₂ one, because there's a lot of contemporary interest in that, too. You see, one of the more convincing bits of evidence for Gaia was the constancy of the climate throughout geological time. For 3 1/2 thousand million years, the time that life has been on Earth, nearly half the age of the universe--well, a third of the age of the universe, that is--the temperature has been constant, the climate's been constant, and yet the sun has been steadily warming up and this is, I think, one of the strongest arguments in favour of regulation. So how did it happen? Well, one geochemist, Jim Walker, tried to explain it on purely geological grounds. He said, or rather accepted, the geological evidence that right back in the beginning, when life started, there was a great deal of carbon dioxide in the atmosphere, perhaps as much as 30 per cent of the atmosphere was CO₂, and that's what kept the earth warm and enabled life to get its start. He then said that the simple process of weathering--that's the reaction of carbon dioxide with calcium silicate rock which removes carbon dioxide from the air and deposits it in the sea as limestone--would account

for a steady diminution of CO₂ over time, which would exactly equal the rate of rise of solar luminosity. It was a nice theory and a good try, but when you put the numbers in it, it wouldn't work. And I thought that he'd done exactly the right thing. The only thing he'd done wrong was to leave life out. You see, life is very much in the business of weathering, of rock digesting and so on and so forth, and Jim Walker's process can be made to work beautifully if you put life there. If you analyze the soil in most places on the earth, you'll find that its carbon dioxide content is thirty times higher than that of the atmosphere. So on the soil, in the soil everywhere, life is pumping CO₂ out of the air as hard as it can in order to get it to react better with calcium silicate rock and get Jim Walker's reluctant chemistry to proceed. In other words, Gaia facilitates the process that the geologists had envisaged, and without life it wouldn't happen. And in the sea, the same process is going on. The sea is continuously pumping CO₂ out of the air and down to the depths. There's a constant rain of shells, of calcium carbonate bearing creatures that take it right down to the bottom, a sort of conveyer belt, and without their pumping, CO₂ would rapidly rise in concentration and make the earth uninhabitable by living things, and earth is a feedback system which is operated right the way back from the beginning.

David Cayley

The objections that have been made to your hypothesis by Ford Doolittle of Dalhousie, for example, centre on the fact that it offends against conventional Darwinian notions of how natural selection operates, because he claims that there would have to have been foresight or planning amongst the biota which is denied a priori by the theory. How do you respond to that?

James Lovelock

His criticism was understandable in the context of biology as it interprets Darwin nowadays. It's just like the geologists I spoke of earlier. They live in a paradigm which does not see a world where the environment and life are so tightly coupled as to constitute a single cybernetic system. They see the evolution of the species as taking place independently almost of the environment. The species may adapt to changes in the physical environment but they don't see that the evolution of the different species automatically changes the environment, changes the rules of the game in which the next species is going to evolve, and that this tight coupling is what makes Gaia work.

David Cayley

Jim Lovelock first formulated the Gaia hypothesis in the 1960s. One of the few scientific colleagues who took his idea seriously was American microbiologist Lynn Margulis, and they have collaborated ever since. She filled in many of the details of the theory from her studies in microbial evolution, describing how microbes have altered both the atmosphere and the surface of the earth and emphasizing how much more important symbiosis and co-operation have been in evolution than competition. Ten years later, in the '70s, this work caught the eye of cultural historian William Irwin

Thompson. As a cultural historian, Thompson believes that science is always embedded in some larger story, and he saw in the Gaia hypothesis the scientific narrative that could knit together a planetary culture. Bill Thompson is a poet, essayist and author. His thirteen books range from 1971's *Evil and World Order* to last year's *Imaginary Landscapes: Making Worlds in Myth and Science*. He's also director of the Lindisfarne Association, a loose affiliation of thinkers devoted to fostering a planetary culture. The association is named after a Celtic monastery established in the 7th century off the coast of Northumbria. Lindisfarne was one of the centres from which the medieval Christian civilization spread through Europe, a place where the ideas of classical civilization were "miniaturized," as Thompson put it, into a curriculum for a New Age. The new Lindisfarne, founded in 1973, was to be a seed of planetary civilization. It became the intellectual vanguard of the New Age movement at a time when "New Age" still meant something more than crystals, channeling and feeling good about yourself. In 1989, Bill Thompson brought out a collection of essays called "Gaia: A Way of Knowing," subtitled "Political Implications of the New Biology." "Ecology," he states in this book, "will be the political science of the future" and Gaia the sign of a new way of knowing the world. The following interview was recorded last fall at the home of Tim Wilson and Andrea Milinkovich.

William Irwin Thompson

The quintessential idea in Lovelock is that worlds embrace repulsions, you know, and that processes that seem to be violently opposed can be constitutive of other architectures of order, so one animal's excrement becomes the food for another bacteria and the planet is a delicately balanced thing between the fixed and the fluid. The continental plates are fixed, more or less, over time. They are also another kind of fluid, but for the sake of time, they're fixed and the gaseous atmosphere is fluid. So a healthy living system like us, with our fixed skeleton and our fluid rivers of blood, has to embrace these opposites, and if we don't, then we come up with defensive mechanisms of trying to crystallize value into a gene, a subatomic particle, a museum, a currency, a metal, and all of these ideas of value fixed in objects are perishing everywhere you look in the culture, whether you look in art or whatever. And a really good way to get a handle on that and understand it is, I think, with Lovelock and Margulis, so for me, they're the quintessential shift from ideological thinking to ecological thinking.

David Cayley

But what does the Gaia hypothesis say to our more traditional ideas of nature, the objective existence of nature?

William Irwin Thompson

Well, you have a real problem in your language right there—not you, but one. First of all, it says that nature is an arbitrary threshold. You cut a square in the universe and you stand on the bottom of the square and you call that threshold the window, and on the other side nature. But where are you going to cut that square? Are you going to do

it at the molecular level and see the entrancing dance of molecules and flashing electric skins and light that might be at another threshold pollution? And this beautiful vision you're having of the dance of molecules in nature might be a New Jersey toxic dump, but if you're inside it, at the molecular level, it could be wonderfully natural. Or you could be at a level of a supernova exploding and just creating havoc, and that can be nature, too. So when we say "nature," we're really influenced by the Sierra Club calendars, the Elliot Porter photographs, Ansel Adams, which are influenced by Constable and by Gainsborough. It is a kind of 18th century gentlemanly vision of the great estate and the park, and it's been given to us by great city planners like Olmsted in creating Central Park in New York City. That's a cultural idea. It has nothing to do with nature. In the 19th century, nature was objective and the observer was subjective and had no value. All value therefore came by decreasing subjective contamination to achieve a reading of nature which was pure and true, and the most pure was where human was least present, as in reading a meter. We now have the same thing, only we call it deep ecology, that nature is at its purest when it's not contaminated by trailer parks, not contaminated by weekend hikers, not contaminated by selling pharmaceuticals from the Amazon rain forest for Ciba Geigy companies, or something of this sort, that that is nature in its purest and its uncontaminated state. But there is no such thing as that nature, that's a fiction. Nature is the horizon of culture. Every time you change cultures, you change the horizon. So nature in a shamanic culture might have angels and elementals and spirits. Nature in a cybernetic, cyberpunk landscape might have machines that were ensouled by entelechies.

David Cayley

"Cyberpunk," in case the term is new, as it was to me, is a literary genre, working the blurred boundary between reality and its simulations. The best known example is William Gibson's novel, *Neuromancer*. Gibson's characters have electrodes implanted in their skulls. They jack in and cruise the video landscapes and virtual realities of what Gibson calls "cyberspace." "Entelechy" in this context means a soul or guiding spirit.

William Irwin Thompson

Imagine, say, for example the cyberpunk world of *Neuromancer*. Here we're going into the sci-fi landscape of the "unnatural." In a Hopi culture, you would take the molecular lattice of a sacred mountain and a holy spirit would ensoul the holy mountain, and then the shaman going into meditation would commune with the mountain and have a vision. In a cyberpunk landscape, the molecular lattice of a cybernetic organism would be ensouled by an entelechy and the Druid wizard who was jacking into cyberspace would begin to commune with the spirit that ensouled that mechanism. Now, for us in our 19th century romantic world we think nature is trees and mountains but not that other technology, that is abhorrent, that is evil and that is unnatural. But I think if one really wants to understand what's going on in the shifting horizons of our culture, one

has to understand nature as going in two directions simultaneously. One is the return to nature, with the Greens, and the other is the destruction of nature in the cyberpunk landscape of things like Blade Runner or Neuromancer. And unless you look at both of those edges of our culture and ask yourself what is nature, I don't think you'll really come up with the transformation that's going on right under our nose.

David Cayley

The obvious difference between the Hopi shaman's mountain and the cyberpunk landscape is that the one is human made, the other is not.

William Irwin Thompson

Well, we didn't make the silicon and we didn't make the electrical pulses and we didn't make the laws of physics and nature and entropy and all those other things. So at one level--

David Cayley

So to say that that's human made is--

William Irwin Thompson

Let me give you Lynn Margulis's example of what is nature. She said all the environmentalists come to Boston and they look at Boston harbour and say it's dead and it's polluted and it's unnatural. And she says no, I see all my friends out there--meaning all her bacteria that she studies--and they're chewing the tires and they're frolicking in the oil slick. And you have a whole sense that it is an arrogant consumer's 19th century aristocratic image of nature that we're talking about. So nature is a fiction. I think the only precise way you can define it is there is no such thing as nature. Nature is the horizon of culture, and whatever you are in, in whatever human activity, you will always have a horizon, you know.

David Cayley

Well then, how can ecology provide the moral dimension in political science which you said it would?

William Irwin Thompson

Because ecology is actually studying processes within our horizon. You know, I didn't say that there wasn't a horizon to our consciousness, so ecology is studying how does a cell work, how does a swamp work, how does a marsh work, how do actually biological processes enter into a dialogue, and we find that they interact with human beings. Rene Dubos would say if you look at the horizon of Florence, you see a man-made artifact. You are seeing the beautiful Tuscan hills and the vineyards, and you're seeing something that's been sculpted by humans in the same way that a beaver would create a dam or in the same way that a bacterial mat would create a stromatolite, which is kind of an artifact left from bacterial activity. The schist here, the Gunflint Schist in Ontario, is actually the remnant, the iron ore is the remnants of the oxidation processes of bacteria from zillions of years ago. So when Lynn talked about that, my mind flashed with Disney, you know, dwarfs in the mines as what the meaning of the old animistic myth is. So the first thing that comes up

with Gaia is the division between "animal, vegetable and mineral" of the old quiz game breaks down. There is not a wall between them, it's a shifting and highly permeable membrane. So you don't want to say the mineral is unnatural. You know, do you want to say nature only begins to be nature when there are animals and trees, or do you want to take it back to the origins of life? But what about before life evolved, the pre-biotic soup? What about the mineral period, the Hadean epoch, before we had even pre-biotic molecules kicking around in the ocean. That has to be seen as nature. But if we study these things and say okay, now we can see that it's an industrial cultural mentality to come in and level Kansas and put in wheat, that the prairie operates in a different way and has a more complex dialogue. But you don't want to romanticize it and say it was pure when the Indians were there, because they came in and they had prairie fires, and they burned out a lot of the higher vegetation and they, as much as we can tell, would create stampedes with fire to have all the animals fall off a cliff and have a huge slaughter. It's called the extinction of the Pleistocene megafauna. So that there were intrusions on nature in the period of what, 9,000, 8,000 B.C., that were when Gary Snyder's Indians were the only inhabitants of this continent, but they were doing stuff that was changing nature and they were sculpting the prairies. And so everywhere we look in, quote, "nature," we see processes like that going on, and they then teach us about how culture works and how we understand the interrelationship of opposites in a condition of health.

David Cayley

The Gaia hypothesis shows all creatures actively constructing their environments and, in effect, becoming environments for each other. A tree isn't just standing there in the environment, it's creating the environment by entraining the forces of wind and water, developing the soils and making a home for a myriad of other beings who, in turn, serve the tree. This Gaian perspective offers an understanding of evolution quite different from the classical Darwinian view. Thompson's close associate, Francisco Varela, suggests replacing the term "natural selection" with the words "natural drift" in order to eliminate the fiction of a stable environment which can do the selecting. In his essay, in "Gaia, A Way of Knowing," Varela illustrates the concept with a translation of a poem by Antonio Machado. "Wanderer," the poem says, "the road is your footsteps, nothing else. In wandering, you lay down a path. Turn back, and path there is none, only tracks on ocean foam."

William Irwin Thompson

Let's go back to this old way of thinking. The object in the container, the organism in the niche. Now, that's a way of thinking in biology that none of my colleagues in this mind jazz ensemble would accept. So what you get now is that animals, through their metabolic processes that are shared in a common phase space extrude the evolutionary landscape so that their excretions and their inhalations, everything, are creating a kind of dialogue through time, and so they're climbing on top of one another's niches. And one will create

a form of pollution that's a disaster and the other one will scurry around very quickly and then slowly begin to adapt to, say, the presence of the oxygen excreted by the cyanobacteria, and then that begins to change the atmosphere, and then organisms begin to change with the atmosphere. So the dance of life is now seen more in terms of what Varela calls natural drift rather than adaptation. The old notion is you have to adapt or you're going to die, and so identity is in a gene which you can manipulate and there's an organism that must adapt to its niche, which is clamped into its niche. In the other Prigogine kind of biology, the organisms are actually dancing and they are extruding their environment, so it's a like a river that is changing the banks at the same time that the banks are sculpting the river and the river is sculpting the bank. And the landscape that emerges--so you have to change your language, so Varela uses lovely poetic language like "brought forth," "worlds are brought forth," or you use concepts of "emergence." So the particular evolutionary landscape that's brought forth is radically different at each particular time, and so nature is changing all through this.

David Cayley

Since you've mentioned Varela and you alluded to him earlier, could you say--this has been an important colleague of yours, I think.

William Irwin Thompson

Yes.

David Cayley

Can you say who he is and what the new biology you've spoken about is?

William Irwin Thompson

Well, his voyage is an interesting one in terms of planetary culture. He started out, as a teenager, reading Heidegger in German in Santiago, as a kid who grew up in a mountain village in the Andes. He got his PhD at Harvard at age 23 and then moved in the '70s into studying Tibetan Buddhism with Chogyam Trungpa Rinpoche in Boulder and came and lived at Lindisfarne as scientist, scholar in residence in the '70s. And we've been working together on a program for biology, cognition, and ethics over the last three years and have written four books together that are in the process of appearing. So he's definitely a colleague and he's been one of those who's greatly influenced my thinking, and he enabled me to try to make the connection between cognitive science and the Gaia hypothesis and tried to build a bridge between--see, what I'm trying to do is connect ecology and biology and cognitive science and political science. For example, in the old days, cities were charismatic, and you would have the idea that elites would be in the city and particular cities would carry the civilizational energy for a time, so you would have like T.S. Eliot in London or you would have Jean-Paul Sartre in Paris. And now, I think, right at the time we're beginning to look in terms of Gaian processes at large, of how the circulation of the plankton in the sea affects the formation of the clouds, affects the albedo, the reflection of the solar radiation, affects the temperature of the planet,

we're beginning to see that civilization is no longer *civitas*, it's no longer located in the city. It's a distributive lattice, which is a concept that comes out of cognitive science, and Varela is a cognitive scientist. He's a neurophysiologist. And this is a particular term that comes out of a branch of cognitive science that's called connectionism, that's devoted to trying to create slower computers with fuzzy logic that think analogically, rather than fast computers that work digitally with just gates of off-on, one-zero, and in this particular way, the only way they can achieve the complexity is through parallel distributive processing. And so the ideas in the brain are not simply located in one cell, they're a distributive lattice that organizes the whole brain into a domain or a state. Parallel distributive processing and connectionist lattices and emergent states that have the capacity to learn are precisely what we're talking about when we're dealing with Gaia. Gaia is a system of learning that maintains itself over time. Varela has also studied the immune system, and from another point of view you could define Gaia almost as the immune system of the planet that maintains itself and its self-identity over time. So that if you look at Gaia at the atmospheric level, with Lovelock's work in atmospheric chemistry, you look at the macrocosm, you look at the microcosm of the bacteria with Lynn Margulis, where she'll argue that bacteria are not distinct species, they are one super-organism, a planetary bioplasm, which is an idea that's been developed by Sorin Sonea in his new bacteriology in Montreal. As a matter of fact, the leading expert of this is Sorin Sonea in Montreal. That that gives you a planetary bioplasm and if you study the immune system in the individual, that gives you a particular entity that isn't a discrete object but is like an enclosed self that is maintaining through the blood and through the marrow a definition of selfhood over time, where the self really begins to be the phase space of the body in the same way that if you study the movement of the Foucault pendulum, its phase space is larger than the ball. And so the concept of dynamics and learning and how a metadynamic can emerge from a highly connected system so that it begins to be self-naming, autonomous and maintain that autonomy and identity over time begins to be really fascinating. In order to understand those, because they're processes and not objects, you have to say I need a new geometry to be able to perceive these because my old geometry always asked me to look for an object. But this is saying no, an object is not a phase space, that you need not to think in terms of Euclidean geometry but in terms of chaos dynamics.

David Cayley

"Chaos dynamics" refers to a new science able to make mathematical models of complex forms: a wave breaking, smoke rising from a cigarette in turbulent air, the flow of air over the wing of a bird in flight. It belongs to a new phase of mathematics able to describe the interacting processes which comprise Gaia. This heady brew is what Thompson calls "the new biology." I myself find it somewhat unnerving because it pictures a world without a ground, without, as Varela says explicitly, "a privileged perspective." It offers no way of clearly demarcating the human from the continuum of life. Inside Gaia's magic bubble, where identity derives

from a process and not an object, all boundaries seem permeable and impermanent. Out of this Thompson conjures the vision of a new politics, based not on turf and egotistical interest but on what he calls "noetic ecologies," temporary structures of shared information like, say, the Live Aid concerts for African famine relief which dissolve, disappear and reform like clouds. I wondered aloud during our conversation about the sense of home in such a world.

Do you see any danger of losing rootedness, embodiment, sense of place by adopting this ecology of consciousness?

William Irwin Thompson

Well, I guess that's why I've always been involved in contemplative practice because--I had this argument with Wendell Berry once at Lindisfarne in Colorado, and Wendell, for me, who is a close friend as well as a Lindisfarne fellow, and we've all been thinking out loud in these jam sessions for the last twelve years. And Wendell was going on about his rootedness and the spirit of place, and his family have been in Henry County, Kentucky for nine generations. And I'm more of an electron than a nucleus. I don't have a location, so I am almost Wendell's exact opposite, and so I have a tendency to feel that I am deracinated, that I am unnatural, that I am unrooted, that I have no sense of identity, that I'm your typical uprooted academic nomadic intellectual. So I remember feeling frustrated and I said, "Damn it, Wendell, you keep talking about place, but I see the monarch butterflies heading for Mexico and I see the humming birds leaving me to spend the winter, and over the horizon I imagine the whales heading south, you know. It wasn't the rich that invented this lifestyle, it was, quote, animals in nature. So what is all this stuff?" And I said, "As a matter of fact, the 19th century farm is perhaps a much more disastrous imposition on nature, that if we go back to 9,000 B.C. before agriculture had gotten fixed with surpluses, we have a seasonal round in gathering, and we have hunting and gathering and fishing, and we don't have values so much fixed in location." It was the increasing surplus of grains that allowed us to start holding food in containers and then surrounding our buildings with walls, and then men could take their hunting bow and arrows and use them for raids, and raids grew into warfare. So you can say that agriculture, the fixing of value in turf, is inseparable from militarism, and that to say that identity is only valuable in fixed values means you're going to have to get your AK-47, it's me and the missus and my rifle and everybody else is a threat. So I don't draw my identity from fixed turf or from my meat body. I find my identity much more involved in very complex topological processes that move more than in three dimensions, so this enables me to live in a way that might be disorienting for someone who's in a 19th century family farm.

David Cayley

The debate between Bill Thompson and Wendell Berry is one that now divides the entire environmental movement. As Donald Worster and Wolfgang Sachs have both argued, ecology has always been an ambivalent field of thought, containing both a modern and an anti-modern mood. As

science, it's modern. As a romantic reaction to science, it's anti-modern. Thompson has committed himself unequivocally to science and has faced the consequences: the end of any stable or permanent idea of nature, including human nature. His choice highlights the much more conservative mood of other elements in the environmental movement. Thompson calls the Greens, for example, a nativistic movement, a movement which sees the past as the future.

William Irwin Thompson

Part of their project, and Rudolf Bahro and others, is to sort of go back to a pre-industrial society and to try to recover archaic terms. They don't want to deal with the world of chaos dynamics and mathematics and big science and space probes to Mars, or whatever. They have a very reactionary view. It's basically a nativistic movement.

David Cayley

It seems to me that at one time you yourself may have held these contradictions together, too.

William Irwin Thompson

I'm sure I still hold contradictions because I think you couldn't have a brain or a complex personality unless you embraced opposites. I think the creative process is inherently one of the dance of opposites, it's a complex kind of alchemy, and that any other simplifying ideology always falsifies one side of our nature. So I did set up Lindisfarne as a younger person more naively, as a nativistic movement. It would be the revival of the humanities in an age of technology, and since I couldn't do it at MIT, I quit MIT and came to York, and then found the vision for the development of a modern university at York was Stanford and MIT, to basically boost the Ontarian economy, and that was not what I had in mind. So then I quit and set up Lindisfarne and it became captured by too much nativism, trying to go back rather than forward. It was not the prophetic imagination, it was the regressive one, and the whole New Age movement is full of that. I mean, look, neolithic matrilineal agricultural villages, palmistry, dowsing, Zen, Tibetan Buddhism, these are all cultures, we've been there before. This isn't new stuff, this is old stuff. I mean, it's good stuff but it's old, but it's called the "New Age," but it's not new. And so it was at that point that I began to be aware that in the dynamic of understanding the complexity of change, your imagination was too limited to what Marshall McLuhan would call looking in the rear-view mirror, and to really get a sense of the horizon, you had to ask yourself What am I afraid of? What terrifies the hell out of me? Where do I see evil and the unnatural? And then when one confronts evil and the unnatural, this is why I became fascinated with cyberpunk landscapes, then one begins to see where the emergent change is really occurring. And if one has a prophetic imagination, then one begins to realize that the transformation of evil into good, the Christic transformation of the Mephistophelean that Goethe studied, has always been with us and is most likely to occur in those areas where we're afraid. And once we walk through our fears and understand

the disintegration of nature, the end of nature, understand that we're at the edge of the flesh, then the novel and unexpected becomes possible. Then I began getting interested in where did this happen in history before, and then I realized I had called my nativistic movement the Lindisfarne Association, and that was named after a bunch of Celtic monks who I thought were affecting the transition from disintegrating Greco-Roman world order to the emerging medieval Christendom. But Lindisfarne also was blessed as being the first monastery sacked by the Viking terror in 793. Now, the Viking terror was interesting because if you want to pick a period in time where the Mediterranean cultural ecology shifted to what would become the Atlantic, and shifted outward to first the Netherlands, then England and then the United States, the Viking terror is actually the first shift of the projection outward from the Mediterranean cultural ecology to the Atlantic, and the places they chose to attack were the monasteries, namely the central nervous system of medieval Christendom. So the Viking terror is an evil phenomenon but it's the signal of the emerging next level of organization which becomes Atlantic civilization. So I asked myself, well, where have I seen that one before, and of course I had just been reading Margulis's and Jim Lovelock's books, where they defined oxygen as the greatest pollution disaster to ever hit this planet, and it had driven all the anaerobic bacteria down into the slime. So some of the architectonic events of evolution are such that you can't block them and mark them and keep the records in terms of simple good. You have to see the interpenetrating dynamic of good and evil, and when you begin thinking in that larger scale, then sure, there are bad guys out there who are going to degrade and co-opt every idea that I can spit out. There are Shirley MacLaines who are going to be movie stars selling yoga on talk shows. That's a process of degradation that's like a compost heap. It just means those ideas have had their time and they're just breaking them down. What you get from digestion are broken down ideas. I can only deal with my way of thinking if I try to look at a bigger picture, because otherwise I think you just get depressed because you want to be optimistic, and optimism always demands that something happen now in the ego's time frame, and I just don't think that's big enough.

David Cayley

Thompson's realization that his own Lindisfarne Association had been, in part, a nativistic movement was tied to what he was seeing in the new biology: a world in which time and change produce constant novelties, a world without an external Archimedean point from which it can be viewed, a world where the sacred means something very different than in the traditional schools Lindisfarne was originally intended to revive.

William Irwin Thompson

I began to understand why the school that I had actually helped bring together and funded for, the school of sacred architecture, made me unhappy, because I remember an argument with Keith Critchlow in London--who is not a reactionary, he's a kind of Summerhill educated English

Labour party socialist, but he's very much committed to the Platonic idea. And he pointed to his watch and said, "The centre is fixed," you know, and that all the world of temporality and change and appearance just goes round and round and round, and so there was the whole idea that nothing is ever new and that values are fixed. And I had a kind of deep experience in meditation where all of that just died to me. It was like a real death experience, and it was like I could feel the *metanoia* where my mentality changed and I sort of moved out of that. And then intellectually I began to understand and appreciate that there was a new mathematics on the horizon that was part and parcel of the true New Age and was not this medieval Platonism. And I had grown up with Whitehead as my high school culture hero, and so I was always a Platonist, and at that point, in around 1983, I diverged and split and resigned from the New Age and began moving. And so I began to be much more interested in my association with people like Ralph Abraham and Francisco Varela and less in the earlier project where I had been working vigorously with Keith Critchlow and Kathleen Raine and very much in the idea of the return to the past in a kind of Yeatsian romanticism.

David Cayley

The original Lindisfarne was a monastery, a cultural enclave in an era that history called the Dark Ages. And during the late '70s, in books like *Darkness and Scattered Light*, Thompson did see the new Lindisfarne in essentially monastic terms. He now rejects this view.

William Irwin Thompson

When I set up Lindisfarne as preserving the humanities in an age of, you know, the "dark age" metaphor--we have to preserve knowledge in age of change or loss--what I didn't appreciate was that the metaphor was right but the content of little enclaves off in Auroville, Findhorn, or us out at the end of Long Island was misplaced concreteness and was too literal, that we were going through a period of cultural loss with incredible degradation of literate culture, that we would end up with, "McBooks," and the New York editorial elite becoming just a commodity marketing thing, and that Time magazine would decay to the level of People and newspapers would come down to the level of USA Today, and television, Sesame Street would ensure that children didn't have an attention span. So we've gone through an incredible period of the loss of literate culture. Now, in that sense, Lindisfarne was an attempt to bring together artists and scientists and poets and painters and folk to hold on to some levels of culture at a period when we were just getting the Shirley MacLaine of everything, and so its model was defensive of identity. It was the profane again. It's "us" versus "them," and I think that was not imaginative and inappropriate on my part. It was too narrow and didn't understand the larger process. Now, see, if I had invested my identity in that, I would be a bitter intellectual, hating the modern world. Now, as a matter of fact, I've talked to many professors of English literature. I'm thinking of a vivid conversation, one in Chapel Hill, North Carolina, and he hates the young, he hates music videos, he hates David Byrne in Talking Heads.

He wants them to go back to Allen Tate and William Faulkner and, you know, "I take my stand with Dixie." So his whole response of an English teacher in an electronic culture is one of embitteredness and hatred of the young, and that's where that position leads to. So if I don't invest my identity in that and see degradation as a digestion process, then even Shirley MacLaine has her way of signalling that the New Age movement is over, and now that it's getting broadcast everywhere, it's time to let it go and move on to other things, and that she is providing actually a public health service for people. Then I can feel less threatened and less paranoid.

David Cayley

Bill Thompson's thought has always been based on the insight that historical outcomes are inevitably paradoxical. Human beings, by definition, can never know what they are doing because the rational mind can only illuminate one thing by obscuring another. The world is therefore "a structure of unconscious relations," as Thompson says, and planetary culture can only be the result of a process apparently driven by terror and greed. The Gaia hypothesis offers Thompson a physical cosmology in which these paradoxes of history make sense. Gaia is the larger systemic mind of which we are the unconscious parts. We cannot be conscious of this greater mind by definition, but we can identify ourselves with it, and it is this identification, I think, which animates Bill Thompson.

William Irwin Thompson

If one adopts the big picture, the normal response is I've just lost my sense of value and location, and how can I be motivated to go out tomorrow and join, you know, the Sierra Club or Greenpeace, or whatever. And so the larger scale of time is disorienting if one has as one's value of one's identity an ego with an agenda, it is a shattering experience. So what follows from that immediately is a sense of devaluation because their value, their identity has been invested into the container model again, with a particular agenda of action that's going to enhance their value, and therefore they think that if one has the disorientation that it leads immediately to nihilism, because the flip side of idealism is nihilism. In point of fact, I'm not on that pH scale at all. In order to be empowered to act and to do what I feel is of value, I don't think it has to occur in my own lifetime, that I'm perfectly willing to involve myself in a project where I may never see the results of the activity--which is the original reason for calling it Lindisfarne, because the monks didn't live to see the cathedral of Chartres, the monks of Lindisfarne in 635. So that if you're dealing with a systemic shift from one world system to another, that's not in the clock time of an individual life. You're talking about the shift from Greco-Roman to medieval, or from medieval to modern, or from our modern to the new planetary culture, saying that we're coming out of the world system from, say, 1500 to 1945. So I don't involve myself in either pessimism or optimism. I find that a more contemplative sense of the big picture is actually empowering, because if I took too narrow a point of view, I'd really get bummed out because I'd be only looking at the short term thing, and the short

term thing always shows you bad guys 99, good guys zero, you know, we haven't even got a chance to score one for our side. But if one looks at a larger picture and says that once we were eukaryotic bacteria and once we were dinosaurs, and then we were hominids and then we adopted this contradiction between animals and apes that we like to call human, and now the human is ending and we're moving into some end of nature and end of human nature with it, and it's beyond our imagination but it involves a revisioning of identity and value and politics and science and everything else, I find that empowering rather than disempowering.

When writing came in, it was a threat to oral culture and it was seen as a threat to memory. There is a quote of Plato's where he talks about writing as the attack on memory. And we go through a period of darkness, and then after a couple of centuries we get, lo and behold, something called sacred texts, and we suddenly begin to get Upanishads and the Bible becoming a Torah and a canon, and now the sacred is invested in what before was evil.

There's a wonderful story that a friend of mine, a physicist at Lindisfarne named Lou Balamuth used to tell, of two people standing by a stream, watching ants on a log flowing down a turbulent stream, and the ants keep moving their position to stay out of the water. And one guy says to the other, "Gosh, look at those ants move," and the other says, "Yeah, and those ants think they're driving that thing."

Lister Sinclair

The Age of Ecology continues tomorrow night on IDEAS with conversations with Murray Bookchin and Stuart Hill. Heard on tonight's program were scientist James Lovelock and cultural historian William Irwin Thompson.

* * * * *

Lister Sinclair

Good evening. I'm Lister Sinclair and this is The Age of Ecology on IDEAS. Tonight we present conversations with two very different thinkers. In the second half of the show, soil ecologist Stuart Hill discusses the poor health of our agricultural soils and calls for a more subtle, more comprehensive science of agriculture.

Stuart Hill

You know, if you think of ecology, in a way it's the study of the relationship between everything and everything, and anything you leave out could be the key thing to understanding the whole.

Lister Sinclair

We begin with a visit with Murray Bookchin, the originator of a political and philosophical approach to ecology which he calls "social ecology."

Murray Bookchin

Nature is not a scenic, beautiful vision from a mountain top. I think true nature, philosophically understood, is that whole evolutionary process toward ever greater subjectivity, self-awareness, and ultimately, in the case of human beings, conceptual thought, that this is an evolutionary process. And I think that this is what I would call nature.

Lister Sinclair

The Age of Ecology is a series of eight programs featuring conversations with challenging thinkers in the field. This is the seventh in the series. The Age of Ecology is written and presented by David Cayley.

David Cayley

Murray Bookchin has been a pioneer in philosophical ecology for nearly forty years. A New Yorker by birth, his first intellectual roots were in Marxism and the trade union movement. But by the late '40s, he was already criticizing Marxism and charting a new approach. Marxism still followed the modern Western tradition that pitted humanity against nature. Nature, for Marx, was blind necessity which had to be overcome. Bookchin understood that this image of nature is a reflection of the social relations of a competitive market society. He saw nature in terms of cooperation and freedom. Natural evolution, Bookchin argued, tends to diversity, complexity and spontaneity. This results in greater subjectivity and greater choice, and ultimately gives an objective ground for human freedom. But social relations based on domination blind us to our natural possibilities. The solution to the ecological problem therefore must lie in solving the prior social problem of our unnatural social relations. This, in a nutshell, is social ecology. Bookchin has argued it in books like *The Ecology of Freedom* and *Post-Scarcity Anarchism* for many years. He's never really received the public recognition he feels his work deserves, but in the early '80s, he was heartened by the emergence of a green movement in both Europe and North America which acknowledged his ideas and adopted the radical political approach to the environmental crisis which he favoured. Today he worries that the environmental movement is either selling out or retreating into mysticism. His particular bete noire is what is called "deep ecology," a philosophy which tries to overcome anthropocentrism by substituting biocentrism or nature centredness. Bookchin believes that deep ecology and its action arm, the Earth First movement, have produced a nasty misanthropic rhetoric which, in his words, "reduces humanity to a parasitic swarm of mosquitoes in a mystified swamp called nature." I visited Murray Bookchin recently in Burlington, Vermont, where he's lived for many years, and we talked in his office.

Murray, your new book, *Remaking Society*, has at times a somewhat polemical tone. You seem concerned that various tendencies within the environmental movements are not seeing your vision of a social ecology, and I wonder what's on your mind.

Murray Bookchin

Well, I've been involved in the ecology movement since 1952, 1951. I've been teaching, writing, organizing, belonging, helping form all kinds of ecology movements. And what is disappointing is that the so-called ecological awakening that is taking place today, in the face of predictable catastrophes, in many cases, and predictable trends that are very adverse, is taking a very bizarre and not entirely, in my opinion, wholesome form. I had hoped that when people were going to be awakened to some kind of ecological consciousness that they would move to a broad social consciousness, namely that they would understand that the basic source of our ecological problems are social in character. There is a tendency today to create a sense of original sin. What I mean by original sin is that people are some vast amorphous thing called humanity, a concept that I would like to criticize, and they are being accused and guilty. That's one tendency. "You" are responsible, without defining who "you" are, whether you're a man or a woman, whether you're a person of colour or whether you are white, or whether you are rich or whether you are poor, or whether you have power or whether you are powerless--"you" are responsible. The corporations love to throw that at you. You see what I'm saying? And that makes me very angry. The second tendency is a hyperspiritualism that really verges on theology. I certainly believe that we have to consume less. I think we consume absurdly--those who can afford to consume if you please--and I certainly believe that we have to have a sensitivity, indeed a very marked sensitivity and sensibility toward the natural world and toward other forms of life. But all of this is now being translated into a Goddess-worshipping religion or a mystical Gaia, or an idea of "thinking like a mountain", you see, whatever Aldo Leopold meant by that when he wrote that way back, years ago. And this whole "losing yourself in the cosmic self," all of this is distorting, unfortunately distorting and concealing the real sources of the ecological crisis we face today, which are not simply spiritual ones but are primarily social ones. And more frequently than not, these new developments in the ecology movement which I regard as being asocial, being psychological, mystical or religious, are in my opinion reflections primarily of the sense of helplessness that people have today and their inability to understand the social sources of the ecological problem. Therefore I call my view social ecology, in contrast to this alleged deep ecology--or is it deeper ecology, or is it the deepest ecology? I haven't found out which it is--which is really a religion, basically a religion formulated by one Arne Naess with a group of California professors behind him, that is now also beginning to percolate through Canadian schools and universities. I think these are very well intentioned people, I think they mean well, but I think there is a real problem of emphasizing the social nature of the ecological crisis.

David Cayley

Can we take some of these assumptions more particularly? In deep ecology, for example, there is what's called a biocentric perspective: the idea, as Leopold said, that human

be a hermit and be a practicing Jew. You have to have to have a community.

David Cayley

I'd like you ask you finally about what I'll call environmentalism for want of a better term, meaning all those persons who are concerned with this. And this is a movement which seems divided in many ways but which ranges certainly from a managerial perspective at one end, an attitude which is confident that sustainable development is possible, that you can have growth and environmental protection, however it's phrased, and at the other end one has a biocentric perspective, let's say, descending from Leopold's famous saying that we should be only a "plain citizen" of the biotic community. It seems to me that coming out of your Jewish roots, you take a different view, neither one nor the other.

David Ehrenfeld

Yes, let me try to answer your question by describing the Jewish attitude towards work and the Sabbath, which I think is the ultimate, for me at least, the ultimate way of stating this problem. In Judaism, you're supposed to work six days and rest on the seventh. On the seventh day, on the Sabbath, which for us is Saturday--or it actually starts Friday evening at sundown, you are supposed to stop working and there's three things you have to do if you are going to observe the Sabbath correctly. You can't create anything. I mean anything. If you get an idea for a book, you cannot write it down on a piece of paper. That's very painful for an author and it happens to me all the time, and I wonder, will I remember this till after sundown on Saturday, and sometimes I do and sometimes I don't, and I have stopped worrying about it. If you're a gardener, you can't plant a seed. That's a creative act. You can't do it. You also can't destroy anything. That's the second thing you can't do. Again, if you're a gardener and you see a weed growing in your garden, you can't pull it up, you can't kill an insect pest, you can't shoot a rabbit, or anything of that sort on the Sabbath. The third thing that you're supposed to do is a positive injunction, which is to celebrate the Sabbath and celebrate the fullness of the earth that was given to people to live in, to work in and to enjoy. So you have this prohibition against creating or destroying, which means you cannot be a manager, you can't be a steward even in any sense. You've got to leave it alone, and it will continue all by itself. It's a wonderful lesson. You also have to learn how to enjoy it, and that's the other part of the lesson. People were told you had to have the confidence, in a sense, in the earth and in the creator of the earth that says I'm going to just rest for one day, I'm going to leave it alone. Now, I think that stewardship without the idea of the Sabbath is bound to go wrong. Without the idea of the Sabbath, without some idea of a built-in restraint, then the steward eventually becomes very arrogant. Hence my title, *The Arrogance of Humanism*. The stewards says I'm really the king. You know, the late J.R. Tolkien, in his book, his wonderful Ring trilogy, *The Lord of the Rings*, has this dilemma of a steward who says How long do I have to stay a steward if the king doesn't

show up? When do I become a king? And the man who asks this question is told by his father, who is the steward, Even ten thousand years wouldn't be enough, and essentially there is never a time when a steward becomes a king. Well, I think that there's a great temptation for stewards to want to play king, to want to play God, and without some kind of a restraint that's built in at a regular basis, a kind of constant reminder you're not running the show, you can't run the show. You don't know enough to run the show and you never will and you're only going to mess it up if you have that attitude. Without that idea, then I think that stewardship is bound to go awry, to go amiss. I think that the idea of the Sabbath, for Jews, and perhaps for Christians too, introduces this idea of restraint which is so essential to keep stewardship on the right track. So I think that stewardship is the only hope, but I think it has to have some kind of restraint built into it.

David Cayley

David, thank you so much.

David Ehrenfeld

You're welcome.

David Cayley

In 1980 a book appeared which I think of as a kind of sibling to *The Arrogance of Humanism*. It was called *The Fallacy of Wildlife Conservation* and it was written by John Livingstone, a lifelong naturalist and a professor in the Faculty of Environmental Studies at York University. It was a book, Livingstone once told me, written in blood--his life's blood. After a lifetime of arguing for wildlife conservation, Livingstone took apart the arguments he himself had made and found them all wanting. Everything seemed to come back to what David Ehrenfeld calls "the doctrine of final causes," the idea that the end to which something can be put is the cause for which it was created, the idea, as Ehrenfeld says, that gravity exists in order to make it easier for us to sit down or that rain forests should be saved because they may contain undiscovered medicines. Species and places with no obvious economic usefulness become recreational amenities, prized for their aesthetic value. All arguments circle back on humanity. None can penetrate what Livingstone calls "the metaphysical dome" which encloses human society and cuts us off from the living world. In the light of *The Fallacy of Wildlife Conservation*, John Livingstone began, in effect, a second career, searching for a way out of environmentalism's utilitarian bind, trying to put a retractable roof on the metaphysical dome. We spoke recently in his office at York.

John Livingstone

If I have a technique, it has been, I think, to ask the question that my colleague, Reg Lang, always asks: What is the problem to which this is the solution? So what I've done mostly is critical analysis, I think, of the statements of the so-called conservation movement, the so-called environmental movement, and so forth. Nobody seems to want to reveal what the problem is that is being addressed by all the environmental placards. I like to say to my students, "Go out